

enumext

ENUMERATE EXERCISE SHEETS

V1.5 2025-06-11^{*}

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CTAN: <https://www.ctan.org/pkg/enumext>

 <https://github.com/pablgonz/enumext>

Abstract

This package provides enumerated list environments compatible with *tagging* PDF for creating “*simple exercise sheets*” along with “*multiple choice questions*”, storing the “*answers*” to these in memory using *multicol* package.

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Motivation and acknowledgments

Usually it is enough to use the classic `enumerate` environment to generate “*simple exercise sheets*” or “*multiple choice questions*”, the basic idea behind `enumext` is to cover three points:

1. To have a simple interface to be able to write “*lists of exercises*” with “*answers*”.
2. To have a simple interface for writing “*multiple choice questions*”.
3. To have a simple interface for placing “*columns*” and “*drawings*” or “*tables*”.

This package would not be possible without Phelype Oleinik who has collaborated and adapted a large part of the code and all L^AT_EX team for their great work and to the different members of the TeX-SX community who have provided great answers and ideas. Here a note of the main ones:

1. Answer given by Alan Munn in `\topsep`, `\itemsep`, `\partopsep`, `\parsep` - what do they each mean (and what about the bottom)?
2. Answer given by Enrico Gregorio in [Understanding minipages - aligning at top](#)
3. Answer given by Ulrich Diez in [Different mechanics of hyperlink vs. hyperref](#)
4. Answer given by Enrico Gregorio in [Minipage and multicol, vertical alignment](#)

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License and Requirements

Permission is granted to copy, distribute and/or modify this software under the terms of the LaTeX Project Public License (lpp), version 1.3 or later (<https://www.latex-project.org/lppl.txt>). The software has the status “maintained”.
The enumext package loads and requires multicol[3] package, need to have a modern T_EX distribution such as T_EX Live or MiK_TTeX. It has been tested with the standard classes provided by L^AT_EX: book, report, article and letter on 10pt, 11pt and 12pt.

The minimum requirement is L^AT_EX release 2025-06-01.

1 Introduction

In the L^AT_EX world there are many useful packages and classes for creating “lists of exercises”, “worksheets” or “multiple choice questions”, classes like exam[1] and packages like xsim[2] do the job perfectly, but they don’t always fit the basic day to day needs.

In my work (and in the work of many teachers) it is common to use “simple exercise sheets” also known as “informal lists of exercises”, as an example:

1. Factor $x^2 - 2x + 1$

2. Factor $3x + 3y + 3z$

3. True False

(a) $\alpha > \delta$

(b) L^AT_EXze is cool?

4. Related to Linux
- (a) You use linux?

(b) Usually uses the package manager?

(c) Rate the following package and class

i. xsim-exam

ii. xsim

iii. exsheets

Sometimes we are also interested in showing the “answers” along with the questions:

1. Factor $x^2 - 2x + 1$

*

$(x - 1)^2$

2. Factor $3x + 3y + 3z$

*

$3(x + y + z)$

3. True False

(a) $\alpha > \delta$

*

False

(b) L^AT_EXze is cool?

*

Very True!

4. Related to Linux
- (a) You use linux?

*

Yes

(b) Usually uses the package manager?

*

Yes, dnf

(c) Rate the following package and class

i. xsim-exam

*

doesn’t exist for now :(

ii. xsim

*

very good

iii. exsheets

*

obsolete

Or we are interested in referring to a specific question and its “answer”, for example:

The answer to 3.(b) is “Very True!” and the answer to 4.(c).ii is “very good”.

Or we are interested in printing all the “answers”:

1. $(x - 1)^2$

2. $3(x + y + z)$

3. (a) False

(b) Very True!

4. (a) Yes
- ⌘ (b) Yes, dnf

⌘ (c) i. doesn’t exist for now :(

⌘ ii. very good

⌘ iii. obsolete

⌘

Another very common thing to use in my work is “multiple choice questions”, for example:

1. First type of questions

A) value

B) correct

C) value

D) value

2. Second type of questions

I. $2\alpha + 2\delta = 90^\circ$

II. $\alpha = \delta$

III. $\angle EDF = 45^\circ$

A) I only

B) II only

C) I and II only

D) I and III only

E) I, II, and III

★ 3. Third type of questions

(1) $2\alpha + 2\delta = 90^\circ$

(2) $\angle EDF = 45^\circ$

A) value

B) value

C) value

D) value

E) value
4. Question with image and label below:

A

A)

B


B)

A

C)

A

D)



E)

5. Question with image on right side:

A) value

B) value

C) value

D) correct

E) value

B
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Where what we are interested in the $\langle label \rangle$ and a “short note” that we leave as an explanation, and then print them:

1. B) $x = 5$

2. D)

3. C) some note
- ⌘ 4. E) A duck

⌘ 5. D) “other note”

⌘

The `enumext` package was created and designed to meet these small requirements in the creation of “simple worksheets” and “multiple choice questions”.

- These “simple worksheets” or “multiple choice questions” appear to be easy to obtain using a combination of the `enumerate`, `minipage` and `multicols` environments, but like many things, what “looks simple” is not so simple.

1.1 Description and usage

The `enumext` package defines enumerated environments using the `list` environment provided by \TeX , but “does not redefine” any internal commands associated with it such as `\list`, `\endlist` or `\item` outside of the “scope” in which they are defined.

- This package is NOT intend to replace the `enumerate` environment nor replace the powerful `enumitem`[6], the approach is intended to work without hindering either of them.

This package can be used with `xelatex`, `lualatex`, `pdflatex` and the classical `latex`»`dvips`»`ps2pdf` and is present in \TeX Live and $\text{MiK}\text{\TeX}$, use the package manager to install. For manual installation, download `enumext.zip` and unzip it, run `luatex enumext.ins` and move all files to appropriate locations, then run `mktexlsr`. To produce the documentation run `arara enumext.dtx`.

<code>enumext.sty</code>	»	<code>TDS:tex/latex/enumext/</code>
<code>enumext.pdf</code>	»	<code>TDS:doc/latex/enumext/</code>
<code>README.md</code>	»	<code>TDS:doc/latex/enumext/</code>
<code>enumext.dtx</code>	»	<code>TDS:source/latex/enumext/</code>
<code>enumext.ins</code>	»	<code>TDS:source/latex/enumext/</code>

The package is loaded in the usual way:

```
\usepackage{enumext}
```

1.2 The concept of left margin

There is a direct relationship between the parameters `\leftmargin`, `\itemindent`, `\labelwidth` and `\labelsep` plus an “extra space” that makes it difficult to obtain the desired *horizontal spaces* in a `list` environment. Usually we don’t want the `list` to go beyond the left margin of the page, but since these four values are related, that causes a problem.

The `enumitem`[6] package adds the `\labelindent` parameter to solve some of these problems. A simplified representation of this in the figure 1.

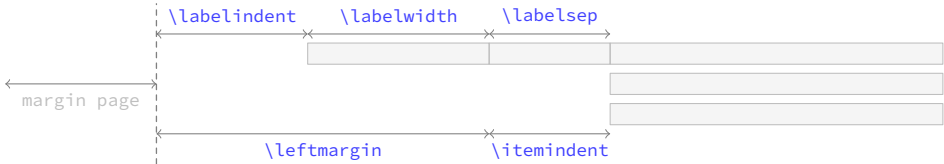


Figure 1: Representation of horizontal lengths in `enumitem`.

The `enumext` package does NOT provide a user interface to set the values for `\leftmargin` and `\itemindent`, instead it provides the keys `list-offset` and `list-indent` which internally set the values for `\leftmargin` and `\itemindent`. The concepts of `\leftmargin` and `\itemindent` are different in `enumext`. The figure 2 shows the visual representation of idea.

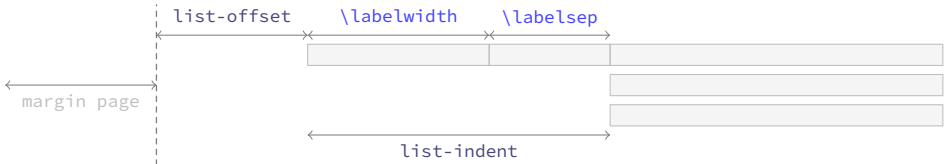


Figure 2: Representation of horizontal lengths concept in `enumext`.

In this way we reduce a *little* the amount of parameters we have to pass. With the default values of keys `list-offset`, `list-indent`, `labelwidth` and `labelsep` the lists will have the (usually) expected output for “simple worksheets”. The figure 3 shows the visual representation.

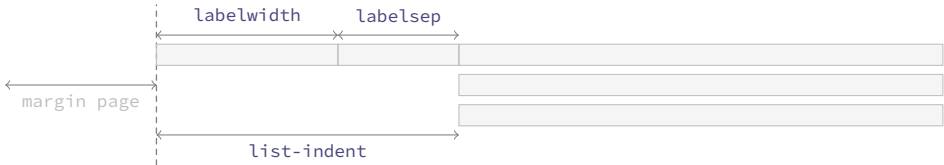


Figure 3: Default horizontal lengths `list-offset=0pt`, `list-indent=\labelwidth+\labelsep` in `enumext`.

1.3 User interface

The user interface consists of two main list environments `enumext` (vertical) and `enumext*` (horizontal), the environment `anskey*` and the command `\anskey` to “store content” and the environments `keyans`, `keyans*` and `keyanspic` for multiple choice. It also provides the commands `\getkeyans` to print individual *stored content*, `\printkeyans` and `\foreachkeyans` to print all *stored content*, `\miniright` for `minipage`, `\setenumext` and `\setenumextmeta` to config [*key* = *val*] options.

1.3.1 Internal counters

The package `enumext` uses internally the `enumXi`, `enumXii`, `enumXiii`, `enumXiv` counters for the four nesting levels of the `enumext` environment, the `enumXv` counter for the `keyans` environment, the `enumXvi` counter for the `keyanspic` environment, the counter `enumXvii` for `enumext*` environment and the counter `enumXviii` for `keyans*` environment.

- If any package defines these counters or they are user-defined in the document, the package will return a fatal error and abort the load.

1.3.2 Public dimension

The package `enumext` only provides a single public dimension `\itemwidth` and is intended for user convenience only and is not for internal use as such. The dimension `\itemwidth` is *rigid length* and contains the “width of the content” of each `\item` regardless of `labelwidth` and `labelsep`.

- If any package defines `\itemwidth` or they are user-defined `\itemwidth` in the document, the package will overwrite it without warning.

1.3.3 Support for multicol

The package provides direct support for using the `multicol`[3] package. This allows to obtain directly a two-column output as shown in the figure 4.

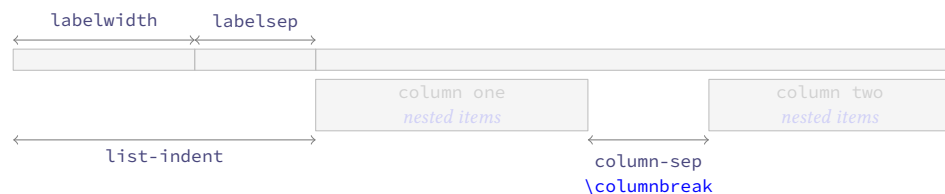


Figure 4: Representation of the two column output for a nested level in `enumext` environment.

The “non starred” version of the `multicols` environment is always used together with the `\raggedcolumns` command and is controlled by `columns` and `columns-sep` keys. It can be used in all nesting levels of the environment `enumext` and the environment `keyans` and can together with the `mini-env` key. If you need to force a start a new column `\columnbreak` must be used (see §5.6).

- The `\columnseprule` command is not available as a key and is set to “zero” for the inner levels and the `keyans` environment. If the value of this is set inside the document, it will affect “all environments” that use the `columns` key.

1.3.4 Support for minipage

The package provides direct support for `minipage` environment, this allows you to obtain an output like the one shown in figure 5.



Figure 5: Representation of the `mini-env` output for a nested level `enumext` environment.

The `minipage` environments on “left side” and “right side” is always used with “aligned on top” [*t*]. It can be used in all nesting levels of the environment `enumext` and the environment `keyans` and is controlled by `mini-env` and `mini-sep` keys. In order to switch from the “left” side `minipage` environment to the “right” side one must use the command `\miniright` (see §5.7).

1.3.5 The \label and \ref system

This package provides a user interface like the `enumitem`[6] package to customize the references which is activated by the `ref` key (§5.1), the standard \LaTeX `\label` and `\ref` commands work as usual. It also provides an “internal reference” system for the “stored content” by means of the key `save-ref` (§6.1.1) when the key `save-ans` (§6.1) is active.

1.3.6 Support for \footnote

The `enumext*` and `keyans*` environments and the `mini-env` key use the `minipage` environment in their implementation but in a transparent way for the user, i.e. it is only used for typesetting and not directly. The `enumext` package provides an *internal implementation* for the command `\footnote` compatible with the `hyperref` package to work in the same way as if it were used anywhere in the document.

Unfortunately, if *tagging* PDF is not enabled, it will not produce the expected “links” because the internal implementation uses `\footnotetext[⟨number⟩]` and `\footnotemark[⟨number⟩]{⟨text⟩}` and support for these is limited by the `hyperref` package.

The best way to solve this if *tagged* PDF is NOT active is to use Jean-François Burnol `footnotehyper`[9] package, it will support keeping the “links” if `hyperref` is loaded with the `hyperfootnotes=true` option (default). Load it is as follows:

```
\IfDocumentMetadataF
{
  \usepackage{footnotehyper}
  \makesavenoteenv{enumext}
  \makesavenoteenv{enumext*}
}
```

At the moment the `footnotehyper` package is not compatible with *tagged* PDF.

2 The environments provided

The package `enumext` provides two main list environments, the *vertical* environment `enumext` and the *horizontal* environment `enumext*`.

enumext	<code>\begin{enumext}[⟨keyval list⟩]</code>	<code>\begin{enumext*}[⟨keyval list⟩]</code>
enumext*	<code>\item ⟨item content⟩</code>	<code>\item ⟨item content⟩</code>
	<code>\item [⟨custom⟩] ⟨item content⟩</code>	<code>\item [⟨custom⟩] ⟨item content⟩</code>
	<code>\item* [⟨symbol⟩] [⟨offset⟩] ⟨item content⟩</code>	<code>\item* [⟨symbol⟩] [⟨offset⟩] ⟨item content⟩</code>
	<code>\end{enumext}</code>	<code>\end{enumext*}</code>

2.1 The environment enumext

The `enumext` is an environment that works in the same way as the standard `enumerate` environment provided by \LaTeX , `\item` and `\item[⟨custom⟩]` commands work in the usual way. The environment can be nested with at most “four levels” and the options can be configured globally using `\setenumext` command and locally using `[⟨key = val⟩]` in the environment.

Example with `columns=2`

1. This text is in the first level.
- A. This text is in the fourth level.
- (a) This text is in the second level.
- X This text is in the first level.
- i. This text is in the third level.
- ★ 2. This text is in the first level.

2.2 The environment enumext*

The `enumext*` is a *horizontal list environment* similar to the `shortenumberate` or `tasks` environments provided by the `shortlst`[16] and `tasks`[17] packages, `\item` and `\item[⟨custom⟩]` work as usual. The options can be configured globally using `\setenumext` command and locally using `[⟨key = val⟩]` in the environment.

Some considerations to take into account for this environment:

- The environment cannot be nested within itself or in the environment `keyans*`, but it can be nested within `enumext` and vice versa.
- Each “item content” in the environment is placed within a `minipage` environment whose *width* is stored in the dimension `\itemwidth` that NOT includes `labelwidth`, `labelsep`, only the *width of the content*.
- You cannot have floating environments like `figure` or `table` but `\footnote` with `hyperref` support is supported if the `footnotehyper` package is loaded (see §1.3.6 for full support).
- You cannot have any standard list environments like `itemize`, `enumerate`, `description`, `quote`, `quotation`, `verse`, `center`, `flushleft`, `flushright`, `verbatim`, `tabbing`, `trivlist`, `list` and all environments created with `\newtheorem`.

Example with `columns=2`

1. This text is in the first level.
2. This text is in the first level.
- X This text is in the first level.
- ★ 4. This text is in the first level.

2.3 The command \item*

```
\item* \item* [⟨symbol⟩] [⟨offset⟩]
```

The `\item*`, `\item*[⟨symbol⟩]` and `\item*[⟨symbol⟩][⟨offset⟩]` works like the numbered `\item`, but placing a `⟨symbol⟩` to the “left” of the `⟨label⟩` separated from it by the `⟨offset⟩` set by the the *second optional argument*. The *starred argument* “*” cannot be separated by spaces ‘`␣`’ from the command, i.e. `\item*` and the *first optional argument* does “NOT” support *verbatim content*. Can be configure with the keys `item-sym*` and `item-pos*` locally in the environment or globally using `\setenumext` command (§3).

The behavior of `\item*` in the `enumext` and `enumext*` environments is NOT the same as in the `keyans` and `keyans*` environments.

2.3.1 Keys for \item*

`item-sym*` = {<symbol>} default: \textborn
Sets the *symbol* to be displayed in the “left” of the box containing the current <label> set by `labelwidth` key for `\item*` in `enumext` and `enumext*`. The *symbol* can be in *text* or *math* mode, for example `item-sym*={\star}`.
`item-pos*` = {<rigid length>} default: by levels
Sets the *offset* between the box containing the current <label> defined by `labelwidth` key and the <symbol> set by `item-sym*` key. The default values are set by `labelsep` key at each level. If positive values are passed it will *offset to the left* and if negative values are passed it will *offset to the right*.

2.4 The command \item in enumext*

The `\item` command for the `enumext*` environment provides an “first optional argument” `\item(<columns>)` which “joins items” between columns. Let’s consider the following examples adapted directly from the `task` package:

```
\begin{enumext*}[widest=10,columns=4]
  \item The first
  \item* The second
  \item The third
  \item The fourth
  \item(3)* The fifth item is way too long for this and needs three columns
  \item The sixth
  \item The seventh
  \item(2)[X] The eighth item is way too long for this and needs two columns
    (\the\itemwidth)
  \item The ninth
  \item[Z] The tenth (\the\itemwidth)
\end{enumext*}
```

1. The first
- ★ 2. The second
3. The third
4. The fourth
- ★ 5. The fifth item is way too long for this and needs three columns
6. The sixth
7. The seventh
- X 8. The eighth item is way too long for this and needs two columns (196.17749pt)
9. The ninth
- Z 10. The tenth (89.28171pt)

3 The command \setenumext

<code>\setenumext</code>	<code>\setenumext{<key = val>}</code>	<code>\setenumext[<keyans*>]{<key = val>}</code>
	<code>\setenumext[<enumext, level>]{<key = val>}</code>	<code>\setenumext[<print, level>]{<key = val>}</code>
	<code>\setenumext[<enumext*>]{<key = val>}</code>	<code>\setenumext[<print, *>]{<key = val>}</code>
	<code>\setenumext[<keyans>]{<key = val>}</code>	<code>\setenumext[<print*>]{<key = val>}</code>

The command `\setenumext` sets the <keys> on a global basis for environments `enumext`, `enumext*`, `keyans`, `keyans*` and the `\printkeyans` command. It can be used both in the preamble and in the body of the document as many times as desired.

The <keys> set in the *optional argument* of environments and commands have the *highest precedence*, overriding both options passed by `\setenumext`. If the *optional argument* is not passed, the first level of the environment `enumext` will be taken by default.

- The key `save-ans` that activate the “storage system” must NOT be passed through this command and must be passed directly in the *optional argument* of the “first level” of the environment in which they are executed.

4 The command \setenumextmeta

<code>\setenumextmeta</code>	<code>\setenumextmeta {<key name>}{<key-one = val, key-two = val, ...>}</code>
	<code>\setenumextmeta*{<key name>}{<key-one = val, key-two = val, ...>}</code>
	<code>\setenumextmeta [<enumext*>]{<key name>}{<key-one = val, key-two = val, ...>}</code>
	<code>\setenumextmeta [<enumext, level>]{<key name>}{<key-one = val, key-two = val, ...>}</code>

The command `\setenumextmeta` adds a new “meta-key” for the environments `enumext` and `enumext*`, the {<key name>} must be different from those defined by the package. If the *optional argument* is not passed, the new “meta-key” will be created for the “first level” of the environment `enumext`.

The *starred argument* ‘*’ will create the new “meta-key” for the environment `enumext*` and for all levels of the environment `enumext`. For example: `\setenumextmeta*{midsep}{topsep=3pt, partopsep=0pt}` will create a new key `midsep` available for all levels of the `enumext` environment and the `enumext*` environment and we can use it like any other key so `\begin{enumext}[midsep]` and `\begin{enumext*}[midsep]` will be valid.

5 The keyval system

The $\langle key = val \rangle$ system used by the `enumext` package is implemented using `l3keys` so it must be taken into consideration that those keys marked as “*value forbidden*”, that is $\langle key \rangle$ is different from $\langle key = \rangle$.

All $\langle keys \rangle$ described in this section are available for the `enumext`, `enumext*`, `keyans` and `keyans*` environments with the exception of the keys `series`, `resume`, `resume*` which are only available for the “*first level*” of the environments `enumext` and `enumext*`; and the keys `mini-right`, `mini-right*` which are only available for the `enumext*` and `keyans*` environments.

All $\langle keys \rangle$ related to vertical or horizontal spacing accept a “*skip*” or “*dim*” expression if passed between braces, i.e. you do not need to use `\dimeval` or `\dimexpr` to perform calculations.

- It should be kept in mind that using any $\langle key \rangle$ that sets a *rubber lengths* or *rigid lengths* for vertical or horizontal space on a level will influence the vertical and horizontal space for *inners levels* and `keyans`, `keyans*` and `keyanspic` environments.

5.1 Keys for label and ref

`mode-box` $\langle value forbidden \rangle$ default: *not used*

This is a “*switch-key*” that does not receive an argument and is “*only*” available for the “*first level*” of the `enumext` environment and the `enumext*` environment. When this is set the `label`, `font`, `wrap-label` and `wrap-label*` keys are executed within `\makebox` for the `enumext` and `keyans` environments.

- This key is intended for compatibility with *tagged* PDF and is forcibly “*enabled*” when `\DocumentMetadata` is present. If you want to get the same document output whether `\DocumentMetadata` is active or not, you must enable this key.
- In the `enumext*` and `keyans*` environments `\makebox` are redefined using `\makebox` by default. If `enumext` or `keyans` is used in the `enumext*` environment the key must be activated manually.

`label` = { $\langle \backslash\alpha^* | \backslash\Alpha^* | \backslash\arabic^* | \backslash\roman^* | \backslash\Roman^* \rangle$ } default: *by levels*

Sets the $\langle label \rangle$ that will be printed at the *current level* and default value for `labelwidth` key. The default value for the first level of the environments `enumext` and `enumext*` are `\arabic*`, for second level are $\langle \backslash\alpha^* \rangle$, for third level are `\roman*`, and for fourth level are `\Alpha*`. For `keyans` and `keyans*` environments the default value is `\Alpha*`.

- This key is intended to give the basic structure with which the $\langle label \rangle$ will be displayed, and the form in which it is used by standard “*label and ref*” and the “*internal label and ref*” system with the `save-ref` key. You cannot use commands with $\langle label \rangle$ as an argument, for example `\emph{\langle \backslash\alpha^* \rangle}` will return an error. For full customization of how $\langle label \rangle$ is displayed use the `font`, `wrap-label` and/or `wrap-label*` keys.

`labelsep` = { $\langle rigid length \rangle$ } default: `0.3333em`

Sets the *horizontal space* between the box containing the current $\langle label \rangle$ defined by `label` key and the text of an item on the first line. Internally sets the value of `\labelsep` for the current level.

`labelwidth` = { $\langle rigid length \rangle$ } default: *by label*

Sets the *width* of the box containing the current $\langle label \rangle$ set by the `label` key. Internally sets the value of `\labelwidth` for the current level. The default values are calculated by means of the *width* of a box by setting a *value* to the current counter set by `label` key using ‘0’ for `\arabic*`, ‘M’ for `\Alpha*`, ‘m’ for `\alpha*`, ‘VIII’ for `\Roman*` and ‘viii’ for `\roman*`.

`widest` = { $\langle integer | string \rangle$ } default: *empty*

Sets the `labelwidth` key pass the $\langle integer \rangle$ or converting the $\langle string \rangle$ of the form `\Alpha`, `\alpha`, `\Roman` or `\roman` to a *value* for the current counter defined by `label` key, then calculating the *width* by means of a box. For example `widest={XXIII}` or `widest={23}` are equivalent. This key is useful when the default values of the `labelwidth` key are smaller than those actually used.

`font` = { $\langle font commands \rangle$ } default: *empty*

Sets the *font style* for the current $\langle label \rangle$ defined by `label` key. For example `font={\bfseries\small}`.

`align` = { $\langle left | right | center \rangle$ } default: *left*

Sets the *aligned* of $\langle label \rangle$ defined by `label` key on the current level in the label box.

`wrap-label` = { $\langle code \{ \#1 \} more code \rangle$ } default: *empty*

Wraps the *current* $\langle label \rangle$ defined by `label` key referenced by $\{ \#1 \}$ after executing the `align` and `font` keys. The $\{ \langle code \rangle \}$ must be passed between braces and this does not modify the value set by the `labelwidth` key and is applied *only* on `\item` and `\item*`. When using it in the `\setenumext` command it is necessary to use the *double* ‘ $\{ \# \#1 \}$ ’. For example `wrap-label={\fbox{\#1}}` or you can create a command:

```
\NewDocumentCommand \mywrap { s m }
{
  \IfBooleanTF{\#1}
  {
    {\textcolor{red}{\textbf{Q}}\textcolor{blue}{\textbf{.}}\textcolor{gray}{\#2}}
    {\textcolor{blue}{\textbf{Q}}\textcolor{red}{\textbf{.}}\textcolor{gray}{\#2}}
  }
}
```

and then pass it through the key `wrap-label={\mywrap{\#1}}` or `wrap-label={\mywrap*{\#1}}`.

`wrap-label*` = { $\langle code \{ \#1 \} more code \rangle$ } default: *empty*

The same as the `wrap-label` key but also applies on `\item[custom]`.

`ref = {\code {\alph*|\Alph*|\arabic*|\roman*|\Roman*} more code}` default: *empty*

Modifies the way *cross references* are displayed. The `label` key sets the default form of the *cross references*, by using this key you can define a different format, for example: `ref=\emph{\alph*}` is valid.

Internally it renews the command associated with each counter when it is executed, i.e., in the environment `enumext` the command `\theenumxi` is modified when the key is executed at the first level, `\theenumxii` when it is executed at the second level and `\theenumxiii` together with `\theenumxiv` when it is executed at the third and fourth levels.

- This must be kept in mind, since the values set by the `label` and `ref` keys are not cumulative by levels, so if you have used the `ref` key in the first level and then want to associate the counter with `label` or `ref` in the second level you must use the direct commands, i.e. `\arabic{enumxi}` to indicate the count of the first level instead of using `\theenumxi`.

5.2 Keys for penalties

Page breaks in the provided environments are controlled by the following three parameters, which work together to ensure they look good, avoiding unsightly page breaks that could distort the output.

`beginpenalty = {\integer}` default: *-51*

Set the *page breaking* penalty for breaking at the beginning of the `enumext`, `enumext*`, `keyans`, and `keyans*` environments. Internally sets the value of `\@beginparpenalty`.

`midpenalty = {\integer}` default: *-51*

Set the *page breaking* penalty for breaking between items of the `enumext`, `enumext*`, `keyans`, and `keyans*` environments. Internally sets the value of `\@itempenalty`.

`endpenalty = {\integer}` default: *-51*

Set the *page breaking* penalty for breaking at the end of the `enumext`, `enumext*`, `keyans`, and `keyans*` environments. Internally sets the value of `\@endparpenalty`.

- The values passed to these *keys* affect the nested environments in which they were set and cannot be reset. \LaTeX default is `-\@lowpenalty`, that is, `-51`. Because it is negative, it somewhat encourages a page break at each spot. Change it with, e.g., `\@beginparpenalty=9999`; a value of `10000` prohibits a page break. Please, refer to your \LaTeX or \TeX manual about how penalties control page breaks.

5.3 Keys for spaces

`show-length = {\true | false}` default: *false*

Displays on the terminal the values for *all list parameters* at the current level. For *vertical spaces* show the values of `\topsep`, `\itemsep`, `\parsep` and `\partopsep`. For *horizontal spaces* show the values of `\labelwidth`, `\labelsep`, `\itemindent`, `\listparindent` and `\leftmargin`.

5.3.1 Vertical spaces

`topsep = {\rubber length | rigid length}` default: *by levels*

Set the *vertical space* added to both the top and bottom of the list. Internally sets the value of `\topsep` for the current level. The default value for the first level of the environments `enumext` and `enumext*` are `8.0pt` plus `2.0pt` minus `4.0pt`, for second level are `4.0pt` plus `2.0pt` minus `1.0pt`, for third and fourth level are `2.0pt` plus `1.0pt` minus `1.0pt`. For `keyans` and `keyans*` environments the default value is `4.0pt` plus `2.0pt` minus `1.0pt`.

`parsep = {\rubber length | rigid length}` default: *by levels*

Set the *vertical space* between paragraphs within an item. Internally sets the value of `\parsep` for the current level. The default value for the first level of the environments `enumext` and `enumext*` are `4.0pt` plus `2.0pt` minus `1.0pt`, for second level are `2.0pt` plus `1.0pt` minus `1.0pt`, for third and fourth level are `0pt`. For `keyans` and `keyans*` environments the default value is `2.0pt` plus `1.0pt` minus `1.0pt`.

- In the `enumext*` and `keyans*` environments this value is passed to `\parskip` within the `minipage` environment where “item content” is placed.

`partopsep = {\rubber length | rigid length}` default: *by levels*

Set the *vertical space* added, beyond `topsep`, to the “top” and “bottom” of the entire environment if the environment instance is preceded by a “blank line” or `\par` command. Internally sets the value of `\partopsep` for the current level. The default values for first and second level in environment `enumext` are `2.0pt` plus `1.0pt` minus `1.0pt`, for third and fourth level are `1.0pt` minus `1.0pt`. For the `keyans` environment the default value is `2.0pt` plus `1.0pt` minus `1.0pt`, and for the `keyans*` and `enumext*` environments it is available but *without* effect.

- The value of this parameter also affects the *inner levels* and the environments `keyans`, `keyanspic` and `keyans*`. Caution should be taken with “blank lines” or `\par` command “before” each environment or nested level when formatting the source code of document. \TeX will enter *vertical mode* and apply this value to the “top” and “bottom” the environment or nested level.

`itemsep = {\rubber length | rigid length}` default: *by levels*

Set the *vertical space* between items, beyond the `parsep`. Internally sets the value of `\itemsep` for the current level. The default value for the first level of the environments `enumext` and `enumext*` are `4.0pt` plus `2.0pt`

minus 1.0pt, for the rest of the levels are 2.0pt plus 1.0pt minus 1.0pt. For `keyans` and `keyans*` environments the default value is 4.0pt plus 2.0pt minus 1.0pt.

- In the `enumext*` and `keyans*` environments this value corresponds to the separation between rows.

`noitemsep` $\langle \text{value forbidden} \rangle$ default: *not used*
This is a “meta-key” that does not receive an argument. Set `itemsep` and `parsep` equal to 0pt the entire level of environment.

`nosep` $\langle \text{value forbidden} \rangle$ default: *not used*
This is a “meta-key” that does not receive an argument. Sets all keys for vertical spacing equal to 0pt the entire level of environment.

`base-fix` $\langle \text{value forbidden} \rangle$ default: *not used*
This is a “switch-key” that does not receive an argument available *only* for the “first level” of environment `enumext`. Fix the *baseline* when an environment `enumext` is nested in `enumext*` and there is no material between the `\item` and the start of the environment for example `\item \begin{enumext}` within the environment `enumext*`. Internally sets the keys `topsep`, `above` and `above*` at 0pt.

- This key is provided as a way to work around this minor issue, but you should be aware that if for some reason you have the `itemindent` key set in the `enumext*` environment it will be lost and you will need to adjust it using the `list-offset` key in the `enumext` environment.

Extra vertical spaces

- The following $\langle \text{keys} \rangle$ should be used with “caution”, they are intended to be used at the “top” and “bottom” of the environment when the `columns` or `mini-env` keys do not provide adequate *vertical spaces*. The values passed can be *rubber* or *rigid* lengths, the way they are applied is the way you differ, using the star ‘*’ $\langle \text{keys} \rangle$ applies `\vspace*` so that \LaTeX does *not discard* this space at page break.

`above` = $\{ \langle \text{rubber length} \mid \text{rigid length} \rangle \}$ default: *not used*
Set the *extra vertical space* added, beyond `topsep`, to the top of the entire level of environment. This key is intended to give a “fine adjustment” of the vertical space “above” the environment without hindering the value of the `topsep` key. The space is added with `\vspace` so is “discardable”.

`above*` = $\{ \langle \text{rubber length} \mid \text{rigid length} \rangle \}$ default: *not used*
Set the *extra vertical space* added, beyond `topsep`, to the top of the entire level of environment. This key is intended to give a “fine adjustment” of the vertical space “above” the environment without hindering the value of the `topsep` key. The space is added with `\vspace*` so is “not discardable”.

`below` = $\{ \langle \text{rubber length} \mid \text{rigid length} \rangle \}$ default: *not used*
Set the *extra vertical space* added, beyond `topsep`, to the bottom of the entire level of environment. This key is intended to give a “fine adjustment” of the vertical space on the “below” the environment without hindering the value of the `topsep` key. The space is added with `\vspace` so is “discardable”.

`below*` = $\{ \langle \text{rubber length} \mid \text{rigid length} \rangle \}$ default: *not used*
Set the *extra vertical space* added, beyond `topsep`, to the bottom of the entire level of environment. This key is intended to give a “fine adjustment” of the vertical space on the “below” the environment without hindering the value of the `topsep` key. The space is added with `\vspace*` so is “not discardable”.

5.3.2 Horizontal spaces

`list-offset` = $\{ \langle \text{rigid length} \rangle \}$ default: 0pt
Sets the *horizontal translation* of the entire environment level from the left edge of the box defined by the `labelwidth` key. Internally sets the values of `\leftmargin` and `\itemindent` for the current level.

`list-indent` = $\{ \langle \text{rigid length} \rangle \}$ default: `labelwidth + labelsep`
Sets the *indentation* of the whole environment under the box defined by `labelwidth` and `labelsep` keys. Internally sets the value of `\leftmargin` and `\itemindent` for the current level. If `list-indent=0pt` is set in the environments `enumext` and `keyans` the $\langle \text{label} \rangle$ will be part of the text, separated by the value of the `labelsep` key and the *first word*, in simple terms it will look like a “common paragraph”.

- The `enumext*` and `keyans*` environments are implemented using `\makebox` and `minipage` which causes “list indent” to always be equal to the value passed to `labelwidth` plus `labelsep`. Passing a value to this key is equivalent to setting the value for the `list-offset` key.

`itemindent` = $\{ \langle \text{rigid length} \rangle \}$ default: 0pt
Sets the extra *horizontal indentation*, beyond `labelsep`, of the “first line” off each `\item` that is not followed by a “blank line” or the `\par` command. This value must be greater than or equal to 0pt and is applied internally using `\hspace` without modifying the value of `\itemindent`.

- This key is intended for the `enumext*` and `keyans*` environments where, by their implementation, it is not possible to adjust `labelwidth` and `list-indent` without modifying the output. If you use `enumext` or `keyans` and want to get around the *blank line* limitation or the `\par` command followed by `\item` you can modify `labelwidth` and `list-indent` and get the same effect.

`rightmargin = {⟨rigid length⟩}` default: `0pt`

Set the *horizontal space* between the right margin of the environment and the right margin of the enclosing environment, the value it takes must be greater than or equal to `0pt`. Internally sets the value of `\rightmargin` for the current level.

`listparindent = {⟨rigid length⟩}` default: `0pt`

Sets the *horizontal space* indentation, beyond `list-indent`, for second and subsequent paragraphs within a list item. Internally sets the value of `\listparindent` for the current level.

- In the `enumext*` and `keyans*` environments this value is passed to `\parindent` within the `minipage` environment where “item content” is placed.

5.4 Keys for add code

The following *⟨keys⟩* should be used with “caution”, they are intended to inject `{⟨code⟩}` into different parts of the defined environments. We must keep in mind that the defined environments are based on the `list` base environment provided by \TeX which is defined (simplified) as plain form `\list{⟨arg one⟩}{⟨arg two⟩}`. Using the `before*` key does not allow access to the `list` parameters defined by `[⟨key = val⟩]`.

`before = {⟨code⟩}` default: *not used*

Execute `{⟨code⟩}` “before” the environment starts. The `{⟨code⟩}` must be passed between braces, is executed “after” all calculations related to the *list parameters* in the environment and the *⟨keys⟩* sets by `[⟨key = val⟩]` have been performed, with the exception of the *⟨keys⟩* `start` and `start*`, that is, in the *second argument* of the list: `\begin{list}{⟨arg one⟩}{⟨arg two⟩}{⟨code⟩}`.

`before* = {⟨code⟩}` default: *not used*

Execute `{⟨code⟩}` “before” the environment starts. The `{⟨code⟩}` must be passed between braces, is executed “before” performing all calculations related to the *list parameters* and the *⟨keys⟩* sets in `[⟨key = val⟩]` of the environment that is, “before” the arguments defining the list environment are executed: `{⟨code⟩}\begin{list}{⟨arg one⟩}{⟨arg two⟩}`.

`first = {⟨code⟩}` default: *not used*

Executes `{⟨code⟩}` when “starting” the environment. The `{⟨code⟩}` must be passed between braces, is executed right “after” all *list parameters* are done, after the second argument of list, just before the first occurrence of `\item`: `\begin{list}{⟨arg one⟩}{⟨arg two⟩}{⟨code⟩}\item`.

- Keep in mind that the `{⟨code⟩}` set in this *⟨key⟩* will affect the entire “body” of the environment and therefore the inner levels of the list and the `keyans`, `keyans*` and `keyanspic` environments. It is recommended to set this *⟨key⟩* per level. In the `enumext*` and `keyans*` environments this *⟨key⟩* is executed “after” the `listparindent`, `parsep` and `itemindent` *⟨keys⟩* within the `minipage` environment in which the “item content” is placed.

`after = {⟨code⟩}` default: *not used*

Execute `{⟨code⟩}` “after” finishing the environment. The `{⟨code⟩}` must be passed between braces.

5.5 Keys for start, series and resume

`start = {⟨integer | integer expression⟩}` default: `1`

Sets the *start value* of the numbering on the current level. The `{⟨integer expression⟩}` must be passed between braces, internally is evaluated and pass to the counter defined by `label` key on the current level, i.e. it is equivalent to enter `start={\dimeval{100*⟨value⟩}{chapter}}` or `start={100*⟨value⟩}{chapter}}`.

`start* = {⟨integer | string⟩}` default: *not used*

Sets the *start value* of the numbering on the current level. Internally *⟨string⟩* is converted and passed as value to the counter defined by `label` key on the current level, i.e. it is equivalent to enter `start*=5`, `start*=E` or `start*=v`.

- For compatibility with tagged PDF, the *start counter* are set “after” the *second argument* to the `list` environment and “before” the execution of the first `\item` and the `first` key: `\begin{list}{⟨arg one⟩}{⟨arg two⟩}\setcounter{enumX}\item`.
- The following *⟨keys⟩* are “only” available for the `enumext*` environment and the “first level” of the `enumext` environment and are ignored if set when nested within each other.

`series = {⟨series name⟩}` default: *not used*

Stores the *keys* of the *optional argument* of the “first level” of the environment in which it is executed in `{⟨series name⟩}` which is used as an argument in the key `resume`. The *⟨keys⟩* stored in `{⟨series name⟩}` are not cumulative and are overwritten if the same `{⟨series name⟩}` is used again.

`resume = {⟨series name⟩}` default: *not used*

Sets the *start value* and *options* for the “first level” continuing the numbering of the environment in which the `series={⟨series name⟩}` key was executed. If passed *without value* this will only set *start value* continue the numbering from the last environment in which `series={⟨series name⟩}` or `resume={⟨series name⟩}` is NOT present and if the `save-ans` key is active it will continue the numbering from the last environment in which it was executed. The *start value* can be overwritten using `start` or `start*` keys.

`resume* ⟨value forbidden⟩` default: *not used*

Sets the *start value* and *options* for the “first level” continuing the numbering of the environment in which the `series={⟨series name⟩}` or `resume={⟨series name⟩}` keys are NOT present, if the `save-ans` key is active

it will continue the numbering from the last environment in which it was executed. The *start value* can be overwritten using `start` or `start*` keys.

- For security reasons the `series` key will never save in $\{\langle series\ name\rangle\}$ the keys `series`, `resume`, `resume*`, `save-ans`, `save-key`, `start*` and `start`. When using the key `resume=\{\langle series\ name\rangle\}` it will have hierarchy in the $\langle keys\rangle$ that are saved in $\{\langle series\ name\rangle\}$, in order to establish the value of a $\langle key\rangle$ already saved in $\{\langle series\ name\rangle\}$ it must be placed to the “right” of `resume=\{\langle series\ name\rangle\}`, the same thing happens with the `resume*` key, the exception is the `save-ans` key that must be placed on the “left” if you want to start the numbering with its value. The `resume` key passed “without value” must be exactly “without value”, i.e. `resume=` cannot be used and if executed before `resume*` it will affect the *start value*.

5.6 Keys for multicols

`columns = \{\langle integer\rangle\}`

default: 1

Set the *number of columns* to be used by the `multicols` environment within the environments `enumext` and `keyans`. The value must be a positive integer less than or equal to 10. In the `enumext*` and `keyans*` environments they correspond to the default number of columns (without joining) and internally adjust the value of `\itemwidth`.

`columns-sep = \{\langle rigid\ length\rangle\}`

default: by level

Set the *space between columns* used by the `multicols` environment within the environments `enumext` and `keyans`. Internally sets the value of `\columnsep`, by default its value is equal to the sum of the values set in the keys `labelwidth` and `labelsep` of the current level. In the `enumext*` and `keyans*` environments they correspond to the *space between columns* (without joining) and internally adjust the value of `\itemwidth`.

5.7 Keys for minipage

`mini-env = \{\langle rigid\ length\rangle\}`

default: not used

Sets the *width* of the `minipage` environment on the “right side”. This value added to the value set by the `mini-sep` key to determines the *width* of the `minipage` environment on the “left side”, taking `\linewidth` as the maximum reference value.

`mini-sep = \{\langle rigid\ length\rangle\}`

default: 0.3333em

Sets the *space between* the `minipage` environment on the “left side” and the `minipage` environment on the “right side”. This separation is applied together with `\hfill`.

5.7.1 The command `\miniright`

```
\miniright \begin{enumext}[mini-env=\{\langle rigid\ length\rangle\}] \item's before \item \miniright \langle content\rangle \end{enumext}
\begin{enumext}[mini-env=\{\langle rigid\ length\rangle\}] \item's before \item \miniright* \langle content\rangle \end{enumext}
```

The `\miniright` command close the `minipage` environment on the “left side” and opens the `minipage` environment on the “right side” by starting it with the `\centering` command. It must be placed “after” the last `\item` of the current environment and “before” starting the material to be placed on the “right side”.

The *starred argument* “*” inhibits the use of `\centering` command i.e. the usual L^AT_EX justification is maintained in the `minipage` on the “right side”.

5.7.2 The key `mini-right`

In the *horizontal list environments* `enumext*` and `keyans*` it is not possible to use the `\miniright` command and the `mini-right` key must be used instead.

`mini-right = \{\langle content\rangle\}`

default: not used

Set the *content* for the drawing or tabular to be placed in the `minipage` environment on the “right side” by starting it with `\centering`. The $\{\langle content\rangle\}$ must be passed between braces.

`mini-right* = \{\langle content\rangle\}`

default: not used

Same as above, but *without* starting with `\centering`.

6 The storage system

The entire mechanism for “*storing content*” it is activated according to `save-ans` key on the “*first level*” of `enumext` or `enumext*` environments and it is ignored if they are established when they are nested inside each other. Only when this $\langle key\rangle$ is “*active*” the `\anskey` command and the environments `anskey*`, `keyans`, `keyans*` and `keyanspic` are available.

<code>\begin{enumext}[save-ans=\{\langle store\ name\rangle\}]</code>	<code>\begin{enumext}[save-ans=\{\langle store\ name\rangle\}]</code>
<code>\item Text \anskey{answer}</code>	<code>\item Text \anskey{answer}</code>
<code>\item Text</code>	<code>\item Text</code>
<code>\begin{keyans}</code>	<code>\begin{keyanspic}</code>
<code>...</code>	<code>...</code>
<code>\end{keyans}</code>	<code>\end{keyanspic}</code>
<code>\end{enumext}</code>	<code>\end{enumext}</code>

By executing the key `save-ans=\{\langle store\ name\rangle\}` the entire “*structure*” of the environment (excluding the *first level*) including the *optional argument* passed to the inner levels or the environment nested in it, along with the

$\langle content \rangle$ passed to $\backslash anskey$ or $anskey^*$, the current $\langle labels \rangle$ for $\backslash item^*$ and $\backslash anspic^*$ in the environments $keyans$, $keyans^*$ and $keyanspic$ will be “stored” in a *sequence* $\{\langle store name \rangle\}$ and at the same time will be “stored” (without the “structure” or *optional argument*) in a *prop list* $\{\langle store name \rangle\}$.

For security reasons the *optional argument* of the inner levels or the nested environment are *filtered* by excluding all $\langle keys \rangle$ related to the “storage system” (§6.1) along with the keys `mini-env`, `mini-sep`, `mini-right`, `mini-right^*`, `series`, `resume` and `resume^*` when storing in *sequence* $\{\langle store name \rangle\}$ set by `save-ans` key.

6.1 Keys for storage system

The only $\langle keys \rangle$ available for all levels of the `enumext` environment and the `enumext^*` environment are `no-store` and `save-key`, the rest of the $\langle keys \rangle$ described in this section must be passed directly in the *optional argument* of the “first level” of the environment in which the key `save-ans` is executed. The key `save-ans` should NOT be passed with the command `\setenumext`.

`save-ans` = $\{\langle store name \rangle\}$ default: *not set*

Sets the *name* of the *sequence* and *prop list* in which the $\{\langle contents \rangle\}$ will be “stored” by $\backslash anskey$ and $anskey^*$ in `enumext` and `enumext^*` environments and the current $\langle labels \rangle$ for $\backslash item^*$ and $\backslash anspic^*$ in the environments $keyans$, $keyans^*$ and $keyanspic$. If the *sequence* or *prop list* $\{\langle store name \rangle\}$ does not exist, it will be created globally and will not be *overwritten* if the key is used again.

`save-key` = $\{\langle key list \rangle\}$ default: *not set*

This key *overrides* the default “stored keys” of the *optional argument* of the inner levels or nested environment that will be passed to the *sequence*. The $\langle key list \rangle$ passed to this key ignores any $\langle keys \rangle$ in the “stored structure” and must be passed between braces. For example, if we execute at a second level:

```
\begin{enumext}[save-ans={\langle store name \rangle}]
  \item Text \anskey{answer}
  \item Text
    \begin{enumext}[nosep, columns=2, save-key={columns=3}]
      ...
    \end{enumext}
\end{enumext}
```

The “stored keys” by default in the *sequence* $\{\langle store name \rangle\}$ would be `nosep`, `columns=2`, but using the key `save-key={columns=3}` will overwrite and the “stored key” in the *sequence* $\{\langle store name \rangle\}$ are only `columns=3` ignoring all the others.

`save-sep` = $\{\langle text symbol \rangle\}$ default: $\{, \}$

Sets the *text symbol* that will separate the current $\langle label \rangle$ to the *optional argument* passed to the $\backslash item^*$ and $\backslash anspic^*$ in the environments $keyans$, $keyans^*$ and $keyanspic$ and storing them in the *sequence* and *prop list* $\{\langle store name \rangle\}$ set by `save-ans` key. The $\{\langle text symbol \rangle\}$ must always be passed between braces, whitespace ‘`␣`’ is preserved within the braces and only affects the “stored content” and not what is displayed when using the `show-ans` or `show-pos` keys.

`no-store` $\langle value forbidden \rangle$ default: *not used*

This is a “switch-key” that does not receive an argument and disables the “storing content” in the *sequence* and *prop list* $\{\langle store name \rangle\}$ set by `save-ans` key at the entire level or a nested environment in which it runs. This key is intended for use in internal levels or nested `enumext` or `enumext^*` environments in which you want to use `enumext` or `enumext^*` but “without” using the $\backslash anskey$ command or use $anskey^*$ environment and “without” interfering with the `check-ans` key.

6.1.1 Keys for label and ref

`save-ref` = $\{\langle true | false \rangle\}$ default: *false*

Activates the “internal label and ref” mechanism for referencing “stored content” in *prop list* $\{\langle store name \rangle\}$ set by `save-ans` key. To reference the location of the “stored content” within the environment you must use $\backslash ref\{\langle store name : position \rangle\}$, where $\langle position \rangle$ corresponds to the position occupied by the “stored content” in the *prop list* $\{\langle store name \rangle\}$ returned by the `show-pos` key. For example $\backslash ref\{test:4\}$ will return `3`. (b) which corresponds to the location of the “stored content” at position `4` in *prop list* `test` within the environment in which the key `save-ans=test` was set.

`mark-ref` = $\{\langle symbol \rangle\}$ default: `\textreferencemark`

Sets the *symbol* that will be displayed by the $\backslash printkeyans$ command only if the `hyperref` package is detected and the `save-ref` key are active. This “symbol” is used as a “link” between the environment in which the `save-ans` key was used and the place where the command is executed.

6.1.2 Keys for wrap and marks

The `enumext` package provides a set of $\langle keys \rangle$ to set and manipulate “symbol marks” associated with “answers” and how they are displayed and stored in the *sequence* and *prop list*.

The $\langle keys \rangle$ available for the $\backslash anskey$ command and the $anskey^*$ environment can be passed “only” in the *optional argument* in the “first level” of the `enumext` or `enumext^*` environment.

The $\langle keys \rangle$ available for the $keyans$ and $keyans^*$ environments can be passed locally in the *optional argument*, at the “first level” of the `enumext` or `enumext^*` environment or via the $\backslash setenumext$ command with one

minor difference, when $\langle keys \rangle$ are passed through the “first level” of the `enumext` or `enumext*` environment they are set in “both” environments, but when they are passed using the `\setenumext` command they are set “individually” in each environment.

`show-ans = { $\langle true | false \rangle$ }` default: `false`

Display the *symbol* set by the `mark-ans` key to the left of the *mandatory argument* $\langle content \rangle$ passed to the `\anskey` command and $\langle body \rangle$ for the `anskey*` environment using the `wrap-ans` key if set.

For `\item*` and `\anspic*` the `keyans`, `keyans*` and `keyanspic` environments it will display the *symbol* set by the `mark-ans*` key to the left of the current $\langle label \rangle$ and *optional argument*. If the *optional argument* is present in `\item*` or `\anspic*` it will be shown using `wrap-opt` key.

Keys for `\anskey` and `anskey*`

`mark-ans = { $\langle symbol \rangle$ }` default: `\textasteriskcentered`

Sets the *symbol* to be displayed in the left margin for `\anskey` command and `anskey*` environment when using the key `show-ans`. The “*symbol*” is placed in a box of width equal to the value of `labelwidth` at the current level, separated by the value of the key `mark-sep` and aligned by the value of the key `mark-pos`. This key is not affected by the keys `font` or `wrap-label` so if you want to apply *styling* you have to do it directly, for example: `mark-ans={\textcolor{red}{\textbf{\textasteriskcentered}}}`

`mark-pos = { $\langle left | right | center \rangle$ }` default: `left`

Sets the *aligned* of the “*symbol*” defined by `mark-ans` key for `\anskey` command and `anskey*` environment. The “*symbol*” is aligned in a box with the same dimensions of the label box defined by `labelwidth` key on the current level and separated by the value of the `mark-sep` key.

`mark-sep = { $\langle rigid length \rangle$ }` default: `labelsep`

Sets the *horizontal space* between the box containing the “*symbol*” defined by `mark-ans` key and the *mandatory argument* $\langle content \rangle$ passed to the `\anskey` command and the *body* in `anskey*` environment.

`wrap-ans = { $\langle code \{ \#1 \} \text{ more code} \rangle$ }` default: `\fbox+\parbox{\#1}`

Wraps the *mandatory argument* $\langle content \rangle$ passed to the `\anskey` and the *body* in `anskey*` environment referenced by $\{ \#1 \}$ when using the `show-ans` or `show-pos` keys. The $\{ \langle code \rangle \}$ must be passed between braces and only affects how the *argument* or *body* is displayed and NOT the “*stored content*” in the *sequence* and *prop list* $\{ \langle store name \rangle \}$ set by `save-ans` key. If this key is passed using `\setenumext` it is necessary to use double $\{ \{ \#1 \} \}$.

Keys for `keyans`, `keyans*` and `keyanspic`

`mark-ans* = { $\langle symbol \rangle$ }` default: `\textasteriskcentered`

Sets the *symbol* to be displayed in the left margin for `\item*` and `\anspic*` for the `keyans`, `keyans*` and `keyanspic` environments when using the key `show-ans`. The “*symbol*” is placed in a box of width equal to the value of `labelwidth` of the environment in which it is executed, separated by the value of the key `mark-sep*` and aligned by the value of the key `mark-pos*`. This key is not affected by the keys `font` or `wrap-label` so if you want to apply *styling* you have to do it directly, for example: `mark-ans*={\textcolor{red}{\textbf{\textasteriskcentered}}}`.

`mark-pos* = { $\langle left | right | center \rangle$ }` default: `left`

Sets the *aligned* of the “*symbol*” defined by `mark-ans*` key for the `keyans`, `keyans*` and `keyanspic` environments. The “*symbol*” is aligned in a box with the same dimensions of the label box defined by `labelwidth` key of the environment in which it is executed and separated by the value of the `mark-sep*` key.

`mark-sep* = { $\langle rigid length \rangle$ }` default: `labelsep`

Sets the *horizontal space* between the box containing the “*symbol*” defined by `mark-ans*` key and the current $\langle label \rangle$ for `\item*` and `\anspic*` in the `keyans`, `keyans*` and `keyanspic` environments.

`wrap-ans* = { $\langle code \{ \#1 \} \text{ more code} \rangle$ }` default: `not used`

Wraps the *current* $\langle label \rangle$ when using the `show-ans` key for `\item*` and `\anspic*` referenced by $\{ \#1 \}$ in the `keyans`, `keyans*` and `keyanspic` environments after executing the `align` and `font` keys. The $\{ \langle code \rangle \}$ must be passed between braces and *only* affects how the $\langle label \rangle$ is displayed and NOT the “*stored label*” in the *sequence* and *prop list* $\{ \langle store name \rangle \}$ set by `save-ans` key. This key overwrites the key `wrap-label` and if is passed using `\setenumext` it is necessary to use double $\{ \{ \#1 \} \}$. For example, if you want the $\langle label \rangle$ to be displayed in red when using `show-ans` you just set `wrap-ans*={\textcolor{red}{\#1}}`.

`wrap-opt = { $\langle code \{ \#1 \} \text{ more code} \rangle$ }` default: `[[\#1]]`

Wraps the *optional argument* passed to the `\item*` and `\anspic*` referenced by $\{ \#1 \}$ in the `keyans`, `keyans*` and `keyanspic` environments when using the `show-ans` or `show-pos` keys. The $\{ \langle code \rangle \}$ must be passed between braces and *only* affects the current *optional argument* and NOT the “*stored content*” in the *sequence* and *prop list* $\{ \langle store name \rangle \}$ set by `save-ans` key. If this key is passed using `\setenumext` it is necessary to use double $\{ \{ \#1 \} \}$.

6.1.3 Keys for debug and checking

`show-pos = {⟨true | false⟩}` default: *false*

Displays the *position* occupied by the “stored content” by `\anskey`, `anskey*`, `\item*` and `\anspic*` in the *prop list* {⟨*store name*⟩} set by `save-ans` key. This position is used by the `\getkeyans` command and by the `\ref` command if the `save-ref` key is active.

`check-ans = {⟨true | false⟩}` default: *false*

Enables the *checking answer* mechanism displaying an appropriate message on the terminal. This key works under the logic that each `\item` or `\item*` that does not open an inner level or nested environment contains “only one answer” or “only one execution” of the `\anskey` or `anskey*`. It is intended to be used in conjunction with the `no-store` key.

6.2 The command `\anskey`

`\anskey` `\anskey`[⟨*keys*⟩][⟨*content*⟩]

The command `\anskey` takes a mandatory non empty argument {⟨*content*⟩} and “stores” it in the *sequence* and *prop list* {⟨*store name*⟩} set by `save-ans` key. By design the command cannot be nested or passed *verbatim material* in the argument and it is assumed that each *numbered* `\item` or `\item*` within the environment in which it is active it has a “single execution” of `\anskey` unless `\item` or `\item*` open a nested level or use the `no-store` key.

If `save-ref` key are active and the `hyperref`[8] package is detected, `\hyperlink` and `\hypertarget` will be used, otherwise the usual “label and ref” system provided by L^AT_EX will be used.

The `\anskey` command is available for all levels of the `enumext` environment and the `enumext*` environment, but is disabled for the `keyans`, `keyans*` and `keyanspic` environments.

6.2.1 Keys for `\anskey`

By default the *mandatory argument* {⟨*content*⟩} passed to `\anskey` when “storing” in the *sequence* {⟨*store name*⟩} has the form `\item` {⟨*content*⟩}, the following {⟨*keys*⟩} allow modifying the way in which it is “stored” in the *sequence*.

`break-col` {⟨*value forbidden*⟩} default: *not used*

Stores {⟨*content*⟩} in the *sequence* {⟨*store name*⟩} of the form `\columnbreak` `\item` {⟨*content*⟩}.

`item-join` = {⟨*columns*⟩} default: *not set*

Set the *number of columns* to be used for `\item`(⟨*columns*⟩) and stores {⟨*content*⟩} in the *sequence* {⟨*store name*⟩} of the form `\item`(⟨*columns*⟩) {⟨*content*⟩}.

`item-star` {⟨*value forbidden*⟩} default: *not used*

Stores {⟨*content*⟩} in the *sequence* {⟨*store name*⟩} of the form `\item*` {⟨*content*⟩}.

`item-sym*` = {⟨*symbol*⟩} default: *not set*

Sets the *symbol* for `\item*` when using the key `item-star` and stores {⟨*content*⟩} in the *sequence* {⟨*store name*⟩} of the form `\item*`[⟨*symbol*⟩] {⟨*content*⟩}. The *symbol* can be in text or math mode, for example `item-sym*={\ast}` stores `\item*[\ast]` {⟨*content*⟩}.

`item-pos*` = {⟨*rigid length*⟩} default: *not set*

Sets the *offset* for `\item*` when using the keys `item-star` and `item-sym*` and stores {⟨*content*⟩} in the *sequence* {⟨*store name*⟩} of the form `\item*`[⟨*symbol*⟩][⟨*offset*⟩] {⟨*content*⟩}.

Example

```
\begin{enumext}[save-ans=test,show-ans=true]
  \item* Text containing our instructions or questions. \anskey{first answer}
  \item Text containing our instructions or questions.
    \begin{enumext}
      \item Question.\anskey{second answer}
    \end{enumext}
  \item Text containing our instructions or questions. \anskey{third answer}
  \item Text containing our instructions or questions. \anskey{fourth answer}
\end{enumext}
```

- ★ 1. Text containing our instructions or questions.

*

first answer
2. Text containing our instructions or questions.

(a) Question.

*

second answer
3. Text containing our instructions or questions.

*

third answer
4. Text containing our instructions or questions.

*

fourth answer

6.3 The environment anskey*

anskey* `\begin{anskey*}[\langle key = val \rangle] \langle body content \rangle \end{anskey*}`

The environment `anskey*` takes a mandatory `\langle body content \rangle` and “stores it” in the *sequence* and *prop list* `\langle store name \rangle` set by `save-ans` key. If `save-ref` key are active and the `hyperref`[8] package is detected `\hyperLink` and `\hypertarget` will be used, otherwise the usual “*label and ref*” system provided by L^AT_EX will be used.

By design the environment cannot be nested but full supports “*verbatim material*” in the `\langle body \rangle` and it is assumed that “*each numbered*” `\item` or `\item*` within the environment in which it is active it has a “*single execution*” unless `\item` or `\item*` open a nested level or use the `no-store` key.

The `anskey*` environment is implemented using the new “*collect code*” c-type argument part of L^AT_EX release 2025-06-01[13]. `\begin{anskey*}` and `\end{anskey*}` must be in different lines and should not appear within verbatim environments or commands. All `\langle keys \rangle` must be passed separated by commas and “without separation” of the start of the environment.

Comments “%” or “any character” after `\begin{anskey*}` or `[\langle key = val \rangle]` on the same line are NOT supported, L^AT_EX will return an “error” message if this happens. In a similar way comments “%” or “any character” after `\end{anskey*}` on the same line L^AT_EX will return a “warning” message.

6.3.1 Keys for anskey*

The `anskey*` environment uses the same `\langle keys \rangle` as the `\anskey` command next to the `\langle keys \rangle` `write-env`, `overwrite` and `force-eol`. The environment is available for all levels of the `enumext` environment and the `enumext*` environment, but it is disabled for the `keyans`, `keyans*` and `keyanspic` environments.

`write-env` = `\langle file.ext \rangle` default: *not used*

Sets the name of the `\langle external file \rangle` in which the `\langle contents \rangle` of the environment will be written. The `\langle file.ext \rangle` will be created in the working directory, relative or absolute paths are not supported. If `\langle file.ext \rangle` does not exist, it will be created or overwritten if the `overwrite` key is used.

`overwrite` = `\langle true | false \rangle` default: *false*

Sets whether the `\langle file.ext \rangle` generated by `write-env` from the `anskey*` environment will be rewritten.

`force-eol` = `\langle true | false \rangle` default: *false*

Sets if the *end of line* for the `\langle stored content \rangle` is hidden or not. This key is necessary only if the last line is the closing of some environment defined by the `fancyvrb` package as `\end{Verbatim}` or another environment that does not support a comments “%” after closing `\end{Verbatim}%`.

Example

```
\begin{enumext}[save-ans=test,show-pos=true,start=5]
  \item* Text containing our instructions or questions.

  \begin{anskey*}[item-star]
    \langle first answer \rangle
  \end{anskey*}

  \item Text containing our instructions or questions.

  \begin{enumext}
    \item Question.
    \begin{anskey*}
      \langle second answer \rangle
    \end{anskey*}
  \end{enumext}

  \item Text containing our instructions or questions.

  \begin{anskey*}
    \langle third answer \rangle
  \end{anskey*}

  \item Text containing our instructions or questions.

  \begin{anskey*}
    \langle fourth answer \rangle
  \end{anskey*}
\end{enumext}
```

★ 5. Text containing our instructions or questions.

[5] First answer with verbatim

6. Text containing our instructions or questions.

(a) Question.

[6] second answer

7. Text containing our instructions or questions.

[7] third answer

8. Text containing our instructions or questions.

[8] fourth answer

6.4 The environments `keyans` and `keyans*`

`keyans` `\begin{keyans}[\langle key = val \rangle] \item \item[\langle custom \rangle] \item* \item*[\langle content \rangle] \end{keyans}`

`keyans*` `\begin{keyans*}[\langle key = val \rangle] \item \item[\langle custom \rangle] \item* \item*[\langle content \rangle] \end{keyans*}`

The `keyans` and `keyans*` environments are “*enumerated list*” environments designed for “*multiple choice*” questions activated by the `save-ans` key. This environments can NOT be nested and must always be at the “*first level*” of the `enumext` environment, the commands `\item` and `\item[\langle custom \rangle]` work in the usual and the command `\item(\langle columns \rangle)` is available for the `keyans*` environment.

🟡 The behavior of `\item*` in `keyans` and `keyans*` environments is NOT the same as in the `enumext` or `enumext*` environments.

```
\begin{enumext}[save-ans=test]
  \item \langle item content \rangle
  \begin{keyans}[\langle key = val \rangle]
    \item \langle item content \rangle
    \item [\langle custom \rangle] \langle item content \rangle
    \item* \langle item content \rangle
    \item*[\langle content \rangle] \langle item content \rangle
  \end{keyans}
\end{enumext}
```

```
\begin{enumext}[save-ans=test]
  \item \langle item content \rangle
  \begin{keyans*}[\langle key = val \rangle]
    \item \langle item content \rangle
    \item [\langle custom \rangle] \langle item content \rangle
    \item* \langle item content \rangle
    \item*[\langle content \rangle] \langle item content \rangle
  \end{keyans*}
\end{enumext}
```

The `\langle keys \rangle` set in the *optional argument* of the environment are the same (almost) as those of the `enumext` and `enumext*` environments and have *higher precedence* than those set by `\setenumext[\langle keyans \rangle]{\langle key = val \rangle}` or `\setenumext[\langle keyans* \rangle]{\langle key = val \rangle}`. If the *optional argument* is not passed or the `\langle keys \rangle` are not set by `\setenumext`, the default values will be the same as the “*second level*” of the `enumext` environment with the difference in the `\langle label \rangle` which will be set to `label=\Alph*`.

The keys `mark-ans*`, `mark-pos*`, `mark-sep*`, `save-sep`, `wrap-opt`, `wrap-ans*`, `show-ans` and `show-pos` are available for both environments.

6.4.1 The `\item*` in `keyans` and `keyans*`

`\item*` `\item*`
`\item*[\langle content \rangle]`

The `\item*` and `\item*[\langle content \rangle]` command “*store*” the current `\langle label \rangle` set by `label` key next to the *optional argument* `\langle content \rangle` in *sequence* and *prop list* `{\langle store name \rangle}` set by `save-ans` key in the “*first level*” of the `enumext` or `enumext*` environments.

The *starred argument* “`*`” cannot be separated by spaces ‘`␣`’ from the command, i.e. `\item*` and the *optional argument* does “*NOT*” support *verbatim content*. By design it is assumed that the `\item*` will only appear “*once*” within the environment.

Example

```
\begin{enumext}[save-ans=test,columns=2,show-ans=true]
  \item Text containing a question.

  \begin{keyans*}[nosep,columns=2]
    \item Choice
    \item* Correct choice
    \item Choice
    \item Choice
    \item Choice
  \end{keyans*}


  \item Text containing a question and image.

  \begin{keyans}[nosep,mini-env={0.4\linewidth}]
    \item Choice
    \item Choice
    \item Choice
    \item Choice
    \item*[\langle note \rangle] Correct choice
    \miniright
    \includegraphics[scale=0.25]{example-image-a}
    Some text
  \end{keyans}
```

```
\end{keyans}  
\end{enumext}
```

1. Text containing a question.
A) Choice
C) Choice
E) Choice

* B) Correct choice
D) Choice
2. Text containing a question and image.
A) Choice
B) Choice
C) Choice
D) Choice
* E) [note] Correct choice


Some text

6.5 The environment keyanspic

```
keyanspic \begin{keyanspic}[\langle key = val \rangle] \anspic*[\langle content \rangle]{\langle drawing or tabular \rangle} \end{keyanspic}
```

The `keyanspic` environment is an “*enumerated list*” environment activated by the `save-ans` key that has the same configuration for “*spacing*” and `\label` as the `keyans` environment that uses the `\anspic` command instead of `\item`. It is intended for placing *drawings or tabular* with `\label` centered *above* or *below* in a *single line* or *upper and lower* layout style.

When the `keyanspic` environment is used *without keys* the `\labels` are centered *below* the *drawings or tabular* in a *single line* layout style.

A representation of the output can be seen in the figure 6.

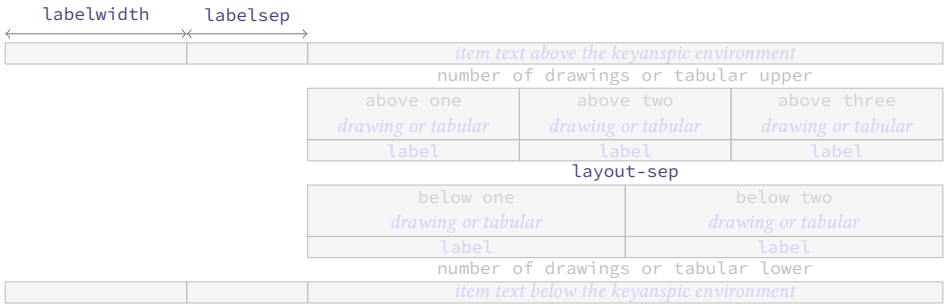


Figure 6: Representation of the `keyanspic` environment with `layout-sty={3, 2}` in `enumext`.

This environment cannot be nested and must *always* be at the “*first level*” of the `enumext` environment, the `\item` command is disabled and `\keys` cannot be set using `\setenumext`.

6.5.1 Keys for keyanspic

```
label-pos = {\langle above | below \rangle} default: below
```

Set the *position* of `\label` to be centered “*above*” or “*below*” *drawings or tabular* when the `\anspic` command is executed.

```
label-sep = {\langle rubber length | rigid length \rangle} default: internal adjustment
```

Set the *vertical spacing* between the `\label` centered “*above*” or “*below*” and *drawings or tabular* when running the `\anspic` command.

```
layout-sty = {\langle n° upper , n° lower \rangle} default: not set
```

Set the *number of drawings or tabular* that will be distributed “*upper*” and “*lower*” within the environment when executing the `\anspic` command. The value must be passed in braces and if not set or the `\n° lower` is omitted the *drawings or tabular* will be put on a *single line*.

```
layout-sep = {\langle rubber length | rigid length \rangle} default: adjusted parsep from keyans
```

Set the *vertical separation* between the number of *drawings or tabular* placed at the “*upper*” and “*lower*” within the environment when executing the `\anspic` command. Internally adjusts the `parsep` value taken from the `keyans` environment.

```
layout-top = {\langle rubber length | rigid length \rangle} default: adjusted topsep from keyans
```

Set the *vertical space* added to both the top and bottom of the environment. Internally adjust the value of `topsep` taken from `keyans` environment.

The keys `mark-ans*`, `mark-pos*`, `mark-sep*`, `save-sep`, `wrap-opt`, `wrap-ans*`, `show-ans` and `show-pos` are available for this environment.

6.5.2 The command \anspic

```
\anspic \anspic{\langle drawing or tabular \rangle}  
\anspic*[\langle content \rangle]{\langle drawing or tabular \rangle}
```

The `\anspic` command take three arguments, the *starred argument* “`*`” store the current `\label` next to the *optional argument* `\langle content \rangle` in *sequence* and *prop list* `{\langle store name \rangle}` set by `save-ans` key.

The *starred argument* “`*`” cannot be separated by spaces “`␣`” from the command, i.e. `\anspic*` and the *optional argument* does “*NOT*” support *verbatim content*. By design it is assumed that the *starred argument* “`*`” will only appear “*once*” within the environment.

Example

```

\begin{enumext}[save-ans=test,show-ans=true,nosep]
  \item Question with images and labels below.

  \begin{keyanspic}[layout-sty={3,2}]
    \anspic{\includegraphics[scale=0.15]{example-image-a}}
    \anspic{\includegraphics[scale=0.15]{example-image-b}}
    \anspic{\includegraphics[scale=0.15]{example-image-a}}
    \anspic{\includegraphics[scale=0.15]{example-image-a}}
    \anspic*[note]{\includegraphics[scale=0.15]{example-image-a}}
  \end{keyanspic}

  \item Question with images and labels above.

  \begin{keyanspic}[label-pos=above, layout-sty={3,2},layout-sep=0.25cm]
    \anspic{\includegraphics[scale=0.15]{example-image-a}}
    \anspic{\includegraphics[scale=0.15]{example-image-b}}
    \anspic{\includegraphics[scale=0.15]{example-image-a}}
    \anspic{\includegraphics[scale=0.15]{example-image-a}}
    \anspic*[note]{\includegraphics[scale=0.15]{example-image-a}}
  \end{keyanspic}

  \item Question with images and labels below on a single line.

  \begin{keyanspic}
    \anspic{\includegraphics[scale=0.15]{example-image-a}}
    \anspic{\includegraphics[scale=0.15]{example-image-b}}
    \anspic{\includegraphics[scale=0.15]{example-image-a}}
    \anspic{\includegraphics[scale=0.15]{example-image-a}}
    \anspic*[note]{\includegraphics[scale=0.15]{example-image-a}}
  \end{keyanspic}

\end{enumext}

```


1. Question with images and labels below.



A)



B)



C)

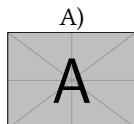


D)

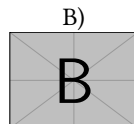


* E) [note]

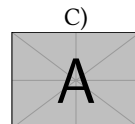
2. Question with images and labels above.



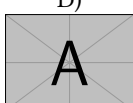
A)



B)



C)



D)



* E) [note]

3. Question with images and labels below on a single line.



A)



B)



C)



D)



* E) [note]

Remember to pass the `alt={description}` key to the `\includegraphics` command when creating a *tagged* PDF.

6.6 Printing stored content

6.6.1 The command `\getkeyans`

```
\getkeyans \getkeyans{<store name> : <position>}
```

The command `\getkeyans` prints the “stored content” in *prop list* `{<store name>}` defined by `save-ans` key in the `<position>` returned by the `show-pos` key.

The “stored content” can only be accessed *after* it is stored, if `{<store name>}` does not exist the command will return an error.

The form taken by the argument `{<store name> : <position>}` is the same as that used to generate the “internal label and ref” system when `save-ref` key are active, so to refer to a “stored content”. For example `\getkeyans{test:4}` will return the “stored content” at position 4 of the environment in which the key `save-ans=test` was set.

6.6.2 The command `\foreachkeyans`

```
\foreachkeyans \foreachkeyans[<key = val>]{<store name>}
```

The command `\foreachkeyans` goes through and executes the command `\getkeyans` on the contents in *prop list* `{<store name>}`. If you pass without options run `\getkeyans` on all contents in *prop list* `{<store name>}`.

Options for command

`sep = {<code>}` default: {;}

Establishes the *separation* between “each” `{<content>}` stored in *prop list* `{<store name>}`. For example, you can use `sep={\[\[10pt]}` for vertical separation of stored contents.

`step = {<integer>}` default: 1

Sets the *step* (increment) applied to the value set by key `start` for “each” `{<content>}` stored in *prop list* `{<store name>}`. The value must be a *positive integer*.

`start = {<integer>}` default: 1

Sets the *position* of the *prop list* `{<store name>}` from which execution will start. The value must be a *positive integer*.

`stop = {<integer>}` default: 0

Sets the *position* of the *prop list* `{<store name>}` from which execution will finish. The value must be a *positive integer*.

`before = {⟨code⟩}` default: *empty*
 Sets the {⟨code⟩} that will be executed ⟨before⟩ each {⟨content⟩} stored in *prop list* {⟨store name⟩}. The {⟨code⟩} must be passed between braces.

`after = {⟨code⟩}` default: *empty*
 Sets the {⟨code⟩} that will be executed ⟨after⟩ each {⟨content⟩} stored in *prop list* {⟨store name⟩}. The {⟨code⟩} must be passed between braces.

`wrapper = {⟨code #1⟩ more code}` default: *empty*
 Wraps the {⟨content⟩} stored in *prop list* {⟨store name⟩} referenced by {#1}. The {⟨code⟩} must be passed between braces. For example `\foreachkeyans[wrapper={\makebox[1em][l]{#1}}]{⟨store name⟩}`.

6.6.3 The command `\printkeyans`

```
\printkeyans {⟨store name⟩}
\printkeyans [⟨keys⟩]{⟨store name⟩}
\printkeyans * [⟨keys⟩]{⟨store name⟩}
```

The command `\printkeyans` prints “all stored content” in *sequence* {⟨store name⟩} defined by `save-ans` key placing this inside the `enumext` or `enumext*` environment if the *starred argument* ‘*’ is used.

The “stored content” can only be accessed *after* it is stored in the *sequence*, if {⟨store name⟩} does not exist the command will return an error.

The *optional argument* allows managing the ⟨keys⟩ in the “first level” of the environment in which the “stored content” of the *sequence* {⟨store name⟩} will be printed, if the *starred argument* ‘*’ is used it will be `enumext*` otherwise `enumext`.

The default values for the “first level” are the same as the default values for the `enumext` and `enumext*` environments along with the keys `nosep`, `first=\small`, `font=\small` and `columns=2`. For the inner levels of the environment `enumext` saved in the *sequence* {⟨store name⟩} the default values are the same as those established for the second, third and fourth levels plus the keys `nosep`, `first=\small`, `font=\small`. If the environment `enumext*` is saved within the *sequence* {⟨store name⟩} it will have the same default values plus the keys `nosep`, `first=\small`, `font=\small`.

Since the command encapsulates by default the `enumext` environment or the `enumext*` environment, we must take some considerations:

- If we execute `\printkeyans*{⟨store name⟩}` and the *sequence* {⟨store name⟩} already contains any `enumext*` environment an error will be returned as we cannot nest.
- If we execute `\printkeyans*{⟨store name⟩}` and the *sequence* {⟨store name⟩} contains any `enumext` environments, they will start with the ⟨keys⟩ set for the first level unless they are set in the *optional argument* or `save-key` is used to modify it.
- If we execute `\printkeyans{⟨store name⟩}` and the *sequence* {⟨store name⟩} contains any environment `enumext*`, they will start with the ⟨keys⟩ set by default unless they are set in the *optional argument* or `save-key` is used to modify it.

The default values for the “first level” of `\printkeyans` commands and `\printkeyans*` are established using `\setenumext[⟨print , 1⟩]{⟨keys⟩}` and `\setenumext[⟨print*⟩]{⟨keys⟩}`.

If we need to set the ⟨keys⟩ for the environment `enumext` “saved” in the *sequence* {⟨store name⟩} we will use `\setenumext[⟨print , level⟩]{⟨keys⟩}` and if we need to set the ⟨keys⟩ for the environment `enumext*` “saved” in the *sequence* {⟨store name⟩} we will use `\setenumext[⟨print , *⟩]{⟨keys⟩}`.

Example

```
\begin{enumext}[save-ans=sample,columns=1,show-pos=true,nosep,save-ref=true]
  \item Factor $3x+3y+3z$. \anskey{$3(x+y+z)}$
  \item True False

  \begin{enumext}[nosep]
    \item \LaTeX2e\ is cool? \anskey{Very True!}
  \end{enumext}

  \item Related to Linux

  \begin{enumext}[nosep]
    \item You use linux? \anskey{Yes}
    \item Rate the following package and class
      \begin{enumext}[nosep]
        \item \texttt{xsim} \anskey{very good}
        \item \texttt{exsheets} \anskey{obsolete}
      \end{enumext}
    \end{enumext}
  \end{enumext}
```

```
The answer to \ref{sample:4} is \getkeyans{sample:4} and the answers to
all the worksheets are as follows:

\printkeyans{sample}
```

1. Factor $3x + 3y + 3z$.
- [1]
2. True False
- (a) ~~TeX~~ze is cool?
- [2]
3. Related to Linux
- (a) You use linux?
- [3]
- (b) Rate the following package and class
- i. `xsim`
- [4]
- ii. `exsheets`
- [5]

The answer to 3.(b).i is very good and the answers to all the worksheets are as follows:

1. $3(x + y + z)$ ✖
2. (a) Very True! ✖
3. (a) Yes ✖
- (b) i. very good ✖
- ii. obsolete ✖


7 Full examples

Here I will leave as an example some adaptations questions taken from TeX-SX. The examples are attached to this documentation and can be extracted from your PDF viewer or from the command line by running:

```
$ pdfdetach -saveall enumext.pdf
```

and then you can use the excellent arara¹ tool to compile them.

Example 1

Adapted from the response given by Enrico Gregorio in Squares for answer choice options and perfect alignment to mathematical answers .

1. La velocità di $1,00 \times 10^2$ m/s espressa in km/h è:
- A

 36 km/h.
- B

 360 km/h.
- C

 27,8 km/h.
- D

 $3,60 \times 10^8$ km/h.

3. La velocità di $1,00 \times 10^2$ m/s espressa in km/h è:

A

 36 km/h.

B

 360 km/h.

C

 27,8 km/h.

D

 $3,60 \times 10^8$ km/h.2. In fisica nucleare si usa l'angstrom (simbolo: $1 \text{ \AA} = 1 \times 10^{-10}$ m) e il fermi o femtometro ($1 \text{ fm} = 1 \times 10^{-15}$ m). Qual è la relazione tra queste due unità di misura?

A

 $1 \text{ \AA} = 1 \times 10^5 \text{ fm}$.

B

 $1 \text{ \AA} = 1 \times 10^{-5} \text{ fm}$.

C

 $1 \text{ \AA} = 1 \times 10^{-15} \text{ fm}$.

D

 $1 \text{ \AA} = 1 \times 10^3 \text{ fm}$.4. In fisica nucleare si usa l'angstrom (simbolo: $1 \text{ \AA} = 1 \times 10^{-10}$ m) e il fermi o femtometro ($1 \text{ fm} = 1 \times 10^{-15}$ m). Qual è la relazione tra queste due unità di misura?

A

 $1 \text{ \AA} = 1 \times 10^5 \text{ fm}$.

B

 $1 \text{ \AA} = 1 \times 10^{-5} \text{ fm}$.

C


 $1 \text{ \AA} = 1 \times 10^{-15} \text{ fm}$.

D

 $1 \text{ \AA} = 1 \times 10^3 \text{ fm}$.

1. B
2. A
3. B
4. A

Example 2

Adapted from the response given by Florent Rougon in Multiple choice questions with proposed answers in random order — addition of automatic correction (cross mark) .

¹The cool TeX automation tool: <https://www.ctan.org/pkg/arara>

1. La velocità di $1,00 \times 10^2$ m/s espressa in km/h è:
- ☐ A 36 km/h.
☒ B 360 km/h.
☐ C 27,8 km/h.
☐ D $3,60 \times 10^8$ km/h.
2. In fisica nucleare si usa l'angstrom (simbolo: $1 \text{ \AA} = 1 \times 10^{-10}$ m) e il fermi o femtometro ($1 \text{ fm} = 1 \times 10^{-15}$ m). Qual è la relazione tra queste due unità di misura?
- ☒ A $1 \text{ \AA} = 1 \times 10^5 \text{ fm}$.
☐ B $1 \text{ \AA} = 1 \times 10^{-5} \text{ fm}$.
☐ C $1 \text{ \AA} = 1 \times 10^{-15} \text{ fm}$.
☐ D $1 \text{ \AA} = 1 \times 10^3 \text{ fm}$.
3. La velocità di $1,00 \times 10^2$ m/s espressa in km/h è:
- ☐ A 36 km/h.
☒ B 360 km/h.
☐ C 27,8 km/h.
☐ D $3,60 \times 10^8$ km/h.
4. In fisica nucleare si usa l'angstrom (simbolo: $1 \text{ \AA} = 1 \times 10^{-10}$ m) e il fermi o femtometro ($1 \text{ fm} = 1 \times 10^{-15}$ m). Qual è la relazione tra queste due unità di misura?
- ☒ A $1 \text{ \AA} = 1 \times 10^5 \text{ fm}$.
☐ B $1 \text{ \AA} = 1 \times 10^{-5} \text{ fm}$.
☐ C $1 \text{ \AA} = 1 \times 10^{-15} \text{ fm}$.
☐ D $1 \text{ \AA} = 1 \times 10^3 \text{ fm}$.
1. B
 3. B
- ✱ 2. A
 ✱ 4. A

Example 3

A "simple multiple choice" test .

1. First type of questions

- ☐ A value
☐ C value

- ☐ B correct
☐ D value

2. Second type of questions

- I. $2\alpha + 2\delta = 90^\circ$
 II. $\alpha = \delta$
 III. $\angle EDF = 45^\circ$

- ☐ A I only
☐ B II only
☐ C I and II only

- ☐ D I and III only
☐ E I, II, and III

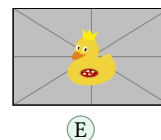
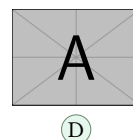
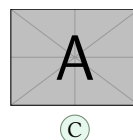
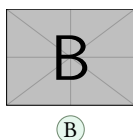
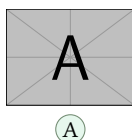
3. Third type of questions

- (1) $2\alpha + 2\delta = 90^\circ$
 (2) $\angle EDF = 45^\circ$

- ☐ A value
☐ B value
☐ C value

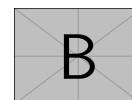
- ☐ D value
☐ E value

4. Question with image and label below:



5. Question with image on right side:

- ☐ A value
☐ B value
☐ C value
☐ D correct
☐ E value





Test keys


1. B, $x = 5$
 2. D
 3. C, some note

- ✱ 4. E, A duck
 ✱ 5. D, other note
 ✱

Example 4

A "simple worksheet" using ducks :) .

 Factor $x^2 - 2x + 1$

 Factor $3x + 3y + 3z$

The following questions need to be cuaqtified :)

 True False

- (a) $\alpha > \delta$
 (b) \LaTeX is cool?

 Related to Linux


- (a) You use linux?

- (b) Usually uses the package manager?
- (c) Rate the following package and class
 - i. xsim-exam
 - ii. xsim
 - iii. exsheets

The answer to 1 is $(x - 1)^2$ and the answer to 3.(a) is False.

- | | | | |
|-------------------|---|---------------------------------|---|
| 1. $(x - 1)^2$ | ⌘ | (b) Yes, dnf | ⌘ |
| 2. $3(x + y + z)$ | ⌘ | (c) i. doesn't exist for now :(| ⌘ |
| 3. (a) False | ⌘ | ii. very good | ⌘ |
| (b) Very True! | ⌘ | iii. obsolete | ⌘ |
| 4. (a) Yes | ⌘ | | |

Example 5

Adapted from the response given by Stephen in SAT like question format .

<div>1</div> <p>Which choice best describes what happens in the passage?</p> <p>A) One character argues with another character who intrudes on her home.</p> <p>B) One character receives a surprising request from another character.</p> <p>C) One character reminisces about choices she has made over the years.</p> <p>D) One character criticizes another character for pursuing an unexpected course of action.</p>	<div>3</div> <p>Which choice best describes what happens in the passage?</p> <p>A) One character argues with another character who intrudes on her home.</p> <p>B) One character receives a surprising request from another character.</p> <p>C) One character reminisces about choices she has made over the years.</p> <p>D) One character criticizes another character for pursuing an unexpected course of action.</p>
<div>2</div> <p>Which choice best describes what happens in the passage?</p> <p>A) One character argues with another character who intrudes on her home.</p> <p>B) One character receives a surprising request from another character.</p> <p>C) One character reminisces about choices she has made over the years.</p> <p>D) One character criticizes another character for pursuing an unexpected course of action.</p>	<div>4</div> <p>Which choice best describes what happens in the passage?</p> <p>A) One character argues with another character who intrudes on her home.</p> <p>B) One character receives a surprising request from another character.</p> <p>C) One character reminisces about choices she has made over the years.</p> <p>D) One character criticizes another character for pursuing an unexpected course of action.</p>

1. A) 2. C) 3. B) 4. D)

Example 6

Adapted from the response to Environment for enumerate environment .

- 8.5a, KSC 10. sample
- A sample
- ✓ B answer
- C sample
- D sample
- 9.5a, KSC 11. sample
- A sample
- B sample
- C sample
- ✓ D answer
12. sample
- A sample
- B answer
- C sample
- D sample
13. sample
- A sample
- B sample
- C sample
- D answer

10. B (8.5a, KSC)
11. D (9.5a, KSC)

12. B (10.5a, KSC)
13. D (11.5a, KSC)













8 Tagged PDF examples

This section is just to show the compatibility of `enumext` with *tagged* PDF using `lualatex`. The attached files here are just for testing and are intended as examples and, in a way, to simplify the time of Matthew Bertucci (@mbertucci) when he sees this excellent package and adds it to [The LaTeX Tagged PDF repository](#).

To compile the tests with `lualatex-dev` the packages `multicol`, `unicode-math`, `geometry`, `graphicx`, `luamml` and `hyperref` are required along with the line:

```
\DocumentMetadata
{
  lang = en-US, pdfversion = 2.0, pdfstandard = ua-2, tagging=on,
}
```

◆ All examples have been checked using `veraPDF` together with `ngpdf`.

- The file `enumext-01.tex` contains the basic tests for the `enumext` and `enumext*` environments and the nesting between them plus the use of the `label`, `labelwidth`, `labelsep`, `ref`, `align` and `wrap-label` keys. Source file  and *tagged* PDF .
- The file `enumext-02.tex` contains the tests for the `enumext` and `enumext*` environments and the support for `minipage` and `multicol` environments using the keys `columns`, `columns-sep`, `mini-env`, `mini-right` and `\miniright` command. Source file  and *tagged* PDF .
- The file `enumext-03.tex` contains the tests for the `enumext` and `keyanspic` environments activated by the `save-ans` key together with the `save-sep` and `save-ref` keys and the `\printkeyans` command. Source file  and *tagged* PDF .
- The file `enumext-04.tex` contains the tests for the `\anskey` command and the `anskey*` environment activated by the `save-ans` key along with the `\getkeyans` and `\printkeyans` commands. Source file  and *tagged* PDF .
- The file `enumext-05.tex` contains the tests for the environments `keyans`, `keyans*` and `keyanspic` activated by the key `save-ans` together with the keys `no-store` and `show-ans` and the commands `\setenumext`, `\setenumextmeta`, `\printkeyans` and `\foreachkeyans`. Source file  and *tagged* PDF .
- The file `enumext-06.tex` contains the tests for the environments `enumext` and `enumext*` for *fake itemize* and *description*. Source file  and *tagged* PDF .

9 The way of non-enumerated lists

It is possible to use (or abuse) the `enumext` and `enumext*` environments to mimic *non-enumerated* list environments such as `itemize` and `description`, clearly the `\keys` to “store answers”, the `keyans`, `keyans*` and `keyanspic` environments lose their sense and it is not the focus of `enumext` package, but, why not to do it?.

Here I leave as an example other uses of the `enumext` environment that can be helpful for specific purposes. The *trick* to generate these “fake environments” is set `label={}` or `label={\some}` and play with the `list-indent`, `list-offset`, `font` and `wrap-label` keys.

Fake itemize environment

Here we set the `label` key using the default settings in \TeX for the four levels `\textbullet`, `\textendash`, `\textasteriskcentered` and `\textperiodcentered` together with the `nosep` key to reduce the vertical spaces in the left side example and set the `label` key in *mathematical mode* for the right side as `\ast`, `\diamond`, `\circ` and `\star` for the four levels together with the `nosep` key

- | | |
|---------------------|---------------------|
| • First level item | * First level item |
| – Second level item | ◇ Second level item |
| • Third level item | ◦ Third level item |
| · Fourth level item | ★ Fourth level item |
| • First level item | * First level item |

Fake description environment

Here we set `label={}` and `list-indent=2.5em`, `font=\bfseries`.

SomeThing A short one-line description.

This is an entry *without* a label.

Something A short *one-line* description text.

Something long A much *longer* description text may take more than one line or more than one paragraph.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.

If we add `list-indent=0pt` you get *widest style*:

SomeThing A short one-line description.
This is an entry *without* a label.
Something A short *one-line* description text.
Something long A much *longer* description text may take more than one line or more than one paragraph.
Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.

- The small space at the beginning of the “*unlabeled entry*” corresponds to `\labelsep` and can be removed using `\hspace{-\labelsep}` at the beginning of the line.
- When *tagged* PDF is active the default `description` style is NOT available due to the redefinition of `\makeLabel` for the `align` key which uses `\makebox` in this case, meaning that `\item[⟨content⟩]` will not extend beyond `\labelwidth` which causes overlaps,

Description indented by label

Here we set `label={}` and we will give a convenient value to `labelsep` and `labelwidth`, for example we can take as reference our *longest label* and pass it as value using:

```
\newlength{\descitemwd}  
\settowidth{\descitemwd}{\textbf{Something long}}  
  
and then use labelsep=4pt,labelwidth=\descitemwd,font=\bfseries.
```

SomeThing A short one-line description.
This is an entry *without* a label.
Something A short one-line description.
Something long A much longer description. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris.

The environment can be translated so that the `⟨labels⟩` are on the left margin calculating the value passed to the `list-offset` key, in this case it will be equal to the sum of the values set by the `labelwidth` and `labelsep` keys finally resulting as `list-offset={-\descitemwd - 4pt}`.

SomeThing A short one-line description.
This is an entry *without* a label.
Something A short one-line description.
Something long A much longer description. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris.

If we add `align=right` it will look like this:

SomeThing A short one-line description.
This is an entry *without* a label.
Something A short one-line description.
Something long A much longer description. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris.

- At this point we have used `list-offset={-\descitemwd - 4pt}` instead of `list-offset={-\labelwidth - \labelsep}`, this is because the parameters `\labelwidth` and `\labelsep` take the default values, as if we had not set `label`.

Description with multi-line labels

The `label` key does not accept *multiline material*, this is where the `wrap-label` and `wrap-label*` keys comes into play. Unlike the `enumitem` package, the `align` key only supports three options, so what we will do is create a command in the style `\parleft` of `enumitem` that allows us to place *multiline labels* using `\parbox`.

```
\NewDocumentCommand \labelbx { s +m }  
{%  
  \SuspendTagging{\parbox}%  
  \IfBooleanTF{#1}  
  {%  
    {\strut\smash{\parbox[t]{\labelwidth}{\raggedright{#2}}}}%  
    {\strut\smash{\parbox[t]{\labelwidth}{\raggedleft{#2}}}}%  
  }\ResumeTagging{\parbox}%  
}
```

Now we just need to set `wrap-label*={\labelbx{#1}}`.

SomeThing A short one-line description.
This is an entry *without* a label.
Something A short one-line description.
Something long A much longer description. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris.
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris.

SoMeThInG A much longer description. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum
LoNg ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris.

Final notes

The original implementation (if you can call it that) of the ideas that led to the creation of `enumext` were some macros using the `enumerate[5]` package for personal use created in early 2003, the code was quite questionable, but functional for these simple requirements.

With the great answers given by Christian Hupfer in [Create a fake label ref using list](#) and the answer given by David Carlisle in [Change the use of label ref by data save in an array \(list\)](#) I managed to create a more solid code than the original version, now using the `l3prop[11]` and `l3seq[11]` modules together with the `hyperref[8]` and `enumitem[6]` packages, which did the job, but with some limitations.

As time went by I took these limitations as a personal challenge which I called “*reinventing the wheel*”, since there were packages and classes that did more or less what I was looking for, but did not fit my simple requirements. This “*reinventing the wheel*” finally ended up becoming `enumext`.

Why list environments?

The answer is simple, first I love the beauty of its syntax and many of what I had already written used the `enumerate` environment or lists created using the `enumitem` package. In my mind I thought: how complicated could it be to write a package that looked like `enumitem`? It seemed simple enough, of course I didn’t have in mind the mess I was getting into working with `list` environments, `minipage` and adding support for the `multicol` and `hyperref` packages.

Of course, seeing the final result of the experiment “*reinventing the wheel*” I am quite satisfied.

Why not random questions and other utilities

The “*random*” type questions I love and hate them at the same time, although they simplify a lot the work when creating a multiple choice test, but you lose the beauty of typesetting a document with \LaTeX , that is to say the output does not always look as nice as it should, even if they are only alternatives these must follow a certain order when presented either numerical or presentation, that said handling that using *nested lists* is quite complicated so I do not classify to be implemented.

Why has it taken so long?

One of the setbacks, beyond my laziness, was including compatibility with *tagged* PDF. To be honest, it’s something I never considered at any point, but I firmly believe that being able to create *accessible documents* provides a great opportunity in the world of mathematics education. From my perspective as a *high school* teacher, beyond theorems and deep mathematics, the use of exercise lists is one of the most common things. Being able to open the way to work in parallel with those who have different abilities is really important and I regret not having looked into this in the past. I hope that `enumext` serves this purpose and inspires more users and authors to follow this path.

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11 Change history

- v1.5 (ctan), 2025-06-11**
 - Replacing `\regex_match:` (deprecated) with `\regex_if_match:`.
 - Add keys `beginpenalty`, `midpenalty` and `endpenalty`.
- v1.4 (ctan), 2025-06-09**
 - Improved implementation of the `start` key for *tagged* PDF.
 - Improved implementation of the `ref` key.
 - Fixed the behavior of the `save-sep` key.
 - Fixed the behavior of the `resume*` key.
- v1.3 (ctan), 2025-06-01**
 - Removed dependency on the `scontents` package.
 - The `anskey*` environment has been rewritten using the new `c`-type argument.
- v1.2 (ctan), 2025-03-28**
 - Replace signature (prevent expansion for optional argument).
 - Solve Inconsistent local/global assignment.
- v1.1 (ctan), 2024-11-14**
 - Fixed implementation for `font` and `base-fix` keys.
 - Added new keys for symbol marks.
 - Update and improvements in the internal code.
 - Adjustments in the documentation.
- v1.0 (ctan), 2024-11-01**
 - First public release.

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13 Implementation

The most recent publicly released version of `enumext` is available at CTAN: <https://www.ctan.org/pkg/enumext>. While general feedback via email is welcomed, specific bugs or feature requests should be reported through the issue tracker: <https://github.com/pablgonz/enumext/issues>.

- The documentation presented here is far from professional, it contains a lot of obvious information that to the eye of a TeXpert are superfluous, but, after so many years developing this project is the only way to remember what does what.

13.1 General conventions

Variables containing `i`, `ii`, `iii` and `iv` are associated by level with the `enumext` environment, variables containing `v` are associated with the `keyans` environment, variables containing `vi` are associated with the `keyanspic` environment, variables containing `vii` are associated with the `enumext*` environment and variables containing `viii` are associated with the `keyans*` environment.

To simplify writing and documentation some variables and functions that are common to the different levels of the environments are described using a capital “X”.

The temporary function `__enumext_tmp:n` is used in different parts of the package code for variable creation or execution of other functions that are grouped into this one.

All variables and functions defined in this package are private and are NOT intended to work or be used by another package or module.

13.2 Initial set up

Start the DocStrip guards.

```
1 <{*package>
```

Identify the internal prefix (L^AT_EX3 DocStrip convention) for l3doc class.

```
2 <{@=enumext>
```

13.3 Declaration of the package

First we will make sure we have a minimum (super updated) version of L^AT_EX to work correctly.

```
3 \NeedsTeXFormat{LaTeX2e}[2025-06-01]
```

Now declare the `enumext` package.

```
4 \ProvidesExplPackage {enumext} {2025-06-11} {1.5} {Enumerate exercise sheets}
```

Finally check if the `multicol` package are loaded, if not we load it.

```
5 \hook_gput_code:nnn {begindocument} {enumext}
6 {
7   \IfPackageLoadedTF { multicol }
8   {
9     \msg_info:nnn { enumext } { package-load } { multicol }
10  }
11  {
12    \msg_info:nnn { enumext } { package-not-load } { multicol }
13    \RequirePackage{multicol}[2024-09-14]
14  }
15 }
```

13.4 Definition of variables

Variables that do not appear in this section are created by means of `\keys_define:nn` or some function described below.

Integer variables will control the nesting levels of the environments, `anskey*` environment and `\anskey` command.

```
\__enumext_level_int
\__enumext_level_h_int
\__enumext_anskey_level_int
\__enumext_keyans_level_int
\__enumext_keyans_level_h_int
\__enumext_keyans_pic_level_int

16 \int_new:N \__enumext_level_int
17 \int_new:N \__enumext_level_h_int
18 \int_new:N \__enumext_anskey_level_int
19 \int_new:N \__enumext_keyans_level_int
20 \int_new:N \__enumext_keyans_level_h_int
21 \int_new:N \__enumext_keyans_pic_level_int
```

(End of definition for `__enumext_level_int` and others.)

```

\l__enumext_starred_bool
\g__enumext_starred_bool
\l__enumext_starred_first_bool
\l__enumext_standar_bool
\g__enumext_standar_bool
\l__enumext_standar_first_bool
\l__enumext_keyans_env_bool
\g__enumext_start_line_tl
\g__enumext_envir_name_tl
\l__enumext_envir_name_tl

```

Internal variables used by functions `__enumext_is_not_nested:`, `__enumext_is_on_first_level:` and `__enumext_keyans_name_and_start:` (§13.5.1).

```

22 \bool_new:N \l__enumext_starred_bool
23 \bool_new:N \g__enumext_starred_bool
24 \bool_new:N \l__enumext_starred_first_bool
25 \bool_new:N \l__enumext_standar_bool
26 \bool_new:N \g__enumext_standar_bool
27 \bool_new:N \l__enumext_standar_first_bool
28 \bool_new:N \l__enumext_keyans_env_bool
29 \tl_new:N \g__enumext_start_line_tl
30 \tl_new:N \g__enumext_envir_name_tl
31 \tl_new:N \l__enumext_envir_name_tl

```

(End of definition for `\l__enumext_starred_bool` and others.)

```

\l__enumext_counter_i_tl
\l__enumext_counter_ii_tl
\l__enumext_counter_iii_tl
\l__enumext_counter_iv_tl
\l__enumext_counter_v_tl
\l__enumext_counter_vi_tl
\l__enumext_counter_vii_tl
\l__enumext_counter_viii_tl

```

Variables to store the “*name of the counters*” `enumXi`, `enumXii`, `enumXiii` and `enumXiv` for `enumext` environment, `enumXv` for `keyans` environment and `enumXvi` for the `keyanspic` environment. The counters `enumXvii` and `enumXviii` are used by `enumext*` and `keyans*` environments.

The initial values of these variables are set by the function `__enumext_define_counter:Nn` (§13.11) and then modified by the function `__enumext_label_style:Nnn` used by `label` key (§13.14).

```

32 \cs_set_protected:Npn \__enumext_tmp:n #1
33 {
34   \tl_new:c { l__enumext_counter_#1_tl }
35 }
36 \clist_map_inline:nn { i, ii, iii, iv, v, vi, vii, viii } { \__enumext_tmp:n {#1} }

```

(End of definition for `\l__enumext_counter_i_tl` and others.)

```

\l__enumext_ref_key_arg_tl
\l__enumext_ref_the_count_tl
\l__enumext_the_counter_X_tl
\l__enumext_renew_counter_X_tl

```

Internal variables used by `ref` key (§13.14).

```

37 \tl_new:N \l__enumext_ref_key_arg_tl
38 \tl_new:N \l__enumext_ref_the_count_tl
39 \cs_set_protected:Npn \__enumext_tmp:n #1
40 {
41   \tl_new:c { l__enumext_renew_counter_#1_tl }
42   \tl_new:c { l__enumext_the_counter_#1_tl }
43   \tl_set:ce { l__enumext_the_counter_#1_tl } { \exp_not:c { theenumX#1 } }
44 }
45 \clist_map_inline:nn { i, ii, iii, iv, v, vi, vii, viii } { \__enumext_tmp:n {#1} }

```

(End of definition for `\l__enumext_ref_key_arg_tl` and others.)

```

\g__enumext_resume_int
\g__enumext_resume_vii_int
\l__enumext_resume_name_tl
\l__enumext_resume_active_bool
\g__enumext_starred_series_tl
\g__enumext_standar_series_tl

```

Internal variables used by `resume`, `resume*` and `series` keys (§13.26).

```

46 \int_new:N \g__enumext_resume_int
47 \int_new:N \g__enumext_resume_vii_int
48 \tl_new:N \l__enumext_resume_name_tl
49 \bool_new:N \l__enumext_resume_active_bool
50 \tl_new:N \g__enumext_standar_series_tl
51 \tl_new:N \g__enumext_starred_series_tl

```

(End of definition for `\g__enumext_resume_int` and others.)

```

\l__enumext_current_widest_dim
\g__enumext_counter_styles_tl
\g__enumext_widest_label_tl
\l__enumext_label_width_by_box

```

The variable `\l__enumext_current_widest_dim` stores the current label width, the variable `\g__enumext_counter_styles_tl` stores the default *label style* and the variable `\g__enumext_widest_label_tl` the label width. These variables are used by `widest` (§13.15) and `label` (§13.13) keys.

```

52 \dim_new:N \l__enumext_current_widest_dim
53 \tl_new:N \g__enumext_counter_styles_tl
54 \tl_new:N \g__enumext_widest_label_tl
55 \box_new:N \l__enumext_label_width_by_box

```

(End of definition for `\l__enumext_current_widest_dim` and others.)

```

\l__enumext_leftmargin_tmp_X_bool
\l__enumext_leftmargin_tmp_X_dim
\l__enumext_leftmargin_X_dim
\l__enumext_itemindent_X_dim

```

The boolean variable `\l__enumext_leftmargin_tmp_X_bool` and the dimensional variable `\l__enumext_leftmargin_tmp_X_dim` are used by the `list-indent` key (§13.19). The variables `\l__enumext_leftmargin_X_dim` and `\l__enumext_itemindent_X_dim` are used and set by the function `__enumext_calc_hspace:NNNNNNNNNN` (§13.39.1).

```

56 \cs_set_protected:Npn \__enumext_tmp:n #1
57 {
58   \bool_new:c { l__enumext_leftmargin_tmp_#1_bool }
59   \dim_new:c { l__enumext_leftmargin_tmp_#1_dim }
60   \dim_new:c { l__enumext_leftmargin_#1_dim }

```

```

61     \dim_new:c { \__enumext_itemindent_#1_dim      }
62   }
63   \clist_map_inline:nn { i, ii, iii, iv, v, vi, vii, viii } { \__enumext_tmp:n {#1} }

```

(End of definition for `__enumext_leftmargin_tmp_X_bool` and others.)

```

\l__enumext_multicols_above_X_skip
\l__enumext_multicols_below_X_skip
\g__enumext_multicols_right_X_skip
\l__enumext_align_label_pos_X_str

```

Internal variables used by `columns` key (§13.23) and `align` key (§13.13).

```

64   \cs_set_protected:Npn \__enumext_tmp:n #1
65   {
66     \skip_new:c { \__enumext_multicols_above_#1_skip }
67     \skip_new:c { \__enumext_multicols_below_#1_skip }
68     \skip_new:c { \g__enumext_multicols_right_#1_skip }
69     \str_new:c { \__enumext_align_label_pos_#1_str }
70   }
71   \clist_map_inline:nn { i, ii, iii, iv, v } { \__enumext_tmp:n {#1} }

```

(End of definition for `\l__enumext_multicols_above_X_skip` and others.)

```

\g__enumext_minipage_stat_int
\l__enumext_minipage_temp_skip
\l__enumext_minipage_left_skip
\l__enumext_minipage_right_skip
\l__enumext_minipage_after_skip
\g__enumext_minipage_right_skip
\g__enumext_minipage_after_skip
\l__enumext_minipage_left_X_dim
\l__enumext_minipage_active_X_bool

```

Internal variables used by `\miniright` command (§13.24.4) and the keys `mini-right`, `mini-right*`, `mini-env` and `mini-sep` (§13.22, §13.24).

```

72   \int_new:N \g__enumext_minipage_stat_int
73   \skip_new:N \l__enumext_minipage_temp_skip
74   \skip_new:N \l__enumext_minipage_left_skip
75   \skip_new:N \l__enumext_minipage_right_skip
76   \skip_new:N \l__enumext_minipage_after_skip
77   \skip_new:N \g__enumext_minipage_right_skip
78   \skip_new:N \g__enumext_minipage_after_skip
79   \cs_set_protected:Npn \__enumext_tmp:n #1
80   {
81     \dim_new:c { \__enumext_minipage_left_#1_dim      }
82     \bool_new:c { \__enumext_minipage_active_#1_bool }
83   }
84   \clist_map_inline:nn { i, ii, iii, iv, v, vii, viii } { \__enumext_tmp:n {#1} }

```

(End of definition for `\g__enumext_minipage_stat_int` and others.)

```

\l__enumext_wrap_label_X_bool
\l__enumext_wrap_label_opt_X_bool
\l__enumext_start_X_int
\l__enumext_fake_item_indent_X_tl
\l__enumext_label_fill_left_X_tl
\l__enumext_label_fill_right_X_tl
\l__enumext_vspace_a_star_X_bool
\l__enumext_vspace_b_star_X_bool

```

The bool vars `\l__enumext_wrap_label_X_bool` and `\l__enumext_wrap_label_opt_X_bool` are used by `wrap-label` and `wrap-label*` keys (§13.13), the integer `\l__enumext_start_X_int` are used by the `start` and `start*` keys (§13.15), the token list `\l__enumext_fake_item_indent_X_tl` is used by `itemindent` key (§13.19.1), the variables `\l__enumext_label_fill_left_X_tl` and `\l__enumext_label_fill_right_X_tl` are used by the `align` key (§13.13). The boolean vars `\l__enumext_vspace_a_star_X_bool`, `\l__enumext_vspace_b_star_X_bool` are used by `above`, `above*`, `below` and `below*` keys (§13.21).

```

85   \cs_set_protected:Npn \__enumext_tmp:n #1
86   {
87     \bool_new:c { \__enumext_wrap_label_#1_bool      }
88     \bool_new:c { \__enumext_wrap_label_opt_#1_bool }
89     \int_new:c { \__enumext_start_#1_int             }
90     \tl_new:c { \__enumext_fake_item_indent_#1_tl    }
91     \tl_new:c { \__enumext_label_fill_left_#1_tl     }
92     \tl_new:c { \__enumext_label_fill_right_#1_tl    }
93     \bool_new:c { \__enumext_vspace_a_star_#1_bool  }
94     \bool_new:c { \__enumext_vspace_b_star_#1_bool  }
95   }
96   \clist_map_inline:nn { i, ii, iii, iv, v, vii, viii } { \__enumext_tmp:n {#1} }

```

(End of definition for `\l__enumext_wrap_label_X_bool` and others.)

```

\l__enumext_store_active_bool
\l__enumext_store_name_tl
\g__enumext_store_name_tl
\l__enumext_store_current_label_tl
\l__enumext_store_current_opt_arg_tl

```

The variable `\l__enumext_store_active_bool` setting by `save-ans` key (§13.27.1) activates all the mechanism related to `\anskey`, `anskey*`, `keyans`, `keyans*` and `keyanspic` environments.

The variable `\l__enumext_store_name_tl` saves the `{⟨store name⟩}` set by the `save-ans` key of the *sequence* and *prop list* in which we will store, the variable `\g__enumext_store_name_tl` it's just a global copy of `{⟨store name⟩}` used by different functions.

The variables `\l__enumext_store_current_label_tl` and `\l__enumext_store_current_opt_arg_tl` save the *current label* and *optional argument* of `\item*` (§13.38) and `\anspic*` (§13.43.2) for the `keyans`, `keyans*` and `keyanspic` environments.

```

97   \bool_new:N \l__enumext_store_active_bool
98   \tl_new:N \l__enumext_store_name_tl
99   \tl_new:N \g__enumext_store_name_tl
100  \tl_new:N \l__enumext_store_current_label_tl
101  \tl_new:N \l__enumext_store_current_opt_arg_tl

```

(End of definition for `\l__enumext_store_active_bool` and others.)

```
\l__enumext_store_anskey_arg_tl
\l__enumext_store_anskey_env_tl
\l__enumext_write_anskey_env_bool
\l__enumext_write_anskey_env_file_name_tl
\l__enumext_write_anskey_env_file_iow
```

The variable `\l__enumext_store_anskey_arg_tl` save the *argument* of `\anskey` (§13.31) and the variables `\l__enumext_store_anskey_env_tl` save the (*body*) of the environment `anskey*` (§13.32).

The variables `\l__enumext_write_anskey_env_bool`, `\l__enumext_write_anskey_env_file_name_tl` and `\l__enumext_write_anskey_env_file_iow` they are used by the `write-env` and `overwrite` keys in the `anskey*` environment implementation.

```
102 \tl_new:N \l__enumext_store_anskey_arg_tl
103 \tl_new:N \l__enumext_store_anskey_env_tl
104 \bool_new:N \l__enumext_write_anskey_env_bool
105 \tl_new:N \l__enumext_write_anskey_env_file_name_tl
106 \iow_new:N \l__enumext_write_anskey_env_file_iow
```

(End of definition for `\l__enumext_store_anskey_arg_tl` and others.)

```
\c__enumext_anskey_env_hidden_space_str
```

The `\c__enumext_anskey_env_hidden_space_str` is a constant *string* to used to hide the (*forced space*) added by T_EX when recording content in a macro. This *string* contains the *reserved phrase* “`%^^Aenumextheol%`” which is added to the end of the argument stored in *sequence* and *prop list* when the key `force-eol` is false.

```
107 \str_const:Ne \c__enumext_anskey_env_hidden_space_str
108 { \c_percent_str \c_circumflex_str \c_circumflex_str A enumextheol \c_percent_str }
```

(End of definition for `\c__enumext_anskey_env_hidden_space_str`.)

```
\l__enumext_setkey_tmpa_tl
\l__enumext_setkey_tmpb_tl
\l__enumext_setkey_tmpa_int
\l__enumext_setkey_tmpa_seq
\l__enumext_setkey_tmpb_seq
```

Internal variables used by the command `\setenumext` (§13.49).

```
109 \tl_new:N \l__enumext_setkey_tmpa_tl
110 \tl_new:N \l__enumext_setkey_tmpb_tl
111 \int_new:N \l__enumext_setkey_tmpa_int
112 \seq_new:N \l__enumext_setkey_tmpa_seq
113 \seq_new:N \l__enumext_setkey_tmpb_seq
```

(End of definition for `\l__enumext_setkey_tmpa_tl` and others.)

```
\l__enumext_meta_path_tl
\l__enumext_foreach_print_seq
\l__enumext_foreach_name_prop_tl
\l__enumext_foreach_default_keys_tl
```

Internal variables used by the `\printkeyans` command (§13.48) and `\foreachkeyans` command (§13.51).

```
114 \tl_new:N \l__enumext_meta_path_tl
115 \seq_new:N \l__enumext_foreach_print_seq
116 \tl_new:N \l__enumext_foreach_name_prop_tl
117 \tl_new:N \l__enumext_foreach_default_keys_tl
```

(End of definition for `\l__enumext_meta_path_tl` and others.)

```
\l__enumext_print_keyans_starred_tl
\l__enumext_print_keyans_star_bool
\l__enumext_mark_position_str
\l__enumext_mark_position_v_str
\l__enumext_mark_position_viii_str
\l__enumext_mark_sep_tmpa_dim
\l__enumext_mark_sep_tmpb_dim
\l__enumext_show_pos_tmp_int
\g__enumext_item_symbol_aux_tl
\l__enumext_print_keyans_X_tl
\l__enumext_store_save_key_X_tl
\l__enumext_store_save_key_X_bool
\l__enumext_store_upper_level_X_bool
```

Internal variables used by command `\printkeyans` (§13.48), `show-pos`, `show-ans`, `mark-pos`, `mark-sep` keys (§13.28), `item-sym*` key (§13.36), `save-key` key (§13.28.3) and “*storing structure*”.

```
118 \tl_new:N \l__enumext_print_keyans_starred_tl
119 \bool_new:N \l__enumext_print_keyans_star_bool
120 \str_new:N \l__enumext_mark_position_str
121 \str_new:N \l__enumext_mark_position_v_str
122 \str_new:N \l__enumext_mark_position_viii_str
123 \dim_new:N \l__enumext_mark_sep_tmpa_dim
124 \dim_new:N \l__enumext_mark_sep_tmpb_dim
125 \int_new:N \l__enumext_show_pos_tmp_int
126 \tl_new:N \g__enumext_item_symbol_aux_tl
127 \cs_set_protected:Npn \l__enumext_tmp:n #1
128 {
129   \tl_new:c { \l__enumext_print_keyans_#1_tl }
130   \tl_new:c { \l__enumext_store_save_key_#1_tl }
131   \bool_new:c { \l__enumext_store_save_key_#1_bool }
132   \bool_new:c { \l__enumext_store_upper_level_#1_bool }
133 }
134 \clist_map_inline:nn { i, ii, iii, iv, vii } { \l__enumext_tmp:n {#1} }
```

(End of definition for `\l__enumext_print_keyans_starred_tl` and others.)

```
\l__enumext_anspic_args_seq
\l__enumext_anspic_mini_width_dim
\l__enumext_anspic_above_int
\l__enumext_anspic_below_int
\l__enumext_anspic_label_above_bool
\l__enumext_anspic_mini_pos_str
\l__enumext_anspic_label_box
\l__enumext_anspic_body_box
\l__enumext_anspic_label_htdp_dim
\l__enumext_anspic_body_htdp_dim
```

Internal variables used by `keyanspic` environment and `\anspic` command (§13.43.1).

```
135 \seq_new:N \l__enumext_anspic_args_seq
136 \dim_new:N \l__enumext_anspic_mini_width_dim
137 \int_new:N \l__enumext_anspic_above_int
138 \int_new:N \l__enumext_anspic_below_int
139 \bool_new:N \l__enumext_anspic_label_above_bool
140 \str_new:N \l__enumext_anspic_mini_pos_str
141 \box_new:N \l__enumext_anspic_label_box
142 \box_new:N \l__enumext_anspic_body_box
143 \dim_new:N \l__enumext_anspic_label_htdp_dim
144 \dim_new:N \l__enumext_anspic_body_htdp_dim
```

(End of definition for `\l__enumext_anspic_args_seq` and others.)

Internal variables used by “*internal check answer*” mechanism (§13.27.3) used by the `check-ans`, `no-store`, `wrap-ans*` keys and check for starred commands `\item*` in `keyans` and `keyans*` environments and `\anspic*` in `keyanspic` environment.

```

145 \bool_new:N \l__enumext_check_answers_bool
146 \bool_new:N \g__enumext_check_ans_key_bool
147 \tl_new:N \l__enumext_check_start_line_env_tl
148 \bool_new:N \l__enumext_item_wrap_key_bool
149 \int_new:N \g__enumext_check_starred_cmd_int
150 \int_new:N \g__enumext_item_anskey_int
151 \int_new:N \g__enumext_item_number_int
152 \bool_new:N \l__enumext_item_number_bool
153 \int_new:N \g__enumext_item_answer_diff_int

```

(End of definition for `\l__enumext_check_answers_bool` and others.)

The boolean variable `\l__enumext_hyperref_bool` will determine if the `hyperref` package is present or load in memory (§13.7). The boolean variable `\l__enumext_footnotes_key_bool` determine if `hyperref` is load with key `hyperfootnotes=true`.

```

154 \bool_new:N \l__enumext_hyperref_bool
155 \bool_new:N \l__enumext_footnotes_key_bool

```

(End of definition for `\l__enumext_hyperref_bool` and `\l__enumext_footnotes_key_bool`.)

Internal variables used by `save-ref` key (§13.28). The variables `\l__enumext_label_copy_X_tl` correspond to temporary copies of the *labels* defined by level on which operations will be performed.

The variables `\l__enumext_newlabel_arg_one_tl` and `\l__enumext_newlabel_arg_two_tl` will be used to form the arguments passed to the function `__enumext_newlabel:nn` (§13.7) and the variable `\l__enumext_write_aux_file_tl` will be in charge of executing the writing code in the `.aux` file.

```

156 \tl_new:N \l__enumext_newlabel_arg_one_tl
157 \tl_new:N \l__enumext_newlabel_arg_two_tl
158 \tl_new:N \l__enumext_write_aux_file_tl
159 \cs_set_protected:Npn \__enumext_tmp:n #1
160 {
161   \tl_new:c { l__enumext_label_copy_#1_tl }
162 }
163 \clist_map_inline:nn { i, ii, iii, iv, v, vi, vii, viii } { \__enumext_tmp:n {#1} }

```

(End of definition for `\l__enumext_newlabel_arg_one_tl` and others.)

Internal variables used for redefinition of `\footnote` (§13.8).

```

164 \int_new:N \g__enumext_footnote_standar_int
165 \int_new:N \g__enumext_footnote_starred_int
166 \seq_new:N \g__enumext_footnote_standar_arg_seq
167 \seq_new:N \g__enumext_footnote_starred_arg_seq
168 \seq_new:N \g__enumext_footnote_standar_int_seq
169 \seq_new:N \g__enumext_footnote_starred_int_seq

```

(End of definition for `\g__enumext_footnote_standar_int` and others.)

Internal variables used by `enumext*` and `keyans*` environments.

```

170 \cs_set_protected:Npn \__enumext_tmp:n #1
171 {
172   \bool_new:c { l__enumext_item_starred_#1_bool }
173   \int_new:c { l__enumext_item_column_pos_#1_int }
174   \int_new:c { g__enumext_item_count_all_#1_int }
175   \int_new:c { l__enumext_joined_item_#1_int }
176   \int_new:c { l__enumext_joined_item_aux_#1_int }
177   \int_new:c { l__enumext_tmpa_#1_int }
178   \dim_new:c { l__enumext_tmpa_#1_dim }
179   \box_new:c { l__enumext_item_text_#1_box }
180   \dim_new:c { l__enumext_joined_width_#1_dim }
181   \dim_new:c { l__enumext_item_width_#1_dim }
182   \tl_new:c { g__enumext_item_symbol_aux_#1_tl }
183   \str_new:c { l__enumext_align_label_#1_str }
184   \bool_new:c { g__enumext_minipage_active_#1_bool }
185   \box_new:c { l__enumext_miniright_code_#1_box }
186   \bool_new:c { g__enumext_minipage_center_#1_bool }
187   \dim_new:c { g__enumext_minipage_right_#1_dim }

```

```

188     \skip_new:c { g__enumext_minipage_right_#1_skip }
189   }
190   \clist_map_inline:nn { vii, viii } { \__enumext_tmp:n {#1} }

```

(End of definition for `__enumext_item_starred_X_bool` and others.)

`\c__enumext_all_envs_clist` An internal `clist-var` variable to run with `__enumext_tmp:n`.

```

191   \clist_const:Nn \c__enumext_all_envs_clist
192   {
193     {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv},
194     {keyans}{v}, {enumext*}{vii}, {keyans*}{viii}
195   }

```

(End of definition for `\c__enumext_all_envs_clist`.)

13.5 Some utility functions

`\keys_precompile:neN` `\seq_use:NV` Non-standard kernel variants used by the `\printkeyans` command (§13.48) and `\foreachkeyans` command (§13.51).

```

196   \cs_generate_variant:Nn \keys_precompile:nnN { neN }
197   \cs_generate_variant:Nn \seq_use:Nn { NV }

```

(End of definition for `\keys_precompile:neN` and `\seq_use:NV`.)

`__enumext_scan_tokens:n` The functions `\tl_rescan:nn` and `\tl_set_rescan:Nnn` provided by `expl3` doesn't fit the needs of this package because it does not allow catcode changes inside the argument, so verbatim stuff used inside one of `anskey*` environment will not work. Here we create a private copy of `\tex_scantokens:D` which will serve our purposes. See the answer by Ulrich Diez in [How do use {<setup>}](#) in `\tl_set_rescan:Nnn` to replace `\scantokens?`.

```

198   \cs_new_protected:Npn \__enumext_scan_tokens:n #1 { \tex_scantokens:D {#1} }

```

(End of definition for `__enumext_scan_tokens:n`.)

`__enumext_at_begin_document:n` A internal “hook” function used for copying plain `list` and `minipage` environments definition and `hyperref` detection.

```

199   \cs_new_protected:Npn \__enumext_at_begin_document:n #1
200   {
201     \hook_gput_code:nnn {begindocument} {enumext} { #1 }
202   }

```

(End of definition for `__enumext_at_begin_document:n`.)

`__enumext_after_env:nn` `__enumext_before_env:nn` A internal “hook” functions for execute code `mini-right` and `mini-right*` keys outside the `enumext*` and `keyans*` environments and print `check-ans` outside the `enumext` and `enumext*` environments.

```

203   \cs_new_protected:Npn \__enumext_after_env:nn #1 #2
204   {
205     \hook_gput_code:nnn {env/#1/after} {enumext} {#2}
206   }
207   \cs_new_protected:Npn \__enumext_before_env:nn #1 #2
208   {
209     \hook_gput_code:nnn {env/#1/before} {enumext} {#2}
210   }

```

(End of definition for `__enumext_after_env:nn` and `__enumext_before_env:nn`.)

`__enumext_level:` Function for check current level in `enumext`.

```

211   \cs_new:Nn \__enumext_level:
212   {
213     \int_to_roman:n { \__enumext_level_int }
214   }

```

(End of definition for `__enumext_level:`.)

`__enumext_if_is_int:nT` `__enumext_if_is_int:nF` `__enumext_if_is_int:nTF` A conditional function to know if the variable we are passing is an integer used by `start` and `widest` keys. This function is taken directly from the answer given by Henri Menke in [How to test if an expl3 function argument is an integer expression?](#).

```

215   \prg_new_protected_conditional:Npnn \__enumext_if_is_int:n #1 { T, F, TF }
216   {
217     \regex_if_match:nnTF { ^[\+|-]?[\d]+$ } {#1} % $
218     { \prg_return_true: }
219     { \prg_return_false: }
220   }

```


(End of definition for `__enumext_if_is_int:nT`, `__enumext_if_is_int:nF`, and `__enumext_if_is_int:nTF`.)

`__enumext_show_length:nnn`

Internal function used by `show-length` key to show “*all lengths*” calculated and use in `enumext`, `enumext*`, `keyans` and `keyans*` environments.

```

221 \cs_new:Npn \__enumext_show_length:nnn #1 #2 #3
222 {
223   *~#2
224   \prg_replicate:nn { 14 - \str_count:n {#2} } {~}
225   =~\use:c { #1_use:c } { \__enumext_#2_#3_#1 } \\
226 }

```

(End of definition for `__enumext_show_length:nnn`.)

`__enumext_unskip_unkern:`

The function `__enumext_unskip_unkern:` will remove the last `<skip>` or `<kern>` at execution time using the values `11` and `12` of `\lastnodetype` to apply `\unskip` or `\unkern` according to the case.

```

227 \cs_new_protected:Nn \__enumext_unskip_unkern:
228 {
229   \int_case:nnT { \lastnodetype }
230   {
231     { 11 } { \unskip }
232     { 12 } { \unkern }
233   }
234 }

```

(End of definition for `__enumext_unskip_unkern:`.)

13.5.1 Utilities for environments and levels

`__enumext_is_not_nested:`

The function `__enumext_is_not_nested:` set the variables `\g__enumext_standar_bool` and `\g__enumext_starred_bool` to “*true*” only if the environments `enumext` and `enumext*` are NOT nested in each other and save the environment name in `\l__enumext_envir_name_tl`.

`__enumext_is_on_first_level:`

```

235 \cs_new_protected:Nn \__enumext_is_not_nested:
236 {
237   \str_case:en { \@currentenv }
238   {
239     {enumext}
240     {
241       \tl_set:Nn \l__enumext_envir_name_tl { enumext }
242       \bool_lazy_and:nnT
243       { \bool_not_p:n { \g__enumext_standar_bool } }
244       { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
245       {
246         \bool_gset_true:N \g__enumext_standar_bool
247       }
248     }
249     {enumext*}
250     {
251       \tl_set:Nn \l__enumext_envir_name_tl { enumext* }
252       \bool_lazy_and:nnT
253       { \bool_not_p:n { \g__enumext_starred_bool } }
254       { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
255       {
256         \bool_gset_true:N \g__enumext_starred_bool
257       }
258     }
259   }
260 }

```

The function `__enumext_is_on_first_level:` will set the variables `\l__enumext_standar_first_bool` (§13.27.1), `\l__enumext_starred_first_bool` (§13.27.1) to “*true*” only if the environment is not nested and we are in the “*first level*” of it . We will also save the *start line number* of each environment in the variable `\g__enumext_start_line_tl` and the *name* of each environment in the variable `\g__enumext_envir_name_tl` to use in messages related to the `check-ans` key and `.log` file.

```

261 \cs_new_protected:Nn \__enumext_is_on_first_level:
262 {
263   \bool_lazy_all:nT
264   {
265     { \bool_if_p:N \g__enumext_standar_bool }
266     { \int_compare_p:nNn { \l__enumext_level_int } = { 1 } }
267     { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
268   }
269   {

```

```

270         \bool_set_true:N \l__enumext_standar_first_bool
271         \tl_gset:Nn \g__enumext_envir_name_tl { enumext }
272         \tl_gset:Ne \g__enumext_start_line_tl
273         {
274             on~line~\exp_not:V \inputlineno
275         }
276     }
277     \bool_lazy_all:nT
278     {
279         { \bool_if_p:N \g__enumext_starred_bool }
280         { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
281         { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
282     }
283     {
284         \bool_set_true:N \l__enumext_starred_first_bool
285         \tl_gset:Nn \g__enumext_envir_name_tl { enumext* }
286         \tl_gset:Ne \g__enumext_start_line_tl
287         {
288             on~line~\exp_not:V \inputlineno
289         }
290     }
291 }

```

(End of definition for \l__enumext_is_not_nested: and \l__enumext_is_on_first_level:.)

\l__enumext_keyans_name_and_start:

The function \l__enumext_keyans_name_and_start: will save the start line number and name of the environments `keyans`, `keyans*` and `keyanspic` in the variables `\l__enumext_check_start_line_env_tl` and `\l__enumext_envir_name_tl` to use in the `\l__enumext_check_starred_cmd:n` function.

```

292 \cs_new_protected:Nn \l__enumext_keyans_name_and_start:
293 {
294     \str_case:en { \@currenvir }
295     {
296         {keyans}
297         {
298             \tl_set:Nn \l__enumext_envir_name_tl { keyans }
299             \tl_set:Ne \l__enumext_check_start_line_env_tl
300             {
301                 in~'keyans'~start~on~line~\exp_not:V \inputlineno
302             }
303         }
304         {keyans*}
305         {
306             \tl_set:Nn \l__enumext_envir_name_tl { keyans* }
307             \tl_set:Ne \l__enumext_check_start_line_env_tl
308             {
309                 in~'keyans*'~start~on~line~\exp_not:V \inputlineno
310             }
311         }
312         {keyanspic}
313         {
314             \tl_set:Nn \l__enumext_envir_name_tl { keyanspic }
315             \tl_set:Ne \l__enumext_check_start_line_env_tl
316             {
317                 in~'keyanspic'~start~on~line~\exp_not:V \inputlineno
318             }
319         }
320     }
321 }

```

(End of definition for \l__enumext_keyans_name_and_start:.)

13.5.2 Utilities for log and terminal

\l__enumext_reset_global_vars:

The function \l__enumext_reset_global_vars: will be passed to the function \l__enumext_execute_after_env: and will return the global variables to their default values after being used.

\l__enumext_reset_global_int:

\l__enumext_reset_global_bool:

\l__enumext_reset_global_tl:

```

322 \cs_new_protected:Nn \l__enumext_reset_global_vars:
323 {
324     \l__enumext_reset_global_int:
325     \l__enumext_reset_global_bool:
326     \l__enumext_reset_global_tl:
327 }
328 \cs_new_protected:Nn \l__enumext_reset_global_int:

```

```

329   {
330     \int_gzero:N \g__enumext_item_number_int
331     \int_gzero:N \g__enumext_item_anskey_int
332     \int_gzero:N \g__enumext_item_answer_diff_int
333   }
334 \cs_new_protected:Nn \__enumext_reset_global_bool:
335   {
336     \bool_gset_false:N \g__enumext_check_ans_key_bool
337     \bool_gset_false:N \g__enumext_standar_bool
338     \bool_gset_false:N \g__enumext_starred_bool
339   }
340 \cs_new_protected:Nn \__enumext_reset_global_tl:
341   {
342     \tl_gclear:N \g__enumext_store_name_tl
343     \tl_gclear:N \g__enumext_start_line_tl
344     \tl_gclear:N \g__enumext_envir_name_tl
345   }

```

(End of definition for __enumext_reset_global_vars: and others.)

__enumext_log_global_vars: The function __enumext_log_global_vars: will be passed to the function __enumext_execute_after_env: and write to the .log file the number of elements saved in the *prop list* and *sequence* created by the *save-ans* key along with the value of the integer variable created for the *resume* key.

```

346 \cs_new_protected:Nn \__enumext_log_global_vars:
347   {
348     \msg_log:nneeee { enumext } { prop-seq-int-hook }
349     { \g__enumext_store_name_tl }
350     { \prop_count:c { g__enumext_ \g__enumext_store_name_tl _prop } }
351     { \seq_count:c { g__enumext_ \g__enumext_store_name_tl _seq } }
352     { \int_use:c { g__enumext_resume_ \g__enumext_store_name_tl _int } }
353   }

```

The function __enumext_log_answer_vars: will be passed to the function __enumext_execute_after_env: and write to the .log file the number of items and answers along with the difference between them.

```

354 \cs_new_protected:Nn \__enumext_log_answer_vars:
355   {
356     \msg_log:nneeee { enumext } { item-answer-hook }
357     { \int_use:N \g__enumext_item_number_int }
358     { \int_use:N \g__enumext_item_anskey_int }
359     { \int_eval:n { \g__enumext_item_number_int - \g__enumext_item_anskey_int } }
360   }

```

(End of definition for __enumext_log_global_vars: and __enumext_log_answer_vars:.)

13.6 Copying list and minipage environments

The `list` environment provided by \TeX has the following plain form:

```

\list{⟨arg one⟩}{⟨arg two⟩}
  \item[⟨opt⟩]
\endlist

```

And `minipage` environment provided by \TeX has the following (simplified) plain form:

```

\minipage[⟨pos⟩][⟨height⟩][⟨inner-pos⟩]{⟨width⟩}
  ⟨internal implement⟩
\endminipage

```

As a precaution we copy them using __enumext_at_begin_document:n in case any package redefines the `list` environment or a related command.

🔍 For compatibility with *tagged* PDF we should use \NewCommandCopy and not \cs_new_eq:NN for \item. When *tagged* PDF is active \item is redefined using `ltxcmd` (see `latex-lab-block`[19]).

```

\__enumext_start_list:nn The functions \__enumext_start_list:nn and \__enumext_stop_list: correspond to copies of \list
\__enumext_stop_list: and \endlist from plain definition of list environment, the function \__enumext_item_std:w is a copy
\__enumext_item_std:w of the \item command.
\__enumext_minipage:w
\__enumext_endminipage:
361 \__enumext_at_begin_document:n
362   {
363     \cs_new_eq:NN \__enumext_start_list:nn \list
364     \cs_new_eq:NN \__enumext_stop_list: \endlist
365     \NewCommandCopy \__enumext_item_std:w \item
366   }

```

The functions `__enumext_minipage:w` and `__enumext_endminipage:` correspond to copies of `\minipage` and `\endminipage` from plain definition of `minipage` environment.

```

367 \__enumext_at_begin_document:n
368 {
369     \cs_new_eq:NN \__enumext_minipage:w \minipage
370     \cs_new_eq:NN \__enumext_endminipage: \endminipage
371 }

```

(End of definition for `__enumext_start_list:nn` and others.)

13.7 Compatibility with hyperref and footnotehyper

First we define the necessary rules using “hooks” to determine if the `hyperref` package is loaded.

```

\__enumext_after_hyperref:
\__enumext_hypertarget:nn
\__enumext_phantomsection:

```

```

372 \hook_gput_code:nnn { begindocument } { enumext } { \__enumext_after_hyperref: }
373 \hook_gset_rule:nnnn { begindocument } { enumext } { after } { hyperref }

```

The function `__enumext_after_hyperref:` sets the state of the boolean variable `\l__enumext_hyperref_bool` to “true” if the package is loaded. At this point we will use the public macro `\IfHyperBoolean` to determine if the `hyperfootnotes=true` key is present, if so, we set the state of the boolean variable `__enumext_footnotes_key_bool` to “true”.

```

374 \cs_new_protected:Nn \__enumext_after_hyperref:
375 {
376     \IfPackageLoadedT { hyperref }
377     {
378         \msg_info:nnn { enumext } { package-load } { hyperref }
379         \bool_set_true:N \l__enumext_hyperref_bool
380         \IfHyperBoolean{hyperfootnotes}
381         {
382             \bool_set_true:N \l__enumext_footnotes_key_bool
383         }
384     }
385 }

```

If the state of the variable `\l__enumext_footnotes_key_bool` is true we will check if the package `footnotehyper` is loaded, in case it is not present, we will set the value of `\l__enumext_footnotes_key_bool` to false and we will redefine `\footnote`.

```

386 \bool_if:NT \l__enumext_footnotes_key_bool
387 {
388     \IfPackageLoadedTF { footnotehyper }
389     {
390         \msg_info:nnn { enumext } { package-load } { footnotehyper }
391     }
392     {
393         \bool_set_false:N \l__enumext_footnotes_key_bool
394     }
395 }

```

The functions `__enumext_hypertarget:nn` and `__enumext_phantomsection:` correspond to the internal copies of `\hypertarget` and `\phantomsection`. If the boolean variable `\l__enumext_hyperref_bool` is false the functions `__enumext_hypertarget:nn` and `__enumext_phantomsection:` will be disabled.

```

396 \bool_if:NTF \l__enumext_hyperref_bool
397 {
398     \cs_new_eq:NN \__enumext_hypertarget:nn \hypertarget
399     \cs_new_eq:NN \__enumext_phantomsection: \phantomsection
400 }
401 {
402     \cs_new_eq:NN \__enumext_hypertarget:nn \use_none:nn
403     \cs_new_eq:NN \__enumext_phantomsection: \prg_do_nothing:
404 }
405 }

```

(End of definition for `__enumext_after_hyperref:`, `__enumext_hypertarget:nn`, and `__enumext_phantomsection:`.)

```
\__enumext_newlabel:nn
```

The function `__enumext_newlabel:nn` write the information to the `.aux` file when using the `save-ref` key. The arguments taken by the function are:

```

#1: \l__enumext_newlabel_arg_one_tl
#2: \l__enumext_newlabel_arg_two_tl

```

- The trick here is to manage the number of arguments passed to `\newlabel{#1}{#2}` according to the presence of the `hyperref` package.

```

406 \cs_new_protected:Npn \__enumext_newlabel:nn #1 #2
407 {

```

```

408 \protected@write \auxout { }
409 {
410   \token_to_str:N \newlabel {#1}
411   {
412     {#2}
413     \bool_if:NT \l__enumext_hyperref_bool
414     { { \thepage } {#2} {#1} }
415     { }
416   }
417 }
418 \__enumext_hypertarget:nn {#1} { }
419 \__enumext_phantomsection:
420 }

```

(End of definition for `__enumext_newlabel:nn`.)

13.8 Internal redefining `\footnote` command

To keep the correct numbering of `\footnote` and to make it work correctly in the `enumext*` and `keyans*` environments and `mini-env` key it is necessary to redefine the `\footnote` command. This implementation is adapted from the answer given by Clea F. Rees (@cfr) in [footnotes in boxes compatible with hyperref](#).

```

\__enumext_footnotetext:nn
\__enumext_renew_footnote:
\__enumext_print_footnote:
  \__enumext_renew_footnote_mini:
  \__enumext_print_footnote_mini:

```

Redefinition of the `\footnote` command using `\footnotetext` and `\footnotemark` for the `mini-env` key in the `enumext` and `keyans` environments.

```

421 \cs_new_protected:Nn \__enumext_footnotetext:nn
422 {
423   \footnotetext[#1]{#2}
424 }
425 \cs_new_protected:Nn \__enumext_renew_footnote:
426 {
427   \RenewDocumentCommand \footnote { o +m }
428   {
429     \tl_if_novalue:nTF {##1}
430     {
431       \stepcounter{footnote}
432       \int_gset_eq:Nc \g__enumext_footnote_standar_int { c@footnote }
433     }
434     {
435       \int_gset:Nn \g__enumext_footnote_standar_int { ##1 }
436     }
437     \footnotemark [ \g__enumext_footnote_standar_int ]
438     \seq_gput_right:Nn \g__enumext_footnote_standar_arg_seq { ##2 }
439     \seq_gput_right:NV
440     \g__enumext_footnote_standar_int_seq \g__enumext_footnote_standar_int
441   }
442 }
443 \cs_new_protected:Nn \__enumext_print_footnote:
444 {
445   \seq_if_empty:NF \g__enumext_footnote_standar_int_seq
446   {
447     \seq_map_pairwise_function:NNN
448     \g__enumext_footnote_standar_int_seq
449     \g__enumext_footnote_standar_arg_seq
450     \__enumext_footnotetext:nn
451   }
452   \seq_gclear:N \g__enumext_footnote_standar_arg_seq
453   \seq_gclear:N \g__enumext_footnote_standar_int_seq
454 }

```

The `enumext*` and `keyans*` environments are implemented using `minipage` so we must also redefine `\footnote` to keep these numbering as if it were part of the document.

```

455 \cs_new_protected:Nn \__enumext_renew_footnote_mini:
456 {
457   \RenewDocumentCommand \footnote { o +m }
458   {
459     \tl_if_novalue:nTF {##1}
460     {
461       \stepcounter{footnote}
462       \int_gset_eq:Nc \g__enumext_footnote_starred_int { c@footnote }
463     }
464     {
465       \int_gset:Nn \g__enumext_footnote_starred_int { ##1 }

```

```

466     }
467     \footnotemark [ \g__enumext_footnote_starred_int ]
468     \seq_gput_right:Nn \g__enumext_footnote_starred_arg_seq { ##2 }
469     \seq_gput_right:NV
470     \g__enumext_footnote_starred_int_seq \g__enumext_footnote_starred_int
471   }
472 }
473 \cs_new_protected:Nn \__enumext_print_footnote_mini:
474 {
475   \seq_if_empty:NF \g__enumext_footnote_starred_int_seq
476   {
477     \seq_map_pairwise_function:NNN
478     \g__enumext_footnote_starred_int_seq
479     \g__enumext_footnote_starred_arg_seq
480     \__enumext_footnotetext:nn
481   }
482   \seq_gclear:N \g__enumext_footnote_starred_arg_seq
483   \seq_gclear:N \g__enumext_footnote_starred_int_seq
484 }

```

(End of definition for `__enumext_footnotetext:nn` and others.)

```

\__enumext_renew_footnote_standar:
\__enumext_print_footnote_standar:
\__enumext_renew_footnote_starred:
\__enumext_print_footnote_starred:

```

We encapsulate the redefinition of `\footnote` to pass it to internal `__enumext_mini_page` environment used by the `mini-env` key in the `enumext` and `keyans` environments. We will run the redefinition when *tagged* PDF is active or when the `footnotehyper` package is not loaded.

```

485 \cs_new_protected:Nn \__enumext_renew_footnote_standar:
486 {
487   \bool_if:NT \g__enumext_standar_bool
488   {
489     \IfDocumentMetadataTF
490     {
491       \__enumext_renew_footnote:
492     }
493     {
494       \bool_if:NF \l__enumext_footnotes_key_bool
495       {
496         \__enumext_renew_footnote:
497       }
498     }
499   }
500 }
501 \cs_new_protected:Nn \__enumext_print_footnote_standar:
502 {
503   \bool_if:NT \g__enumext_standar_bool
504   {
505     \IfDocumentMetadataTF
506     {
507       \__enumext_print_footnote:
508     }
509     {
510       \bool_if:NF \l__enumext_footnotes_key_bool
511       {
512         \__enumext_print_footnote:
513       }
514     }
515   }
516 }

```

We encapsulate the redefinition of `\footnote` to pass it to the `enumext*` and `keyans*` environments. We will run the redefinition when *tagged* PDF is active or when the `footnotehyper` package is not loaded.

```

517 \cs_new_protected:Nn \__enumext_renew_footnote_starred:
518 {
519   \IfDocumentMetadataTF
520   {
521     \__enumext_renew_footnote_mini:
522   }
523   {
524     \bool_if:NF \l__enumext_footnotes_key_bool
525     {
526       \__enumext_renew_footnote_mini:
527     }

```



```

528     }
529 }
530 \cs_new_protected:Nn \__enumext_print_footnote_starred:
531 {
532   \IfDocumentMetadataTF
533   {
534     \__enumext_print_footnote_mini:
535   }
536   {
537     \bool_if:NF \__enumext_footnotes_key_bool
538     {
539       \__enumext_print_footnote_mini:
540     }
541   }
542 }

```

In `enumext*` and `keyans*` environments we need to use “hooks” to print `\footnote` with support for *tagged* PDF.

```

543 \__enumext_after_env:nn { enumext* }
544 {
545   \__enumext_print_footnote_starred:
546 }
547 \__enumext_after_env:nn { keyans* }
548 {
549   \__enumext_print_footnote_starred:
550 }

```

(End of definition for `__enumext_renew_footnote_standar:` and others.)

13.9 The internal minipage environment

```

\__enumext_internal_mini_page:
__enumext_mini_env*

```

The function `__enumext_internal_mini_page:` creates a internal `__enumext_mini_page` environment (*custom version* of `minipage`) setting the `\if@minipage` switch to “false” to allow spaces at the “above” of the environment, plus we will add `\skip_vertical:N \c_zero_skip` to maintain alignment on “top” in the first part and `\skip_vertical:N \c_zero_skip` in the second part to allow spaces “below”. This environment will be used internally by the `mini-env` key, it is NOT documented in the user interface and is for internal use only. Within this environment we redefine `\footnote` to make them look the same as if they were elsewhere in the document. This function is passed to the function `__enumext_safe_exec:` in the `enumext` environment definition (§13.40) and `__enumext_safe_exec_vii:` in the `enumext*` environment definition (§13.45)

```

551 \cs_new_protected:Nn \__enumext_internal_mini_page:
552 {
553   \int_compare:nNtT { \__enumext_level_int } = { 0 }
554   {
555     \DeclareDocumentEnvironment{\__enumext_mini_page}{m}
556     {
557       \__enumext_renew_footnote_standar:
558       \__enumext_minipage:w [ t ] { ##1 }
559       \legacy_if_gset_false:n { @minipage }
560       \skip_vertical:N \c_zero_skip
561     }
562     {
563       \skip_vertical:N \c_zero_skip
564       \__enumext_endminipage:
565       \__enumext_print_footnote_standar:
566     }
567   }
568 }

```

(End of definition for `__enumext_internal_mini_page:` and `__enumext_mini_env*`.)

13.10 Definition of public dimension

The package `enumext` only provides a single public dimension `\itemwidth` and is intended for user convenience only and is not for internal use as such. This dimension is set in all environments and is only used by the `wrap-ans` key at its default value.

```

569 \dim_zero_new:N \itemwidth

```

13.11 Definition of counters

To create the necessary “counters” we must first make sure that they are not already defined by the user or a package such as `enumitem`, otherwise a error will be returned and the package loading will be aborted. The arguments taken by the function are:

- #1: A token list `__enumext_counter_X_tl` for “store” the counter’s name.
 #2: The counter’s name.

```
enumXi 570 \cs_new_protected:Npn \__enumext_define_counter:Nn #1 #2
enumXi 571 {
enumXi 572   \cs_if_exist:cTF { c@ #2 }
enumXvi 573   { \msg_fatal:nnn { enumext } { counters } { #2 } }
enumXvii 574   {
enumXviii 575     \tl_set:Nn #1 { #2 }
576     \newcounter { #2 }
577   }
578 }
```

The counters created here are `enumXi`, `enumXii`, `enumXiii` and `enumXiv` for `enumext` environment, `enumXv` for `keyans` environment, `enumXvi` for `keyanspic` environment, `enumXvii` for `enumext*` and `enumXviii` for the `keyans*` environments.

```
579 \__enumext_define_counter:Nn \__enumext_counter_i_tl { enumXi }
580 \__enumext_define_counter:Nn \__enumext_counter_ii_tl { enumXii }
581 \__enumext_define_counter:Nn \__enumext_counter_iii_tl { enumXiii }
582 \__enumext_define_counter:Nn \__enumext_counter_iv_tl { enumXiv }
583 \__enumext_define_counter:Nn \__enumext_counter_v_tl { enumXv }
584 \__enumext_define_counter:Nn \__enumext_counter_vi_tl { enumXvi }
585 \__enumext_define_counter:Nn \__enumext_counter_vii_tl { enumXvii }
586 \__enumext_define_counter:Nn \__enumext_counter_viii_tl { enumXviii }
```

(End of definition for `__enumext_define_counter:Nn` and others.)

13.12 Definition of labels

This part of the code is inspired by the `enumitem` package. The idea is to be able to access the counters using `\arabic*`, `\Alph*`, `\alph*`, `\Roman*` and `\roman*` to use them in the `label` key.

- 🟢 Direct support for this is provided since \LaTeX release 2025-06-01[13], but we will keep the original implementation so as not to hinder the internal “label and ref” system.

These `<counters>` will be used as default `<labels>` if the `label` key is not used for the different levels of the `enumext`, `enumext*`, `keyans` and `keyans*` environments, so it is necessary to get a default value for `labelwidth` from these `<labels>` at the same time.

```
587 \cs_new_protected:Npn \__enumext_register_default_label_wd:Nn #1 #2
588 {
589   \tl_const:cn { c__enumext_widest_ \cs_to_str:N #1 _tl } {#2}
590   \tl_gput_right:Nn \g__enumext_counter_styles_tl {#1}
591 }
592 \__enumext_register_default_label_wd:Nn \arabic { 0 }
593 \__enumext_register_default_label_wd:Nn \Alph { M }
594 \__enumext_register_default_label_wd:Nn \alph { m }
595 \__enumext_register_default_label_wd:Nn \Roman { VIII }
596 \__enumext_register_default_label_wd:Nn \roman { viii }
```

(End of definition for `__enumext_register_default_label_wd:Nn`.)

The function `__enumext_label_width_by_box:Nn` set the default `\labelwidth` using a box width if no `labelwidth` key is passed.

```
597 \cs_new_protected:Npn \__enumext_label_width_by_box:Nn #1 #2
598 {
599   \hbox_set:Nn \l__enumext_label_width_by_box {#2}
600   \dim_set:Nn #1 { \box_wd:N \l__enumext_label_width_by_box }
601 }
602 \cs_generate_variant:Nn \__enumext_label_width_by_box:Nn { cv }
```

(End of definition for `__enumext_label_width_by_box:Nn`.)

The function `__enumext_label_style:Nnn` is used by the `label` key to creates the variables containing the `<label style>` and will allow to use `\arabic*`, `\Alph*`, `\alph*`, `\Roman*` and `\roman*` as arguments. It loops through the defined counter styles in `\g__enumext_counter_styles_tl` (`\arabic`, `\alph`, `\Alph`, `\roman` and `\Roman`) for example, looking for `\roman*` and replacing that by `\roman{<counter>}`, and doing the same for the `\g__enumext_widest_label_tl` to keep both in sync.

```
603 \cs_new_protected:Npn \__enumext_label_style:Nnn #1 #2 #3
```

```

604 {
605   \tl_clear_new:N #1
606   \tl_put_right:Ne #1 { \tl_trim_spaces:n {#3} }
607   \tl_gset_eq:NN \g__enumext_widest_label_tl #1
608   \tl_map_inline:Nn \g__enumext_counter_styles_tl
609     {
610       \tl_replace_all:Nne #1 { ##1* } { \exp_not:N ##1 {#2} }
611       \tl_greplace_all:Nne \g__enumext_widest_label_tl { ##1* }
612       { \tl_use:c { c__enumext_widest_ \cs_to_str:N ##1 _tl } }
613     }
614   \__enumext_label_width_by_box:Nn \l__enumext_current_widest_dim
615   { \tl_use:N \g__enumext_widest_label_tl }
616   \tl_set_eq:cN { the #2 } #1
617 }
618 \cs_generate_variant:Nn \__enumext_label_style:Nnn { cvn }

```

(End of definition for `__enumext_label_style:Nnn`.)

13.13 Setting keys associated with label

When *tagged* PDF is active `\makelabel` is redefined using `\makebox` to work correctly (§13.35). From the user side it is convenient to have a key that allows using this redefinition with `\makebox` without having `\IfDocumentMetadataTF` active.

`mode-box` We define the key `mode-box` only for the “first level” of `enumext` and `enumext*` environments.

```

619 \cs_set_protected:Npn \__enumext_tmp:n #1
620 {
621   \keys_define:nn { enumext / #1 }
622   {
623     mode-box .bool_set:N = \l__enumext_mode_box_bool,
624     mode-box .initial:n = false,
625     mode-box .value_forbidden:n = true,
626   }
627 }
628 \clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }

```

(End of definition for `mode-box`.)

`font` Definition of keys `font`, `labelsep`, `labelwidth`, `wrap-label` and `wrap-label*` keys for `enumext` and `keyans` environments.

```

629 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
630 {
631   \keys_define:nn { enumext / #1 }
632   {
633     font .tl_set:c = { \l__enumext_label_font_style_#2_tl },
634     font .value_required:n = true,
635     labelsep .dim_set:c = { \l__enumext_labelsep_#2_dim },
636     labelsep .initial:n = {0.3333em},
637     labelsep .value_required:n = true,
638     labelwidth .dim_set:c = { \l__enumext_labelwidth_#2_dim },
639     labelwidth .value_required:n = true,
640     wrap-label .cs_set_protected:cp = { __enumext_wrapper_label_#2:n } ##1,
641     wrap-label .initial:n = {##1},
642     wrap-label .value_required:n = true,
643     wrap-label* .code:n = {
644       \bool_set_true:c { \l__enumext_wrap_label_opt_#2_bool }
645       \keys_set:nn { enumext / #1 } { wrap-label = {##1} }
646     },
647     wrap-label* .value_required:n = true,
648   }
649 }
650 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

(End of definition for `font` and others.)

`align` The `align` key is implemented differently for “starred” and “non starred” environments. For compatibility with *tagged* PDF we must set `\l__enumext_align_label_pos_X_str`.

```

651 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
652 {
653   \keys_define:nn { enumext / #1 }
654   {
655     align .choice:,

```

```

656         align / left      .code:n =
657                             {
658                                 \tl_clear:c { l__enumext_label_fill_left_#2_tl }
659                                 \tl_set:cn { l__enumext_label_fill_right_#2_tl } { \hfill }
660                                 \str_set:cn { l__enumext_align_label_pos_#2_str } { l }
661                             },
662         align / right     .code:n =
663                             {
664                                 \tl_set:cn { l__enumext_label_fill_left_#2_tl } { \hfill }
665                                 \tl_clear:c { l__enumext_label_fill_right_#2_tl }
666                                 \str_set:cn { l__enumext_align_label_pos_#2_str } { r }
667                             },
668         align / center    .code:n =
669                             {
670                                 \tl_set:cn { l__enumext_label_fill_left_#2_tl } { \hfill }
671                                 \tl_set:cn { l__enumext_label_fill_right_#2_tl } { \hfill }
672                                 \str_set:cn { l__enumext_align_label_pos_#2_str } { c }
673                             },
674         align / unknown   .code:n =
675                             \msg_error:nnee { enumext } { unknown-choice }
676                             { align } { left,~right,~ center } { \exp_not:n {##1} },
677         align .initial:n = left,
678         align .value_required:n = true,
679     }
680 }
681 \clist_map_inline:nn
682 {
683     {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {keyans}{v}
684 }
685 { l__enumext_tmp:nn #1 }

686 \cs_set_protected:Npn l__enumext_tmp:nn #1 #2
687 {
688     \keys_define:nn { enumext / #1 }
689     {
690         align .choice:,
691         align / left      .code:n = \str_set:cn { l__enumext_align_label_#2_str } { l },
692         align / right     .code:n = \str_set:cn { l__enumext_align_label_#2_str } { r },
693         align / center    .code:n = \str_set:cn { l__enumext_align_label_#2_str } { c },
694         align / unknown   .code:n =
695                             \msg_error:nnee { enumext } { unknown-choice }
696                             { align } { left,~right,~ center } { \exp_not:n {##1} },
697         align .initial:n = left,
698         align .value_required:n = true,
699     }
700 }
701 \clist_map_inline:nn { {enumext*}{vii}, {keyans*}{viii} } { l__enumext_tmp:nn #1 }

```

(End of definition for align.)

13.14 Setting label and ref keys

The implementation of the keys `label` and `ref` are part of the core of the package `enumext`, here the default values for `<label>`, the value of the variables `\l__enumext_label_X_tl`, the default values for `\labelwidth` and the “*label and ref*” system.

13.14.1 Define and set label and ref keys for enumext environment

Here we set the default `<labels>` of the *four levels* of `enumext` environment, along with the default value for `labelwidth` key and `ref` key.

```

\l__enumext_label_i_tl
\l__enumext_label_ii_tl
\l__enumext_label_iii_tl
\l__enumext_label_iv_tl

702 \cs_set_protected:Npn l__enumext_tmp:nnn #1 #2 #3
703 {
704     \keys_define:nn { enumext / #1 }
705     {
706         label .code:n = {
707             \__enumext_label_style:cvn { l__enumext_label_#2_tl }
708             { l__enumext_counter_#2_tl } {##1}
709             \dim_set_eq:cN { l__enumext_labelwidth_#2_dim }
710             \l__enumext_current_widest_dim
711         },
712         label .initial:n = #3,
713         label .value_required:n = true,
714         ref .code:n = \__enumext_standar_ref:n {##1},

```

```

715         ref .value_required:n = true,
716     }
717 }
718 \__enumext_tmp:nnn { level-1 } { i } { \arabic*.}
719 \__enumext_tmp:nnn { level-2 } { ii } { (\alph*) }
720 \__enumext_tmp:nnn { level-3 } { iii } { \roman*. }
721 \__enumext_tmp:nnn { level-4 } { iv } { \Alph*. }

```

(End of definition for `label` and others.)

```

\__enumext_standar_ref:n
\__enumext_standar_ref:

```

The `__enumext_standar_ref:n` function will first pass the key *argument* `ref` to the variable `\l__enumext_ref_key_arg_tl` and analyze its state, if it is not *empty* it will set a copy of of the *current counter style* save in `\l__enumext_the_counter_X_tl` to `\l__enumext_ref_the_count_tl` and then set the variable `\l__enumext_renew_counter_X_tl` which will modify `\theenumX`.

```

722 \cs_new_protected:Npn \__enumext_standar_ref:n #1
723 {
724     \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
725     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
726     {
727         \msg_error:nnn { enumext } { key-ref-empty } { enumext }
728     }
729     {
730         \tl_set_eq:Nc \l__enumext_ref_the_count_tl
731         {
732             l__enumext_the_counter_ \__enumext_level: _tl
733         }
734         \tl_set:ce { l__enumext_renew_counter_ \__enumext_level: _tl }
735         {
736             \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl }
737             { \exp_not:V \l__enumext_ref_key_arg_tl }
738         }
739     }
740 }

```

Finally the function `__enumext_standar_ref:` will execute the modification for the reference system in the second argument of the environment definition `enumext`.

```

741 \cs_new_protected:Npn \__enumext_standar_ref:
742 {
743     \tl_if_empty:cF { l__enumext_renew_counter_ \__enumext_level: _tl }
744     {
745         \tl_use:c { l__enumext_renew_counter_ \__enumext_level: _tl }
746     }
747 }

```

(End of definition for `__enumext_standar_ref:n` and `__enumext_standar_ref:`.)

13.14.2 Define and set `label` and `ref` keys for `enumext*` and `keyans*` environments

Here we set the default *⟨labels⟩* for `enumext*` and `keyans*` environments, along with the default value for `labelwidth` key and `ref` key.

```

\l__enumext_label_vii_tl
\l__enumext_label_viii_tl

```

```

748 \cs_set_protected:Npn \__enumext_tmp:nnn #1 #2 #3
749 {
750     \keys_define:nn { enumext / #1 }
751     {
752         label .code:n = {
753             \__enumext_label_style:cvn { l__enumext_label_#2_tl }
754             { l__enumext_counter_#2_tl } {##1}
755             \dim_set_eq:cN { l__enumext_labelwidth_#2_dim }
756             \l__enumext_current_widest_dim
757         },
758         label .initial:n = #3,
759         label .value_required:n = true,
760         ref .code:n = \__enumext_starred_ref:n {##1},
761         ref .value_required:n = true,
762     }
763 }
764 \__enumext_tmp:nnn { enumext* } { vii } { \arabic*.}
765 \__enumext_tmp:nnn { keyans* } { viii } { \Alph*) }

```

(End of definition for `label` and others.)

`__enumext_starred_ref:n`
`__enumext_starred_ref:`

The implementation of `__enumext_starred_ref:n` is the same as that used for the environment `enumext`.

```

766 \cs_new_protected:Npn \__enumext_starred_ref:n #1
767 {
768   \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
769   \int_compare:nNnT { \l__enumext_level_h_int } = { 1 }
770   {
771     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
772     {
773       \msg_error:nnn { enumext } { key-ref-empty } { enumext* }
774     }
775     {
776       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_vii_tl
777       \tl_set:Ne \l__enumext_renew_counter_vii_tl
778       {
779         \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V
780       }
781     }
782   }
783   \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
784   {
785     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
786     {
787       \msg_error:nnn { enumext } { key-ref-empty } { keyans* }
788     }
789     {
790       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_viii_tl
791       \tl_set:Ne \l__enumext_renew_counter_viii_tl
792       {
793         \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V
794       }
795     }
796   }
797 }

```

Finally the function `__enumext_starred_ref:` will execute the modification for the reference system in the second argument of the `enumext*` and `keyans*` environment definition.

```

798 \cs_new_protected:Nn \__enumext_starred_ref:
799 {
800   \int_compare:nNnT { \l__enumext_level_h_int } = { 1 }
801   {
802     \tl_if_empty:NF \l__enumext_renew_counter_vii_tl
803     {
804       \tl_use:N \l__enumext_renew_counter_vii_tl
805     }
806   }
807   \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
808   {
809     \tl_if_empty:NF \l__enumext_renew_counter_viii_tl
810     {
811       \tl_use:N \l__enumext_renew_counter_viii_tl
812     }
813   }
814 }

```

(End of definition for `__enumext_starred_ref:n` and `__enumext_starred_ref:`.)

13.14.3 Define and set label and ref keys for keyans and keyanspic environments

Here we set the default `<label>` for `keyans` and `keyanspic` environment, along with the default value for `labelwidth` if it has not been established and `ref` key. The `keyanspic` environment use the same `<label>` as the `keyans` environment.

```

\l__enumext_label_v_tl
\l__enumext_label_vi_tl
815 \keys_define:nn { enumext / keyans }
816 {
817   label .code:n = {
818     \__enumext_label_style:cvn { \l__enumext_label_v_tl }
819     { \l__enumext_counter_v_tl } {#1}
820     \__enumext_label_style:cvn { \l__enumext_label_vi_tl }
821     { \l__enumext_counter_vi_tl } {#1}
822     \dim_set_eq:NN
823     \l__enumext_labelwidth_v_dim \l__enumext_current_widest_dim
824   },
825   label .initial:n = \Alph*,

```



```

826     label .value_required:n = true,
827     ref .code:n = \__enumext_keyans_ref:n {#1},
828     ref .value_required:n = true,
829 }

```

(End of definition for `label` and others.)

`__enumext_keyans_ref:n` The implementation of `__enumext_keyans_ref:n` is the same as that used for the environment `enumext`.

```

\__enumext_keyans_ref:n
830 \cs_new_protected:Npn \__enumext_keyans_ref:n #1
831 {
832   \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
833   \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
834   {
835     \msg_error:nnn { enumext } { key-ref-empty } { keyans }
836   }
837   {
838     \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_v_tl
839     \tl_put_right:Ne \l__enumext_renew_counter_v_tl
840     {
841       \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V \l__
842     }
843   }
844 }

```

Finally the function `__enumext_keyans_ref:` will execute the modification for the reference system in the second argument of the `keyans*` environment definition.

```

845 \cs_new_protected:Nn \__enumext_keyans_ref:
846 {
847   \tl_if_empty:NF \l__enumext_renew_counter_v_tl
848   {
849     \tl_use:N \l__enumext_renew_counter_v_tl
850   }
851 }

```

(End of definition for `__enumext_keyans_ref:n` and `__enumext_keyans_ref:`.)

13.15 Setting `start`, `start*` and widest keys

```

\__enumext_start_from:NNn
\__enumext_start_from:ccn
\__enumext_start_from:cce

```

The function `__enumext_start_from:NNn` used by `start` and `start*` keys take three arguments:

```

#1: \l__enumext_label_X_tl
#2: \l__enumext_start_X_int
#3: <integer or string>

```

The first argument of this function are the “counter style” set by `label` key, the second argument is returned by the function, the third argument can be an *<integer>* or *<string>* of the form `\Alph`, `\alph`, `\Roman` or `\roman`. This effectively allows `start*=A` or `start=1` to be used.

```

852 \cs_new_protected:Npn \__enumext_start_from:NNn #1 #2 #3
853 {
854   \__enumext_if_is_int:nTF { #3 }
855   {
856     \int_set:Nn #2 {#3}
857   }
858   {
859     \regex_if_match:nVT { \c{Alph} | \c{alph} } {#1}
860     { \int_set:Nn #2 { \int_from_alph:n {#3} } }
861     \regex_if_match:nVT { \c{Roman} | \c{roman} } {#1}
862     { \int_set:Nn #2 { \int_from_roman:n {#3} } }
863   }
864 }
865 \cs_generate_variant:Nn \__enumext_start_from:NNn { ccn, cce }

```

(End of definition for `__enumext_start_from:NNn`.)

```

\__enumext_widest_from:nNNn
\__enumext_widest_from:nccn

```

The function `__enumext_widest_from:nNNn` used by the `widest` key take four arguments:

```

#1: The counter associated with the environment level
#2: \l__enumext_label_X_tl
#3: \l__enumext_labelwidth_X_dim
#4: <integer or string>

```

The second and third arguments of this function are the values set by `label` and `labelwidth` keys, the fourth argument can be an *integer* or *string* of the form `\Alph`, `\alph`, `\Roman` or `\roman`. The value of the fourth argument is set temporarily for the identified counter in this point (level), then the value is expanded into a “box” and the “width” of the “box” is returned.

```

866 \cs_new_protected:Npn \__enumext_widest_from:nNNn #1 #2 #3 #4
867 {
868   \__enumext_if_is_int:nTF {#4}
869   {
870     \setcounter{enumX#1} { #4 }
871   }
872   {
873     \regex_if_match:nVT { \c{Alph} | \c{alph} } {#2}
874     { \setcounter{enumX#1} { \int_from_alph:n {#4} } }
875     \regex_if_match:nVT { \c{Roman} | \c{roman} } {#2}
876     { \setcounter{enumX#1} { \int_from_roman:n {#4} } }
877   }
878   \__enumext_label_width_by_box:cv
879   { l__enumext_labelwidth_#1_dim } { l__enumext_label_#1_tl }
880 }
881 \cs_generate_variant:Nn \__enumext_widest_from:nNNn { nccn }

```

(End of definition for `__enumext_widest_from:nNNn`.)

Now define and set `start*`, `start` and `widest` keys for `enumext`, `enumext*`, `keyans` and `keyans*` environments.

```

882 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
883 {
884   \keys_define:nn { enumext / #1 }
885   {
886     start* .code:n = {
887       \__enumext_start_from:ccn
888       { l__enumext_label_#2_tl }
889       { l__enumext_start_#2_int } {##1}
890     },
891     start* .value_required:n = true,
892     start .code:n = {
893       \__enumext_start_from:cce
894       { l__enumext_label_#2_tl }
895       { l__enumext_start_#2_int } { \int_eval:n {##1} }
896     },
897     start .initial:n = 1,
898     start .value_required:n = true,
899     widest .code:n = {
900       \__enumext_widest_from:nccn {#2}
901       { l__enumext_label_#2_tl }
902       { l__enumext_labelwidth_#2_dim } {##1}
903     },
904     widest .value_required:n = true,
905   }
906 }
907 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

(End of definition for `start`, `start*`, and `widest`.)

13.16 Setting keys for penaltys

The three parameters `\@beginparpenalty`, `\@itempenalty` and `\@endparpenalty` work together to ensure that list environments look good, avoiding unsightly page breaks that can break the flow of the `list`, so it’s a good idea to have a *keys* to access these.

```

908 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
909 {
910   \keys_define:nn { enumext / #1 }
911   {
912     beginpenalty .int_set:c = { l__enumext_beginparpenalty_#2_int },
913     beginpenalty .initial:n = -51,
914     beginpenalty .value_required:n = true,
915     midpenalty .int_set:c = { l__enumext_itempenalty_#2_int },
916     midpenalty .initial:n = -51,
917     midpenalty .value_required:n = true,
918     endpenalty .int_set:c = { l__enumext_endparpenalty_#2_int },
919     endpenalty .initial:n = -51,

```

```

920         endpenalty .value_required:n = true,
921     }
922 }
923 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

(End of definition for *beginpenalty*, *midpenalty*, and *endpenalty*.)

13.17 Setting keys for vertical spaces

Define and set `topsep`, `partopsep`, `parsep`, `itemsep`, `noitemsep` and `nosep` keys for `enumext`, `enumext*`, `keyans` and `keyans*` environments.

```

924 \cs_set_protected:Npn \__enumext_tmp:nnnnnn #1 #2 #3 #4 #5 #6
925 {
926     \keys_define:nn { enumext / #1 }
927     {
928         topsep .skip_set:c = { l__enumext_topsep_#2_skip },
929         topsep .initial:n = {#3},
930         topsep .value_required:n = true,
931         partopsep .skip_set:c = { l__enumext_partopsep_#2_skip },
932         partopsep .initial:n = {#4},
933         partopsep .value_required:n = true,
934         parsep .skip_set:c = { l__enumext_parsep_#2_skip },
935         parsep .initial:n = {#5},
936         parsep .value_required:n = true,
937         itemsep .skip_set:c = { l__enumext_itemsep_#2_skip },
938         itemsep .initial:n = {#6},
939         itemsep .value_required:n = true,
940         noitemsep .meta:n = { itemsep = 0pt, parsep = 0pt },
941         noitemsep .value_forbidden:n = true,
942         nosepp .meta:n = {
943             itemsep = 0pt, parsep = 0pt,
944             topsep = 0pt, partopsep = 0pt,
945         },
946         nosepp .value_forbidden:n = true,
947     }
948 }

```

Now we set the values based on standard `article` class in 10pt.

```

949 \__enumext_tmp:nnnnnn { level-1 } { i } { 8.0pt plus 2.0pt minus 4.0pt }
950 { 2.0pt plus 1.0pt minus 1.0pt } { 4.0pt plus 2.0pt minus 1.0pt }
951 { 4.0pt plus 2.0pt minus 1.0pt }
952 \__enumext_tmp:nnnnnn { level-2 } { ii } { 4.0pt plus 2.0pt minus 1.0pt }
953 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
954 { 2.0pt plus 1.0pt minus 1.0pt }
955 \__enumext_tmp:nnnnnn { level-3 } { iii } { 2.0pt plus 1.0pt minus 1.0pt }
956 { 1.0pt minus 1.0pt } { 0pt } { 2.0pt plus 1.0pt minus 1.0pt }
957 \__enumext_tmp:nnnnnn { level-4 } { iv } { 2.0pt plus 1.0pt minus 1.0pt }
958 { 1.0pt minus 1.0pt } { 0pt } { 2.0pt plus 1.0pt minus 1.0pt }
959 \__enumext_tmp:nnnnnn { keyans } { v } { 4.0pt plus 2.0pt minus 1.0pt }
960 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
961 { 2.0pt plus 1.0pt minus 1.0pt }
962 \__enumext_tmp:nnnnnn { enumext* } { vii } { 8.0pt plus 2.0pt minus 4.0pt }
963 { 2.0pt plus 1.0pt minus 1.0pt } { 4.0pt plus 2.0pt minus 1.0pt }
964 { 4.0pt plus 2.0pt minus 1.0pt }
965 \__enumext_tmp:nnnnnn { keyans* } { viii } { 4.0pt plus 2.0pt minus 1.0pt }
966 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
967 { 2.0pt plus 1.0pt minus 1.0pt }

```

(End of definition for *topsep* and others.)

13.18 Setting base-fix key

When nesting starting right after `\item` (without material between them) there is a problem with the alignment of the *baseline* between the two environments. One way to get around this problem is to place `\mode_leave_vertical:` apply `\vspace[-\baselineskip]` and set `\topsep=0pt` for the “first level” of the nested `enumext` environment.

We define the key `base-fix` only for the “first level” of `enumext` environment.

```

base-fix \__enumext_nested_base_line_fix:
968 \keys_define:nn { enumext / level-1 }
969 {
970     base-fix .bool_set:N = \l__enumext_base_line_fix_bool,
971     base-fix .initial:n = false,

```

```

972   base-fix .value_forbidden:n = true,
973 }

```

The function `__enumext_nested_base_line_fix:` passed to the `__enumext_parse_keys:n` function in the definition of the `enumext` environment (§13.40) will be responsible for applying the *baseline correction* and adjusting the *keys* for the `enumext` environment and the `\printkeyans` with *starred argument* ‘*’ (§13.48).

We will first implement the function code from the user side of the `base-fix` key, that is, only the user knows when it is necessary to apply it within the document in which case the variable `__enumext_print_keyans_star_bool` set by the `\printkeyans` command is false and the variable `__enumext_base_line_fix_bool` is true.

We set the values of the keys `topsep`, `above` and `above*` for the “first level” of `enumext` environment equal to `0pt` and finally set the variable `__enumext_base_line_fix_bool` to false.

```

974 \cs_new_protected:Nn \__enumext_nested_base_line_fix:
975 {
976   \bool_lazy_all:nT
977   {
978     { \bool_if_p:N \__enumext_starred_first_bool }
979     { \bool_if_p:N \__enumext_base_line_fix_bool }
980     { \bool_not_p:n { \__enumext_print_keyans_star_bool } }
981   }
982   {
983     \mode_leave_vertical:
984     \vspace { -\dim_eval:n { \baselineskip + \parsep } }
985     \keys_set:nn { enumext / level-1 }
986     {
987       topsep = 0pt, above = 0pt, above* = 0pt,
988     }
989   }

```

When we are running the `\printkeyans` command with the *starred argument* ‘*’ the variable `__enumext_print_keyans_star_bool` is true and we can run a simplified version of `\vspace` using `\skip_vertical:n`.

```

990   \bool_lazy_and:nnT
991   { \bool_if_p:N \__enumext_starred_first_bool }
992   { \bool_if_p:N \__enumext_print_keyans_star_bool }
993   {
994     \mode_leave_vertical:
995     \skip_vertical:n { -\baselineskip }
996     \skip_vertical:N \c_zero_skip
997     \keys_set:nn { enumext / level-1 }
998     {
999       topsep = 0pt, above = 0pt, above* = 0pt,
1000     }
1001   }
1002   \bool_set_false:N \__enumext_base_line_fix_bool
1003 }

```

(End of definition for `base-fix` and `__enumext_nested_base_line_fix:`.)

13.19 Setting keys for horizontal spaces

Define and set `itemindent`, `rightmargin`, `listparindent`, `list-offset` and `list-indent` keys for `enumext`, `enumext*`, `keyans` and `keyans*` environments.

```

1004 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1005 {
1006   \keys_define:nn { enumext / #1 }
1007   {
1008     itemindent .dim_set:c = { \__enumext_fake_item_indent_#2_dim },
1009     itemindent .value_required:n = true,
1010     rightmargin .dim_set:c = { \__enumext_rightmargin_#2_dim },
1011     rightmargin .value_required:n = true,
1012     listparindent .dim_set:c = { \__enumext_listparindent_#2_dim },
1013     listparindent .value_required:n = true,
1014     list-offset .dim_set:c = { \__enumext_listoffset_#2_dim },
1015     list-offset .value_required:n = true,
1016     list-indent .code:n =
1017       \bool_set_true:c { \__enumext_leftmargin_tmp_#2_bool }
1018       \dim_set:cn { \__enumext_leftmargin_tmp_#2_dim } {##1},
1019     list-indent .value_required:n = true,
1020   }

```

```

1021 }
1022 \clist_map_inline:nn
1023 {
1024   {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {keyans}{v}
1025 }
1026 { \__enumext_tmp:nn #1 }

```

(End of definition for *itemindent* and others.)

For `enumext*` and `keyans*` environments the situation is a bit different, the `list-indent` key behaves like the `list-offset` key.

```

1027 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1028 {
1029   \keys_define:nn { enumext / #1 }
1030   {
1031     itemindent .dim_set:c = { \__enumext_fake_item_indent_#2_dim },
1032     itemindent .value_required:n = true,
1033     rightmargin .dim_set:c = { \__enumext_rightmargin_#2_dim },
1034     rightmargin .value_required:n = true,
1035     listparindent .dim_set:c = { \__enumext_listparindent_#2_dim },
1036     listparindent .value_required:n = true,
1037     list-offset .dim_set:c = { \__enumext_listoffset_#2_dim },
1038     list-offset .value_required:n = true,
1039     list-indent .meta:n = { list-offset = ##1 },
1040     list-indent .value_required:n = true,
1041   }
1042 }
1043 \clist_map_inline:nn
1044 {
1045   {enumext*}{vii}, {keyans*}{viii}
1046 }
1047 { \__enumext_tmp:nn #1 }

```

13.19.1 Functions for setting the fake `itemindent`

The `itemindent` key does not set the value of `\itemindent`, it only sets the value of the *horizontal space* applied using `\skip_horizontal:N`. We will store this value in the variable and only apply it when it is greater than `\opt`. Here I will need to place `\mode_leave_vertical:` and the plain TeX macro `\ignorespaces` to avoid unwanted extra space when using the `itemindent` key.

```

1048 \cs_set_protected:Nn \__enumext_fake_item_indent:
1049 {
1050   \dim_compare:nNnT
1051   { \dim_use:c { \__enumext_fake_item_indent_ \__enumext_level: _dim } }
1052   >
1053   { \c_zero_dim }
1054   {
1055     \tl_set:ce { \__enumext_fake_item_indent_ \__enumext_level: _tl }
1056     {
1057       \exp_not:N \mode_leave_vertical:
1058       \exp_not:n { \skip_horizontal:n }
1059       { \dim_use:c { \__enumext_fake_item_indent_ \__enumext_level: _dim } }
1060       \exp_not:N \ignorespaces
1061     }
1062   }
1063 }
1064 \cs_set_protected:Nn \__enumext_keyans_fake_item_indent:
1065 {
1066   \dim_compare:nNnT
1067   { \l__enumext_fake_item_indent_v_dim } > { \c_zero_dim }
1068   {
1069     \tl_set:Nc \l__enumext_fake_item_indent_v_tl
1070     {
1071       \exp_not:N \mode_leave_vertical:
1072       \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_v_dim
1073       \exp_not:N \ignorespaces
1074     }
1075   }
1076 }
1077 \cs_set_protected:Nn \__enumext_fake_item_indent_vii:
1078 {
1079   \dim_compare:nNnT
1080   { \l__enumext_fake_item_indent_vii_dim } > { \c_zero_dim }

```

```

1081     {
1082         \tl_set:Nc \__enumext_fake_item_indent_vii_tl
1083         {
1084             \exp_not:N \skip_horizontal:N \__enumext_fake_item_indent_vii_dim
1085             \exp_not:N \ignorespaces
1086         }
1087     }
1088 }
1089 \cs_set_protected:Nn \__enumext_fake_item_indent_viii:
1090 {
1091     \dim_compare:nNt
1092     { \__enumext_fake_item_indent_viii_dim } > { \c_zero_dim }
1093     {
1094         \tl_set:Nc \__enumext_fake_item_indent_viii_tl
1095         {
1096             \exp_not:N \skip_horizontal:N \__enumext_fake_item_indent_viii_dim
1097             \exp_not:N \ignorespaces
1098         }
1099     }
1100 }

```

(End of definition for `__enumext_fake_item_indent:` and others.)

13.20 Setting show-length key

Define and set `show-length` key for `enumext`, `enumext*`, `keyans` and `keyans*` environments. The function sets the boolean variable `__enumext_show_length_X_bool` used in the definition of all environments to “true” and calls the function `__enumext_show_length:nnn` which prints all the values of the “vertical” and “horizontal” parameters calculated and used.

```

1101 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1102 {
1103     \keys_define:nn { enumext / #1 }
1104     {
1105         show-length .bool_set:c = { \__enumext_show_length_#2_bool },
1106         show-length .initial:n = false,
1107     }
1108 }
1109 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

(End of definition for `show-length`.)

13.21 Setting before, after and first keys

Define and set `before`, `before*`, `after` and `first` keys for `enumext`, `enumext*`, `keyans` and `keyans*` environments.

```

1110 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1111 {
1112     \keys_define:nn { enumext / #1 }
1113     {
1114         before .tl_set:c = { \__enumext_before_no_starred_key_#2_tl },
1115         before .value_required:n = true,
1116         before* .tl_set:c = { \__enumext_before_starred_key_#2_tl },
1117         before* .value_required:n = true,
1118         after .tl_set:c = { \__enumext_after_stop_list_#2_tl },
1119         after .value_required:n = true,
1120         first .tl_set:c = { \__enumext_after_list_args_#2_tl },
1121         first .value_required:n = true,
1122     }
1123 }
1124 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

(End of definition for `before` and others.)

13.21.1 Functions for before, after and first keys in enumext

The function `__enumext_before_args_exec:` executes the `{\code}` set by the `before*` key “before” the `enumext` environment is started. The `{\code}` is executed “without” knowing any definition of the `{\arg two}` of the list: `{\code}\list{\arg one}{\arg two}`.

```

1125 \cs_new_protected:Nn \__enumext_before_args_exec:
1126 {
1127     \tl_use:c { \__enumext_before_starred_key_ \__enumext_level: _tl }
1128 }

```


The function `__enumext_before_keys_exec`: executes the `{⟨code⟩}` set by the `before` key “before” the `enumext` environment is started in *second argument* of the list. The `{⟨code⟩}` is executed “knowing” all definition and values provides by `⟨keys⟩`: `\list{⟨arg one⟩}{⟨arg two⟩{⟨code⟩}}`

```
1129 \cs_new_protected:Nn \__enumext_before_keys_exec:
1130 {
1131   \tl_use:c { l__enumext_before_no_starred_key_ \__enumext_level: _tl }
1132 }
```

The function `__enumext_after_stop_list`: executes the `{⟨code⟩}` set by the `after` key “after” the `enumext` environment has finished: `\endlist{⟨code⟩}`.

```
1133 \cs_new_protected:Nn \__enumext_after_stop_list:
1134 {
1135   \tl_use:c { l__enumext_after_stop_list_ \__enumext_level: _tl }
1136 }
```

The function `__enumext_after_args_exec`: executes the `{⟨code⟩}` set by the `first` key after the end of the second argument of the list defining the `enumext` environment, just before the first occurrence of `\item`: `\list{⟨arg one⟩}{⟨arg two⟩}{⟨code⟩}\item`.

```
1137 \cs_new_protected:Nn \__enumext_after_args_exec:
1138 {
1139   \tl_use:c { l__enumext_after_list_args_ \__enumext_level: _tl }
1140 }
```

(End of definition for `__enumext_before_args_exec`: and others.)

13.21.2 Functions for before, after and first keys in keyans

Same implementation as the one used in the `enumext` environment.

```
\__enumext_before_args_exec_v:
\__enumext_before_keys_exec_v:
\__enumext_after_stop_list_v:
\__enumext_after_args_exec_v:
1141 \cs_new_protected:Nn \__enumext_before_args_exec_v:
1142 {
1143   \tl_use:N \l__enumext_before_starred_key_v_tl
1144 }
1145 \cs_new_protected:Nn \__enumext_before_keys_exec_v:
1146 {
1147   \tl_use:N \l__enumext_before_no_starred_key_v_tl
1148 }
1149 \cs_new_protected:Nn \__enumext_after_stop_list_v:
1150 {
1151   \tl_use:N \l__enumext_after_stop_list_v_tl
1152 }
1153 \cs_new_protected:Nn \__enumext_after_args_exec_v:
1154 {
1155   \tl_use:N \l__enumext_after_list_args_v_tl
1156 }
```

(End of definition for `__enumext_before_args_exec_v`: and others.)

13.21.3 Functions for before, after and first keys in enumext* and keyans*

Same implementation as the one used in the `enumext` environment.

```
\__enumext_before_args_exec_vii:
\__enumext_before_keys_exec_vii:
\__enumext_after_stop_list_vii:
\__enumext_after_args_exec_vii:
1157 \cs_new_protected:Nn \__enumext_before_args_exec_vii:
1158 {
1159   \tl_use:N \l__enumext_before_starred_key_vii_tl
1160 }
1161 \cs_new_protected:Nn \__enumext_before_args_exec_viii:
1162 {
1163   \tl_use:N \l__enumext_before_starred_key_viii_tl
1164 }
1165 \cs_new_protected:Nn \__enumext_before_keys_exec_vii:
1166 {
1167   \tl_use:N \l__enumext_before_no_starred_key_vii_tl
1168 }
1169 \cs_new_protected:Nn \__enumext_before_keys_exec_viii:
1170 {
1171   \tl_use:N \l__enumext_before_no_starred_key_viii_tl
1172 }
1173 \cs_new_protected:Nn \__enumext_after_stop_list_vii:
1174 {
1175   \tl_use:N \l__enumext_after_stop_list_vii_tl
1176 }
1177 \cs_new_protected:Nn \__enumext_after_stop_list_viii:
1178 {
1179   \tl_use:N \l__enumext_after_stop_list_viii_tl
```

```

1180 }
1181 \cs_new_protected:Nn \__enumext_after_args_exec_vii:
1182 {
1183   \tl_use:N \__enumext_after_list_args_vii_tl
1184 }
1185 \cs_new_protected:Nn \__enumext_after_args_exec_viii:
1186 {
1187   \tl_use:N \__enumext_after_list_args_viii_tl
1188 }

```

(End of definition for `__enumext_before_args_exec_vii:` and others.)

13.22 Setting keys for multicols and minipage

The default value of the `columns-sep` key is handled by the state of the boolean variable `\l__enumext_columns_sep_X_bool` which is handled in the internal definition of the `enumext` and `keyans` environments. Define and set `mini-env`, `mini-sep`, `columns-sep` and `columns` keys for `enumext`, `enumext*`, `keyans` and `keyans*` environments.

```

1189 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1190 {
1191   \keys_define:nn { enumext / #1 }
1192   {
1193     mini-env .dim_set:c = { \__enumext_minipage_right_#2_dim },
1194     mini-env .value_required:n = true,
1195     mini-sep .dim_set:c = { \__enumext_minipage_hsep_#2_dim },
1196     mini-sep .initial:n = 0.3333em,
1197     mini-sep .value_required:n = true,
1198     columns-sep .dim_set:c = { \__enumext_columns_sep_#2_dim },
1199     columns-sep .value_required:n = true,
1200     columns .int_set:c = { \__enumext_columns_#2_int },
1201     columns .initial:n = 1,
1202     columns .value_required:n = true,
1203   }
1204 }
1205 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

For `enumext*` and `keyans*` environments the situation is a bit different, the command `\miniright` is not available, so we will add the keys `mini-right` and `mini-right*` to implement support for `minipage` environment.

```

1206 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1207 {
1208   \keys_define:nn { enumext / #1 }
1209   {
1210     mini-right .tl_gset:c = { g__enumext_miniright_code_#2_tl },
1211     mini-right .value_required:n = true,
1212     mini-right* .code:n = {
1213       \bool_gset_true:c { g__enumext_minipage_center_#2_bool }
1214       \keys_set:nn { enumext / #1 } { mini-right = {##1} }
1215     },
1216     mini-right* .value_required:n = true,
1217   }
1218 }
1219 \clist_map_inline:nn { {enumext*}{vii}, {keyans*}{viii} } { \__enumext_tmp:nn #1 }

```

(End of definition for `mini-env` and others.)

13.23 Adjustment of vertical spaces for multicols

When nesting a “list environment” inside the `multicols` environment, the values of the “vertical spaces” are lost, basically the `multicols` environment takes control over them. Graphically it can be seen like in the figure 7.



Figure 7: Representation of the vertical space in `multicols` for a nested level.

To keep the desired spaces *above* and *below* in the “list environment” (`\topsep + [\partopsep]`) it is necessary to “adjust” the spaces added by the `multicols` environment. The most appropriate option in this case is to use a “context sensitive” vertical space with `\addvspace`.

❶ I should make it clear that the implementation here is a “*bit questionable*”. At first glance doing `\multicolsep=\topsep` seemed right, but the results were not always as expected. An almost *imperceptible* detail is that in some cases the `\itemsep` values of are “*stretched*”, possibly due to the use of `\raggedcolumns` and this affects the lower space when closing the environment, which is “*smaller*” than expected. My attempts to find the correct values using `\showoutput` and `\showboxdepth` absolutely failed.

13.23.1 Adjustment of vertical spaces for multicol in enumext

`__enumext_multi_set_vskip:` The function `__enumext_multi_set_vskip:` will take care of determining the “*adjusted spaces*” that we will apply “*above*” and “*below*” the `multicols` environment in `enumext`.

We will set the default values taking into account that \TeX is in *horizontal mode*, then we will make the settings for the *vertical mode* in which `\partopsep` comes into play.

Set the values of `\l__enumext_multicols_above_X_skip` and `\l__enumext_multicols_below_X_skip` equal to the value of `\topsep` in the *current level*.

```

1220 \cs_new_protected:Nn \__enumext_multi_set_vskip:
1221 {
1222   \skip_set:cn { \l__enumext_multicols_above_ \__enumext_level: _skip }
1223   {
1224     \skip_use:c { \l__enumext_topsep_ \__enumext_level: _skip }
1225   }
1226   \skip_set:cn { \l__enumext_multicols_below_ \__enumext_level: _skip }
1227   {
1228     \skip_use:c { \l__enumext_topsep_ \__enumext_level: _skip }
1229   }
1230   \__enumext_add_pre_parsep:
1231 }

```

(End of definition for `__enumext_multi_set_vskip:.`)

`__enumext_add_pre_parsep:` The function `__enumext_add_pre_parsep:` “*adjusted*” the value of `\l__enumext_multicols_above_X_skip` detecting the value of `\parsep` from the previous level. This is necessary since `\parsep` from the previous level affects the *vertical spaces*.

```

1232 \cs_new_protected:Nn \__enumext_add_pre_parsep:
1233 {
1234   \int_case:nn { \l__enumext_level_int }
1235   {
1236     { 2 }{
1237       \skip_if_eq:nnF { \l__enumext_parsep_i_skip } { \c_zero_skip }
1238       {
1239         \skip_add:Nn \l__enumext_multicols_above_ii_skip
1240         {
1241           \l__enumext_parsep_i_skip
1242         }
1243       }
1244     }
1245     { 3 }{
1246       \skip_if_eq:nnF { \l__enumext_parsep_ii_skip } { \c_zero_skip }
1247       {
1248         \skip_add:Nn \l__enumext_multicols_above_iii_skip
1249         {
1250           \l__enumext_parsep_ii_skip
1251         }
1252       }
1253     }
1254     { 4 }{
1255       \skip_if_eq:nnF { \l__enumext_parsep_iii_skip } { \c_zero_skip }
1256       {
1257         \skip_add:Nn \l__enumext_multicols_above_iv_skip
1258         {
1259           \l__enumext_parsep_iii_skip
1260         }
1261       }
1262     }
1263   }
1264 }

```

(End of definition for `__enumext_add_pre_parsep:.`)

`__enumext_multi_addvspace:` The function `__enumext_multi_addvspace:` will apply the spaces set using `\addvspace` “*above*” the `multicols` environment in `enumext`, taking into account whether \TeX is in *horizontal mode* or *vertical mode*.

```

1265 \cs_new_protected:Nn \__enumext_multi_addvspace:
1266 {
1267   \__enumext_multi_set_vskip:
1268   \mode_if_vertical:T
1269   {
1270     \skip_add:cn { \__enumext_multicols_above_ \__enumext_level: _skip }
1271     {
1272       \skip_use:c { \__enumext_partopsep_ \__enumext_level: _skip }
1273     }
1274     \skip_add:cn { \__enumext_multicols_below_ \__enumext_level: _skip }
1275     {
1276       \skip_use:c { \__enumext_partopsep_ \__enumext_level: _skip }
1277     }
1278   }
1279   \par\nopagebreak
1280   \addvspace{ \skip_use:c { \__enumext_multicols_above_ \__enumext_level: _skip } }
1281 }

```

(End of definition for `__enumext_multi_addvspace:`.)

13.23.2 Adjustment of vertical spaces for multicols in keyans

```

\__enumext_keyans_multi_set_vskip:
\__enumext_keyans_multi_addvspace:

```

The function `__enumext_keyans_multi_set_vskip:` will take care of determining the “*adjusted spaces*” that we will apply “*above*” and “*below*” the `\multicols` environment in `keyans`. The implementation of this function is the same as the one used in `enumext`.

```

1282 \cs_new_protected:Nn \__enumext_keyans_multi_set_vskip:
1283 {
1284   \skip_set:Nn \l__enumext_multicols_above_v_skip
1285   {
1286     \l__enumext_topsep_v_skip
1287   }
1288   \skip_set:Nn \l__enumext_multicols_below_v_skip
1289   {
1290     \l__enumext_topsep_v_skip
1291   }
1292 }
1293 \cs_new_protected:Nn \__enumext_keyans_multi_addvspace:
1294 {
1295   \__enumext_keyans_multi_set_vskip:
1296   \mode_if_vertical:T
1297   {
1298     \skip_add:Nn \l__enumext_multicols_above_v_skip
1299     {
1300       \skip_use:N \l__enumext_partopsep_v_skip
1301     }
1302     \skip_add:Nn \l__enumext_multicols_below_v_skip
1303     {
1304       \skip_use:N \l__enumext_partopsep_v_skip
1305     }
1306   }
1307   \par\nopagebreak
1308   \addvspace{ \l__enumext_multicols_above_v_skip }
1309 }

```

(End of definition for `__enumext_keyans_multi_set_vskip:` and `__enumext_keyans_multi_addvspace:`.)

13.24 Adjustment of vertical spaces for minipage

When nesting a “*list environment*” within the `minipage` environment, the values of the “*vertical spaces*” are lost. Graphically it can be seen like in the figure 8.



Figure 8: Representation of the `minipage` spacing adjustment for a nested level.

Since we want to keep the “*left*” and “*right*” environments “*aligned on top*”, preserving the `\baselineskip` and keep the desired “*spaces*” (`\topsep` + `[\partopsep]`) it is necessary to “*adjust*” the “*vertical spaces*” for `minipage` environments.

Here there are several complications that we must circumvent, the `minipage` environment eliminates the “top” spaces, the `multicols` environment can be nested in the `minipage` environment, the “top” and “bottom” spaces are affected when `topsep=0pt` and to this is added the `\partopsep` parameter that comes into action according to whether \TeX is in *horizontal mode* or *vertical mode*. Depending on these cases, small adjustments must be made using `\vspace` and `\addvspace` to obtain the “desired vertical spacing”.

Again I must make clear that the implementation here is a “bit questionable”, but hunting the spaces (`glue`) produced by the `minipage` environment is quite complicated, even more if `multicols` it is nested. The setting of the values was more “trial and error” (approx to `\strutbox`), using the help of the `lua-visual-debug`[15] package, again my attempts to find the correct values using `\showoutput` and `\showboxdepth` absolutely failed.

13.24.1 Adjustment of vertical spaces for minipage in enumext

`__enumext_minipage_set_skip:`
`__enumext_minipage_add_space:`

The function `__enumext_minipage_set_skip:` will take care of determining the “adjust” spaces that we will apply “above” and “below” the `__enumext_mini_page` environment in `enumext`.

First we will set the value of `__enumext_minipage_right_skip` equal to `\topsep`, then we will see if \TeX is in *vertical mode* and we will add `\partopsep`, followed by that we set the value of `__enumext_minipage_after_skip`.

```

1310 \cs_new_protected:Nn \__enumext_minipage_set_skip:
1311 {
1312   \skip_set:Nn \__enumext_minipage_right_skip
1313   {
1314     \skip_use:c { \__enumext_topsep_ \__enumext_level: _skip }
1315   }
1316   \mode_if_vertical:T
1317   {
1318     \skip_add:Nn \__enumext_minipage_right_skip
1319     {
1320       \skip_use:c { \__enumext_partopsep_ \__enumext_level: _skip }
1321     }
1322   }
1323   \skip_set_eq:NN \__enumext_minipage_after_skip \__enumext_minipage_right_skip

```

We will adjust the values `__enumext_multicols_above_X_skip` and `__enumext_multicols_below_X_skip` and call the function `__enumext_pre_itemsep_skip:`.

```

1324   \skip_set_eq:cN
1325   { \__enumext_multicols_above_ \__enumext_level: _skip } \__enumext_minipage_right_skip
1326   \skip_set_eq:cN
1327   { \__enumext_multicols_below_ \__enumext_level: _skip } \__enumext_minipage_right_skip
1328   \__enumext_pre_itemsep_skip:

```

If the environment `multicols` is active, we set `\topskip=0pt` and then we make `\multicolsep` have the same value as `__enumext_multicols_above_X_skip`.

```

1329   \int_compare:nNnT
1330   { \int_use:c { \__enumext_columns_ \__enumext_level: _int } } > { 1 }
1331   {
1332     \skip_zero:N \topskip
1333     \skip_set_eq:Nc \multicolsep { \__enumext_multicols_above_ \__enumext_level: _skip }
1334   }
1335 }

```

The function `__enumext_minipage_add_space:` will apply the spaces on the “left side” using `\addvspace` “above” the `__enumext_mini_page` environment, taking into account whether \TeX is in *horizontal mode* or *vertical mode*. Here we use the plain \TeX macro `\nointerlineskip` to prevent baseline “glue” being added between the next pair of boxes in a *vertical list*. For the latter we will make some adjustments since the `\partopsep` parameter comes into play and this affects the *vertical spacing*.

```

1336 \cs_new_protected:Nn \__enumext_minipage_add_space:
1337 {
1338   \__enumext_minipage_set_skip:
1339   \__enumext_unskip_unkern:
1340   \mode_if_vertical:TF
1341   {
1342     \nopagebreak\nointerlineskip
1343   }
1344   {
1345     \par\nopagebreak\nointerlineskip
1346     \skip_zero:c { \__enumext_partopsep_ \__enumext_level: _skip }
1347   }
1348   \int_compare:nNnTF
1349   { \int_use:c { \__enumext_columns_ \__enumext_level: _int } } > { 1 }
1350   {
1351     \addvspace{ 0.445\box_ht:N \strutbox }

```

```

1352     }
1353     {
1354         \addvspace{ 0.250\box_ht:N \strutbox }
1355     }
1356 }

```

(End of definition for `__enumext_minipage_set_skip:` and `__enumext_minipage_add_space:.`)

`__enumext_pre_itemsep_skip:` The function `__enumext_pre_itemsep_skip:` will adjust the spaces below the environment `minipage` and the environment `multicols` if it is nested in it, taking into account the value of `\itemsep` from the previous level.

```

1357 \cs_new_protected:Nn \__enumext_pre_itemsep_skip:
1358 {
1359     \int_case:nn { \__enumext_level_int }
1360     {
1361         { 2 }{
1362             \skip_if_eq:nnTF
1363             { \__enumext_itemsep_i_skip } { \__enumext_minipage_after_skip }
1364             {
1365                 \skip_set:Nn \__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1366                 \skip_set:Nn \__enumext_multicols_below_ii_skip { 0.350\box_ht:N \strutbox }
1367             }
1368             {
1369                 \dim_compare:nNnT
1370                 { \__enumext_itemsep_i_skip } < { \__enumext_minipage_after_skip }
1371                 {
1372                     \skip_sub:Nn
1373                     \__enumext_minipage_after_skip { \__enumext_itemsep_i_skip }
1374                     \skip_sub:Nn
1375                     \__enumext_multicols_below_ii_skip { \__enumext_itemsep_i_skip }
1376                     \skip_add:Nn
1377                     \__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1378                     \skip_add:Nn
1379                     \__enumext_multicols_below_ii_skip { 0.350\box_ht:N \strutbox }
1380                 }
1381                 \dim_compare:nNnT
1382                 { \__enumext_itemsep_i_skip } > { \__enumext_minipage_after_skip }
1383                 {
1384                     \skip_set:Nn \__enumext_minipage_temp_skip
1385                     {
1386                         \__enumext_itemsep_i_skip - \__enumext_minipage_after_skip
1387                     }
1388                     \skip_sub:Nn
1389                     \__enumext_minipage_after_skip { \__enumext_itemsep_i_skip }
1390                     \skip_sub:Nn
1391                     \__enumext_multicols_below_ii_skip { \__enumext_itemsep_i_skip }
1392                     \skip_add:Nn
1393                     \__enumext_minipage_after_skip
1394                     { 0.150\box_ht:N \strutbox + \__enumext_minipage_temp_skip }
1395                     \skip_add:Nn
1396                     \__enumext_multicols_below_ii_skip
1397                     { 0.350\box_ht:N \strutbox + \__enumext_minipage_temp_skip }
1398                 }
1399             }
1400         }
1401         { 3 }{
1402             \skip_if_eq:nnTF
1403             { \__enumext_itemsep_ii_skip } { \c_zero_skip }
1404             {
1405                 \skip_set:Nn \__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1406                 \skip_set:Nn \__enumext_multicols_below_iii_skip { 0.350\box_ht:N \strutbox }
1407             }
1408             {
1409                 \dim_compare:nNnT
1410                 { \__enumext_itemsep_ii_skip } < { \__enumext_minipage_after_skip }
1411                 {
1412                     \skip_sub:Nn
1413                     \__enumext_minipage_after_skip { \__enumext_itemsep_ii_skip }
1414                     \skip_sub:Nn
1415                     \__enumext_multicols_below_iii_skip { \__enumext_itemsep_ii_skip }
1416                     \skip_add:Nn

```



```

1417         \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1418     \skip_add:Nn
1419         \l__enumext_multicols_below_iii_skip { 0.350\box_ht:N \strutbox }
1420     }
1421 \dim_compare:nNnT
1422 { \l__enumext_itemsep_ii_skip } > { \l__enumext_minipage_after_skip }
1423 {
1424     \skip_set:Nn \l__enumext_minipage_temp_skip
1425     {
1426         \l__enumext_itemsep_ii_skip - \l__enumext_minipage_after_skip
1427     }
1428     \skip_sub:Nn
1429         \l__enumext_minipage_after_skip { \l__enumext_itemsep_ii_skip }
1430     \skip_sub:Nn
1431         \l__enumext_multicols_below_iii_skip { \l__enumext_itemsep_ii_skip }
1432     \skip_add:Nn
1433         \l__enumext_minipage_after_skip
1434         { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1435     \skip_add:Nn
1436         \l__enumext_multicols_below_iii_skip
1437         { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1438     }
1439 }
1440 }
1441 { 4 }{
1442     \skip_if_eq:nnTF { \l__enumext_itemsep_iii_skip } { \c_zero_skip }
1443     {
1444         \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1445         \skip_set:Nn \l__enumext_multicols_below_iv_skip { 0.350\box_ht:N \strutbox }
1446     }
1447     {
1448         \dim_compare:nNnT
1449         { \l__enumext_itemsep_iii_skip } < { \l__enumext_minipage_after_skip }
1450         {
1451             \skip_sub:Nn
1452                 \l__enumext_minipage_after_skip { \l__enumext_itemsep_iii_skip }
1453             \skip_sub:Nn
1454                 \l__enumext_multicols_below_iv_skip { \l__enumext_itemsep_iii_skip }
1455             \skip_add:Nn
1456                 \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1457             \skip_add:Nn
1458                 \l__enumext_multicols_below_iv_skip { 0.350\box_ht:N \strutbox }
1459         }
1460         \dim_compare:nNnT
1461         { \l__enumext_itemsep_iii_skip } > { \l__enumext_minipage_after_skip }
1462         {
1463             \skip_set:Nn \l__enumext_minipage_temp_skip
1464             {
1465                 \l__enumext_itemsep_iii_skip - \l__enumext_minipage_after_skip
1466             }
1467             \skip_sub:Nn
1468                 \l__enumext_minipage_after_skip { \l__enumext_itemsep_iii_skip }
1469             \skip_sub:Nn
1470                 \l__enumext_multicols_below_iv_skip { \l__enumext_itemsep_iii_skip }
1471             \skip_add:Nn
1472                 \l__enumext_minipage_after_skip
1473                 { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1474             \skip_add:Nn
1475                 \l__enumext_multicols_below_iv_skip
1476                 { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1477         }
1478     }
1479 }
1480 }
1481 }

```

(End of definition for `__enumext_pre_itemsep_skip:`)

13.24.2 Adjustment of vertical spaces for minipage in keyans

The function `__enumext_keyans_mini_set_vskip:` will take care of determining the “adjusted” spaces that we will apply “*above*” and “*below*” the `__enumext_mini_page` environment in *keyans*. The implemen-

```

\__enumext_keyans_minipage_set_skip:
\__enumext_keyans_minipage_add_space:
\__enumext_keyans_pre_itemsep_skip:

```

tation of this function is the same as the one used in `enumext`.

```

1482 \cs_new_protected:Nn \__enumext_keyans_minipage_set_skip:
1483 {
1484   \skip_zero:N \l__enumext_minipage_after_skip
1485   \skip_zero:N \l__enumext_minipage_left_skip
1486   \skip_zero:N \l__enumext_minipage_right_skip
1487   \skip_set:Nn \l__enumext_minipage_right_skip
1488   {
1489     \l__enumext_topsep_v_skip
1490   }
1491   \mode_if_vertical:T
1492   {
1493     \skip_add:Nn \l__enumext_minipage_right_skip
1494     {
1495       \l__enumext_partopsep_v_skip
1496     }
1497   }
1498   \skip_set_eq:NN \l__enumext_minipage_after_skip \l__enumext_minipage_right_skip
1499   \skip_set_eq:NN \l__enumext_multicols_above_v_skip \l__enumext_minipage_right_skip
1500   \skip_set_eq:NN \l__enumext_multicols_below_v_skip \l__enumext_minipage_right_skip
1501   \__enumext_keyans_pre_itemsep_skip:
1502   \int_compare:nNnT { \l__enumext_columns_v_int } > { 1 }
1503   {
1504     \skip_zero:N \topskip
1505     \skip_set_eq:NN \multicolsep \l__enumext_minipage_right_skip
1506   }
1507 }
1508 \cs_new_protected:Nn \__enumext_keyans_minipage_add_space:
1509 {
1510   \__enumext_keyans_minipage_set_skip:
1511   \__enumext_unskip_unkern:
1512   \mode_if_vertical:TF
1513   {
1514     \nopagebreak\nointerlineskip
1515   }
1516   {
1517     \par\nopagebreak\nointerlineskip
1518     \skip_zero:N \l__enumext_partopsep_v_skip
1519   }
1520   \int_compare:nNnTF { \l__enumext_columns_v_int } > { 1 }
1521   {
1522     \addvspace{ 0.445\box_ht:N \strutbox }
1523   }
1524   {
1525     \addvspace{ 0.250\box_ht:N \strutbox }
1526   }
1527 }
1528 \cs_new_protected:Nn \__enumext_keyans_pre_itemsep_skip:
1529 {
1530   \skip_if_eq:nnTF
1531   { \l__enumext_itemsep_i_skip } { \l__enumext_minipage_after_skip }
1532   {
1533     \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1534     \skip_set:Nn \l__enumext_multicols_below_v_skip { 0.350\box_ht:N \strutbox }
1535   }
1536   {
1537     \dim_compare:nNnT
1538     { \l__enumext_itemsep_i_skip } < { \l__enumext_minipage_after_skip }
1539     {
1540       \skip_sub:Nn \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1541       \skip_sub:Nn \l__enumext_multicols_below_v_skip { \l__enumext_itemsep_i_skip }
1542       \skip_add:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1543       \skip_add:Nn \l__enumext_multicols_below_v_skip { 0.350\box_ht:N \strutbox }
1544     }
1545     \dim_compare:nNnT
1546     { \l__enumext_itemsep_i_skip } > { \l__enumext_minipage_after_skip }
1547     {
1548       \skip_set:Nn \l__enumext_minipage_temp_skip
1549       {
1550         \l__enumext_itemsep_i_skip - \l__enumext_minipage_after_skip
1551       }

```

```

1552         \skip_sub:Nn \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1553         \skip_sub:Nn \l__enumext_multicols_below_v_skip { \l__enumext_itemsep_i_skip }
1554         \skip_add:Nn \l__enumext_minipage_after_skip
1555             { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1556         \skip_add:Nn \l__enumext_multicols_below_v_skip
1557             { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1558     }
1559 }
1560 }

```

(End of definition for `__enumext_keyans_minipage_set_skip:`, `__enumext_keyans_minipage_add_space:`, and `__enumext_keyans_pre_itemsep_skip:`.)

13.24.3 Adjustment of vertical spaces for minipage in enumext* and keyans*

```

\__enumext_mini_set_vskip_vii:
\__enumext_mini_set_vskip_viii:

```

The functions `__enumext_mini_set_vskip_vii:` and `__enumext_mini_set_vskip_viii:` will take care of determining the “adjusted” spaces that we will apply “above” and “below” the `__enumext_mini_page` environment in `enumext*` and `keyans*`.

```

1561 \cs_new_protected:Nn \__enumext_mini_set_vskip_vii:
1562 {
1563     \skip_zero_new:N \l__enumext_minipage_left_skip
1564     \skip_gzero_new:N \g__enumext_minipage_right_skip
1565     \skip_gzero_new:N \g__enumext_minipage_after_skip
1566     \skip_if_eq:nnTF { \l__enumext_topsep_vii_skip } { \c_zero_skip }
1567     {
1568         \skip_set:Nn \l__enumext_minipage_left_skip { 0.5\box_dp:N \strutbox }
1569         \skip_gset:Nn \g__enumext_minipage_right_skip { 0.325\box_dp:N \strutbox }
1570     }
1571     {
1572         \skip_set:Nn \l__enumext_minipage_left_skip { 0.5875\box_dp:N \strutbox }
1573         \skip_gset:Nn \g__enumext_minipage_right_skip
1574             {
1575                 \l__enumext_topsep_vii_skip
1576             }
1577         \skip_gset:Nn \g__enumext_minipage_after_skip
1578             {
1579                 0.325\box_dp:N \strutbox + \l__enumext_topsep_vii_skip
1580             }
1581     }
1582 }
1583 \cs_new_protected:Nn \__enumext_mini_set_vskip_viii:
1584 {
1585     \skip_zero_new:N \l__enumext_minipage_after_skip
1586     \skip_zero_new:N \l__enumext_minipage_left_skip
1587     \skip_zero_new:N \l__enumext_minipage_right_skip
1588     \skip_if_eq:nnTF { \l__enumext_topsep_viii_skip } { \c_zero_skip }
1589     {
1590         \skip_set:Nn \l__enumext_minipage_left_skip
1591             {
1592                 0.5\box_dp:N \strutbox
1593             }
1594         \skip_set:Nn \l__enumext_minipage_right_skip
1595             {
1596                 \l__enumext_parttopsep_viii_skip
1597             }
1598         \skip_set:Nn \l__enumext_minipage_after_skip
1599             {
1600                 1.6\box_dp:N \strutbox
1601             }
1602     }
1603     {
1604         \skip_set:Nn \l__enumext_minipage_left_skip
1605             {
1606                 0.5875\box_dp:N \strutbox
1607             }
1608         \skip_set:Nn \l__enumext_minipage_right_skip
1609             {
1610                 \l__enumext_topsep_viii_skip
1611             }
1612         \skip_set:Nn \l__enumext_minipage_after_skip
1613             {
1614                 0.325\box_dp:N \strutbox + \l__enumext_topsep_viii_skip

```

```

1615     }
1616   }
1617 }

```

(End of definition for `__enumext_mini_set_vskip_vii:` and `__enumext_mini_set_vskip_viii:`)

```

\__enumext_mini_addvspace_vii:
\__enumext_mini_addvspace_viii:

```

The functions `__enumext_mini_addvspace_vii:` and `__enumext_mini_addvspace_viii:` will apply the vertical space “only above” the `__enumext_mini_page` environment on the *left side* when the `mini-right` key is active in the `enumext*` and `keyans*` environments.

Here we will NOT take into account whether \TeX is in $\langle horizontal\ mode \rangle$ or $\langle vertical\ mode \rangle$, since `\partopsep` is equal to `\opt` in both environments.

```

1618 \cs_new_protected:Nn \__enumext_mini_addvspace_vii:
1619 {
1620   \__enumext_mini_set_vskip_vii:
1621   \par\nopagebreak
1622   \addvspace { \l__enumext_minipage_left_skip }
1623 }
1624 \cs_new_protected:Nn \__enumext_mini_addvspace_viii:
1625 {
1626   \__enumext_mini_set_vskip_viii:
1627   \par\nopagebreak
1628   \addvspace { \l__enumext_minipage_left_skip }
1629 }

```

(End of definition for `__enumext_mini_addvspace_vii:` and `__enumext_mini_addvspace_viii:`)

13.24.4 The command `\miniright`

The command `\miniright` will close the `__enumext_mini_page` environment on the “left side”, open the `__enumext_mini_page` environment on the “right side” adding the *adjusted vertical space*. By default we will add `\centering` when starting the “right side” environment. The *starred argument* ‘`*`’ inhibits the use of `\centering` command i.e. the usual \TeX justification is maintained in the `__enumext_mini_page` on the “right side”.

`\miniright` First we will perform some checks to prevent the command from being executed outside the `enumext` environment or somewhere inappropriate then we will call the internal functions to execute it in the `enumext` and `keyans` environments.

```

1630 \NewDocumentCommand \miniright { s }
1631 {
1632   \int_compare:nNt { \l__enumext_keyans_pic_level_int } = { 1 }
1633   {
1634     \msg_error:nnn { enumext } { wrong-miniright-place }
1635   }
1636   % outside
1637   \bool_lazy_and:nnT
1638   { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
1639   { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
1640   {
1641     \msg_error:nnn { enumext } { wrong-miniright-place }
1642   }
1643   % starred env
1644   \bool_lazy_and:nnT
1645   { \bool_if_p:N \g__enumext_starred_bool }
1646   { \bool_not_p:n { \l__enumext_standar_bool } }
1647   {
1648     \msg_error:nnn { enumext } { wrong-miniright-starred }
1649   }
1650   % exec
1651   \int_compare:nNtTF { \l__enumext_keyans_level_int } = { 1 }
1652   {
1653     \__enumext_keyans_mini_right_cmd:n {#1}
1654   }
1655   { \__enumext_mini_right_cmd:n {#1} }
1656 }

```

(End of definition for `\miniright`. This function is documented on page 11.)

```
\__enumext_mini_right_cmd:n
```

The function `__enumext_mini_right_cmd:n` takes as argument the *starred* ‘`*`’ of the `\miniright` command in the `enumext` environment. We check if the `mini-env` key is active via the variable `\l__enumext_minipage_right_X_dim`, if so we close the `multicols` environment with the `__enumext_mini_page` environment on the “left side”, then we open the `__enumext_mini_page` environment on the “right side”,

apply our adjusted “vertical spaces”, followed by adding the `\centering` command when the *starred* argument ‘*’ is not present and set zero `\g__enumext_minipage_stat_int`, otherwise we return an error.

```

1657 \cs_new_protected:Npn \__enumext_mini_right_cmd:n #1
1658 {
1659   \dim_compare:nNnTF
1660     { \dim_use:c { \l__enumext_minipage_right_ \__enumext_level: _dim } } > { \c_zero_dim }
1661     {
1662       \__enumext_multicols_stop:
1663       \int_compare:nNnT
1664         { \int_use:c { \l__enumext_columns_ \__enumext_level: _int } } = { 1 }
1665         {
1666           \par\addvspace{ \l__enumext_minipage_after_skip }
1667         }
1668       \end__enumext_mini_page
1669       \hfill
1670       \__enumext_mini_page{ \dim_use:c { \l__enumext_minipage_right_ \__enumext_level: _dim } }
1671       \par\nointerlineskip
1672       \addvspace { \l__enumext_minipage_right_skip }
1673       \bool_if:nF {#1}
1674       {
1675         \centering
1676       }
1677       \int_gzero:N \g__enumext_minipage_stat_int
1678     }
1679     { \msg_error:nnn { enumext } { wrong-miniright-use } }
1680   % paranoia
1681   \RenewDocumentCommand \miniright { s }
1682   {
1683     \msg_error:nn { enumext } { many-miniright-used }
1684   }
1685 }

```

(End of definition for `__enumext_mini_right_cmd:n`.)

`__enumext_keyans_mini_right_cmd:n`

The function `__enumext_keyans_mini_right_cmd:n` takes as argument the *starred* ‘*’ of the `\miniright` command in the `keyans` environment. The implementation of this function is the same as that of the `__enumext_mini_right_cmd:n` function of the `enumext` environment.

```

1686 \cs_new_protected:Npn \__enumext_keyans_mini_right_cmd:n #1
1687 {
1688   \dim_compare:nNnTF { \l__enumext_minipage_right_v_dim } > { \c_zero_dim }
1689   {
1690     \__enumext_keyans_multicols_stop:
1691     \int_compare:nNnT { \l__enumext_columns_v_int } = { 1 }
1692     {
1693       \par\addvspace{ \l__enumext_minipage_after_skip }
1694     }
1695     \end__enumext_mini_page
1696     \hfill
1697     \__enumext_mini_page{ \l__enumext_minipage_right_v_dim }
1698     \par\nointerlineskip
1699     \addvspace { \l__enumext_minipage_right_skip }
1700     \bool_if:nF {#1}
1701     {
1702       \centering
1703     }
1704     \int_gzero:N \g__enumext_minipage_stat_int
1705   }
1706   { \msg_error:nnn { enumext } { wrong-miniright-use } }
1707   % paranoia
1708   \RenewDocumentCommand \miniright { s }
1709   {
1710     \msg_error:nn { enumext } { many-miniright-used }
1711   }
1712 }

```

(End of definition for `__enumext_keyans_mini_right_cmd:n`.)

13.25 Setting above and below keys

While having controlled the *vertical spaces* within the `enumext` and `keyans` environments when using the `columns` or `mini-env` keys, sometimes the “vertical spaces above” or “vertical spaces below” the environments are not as expected and it is necessary to be able to apply a “fine correction” to these. As I have not been able

to correct these *glitches*, the best option is to leave a couple of (*keys*) dedicated to this purpose, in this case it is best to use `\vspace` or `\vspace*` when convenient.

Define `above`, `above*`, `below` and `below*` keys for `enumext` and `keyans` environments.

```

1713 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1714 {
1715   \keys_define:nn { enumext / #1 }
1716   {
1717     above .skip_set:c = { l__enumext_vspace_above_#2_skip },
1718     above .value_required:n = true,
1719     above* .code:n      = \bool_set_true:c { l__enumext_vspace_a_star_#2_bool }
1720                      \keys_set:nn { enumext / #1 } { above = {##1} },
1721     above* .value_required:n = true,
1722     below .skip_set:c = { l__enumext_vspace_below_#2_skip },
1723     below .value_required:n = true,
1724     below* .code:n     = \bool_set_true:c { l__enumext_vspace_b_star_#2_bool }
1725                      \keys_set:nn { enumext / #1 } { below = {##1} },
1726     below* .value_required:n = true,
1727   }
1728 }
1729 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

(End of definition for `above` and others.)

13.25.1 Functions for `above` and `below` keys in `enumext`

`__enumext_vspace_above:` The function `__enumext_vspace_above:` apply the *vertical space above* the `enumext` environment set by the `above*` and `above` keys.

```

1730 \cs_new_protected:Nn \__enumext_vspace_above:
1731 {
1732   \skip_if_eq:nnF
1733   { \skip_use:c { l__enumext_vspace_above_ \__enumext_level: _skip } } { \c_zero_skip }
1734   {
1735     \bool_if:cTF { l__enumext_vspace_a_star_ \__enumext_level: _bool }
1736     {
1737       \vspace*{ \skip_use:c { l__enumext_vspace_above_ \__enumext_level: _skip } }
1738     }
1739     {
1740       \vspace { \skip_use:c { l__enumext_vspace_above_ \__enumext_level: _skip } }
1741     }
1742   }
1743 }

```

(End of definition for `__enumext_vspace_above:`.)

`__enumext_vspace_below:` The function `__enumext_vspace_below:` apply the *vertical space below* the `enumext` environment set by the `below*` and `below` keys.

```

1744 \cs_new_protected:Nn \__enumext_vspace_below:
1745 {
1746   \skip_if_eq:nnF
1747   { \skip_use:c { l__enumext_vspace_below_ \__enumext_level: _skip } } { \c_zero_skip }
1748   {
1749     \bool_if:cTF { l__enumext_vspace_b_star_ \__enumext_level: _bool }
1750     {
1751       \vspace*{ \skip_use:c { l__enumext_vspace_below_ \__enumext_level: _skip } }
1752     }
1753     {
1754       \vspace { \skip_use:c { l__enumext_vspace_below_ \__enumext_level: _skip } }
1755     }
1756   }
1757 }

```

(End of definition for `__enumext_vspace_below:`.)

13.25.2 Functions for `above` and `below` keys in `keyans`

`__enumext_vspace_above_v:` The function `__enumext_vspace_above_v:` apply the *vertical space above* the `keyans` environment set by the `above` and `above*` keys.

```

1758 \cs_new_protected:Nn \__enumext_vspace_above_v:
1759 {
1760   \skip_if_eq:nnF { \l__enumext_vspace_above_v_skip } { \c_zero_skip }
1761   {
1762     \bool_if:NTF \l__enumext_vspace_a_star_v_bool

```



```

1763         {
1764             \vspace*{ \l__enumext_vspace_above_v_skip }
1765         }
1766         { \vspace { \l__enumext_vspace_above_v_skip } }
1767     }
1768 }

```

(End of definition for \l__enumext_vspace_above_v:.)

\l__enumext_vspace_below_v:

The function \l__enumext_vspace_below_v: apply the *vertical space below* the **keyans** environment set by the **below*** and **below** keys.

```

1769 \cs_new_protected:Nn \l__enumext_vspace_below_v:
1770 {
1771     \skip_if_eq:nnF { \l__enumext_vspace_below_v_skip } { \c_zero_skip }
1772     {
1773         \bool_if:NTF \l__enumext_vspace_b_star_v_bool
1774         {
1775             \vspace*{ \l__enumext_vspace_below_v_skip }
1776         }
1777         { \vspace { \l__enumext_vspace_below_v_skip } }
1778     }
1779 }

```

(End of definition for \l__enumext_vspace_below_v:.)

13.25.3 Functions for above and below keys in enumext* keyans*

\l__enumext_vspace_above_vii:

The functions \l__enumext_vspace_above_vii: and \l__enumext_vspace_above_viii: apply the *vertical space above* the **enumext*** and **keyans*** environments set by the **above** and **above*** keys.

\l__enumext_vspace_above_viii:

```

1780 \cs_new_protected:Nn \l__enumext_vspace_above_vii:
1781 {
1782     \skip_if_eq:nnF { \l__enumext_vspace_above_vii_skip } { \c_zero_skip }
1783     {
1784         \bool_if:NTF \l__enumext_vspace_a_star_vii_bool
1785         {
1786             \vspace*{ \l__enumext_vspace_above_vii_skip }
1787         }
1788         { \vspace { \l__enumext_vspace_above_vii_skip } }
1789     }
1790 }
1791 \cs_new_protected:Nn \l__enumext_vspace_above_viii:
1792 {
1793     \skip_if_eq:nnF { \l__enumext_vspace_above_viii_skip } { \c_zero_skip }
1794     {
1795         \bool_if:NTF \l__enumext_vspace_a_star_viii_bool
1796         {
1797             \vspace*{ \l__enumext_vspace_above_viii_skip }
1798         }
1799         { \vspace { \l__enumext_vspace_above_viii_skip } }
1800     }
1801 }

```

(End of definition for \l__enumext_vspace_above_vii: and \l__enumext_vspace_above_viii:.)

\l__enumext_vspace_below_vii:

The functions \l__enumext_vspace_below_vii: and \l__enumext_vspace_below_viii: apply the *vertical space below* the **enumext*** and **keyans*** environments set by the **below*** and **below** keys.

\l__enumext_vspace_below_viii:

```

1802 \cs_new_protected:Nn \l__enumext_vspace_below_vii:
1803 {
1804     \skip_if_eq:nnF { \l__enumext_vspace_below_vii_skip } { \c_zero_skip }
1805     {
1806         \bool_if:NTF \l__enumext_vspace_b_star_vii_bool
1807         {
1808             \vspace*{ \l__enumext_vspace_below_vii_skip }
1809         }
1810         { \vspace { \l__enumext_vspace_below_vii_skip } }
1811     }
1812 }
1813 \cs_new_protected:Nn \l__enumext_vspace_below_viii:
1814 {
1815     \skip_if_eq:nnF { \l__enumext_vspace_below_viii_skip } { \c_zero_skip }
1816     {
1817         \bool_if:NTF \l__enumext_vspace_b_star_viii_bool

```

```

1818         {
1819             \vspace*{ \l__enumext_vspace_below_viii_skip }
1820         }
1821         { \vspace { \l__enumext_vspace_below_viii_skip } }
1822     }
1823 }

```

(End of definition for `__enumext_vspace_below_vii:` and `__enumext_vspace_below_viii:`.)

13.26 Setting series, resume and resume* keys

The `series` key is responsible for the whole process of the `resume` and `resume*` keys. The idea behind this is to be able to absorb the $\langle keys \rangle$ passed to the *optional argument* of the “first level” of the environments `enumext` and `enumext*`, but, discarding some specific $\langle keys \rangle$. This implementation is adapted directly from the code provided by Jonathan P. Spratte (@Skillmon) in `chat-Tex-SX`

```

series We define the keys series, resume and resume* only for the “first level” of enumext and enumext*.
resume
resume*
1824 \cs_set_protected:Npn \__enumext_tmp:n #1
1825 {
1826     \keys_define:nn { enumext / #1 }
1827     {
1828         series .str_set:N = \l__enumext_series_str,
1829         series .value_required:n = true,
1830         resume .code:n = \__enumext_resume_series:n {##1},
1831         resume* .code:n = \__enumext_resume_starred:,
1832         resume* .value_forbidden:n = true,
1833     }
1834 }
1835 \clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }

```

(End of definition for `series`, `resume`, and `resume*`.)

13.26.1 Internal functions for series key

The function `__enumext_filter_series:n` will be in charge of filtering the $\langle keys \rangle$ we want to store where `{#1}` represents the *optional argument* passed to the environment.

```

1836 \cs_new:Npn \__enumext_filter_series:n #1
1837 {
1838     \use:e
1839     {
1840         \keyval_parse:NNn
1841         \__enumext_filter_series_key:n
1842         \__enumext_filter_series_pair:nn {#1}
1843     }
1844 }

```

The function `__enumext_filter_series_key:n` will be responsible for filtering the $\langle keys \rangle$ that are passed “without value” by excluding the `resume`, `resume*` and `base-fix` keys.

```

1845 \cs_new:Npn \__enumext_filter_series_key:n #1
1846 {
1847     \str_case:nnF {#1}
1848     {
1849         { resume } {} { resume* } {} { base-fix } {}
1850     }
1851     { , { \exp_not:n {#1} } }
1852 }

```

The function `__enumext_filter_series_pair:nn` will be responsible for filtering the $\langle keys \rangle$ that are passed “with value” by excluding the `series`, `resume`, `start`, `start*`, `save-ans` and `save-key` keys.

```

1853 \cs_new:Npn \__enumext_filter_series_pair:nn #1#2
1854 {
1855     \str_case:nnF {#1}
1856     {
1857         { series } {} { resume } {} { start } {}
1858         { start* } {} { save-ans } {} { save-key } {}
1859     }
1860     { , { \exp_not:n {#1} } = { \exp_not:n {#2} } }
1861 }

```

(End of definition for `__enumext_filter_series:n`, `__enumext_filter_series_key:n`, and `__enumext_filter_series_pair:nn`.)

```

__enumext_parse_series:n
__enumext_resume_last:n

```

The function `__enumext_parse_series:n` will be responsible for storing the filtered *⟨keys⟩* in the global variable `\g__enumext_series_⟨series name⟩_tl` along with the creation of the integer variable `\g__enumext_series_⟨series name⟩_int` when the key is passed as an argument; otherwise, it will check the state of the boolean variable `\l__enumext_resume_active_bool` set by the keys `resume` and `resume*` and will call the function `__enumext_resume_last:n`.

- The value of boolean variable `\l__enumext_resume_active_bool` is set to true by the function `__enumext_resume_counter:n` which is used by the keys `resume` and `resume*`, in this case we must Make sure it is set to false so that it does not overwrite the default filtered *⟨keys⟩*. This function is passed to the function `__enumext_parse_keys:n` in the `enumext` environment definition (§13.40) and to the function `__enumext_parse_keys_vii:n` in the `enumext*` environment definition (§13.45).

```

1862 \cs_new_protected:Npn \__enumext_parse_series:n #1
1863 {
1864   \str_if_empty:NTF \l__enumext_series_str
1865   {
1866     \bool_if:NF \l__enumext_resume_active_bool
1867     {
1868       \__enumext_resume_last:n {#1}
1869     }
1870   }
1871   {
1872     \tl_gclear_new:c { g__enumext_series_ \l__enumext_series_str _tl }
1873     \tl_gset:ce { g__enumext_series_ \l__enumext_series_str _tl }
1874       { \__enumext_filter_series:n {#1} }
1875     \int_if_exist:cF { g__enumext_series_ \l__enumext_series_str _int }
1876     {
1877       \int_new:c { g__enumext_series_ \l__enumext_series_str _int }
1878     }
1879   }
1880 }

```

The function `__enumext_resume_last:n` will be in charge of saving the filtering *⟨keys⟩* when the `series` key is *not used* and will save them in the variable `\g__enumext_standar_series_tl` for the `enumext` environment and in the variable `\g__enumext_starred_series_tl` for the `enumext*` environment.

```

1881 \cs_new_protected:Npn \__enumext_resume_last:n #1
1882 {
1883   \bool_if:NT \l__enumext_standar_first_bool
1884   {
1885     \tl_gclear:N \g__enumext_standar_series_tl
1886     \tl_gset:Ne \g__enumext_standar_series_tl { \__enumext_filter_series:n {#1} }
1887   }
1888   \bool_if:NT \l__enumext_starred_first_bool
1889   {
1890     \tl_gclear:N \g__enumext_starred_series_tl
1891     \tl_gset:Ne \g__enumext_starred_series_tl { \__enumext_filter_series:n {#1} }
1892   }
1893 }

```

(End of definition for `__enumext_parse_series:n` and `__enumext_resume_last:n`)

13.26.2 Internal function to save counter value

```

__enumext_resume_save_counter:

```

The `__enumext_resume_save_counter:` function will save the last counter value to `\g__enumext_series_⟨series name⟩_int` if the `series={⟨series name⟩}` key has been passed, to `\g__enumext_resume_int` if it has passed the key `resume without value` and the key `series` is not active, in `\g__enumext_series_⟨series name⟩_int` if the key `resume={⟨series name⟩}` has been passed and in `\g__enumext_series_⟨store name⟩_int` if the key has been passed `save-ans={⟨store name⟩}`.

- The variables `\l__enumext_series_str` and `\l__enumext__resume_name_tl` contain the same *⟨series name⟩* but are executed at different moments, the integer variable with `\l__enumext_series_str` sets the value when execute `series={⟨series name⟩}` and the integer variable with `\l__enumext__resume_name_tl` sets the subsequent values when use `resume={⟨series name⟩}`. This function is passed to the `enumext` environment definition (§13.40) and the `enumext*` environment definition (§13.45).

```

1894 \cs_new_protected:Npn \__enumext_resume_save_counter:
1895 {
1896   \bool_if:NT \g__enumext_standar_bool
1897   {
1898     \tl_if_empty:NF \l__enumext_series_str
1899     {
1900       \int_gset_eq:cN
1901         { g__enumext_series_ \l__enumext_series_str _int } \value{enumXi}
1902     }

```

```

1903     \tl_if_empty:NTF \l__enumext_resume_name_tl
1904     {
1905         \str_if_empty:NT \l__enumext_series_str
1906         {
1907             \int_gset_eq:NN \g__enumext_resume_int \value{enumXi}
1908         }
1909     }
1910     {
1911         \int_if_exist:cT { g__enumext_series_ \l__enumext_resume_name_tl _int }
1912         {
1913             \int_gset_eq:cN
1914             { g__enumext_series_ \l__enumext_resume_name_tl _int } \value{enumXi}
1915         }
1916     }
1917     \int_if_exist:cT { g__enumext_resume_ \l__enumext_store_name_tl _int }
1918     {
1919         \int_gset_eq:cN
1920         { g__enumext_resume_ \l__enumext_store_name_tl _int } \value{enumXi}
1921     }
1922 }
1923 \bool_if:NT \g__enumext_starred_bool
1924 {
1925     \tl_if_empty:NF \l__enumext_series_str
1926     {
1927         \int_gset_eq:cN
1928         { g__enumext_series_ \l__enumext_series_str _int } \value{enumXvii}
1929     }
1930     \tl_if_empty:NTF \l__enumext_resume_name_tl
1931     {
1932         \str_if_empty:NT \l__enumext_series_str
1933         {
1934             \int_gset_eq:NN \g__enumext_resume_vii_int \value{enumXvii}
1935         }
1936     }
1937     {
1938         \int_if_exist:cT { g__enumext_series_ \l__enumext_resume_name_tl _int }
1939         {
1940             \int_gset_eq:cN
1941             { g__enumext_series_ \l__enumext_resume_name_tl _int } \value{enumXvii}
1942         }
1943     }
1944     \int_if_exist:cT { g__enumext_resume_ \l__enumext_store_name_tl _int }
1945     {
1946         \int_gset_eq:cN
1947         { g__enumext_resume_ \l__enumext_store_name_tl _int } \value{enumXvii}
1948     }
1949 }
1950 }

```

(End of definition for `__enumext_resume_save_counter:`.)

13.26.3 Internal functions for resume key

`__enumext_resume_series:n`

The function `__enumext_resume_series:n` will handle the argument passed to the `resume` key in `enumext` and `enumext*` environments. If the key is passed *without value* the function `__enumext_resume_counter:` is executed which will set the counter according to the numbering of the last `enumext` or `enumext*` environments in which `series={⟨series name⟩}` key is not present, if the `save-ans` key is active it will set the counter according to the value of the integer variable created by that key, otherwise it will verify that the `\g__enumext_series_⟨series name⟩_tl` variable set by the `series` key exists, if so it will pass these keys to the *first level* of the environment, otherwise it will return an error.

```

1951 \cs_new_protected:Npn \__enumext_resume_series:n #1
1952 {
1953     \tl_if_empty:nTF {#1}
1954     {
1955         \__enumext_resume_counter:n { }
1956     }
1957     {
1958         \tl_if_exist:cTF { g__enumext_series_ \tl_to_str:n {#1} _tl }
1959         {
1960             \__enumext_resume_counter:n {#1}
1961             \bool_if:NT \g__enumext_standar_bool
1962             {

```

```

1963         \keys_set:nv { enumext / level-1 }
1964         { g__enumext_series_ \tl_to_str:n {#1} _tl }
1965     }
1966     \bool_if:NT \g__enumext_starred_bool
1967     {
1968         \keys_set:nv { enumext / enumext* }
1969         { g__enumext_series_ \tl_to_str:n {#1} _tl }
1970     }
1971 }
1972 {
1973     \bool_if:NT \g__enumext_standar_bool
1974     {
1975         \msg_error:nnn { enumext } { unknown-series } {#1}
1976     }
1977     \bool_if:NT \g__enumext_starred_bool
1978     {
1979         \msg_error:nnn { enumext } { unknown-series } {#1}
1980     }
1981 }
1982 }
1983 }

```

(End of definition for __enumext_resume_series:n)

```

\__enumext_resume_counter:n
\__enumext_resume_counter:
  \__enumext_resume_counter_series:
  \__enumext_resume_counter_save_ans:

```

The function `__enumext_resume_counter:n` will set the variable `__enumext_resume_active_bool` to true and pass the value of the key `resume` to the variable `__enumext_series_name_tl` which will contain the `{\series name}`. If the variable `__enumext_series_name_tl` is empty, that is, we are passing the key `resume` without value, we will execute the function `__enumext_resume_counter:`; otherwise, when we pass `resume={\series name}` we will execute the function `__enumext_resume_counter_series:`, finally we will execute the function `__enumext_resume_counter_save_ans:` which is associated with the key `save-ans`.

```

1984 \cs_new_protected:Npn \__enumext_resume_counter:n #1
1985 {
1986     \bool_set_true:N \__enumext_resume_active_bool
1987     \tl_set:Nn \__enumext_resume_name_tl {#1}
1988     \tl_if_empty:NTF \__enumext_resume_name_tl
1989     {
1990         \__enumext_resume_counter:
1991     }
1992     {
1993         \__enumext_resume_counter_series:
1994     }
1995     \__enumext_resume_counter_save_ans:
1996 }

```

The `__enumext_resume_counter:` function is executed when the `resume` key is used without value, only the counters for the “first level” of the environments will be set.

```

1997 \cs_new_protected:Nn \__enumext_resume_counter:
1998 {
1999     \bool_if:NT \g__enumext_standar_bool
2000     {
2001         \int_gincr:N \g__enumext_resume_int
2002         \int_set_eq:NN \__enumext_start_i_int \g__enumext_resume_int
2003     }
2004     \bool_if:NT \g__enumext_starred_bool
2005     {
2006         \int_gincr:N \g__enumext_resume_vii_int
2007         \int_set_eq:NN \__enumext_start_vii_int \g__enumext_resume_vii_int
2008     }
2009 }

```

The function `__enumext_resume_counter_series:` will be executed when the `resume={\series name}` key is active, setting the counters for the “first level” of the environments according to the value of the integer variables created by the `series` key.

```

2010 \cs_new_protected:Nn \__enumext_resume_counter_series:
2011 {
2012     \bool_if:NT \g__enumext_standar_bool
2013     {
2014         \int_set:Nn \__enumext_start_i_int
2015         {
2016             \int_use:c { g__enumext_series_ \__enumext_resume_name_tl _int } + 1

```

```

2017     }
2018   }
2019   \bool_if:NT \g__enumext_starred_bool
2020   {
2021     \int_set:Nn \l__enumext_start_vii_int
2022     {
2023       \int_use:c { g__enumext_series_ \l__enumext_resume_name_tl _int } + 1
2024     }
2025   }
2026 }

```

The function `__enumext_resume_counter_save_ans:` will be executed when the `save-ans` key is active along with the `resume` key, setting the counters for the “first level” of the environments according to the value of the integer variables created by the `save-ans` key.

```

2027 \cs_new_protected:Nn \__enumext_resume_counter_save_ans:
2028 {
2029   \bool_lazy_and:nnT
2030   { \bool_if_p:N \l__enumext_standar_first_bool }
2031   { \bool_if_p:N \l__enumext_store_active_bool }
2032   {
2033     \int_set:Nn \l__enumext_start_i_int
2034     {
2035       \int_use:c { g__enumext_resume_ \l__enumext_store_name_tl _int } + 1
2036     }
2037   }
2038   \bool_lazy_and:nnT
2039   { \bool_if_p:N \l__enumext_starred_first_bool }
2040   { \bool_if_p:N \l__enumext_store_active_bool }
2041   {
2042     \int_set:Nn \l__enumext_start_vii_int
2043     {
2044       \int_use:c { g__enumext_resume_ \l__enumext_store_name_tl _int } + 1
2045     }
2046   }
2047 }

```

(End of definition for `__enumext_resume_counter:n` and others.)

13.26.4 Internal function for `resume*` key

`__enumext_resume_starred:`

The function `__enumext_resume_starred:` will handle the `resume*` key in the `enumext` and `enumext*` environments. This function will execute the filtered `(keys)` in the last one and will continue with the numbering according to the last execution of the environment `enumext` or `enumext*` in which the keys `resume={⟨series name⟩}` or `series={⟨series name⟩}` were not active.

```

2048 \cs_new_protected:Nn \__enumext_resume_starred:
2049 {
2050   \bool_if:NT \g__enumext_standar_bool
2051   {
2052     \tl_if_empty:NF \g__enumext_standar_series_tl
2053     {
2054       \__enumext_resume_counter:n { }
2055       \keys_set:nV { enumext / level-1 } \g__enumext_standar_series_tl
2056     }
2057   }
2058   \bool_if:NT \g__enumext_starred_bool
2059   {
2060     \tl_if_empty:NF \g__enumext_starred_series_tl
2061     {
2062       \__enumext_resume_counter:n { }
2063       \keys_set:nV { enumext / enumext* } \g__enumext_starred_series_tl
2064     }
2065   }
2066 }

```

(End of definition for `__enumext_resume_starred:`)

13.27 Setting `save-ans`, `check-ans` and `no-store` keys

The key `save-ans` is directly associated with the keys `check-ans`, `no-store`, `resume` and `resume*`, this will activate the entire “storage system” in the `enumext` package.

13.27.1 Setting save-ans key

save-ans We define the keys `save-ans` only for the “*first level*” of `enumext` and `enumext*`.

```

2067 \cs_set_protected:Npn \__enumext_tmp:n #1
2068 {
2069   \keys_define:nn { enumext / #1 }
2070   {
2071     save-ans .code:n = \__enumext_storing_set:n {##1},
2072     save-ans .value_required:n = true,
2073   }
2074 }
2075 \clist_map_inline:nn { level-1, enumext* } { { \__enumext_tmp:n {#1} }

```

(End of definition for `save-ans`.)

13.27.2 Internal functions for save-ans key

__enumext_start_save_ans_msg: The functions `__enumext_start_save_ans_msg:` and `__enumext_stop_save_ans_msg:` will display in the terminal and `.log` file the environment in which the `save-ans` key was executed along with the line at the beginning and end of it. The function `__enumext_start_save_ans_msg:` will be passed to `__enumext_storing_set:n` and the function `__enumext_stop_save_ans_msg:` will be passed to the function `__enumext_execute_after_env:`.

__enumext_start_save_ans_msg:
__enumext_stop_save_ans_msg:

```

2076 \cs_new_protected:Nn \__enumext_start_save_ans_msg:
2077 {
2078   \msg_term:nnVV { enumext } { save-ans-log }
2079   \g__enumext_envir_name_tl \l__enumext_store_name_tl
2080 }
2081 \cs_new_protected:Nn \__enumext_stop_save_ans_msg:
2082 {
2083   \msg_term:nnVV { enumext } { save-ans-log-hook }
2084   \g__enumext_envir_name_tl \g__enumext_store_name_tl
2085 }

```

(End of definition for `__enumext_start_save_ans_msg:` and `__enumext_stop_save_ans_msg:`.)

__enumext_storing_set:n
__enumext_storing_exec:

The function `__enumext_storing_set:n` first pass the value of the `save-ans` key to the variable `\l__enumext_store_name_tl` which will contain the `{(store name)}` of the *sequence* and *prop list* we will use. If `\l__enumext_store_name_tl` is *empty* we return an error message, otherwise will return the appropriate message `__enumext_start_save_ans_msg:` and proceed to execute the function `__enumext_storing_exec:` for `enumext` and `enumext*` environments.

```

2086 \cs_new_protected:Npn \__enumext_storing_set:n #1
2087 {
2088   \tl_set:Nx \l__enumext_store_name_tl {#1}
2089   \tl_if_empty:NTF \l__enumext_store_name_tl
2090   {
2091     \bool_lazy_or:nnT
2092     { \l__enumext_standar_first_bool } { \l__enumext_starred_first_bool }
2093     {
2094       \msg_error:nnV { enumext } { save-ans-empty } \g__enumext_envir_name_tl
2095     }
2096   }
2097   {
2098     \bool_lazy_or:nnT
2099     { \l__enumext_standar_first_bool } { \l__enumext_starred_first_bool }
2100     {
2101       \__enumext_start_save_ans_msg:
2102       \__enumext_storing_exec:
2103     }
2104   }
2105 }

```

The function `__enumext_storing_exec:` will set to true the variable `\l__enumext_store_active_bool` which activates the use of the `\anskey` command and the `anskey*`, `keyans`, `keyans*` and `keyanspic` environments and will set to “true” the variable `\l__enumext_check_answers_bool` used for internal checking answers mechanism set by the `check-ans` and `no-store` keys, copy `{(store name)}` into the variable `\g__enumext_store_name_tl`.

```

2106 \cs_new_protected:Nn \__enumext_storing_exec:
2107 {
2108   \bool_set_true:N \l__enumext_store_active_bool
2109   \bool_set_true:N \l__enumext_check_answers_bool
2110   \tl_gset:NV \g__enumext_store_name_tl \l__enumext_store_name_tl

```

The *prop list* `\g__enumext_series_⟨store name⟩_prop` and the *sequence* `\g__enumext_series_⟨store name⟩_seq` will be created globally to “store content” in case they do not exist together with the integer variable `\g__enumext_series_⟨store name⟩_int` used by the keys `resume` and `resume*`.

```

2111 \prop_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _prop }
2112 {
2113     \msg_log:nnV { enumext } { store-prop } \l__enumext_store_name_tl
2114     \prop_new:c { g__enumext_ \l__enumext_store_name_tl _prop }
2115 }
2116 \seq_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _seq }
2117 {
2118     \msg_log:nnV { enumext } { store-seq } \l__enumext_store_name_tl
2119     \seq_new:c { g__enumext_ \l__enumext_store_name_tl _seq }
2120 }
2121 \int_if_exist:cF { g__enumext_resume_ \l__enumext_store_name_tl _int }
2122 {
2123     \msg_log:nnV { enumext } { store-int } \l__enumext_store_name_tl
2124     \int_new:c { g__enumext_resume_ \l__enumext_store_name_tl _int }
2125 }
2126 }

```

(End of definition for `__enumext_storing_set:n` and `__enumext_storing_exec:.`)

13.27.3 The check answer mechanism

The internal mechanism for “checking answers” follows this logic:

If the line begins with `\item` or `\item*` and does NOT *open a nested environment*, each `\item` or `\item*` must contain a *single* execution of the `\anskey` command, i.e. the counter of the executions of the `\anskey` command must be equal to the counter associated with the sum of executions of `\item` and `\item*`.

If the line begins with `\item` or `\item*` and *opens a nested environment* each `\item` or `\item*` in the nested environment must have a *single* execution of the `\anskey` command and the counter associated to the sum of `\item` and `\item*` executions must decrementing by “one” to maintain equality.

In order for the mechanism for the check-answer to work (not counting `keyans`, `keyans*` and `keyanspic`) we need:

1. We must keep track of the total number of `\item` and `\item*` (enumerated) that appear within the environment including the nested levels.
2. We must keep track of the total number of `\item` and `\item*` (enumerated) that appear per level of nesting.
3. Keeping track of the number of times the environment nests.

The integer variable associated to the sum of each `\item` and `\item*` in the environment `\g__enumext_item_number_int` must match the integer variable `\g__enumext_item_anskey_int` associated to the execution of the command `\anskey`. We analyze the cases:

- a) If the list only has one level the number of `\item` + `\item*` = `\anskey`
- b) If the list has *nested levels*, for each level of nesting we need to decrementing by one (for the `\item` or `\item*` that opens the nest) so that the account remains the same.

With `keyans`, `keyans*` and `keyanspic` it is enough to increase in one the integer of `\anskey`. The integers created must be global if they are not lost in the interior levels of nesting and to execute the test we will use a “hook” function after closing the *first level* of the environment.

13.27.4 Setting check-ans and no-store keys

Now we define the keys `check-ans` and `no-store` for all levels of `enumext` and `enumext*` environments.

```

check-ans no-store
2127 \cs_set_protected:Npn \__enumext_tmp:n #1
2128 {
2129     \keys_define:nn { enumext / #1 }
2130     {
2131         check-ans .bool_set:N = \l__enumext_check_ans_key_bool,
2132         check-ans .initial:n = false,
2133         check-ans .value_required:n = true,
2134         no-store .code:n = {
2135             \bool_set_false:N \l__enumext_check_answers_bool
2136             \bool_set_false:N \l__enumext_check_ans_key_bool
2137         },
2138         no-store .value_forbidden:n = true,
2139     }
2140 }
2141 \clist_map_inline:nn

```

```

2142 {
2143     level-1, level-2, level-3, level-4, enumext*
2144 }
2145 { \__enumext_tmp:n {#1} }

```

(End of definition for check-ans and no-store.)

13.27.5 Set-up check answer mechanism

The function `__enumext_check_ans_active:` will first check the state of the variable `\l__enumext_store_name_tl`, that is, the `save-ans` key is active, if so it will check the state of the variable `\l__enumext_check_answers_bool` handled by the key `no-store` and will execute the function `__enumext_check_ans_level:` only if “true”, i.e. the key `no-store` is not active.

```

2146 \cs_new_protected:Nn \__enumext_check_ans_active:
2147 {
2148     \tl_if_empty:NF \l__enumext_store_name_tl
2149     {
2150         \bool_if:NT \l__enumext_check_answers_bool
2151         {
2152             \__enumext_check_ans_level:
2153         }
2154     }
2155 }

```

The function `__enumext_check_ans_level:` will decrement by “one” the value of the variable `\g__enumext_item_number_int` which keeps track of the executions of `\item` and `\item*` for each level of nesting of the environment `enumext`, taking into account whether it is nested within `enumext*` or the opposite and set `\l__enumext_item_number_bool` to “false”.

```

2156 \cs_new_protected:Nn \__enumext_check_ans_level:
2157 {
2158     \int_case:nn { \l__enumext_level_int }
2159     {
2160         { 1 }{
2161             \bool_lazy_all:nT
2162             {
2163                 { \bool_if_p:N \g__enumext_starred_bool }
2164                 { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
2165             }
2166             {
2167                 \int_gdecr:N \g__enumext_item_number_int
2168                 \bool_set_false:N \l__enumext_item_number_bool
2169             }
2170         }
2171         { 2 }{
2172             \int_gdecr:N \g__enumext_item_number_int
2173             \bool_set_false:N \l__enumext_item_number_bool
2174         }
2175         { 3 }{
2176             \int_gdecr:N \g__enumext_item_number_int
2177             \bool_set_false:N \l__enumext_item_number_bool
2178         }
2179         { 4 }{
2180             \int_gdecr:N \g__enumext_item_number_int
2181             \bool_set_false:N \l__enumext_item_number_bool
2182         }
2183     }

```

We should only execute this if `enumext*` is nested in the “first level” of `enumext`, for the rest of the cases the value of `\g__enumext_item_number_int` is already decreased.

```

2184     \int_case:nn { \l__enumext_level_h_int }
2185     {
2186         { 1 }{
2187             \bool_lazy_all:nT
2188             {
2189                 { \bool_if_p:N \g__enumext_standar_bool }
2190                 { \int_compare_p:nNn { \l__enumext_level_int } = { 1 } }
2191             }
2192             {
2193                 \int_gdecr:N \g__enumext_item_number_int
2194                 \bool_set_false:N \l__enumext_item_number_bool
2195             }
2196         }

```

```

2197     }
2198 }

```

(End of definition for `__enumext_check_ans_active:` and `__enumext_check_ans_level:`.)

`__enumext_check_ans_key_hook:`

The function `__enumext_check_ans_key_hook:` will *export* the status of the local variable `\l__enumext_check_ans_key_bool` to the global variable `\g__enumext_check_ans_key_bool` only if the key `check-ans` is active.

```

2199 \cs_new_protected:Nn \__enumext_check_ans_key_hook:
2200 {
2201     \bool_lazy_and:nnT
2202     { \bool_if_p:N \l__enumext_check_ans_key_bool }
2203     { \bool_if_p:N \g__enumext_standar_bool }
2204     {
2205         \bool_gset_true:N \g__enumext_check_ans_key_bool
2206     }
2207     \bool_lazy_and:nnT
2208     { \bool_if_p:N \l__enumext_check_ans_key_bool }
2209     { \bool_if_p:N \g__enumext_starred_bool }
2210     {
2211         \bool_gset_true:N \g__enumext_check_ans_key_bool
2212     }
2213 }

```

(End of definition for `__enumext_check_ans_key_hook:`.)

`__enumext_item_answer_diff:`

The function `__enumext_item_answer_diff:` will set the value of the variable `\g__enumext_item_answer_diff_int` which is used by the functions `__enumext_check_ans_show:` for the key `save-ans` and by the function `__enumext_check_ans_log:` by the internal “*check answer*” mechanism. This function will be passed to the function `__enumext_execute_after_env:`.

```

2214 \cs_new_protected:Nn \__enumext_item_answer_diff:
2215 {
2216     \int_gset:Nn \g__enumext_item_answer_diff_int
2217     {
2218         \int_sign:n { \g__enumext_item_number_int - \g__enumext_item_anskey_int }
2219     }
2220 }

```

(End of definition for `__enumext_item_answer_diff:`.)

`__enumext_check_ans_show:`

The function `__enumext_check_ans_show:` will be executed within the function `__enumext_execute_after_env:` when the key `check-ans` is active, that is, when `\g__enumext_check_ans_key_bool` is “*true*” and will return the appropriate message according to the value of `\g__enumext_item_answer_diff_int` set by the function `__enumext_item_answer_diff:`.

`__enumext_check_ans_msg_less:`
`__enumext_check_ans_msg_same_ok:`
`__enumext_check_ans_msg_greater:`

```

2221 \cs_new_protected:Nn \__enumext_check_ans_show:
2222 {
2223     \int_case:nn { \g__enumext_item_answer_diff_int }
2224     {
2225         { -1 } { \__enumext_check_ans_msg_less: }
2226         { 0 } { \__enumext_check_ans_msg_same_ok: }
2227         { 1 } { \__enumext_check_ans_msg_greater: }
2228     }
2229 }
2230 \cs_new_protected:Nn \__enumext_check_ans_msg_less:
2231 {
2232     \msg_warning:nnee { enumext } { item-less-answer } { \g__enumext_store_name_tl }
2233     { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2234 }
2235 \cs_new_protected:Nn \__enumext_check_ans_msg_same_ok:
2236 {
2237     \msg_term:nnee { enumext } { items-same-answer } { \g__enumext_store_name_tl }
2238     { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2239 }
2240 \cs_new_protected:Nn \__enumext_check_ans_msg_greater:
2241 {
2242     \msg_warning:nnee { enumext } { item-greater-answer } { \g__enumext_store_name_tl }
2243     { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2244 }

```

(End of definition for `__enumext_check_ans_show:` and others.)

`__enumext_check_ans_log:` The function `__enumext_check_ans_log:` will be executed within the function `__enumext_execute_after_env:` when the key `check-ans` is not active, that is, when `\g__enumext_check_ans_key_bool` is “false” and write in the log the appropriate message according to the value of `\g__enumext_item_answer_diff_int` set by the function `__enumext_item_answer_diff:`.

```

2245 \cs_new_protected:Nn \__enumext_check_ans_log:
2246 {
2247   \int_case:nn { \g__enumext_item_answer_diff_int }
2248   {
2249     { -1 } { \__enumext_check_ans_log_msg_less: }
2250     { 0 } { \__enumext_check_ans_log_msg_same_ok: }
2251     { 1 } { \__enumext_check_ans_log_msg_greater: }
2252   }
2253 }
2254 \cs_new_protected:Nn \__enumext_check_ans_log_msg_less:
2255 {
2256   \msg_log:nneee { enumext } { item-less-answer } { \g__enumext_store_name_tl }
2257   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2258 }
2259 \cs_new_protected:Nn \__enumext_check_ans_log_msg_same_ok:
2260 {
2261   \msg_log:nneee { enumext } { items-same-answer } { \g__enumext_store_name_tl }
2262   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2263 }
2264 \cs_new_protected:Nn \__enumext_check_ans_log_msg_greater:
2265 {
2266   \msg_log:nneee { enumext } { item-greater-answer } { \g__enumext_store_name_tl }
2267   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2268 }

```

(End of definition for `__enumext_check_ans_log:` and others.)

13.27.6 Check for `\item*` and `\anspic*` commands

`__enumext_check_starred_cmd:n`

The function `__enumext_check_starred_cmd:n` performs an *extra check* for the `keyans`, `keyans*` and `keyanspic` environments. Unlike the *check* executed by `check-ans` key this one is not controlled by any key, it is intended to prevent the forgetting of `\item*` or `\anspic*` in these environments.

```

2269 \cs_new_protected:Npn \__enumext_check_starred_cmd:n #1
2270 {
2271   \int_compare:nNnT
2272   { \g__enumext_check_starred_cmd_int } = { 0 }
2273   {
2274     \msg_warning:nnnV
2275     { enumext } { missing-starred } { #1 } \l__enumext_check_start_line_env_tl
2276   }
2277   \int_compare:nNnT
2278   { \g__enumext_check_starred_cmd_int } > { 1 }
2279   {
2280     \msg_warning:nnnV
2281     { enumext } { many-starred } { #1 } \l__enumext_check_start_line_env_tl
2282   }
2283   \int_gzero:N \g__enumext_check_starred_cmd_int
2284   \tl_clear:N \l__enumext_check_start_line_env_tl
2285 }

```

(End of definition for `__enumext_check_starred_cmd:n`.)

13.28 Keys and functions associated with storage

13.28.1 Keys for marks, wrap and show

The `enumext` package provides a set of *keys* for manipulating “symbol marks” associated with “answers” and how they are displayed and stored in the *sequence* and *prop list* as well as an internal “label and ref” system.

For the `keyans` and `keyans*` environments we will only add the keys `mark-ans*`, `mark-pos*`, `mark-sep*`, `wrap-ans*`, `wrap-opt`, `save-sep`, `show-ans` and `show-pos`.

```

2286 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
2287 {
2288   \keys_define:nn { enumext / #1 }
2289   {
2290     mark-ans* .tl_set:c = { \__enumext_mark_answer_sym_#2_tl },
2291     mark-ans* .initial:n = \textasteriskcentered,
2292     mark-ans* .value_required:n = true,

```

```

2293 mark-pos* .choice:,
2294 mark-pos* / left .code:n = \str_set:cn { \__enumext_mark_position_#2_str } { l },
2295 mark-pos* / right .code:n = \str_set:cn { \__enumext_mark_position_#2_str } { r },
2296 mark-pos* / center .code:n = \str_set:cn { \__enumext_mark_position_#2_str } { c },
2297 mark-pos* / unknown .code:n =
2298 \msg_error:nneee { enumext } { unknown-choice }
2299 { mark-pos } { left,~right,~center } { \exp_not:n {##1} },
2300 mark-pos* .initial:n = right,
2301 mark-pos* .value_required:n = true,
2302 mark-sep* .dim_set:c = { \__enumext_mark_sym_sep_#2_dim },
2303 mark-sep* .value_required:n = true,
2304 wrap-ans* .cs_set_protected:cp = { \__enumext_keyans_wrapper_item_#2:n } ##1,
2305 wrap-ans* .value_required:n = true,
2306 wrap-opt .cs_set_protected:cp = { \__enumext_keyans_wrapper_opt_#2:n } ##1,
2307 wrap-opt .initial:n = [{##1}],
2308 wrap-opt .value_required:n = true,
2309 save-sep .tl_set:c = { \__enumext_store_keyans_item_opt_sep_#2_tl },
2310 save-sep .initial:n = {,~},
2311 save-sep .value_required:n = true,
2312 show-ans .bool_set:N = \__enumext_show_answer_bool,
2313 show-ans .initial:n = false,
2314 show-ans .value_required:n = true,
2315 show-pos .bool_set:N = \__enumext_show_position_bool,
2316 show-pos .initial:n = false,
2317 show-pos .value_required:n = true,
2318 }
2319 }
2320 \clist_map_inline:nn { {keyans}{v}, {keyans*}{viii} } { \__enumext_tmp:n #1 }

```

(End of definition for mark-ans* and others.)

mark-ref We add the $\langle keys \rangle$ mark-ref and save-ref related to the “storage system” and internal mechanism of “label and ref” along with the $\langle keys \rangle$ show-ans, show-pos and the $\langle keys \rangle$ mark-ans, mark-pos, mark-sep and wrap-ans for the command `\anskey`, the environment `anskey*` and the the $\langle keys \rangle$ for environments `keyans` and `keyans*` only at the *first level* of `enumext` and `enumext*`.

```

2321 \cs_set_protected:Npn \__enumext_tmp:n #1
2322 {
2323   \keys_define:nn { enumext / #1 }
2324   {
2325     mark-ref .tl_set:N = \__enumext_mark_ref_sym_tl,
2326     mark-ref .initial:n = \textreferencemark,
2327     mark-ref .value_required:n = true,
2328     save-ref .bool_set:N = \__enumext_store_ref_key_bool,
2329     save-ref .initial:n = false,
2330     save-ref .value_required:n = true,
2331     show-ans .bool_set:N = \__enumext_show_answer_bool,
2332     show-ans .initial:n = false,
2333     show-ans .value_required:n = true,
2334     show-pos .bool_set:N = \__enumext_show_position_bool,
2335     show-pos .initial:n = false,
2336     show-pos .value_required:n = true,
2337     mark-ans .tl_set:N = \__enumext_mark_answer_sym_tl,
2338     mark-ans .initial:n = \textasteriskcentered,
2339     mark-ans .value_required:n = true,
2340     mark-sep .dim_set:N = \__enumext_mark_sym_sep_dim,
2341     mark-sep .value_required:n = true,
2342     mark-pos .choice:,
2343     mark-pos / left .code:n = \str_set:Nn \__enumext_mark_position_str { l },
2344     mark-pos / right .code:n = \str_set:Nn \__enumext_mark_position_str { r },
2345     mark-pos / center .code:n = \str_set:Nn \__enumext_mark_position_str { c },
2346     mark-pos / unknown .code:n =
2347       \msg_error:nneee { enumext } { unknown-choice }
2348       { mark-pos } { left,~right,~center } { \exp_not:n {##1} },
2349     mark-pos .initial:n = right,
2350     mark-pos .value_required:n = true,
2351
2352     wrap-ans .cs_set_protected:Np = \__enumext_anskey_wrapper:n ##1,
2353     wrap-ans .initial:n =
2354       {
2355         \fbox{\parbox[t]{\dimeval{\itemwidth -2\fboxsep -2\fboxrule}}{##1}}
2356       },

```

```

2357     wrap-ans .value_required:n = true,
2358     mark-ans* .code:n = {
2359         \keys_set:nn { enumext / keyans } { mark-ans* = {##1} }
2360         \keys_set:nn { enumext / keyans* } { mark-ans* = {##1} }
2361     },
2362     mark-ans* .value_required:n = true,
2363     mark-pos* .code:n = {
2364         \keys_set:nn { enumext / keyans } { mark-pos* = {##1} }
2365         \keys_set:nn { enumext / keyans* } { mark-pos* = {##1} }
2366     },
2367     mark-pos* .value_required:n = true,
2368     mark-sep* .code:n = {
2369         \keys_set:nn { enumext / keyans } { mark-sep* = {##1} }
2370         \keys_set:nn { enumext / keyans* } { mark-sep* = {##1} }
2371     },
2372     mark-sep* .value_required:n = true,
2373     wrap-ans* .code:n = {
2374         \keys_set:nn { enumext / keyans } { wrap-ans* = {##1} }
2375         \keys_set:nn { enumext / keyans* } { wrap-ans* = {##1} }
2376     },
2377     wrap-ans* .value_required:n = true,
2378     wrap-opt .code:n = {
2379         \keys_set:nn { enumext / keyans } { wrap-opt = {##1} }
2380         \keys_set:nn { enumext / keyans* } { wrap-opt = {##1} }
2381     },
2382     wrap-opt .value_required:n = true,
2383     save-sep .code:n = {
2384         \keys_set:nn { enumext / keyans } { save-sep = {##1} }
2385         \keys_set:nn { enumext / keyans* } { save-sep = {##1} }
2386     },
2387     save-sep .value_required:n = true,
2388 }
2389 }
2390 \clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }

```

(End of definition for *mark-ref* and others.)

13.28.2 Storing structure of the environments

The idea behind “*storing structure*” in the *sequence* is to have a copy of the *structure of the environment* in which the key *save-ans* is being executed so we must capture the *optional argument* passed to the levels of the environment in which it is executed and “*storing*” this in the *sequence*.

```

__enumext_store_active_keys:n
__enumext_store_active_keys_vii:n

```

The functions `__enumext_store_active_keys:n` and `__enumext_store_active_keys_vii:n` will be responsible for the “*storing keys*” filtered from the *optional argument* of the environment in which the key *save-ans* is executed and the levels within this for the *enumext* and *enumext** environments. We will execute this function only if the variable `__enumext_store_save_key_X_bool` is false, that is, the key *store-key* is not active, establishing the variable `__enumext_store_save_key_X_tl` with the filtered *keys*.

```

2391 \cs_new_protected:Npn \__enumext_store_active_keys:n #1
2392 {
2393     \bool_if:cF { \__enumext_store_save_key_ \__enumext_level: _bool }
2394     {
2395         \tl_clear:c { \__enumext_store_save_key_ \__enumext_level: _tl }
2396         \tl_set:ce
2397             { \__enumext_store_save_key_ \__enumext_level: _tl }
2398             { \__enumext_filter_save_key:n {#1} }
2399     }
2400 }
2401 \cs_new_protected:Npn \__enumext_store_active_keys_vii:n #1
2402 {
2403     \bool_if:NF \__enumext_store_save_key_vii_bool
2404     {
2405         \tl_clear:N \__enumext_store_save_key_vii_tl
2406         \tl_set:Ne \__enumext_store_save_key_vii_tl { \__enumext_filter_save_key:n {#1} }
2407     }
2408 }

```

(End of definition for `__enumext_store_active_keys:n` and `__enumext_store_active_keys_vii:n`.)

13.28.3 Setting save-key key

Since this “*storing structure*” in the *sequence* established by the `save-ans` key when executing `\anskey` or `anskey*`, we will not be able to modify it. The best thing here is to have a key that allows you to modify the *optional argument* of the “*storing structure*” in the *sequence*.

`save-key` The values set by this key passed in the *optional argument* of the `enumext` and `enumext*` environments will override the values of the `\l__enumext_store_save_key_X_tl` variable set by the functions `__enumext_store_active_keys:n` and `__enumext_store_active_keys_vii:n`. Now define the key `save-key` for all levels of `enumext` and `enumext*` environments.

```

2409 \cs_set_protected:Npn \__enumext_tmp:n #1
2410 {
2411   \keys_define:nn { enumext / enumext* }
2412   {
2413     save-key .code:n = \__enumext_parse_save_key_vii:n {##1},
2414     save-key .value_required:n = true,
2415   }
2416   \keys_define:nn { enumext / #1 }
2417   {
2418     save-key .code:n = \__enumext_parse_save_key:n {##1},
2419     save-key .value_required:n = true,
2420   }
2421 }
2422 \clist_map_inline:nn { level-1, level-2, level-3, level-4 } { \__enumext_tmp:n {#1} }

```

(End of definition for `save-key`.)

```

\__enumext_parse_save_key:n
\__enumext_parse_save_key_vii:n

```

The functions `__enumext_parse_save_key:n` and `__enumext_parse_save_key_vii:n` will be responsible for “*storing keys*” in the variable `\l__enumext_store_save_key_X_tl` for `enumext` and `enumext*`.

```

2423 \cs_new_protected:Npn \__enumext_parse_save_key:n #1
2424 {
2425   \bool_set_true:c { l__enumext_store_save_key_ \__enumext_level: _bool }
2426   \tl_clear:c { l__enumext_save_key_ \__enumext_level: _tl }
2427   \tl_set:ce
2428   { l__enumext_store_save_key_ \__enumext_level: _tl }
2429   { \__enumext_filter_save_key:n {#1} }
2430 }
2431 \cs_new_protected:Npn \__enumext_parse_save_key_vii:n #1
2432 {
2433   \bool_set_true:N \l__enumext_store_save_key_vii_bool
2434   \tl_clear:N \l__enumext_store_save_key_vii_tl
2435   \tl_set:Ne \l__enumext_store_save_key_vii_tl { \__enumext_filter_save_key:n {#1} }
2436 }

```

(End of definition for `__enumext_parse_save_key:n` and `__enumext_parse_save_key_vii:n`.)

13.28.4 Internal functions to store optional arguments

```

\__enumext_filter_save_key:n
\__enumext_filter_save_key_key:n
\__enumext_filter_save_key_pair:nn

```

The function `__enumext_filter_save_key:n` will be in charge of “*filtering keys*” we want to *stored in sequence* where `{#1}` represents the *optional argument* passed to the environment.

```

2437 \cs_new:Npn \__enumext_filter_save_key:n #1
2438 {
2439   \use:e
2440   {
2441     \keyval_parse:NNn
2442     \__enumext_filter_save_key_key:n
2443     \__enumext_filter_save_key_pair:nn {#1}
2444   }
2445 }

```

The function `__enumext_filter_save_key_key:n` will be responsible for “*filtering keys*” that are passed “*without value*” by excluding the `resume`, `resume*`, `no-store` and `base-fix` keys.

```

2446 \cs_new:Npn \__enumext_filter_save_key_key:n #1
2447 {
2448   \str_case:nnF {#1}
2449   {
2450     { resume } {} { resume* } {} { no-store } {} { base-fix } {}
2451   }
2452   { , { \exp_not:n {#1} } }
2453 }

```

The function `__enumext_filter_save_key_pair:nn` will be responsible for “*filtering keys*” that are passed “*with value*” by excluding the `series`, `resume`, `save-ans`, `save-ref`, `save-key`, `check-ans`, `show-ans`, `save-pos`, `mark-ans`, `mark-pos`, `mark-sep`, `wrap-ans`, `mark-ans*`, `mark-pos*`, `mark-sep*`, `wrap-ans*`, `wrap-opt`, `save-sep`, `mark-ref`, `mini-env`, `mini-sep`, `mini-right` and `mini-right*` keys.

```

2454 \cs_new:Npn \__enumext_filter_save_key_pair:nn #1#2
2455 {
2456   \str_case:nnF {#1}
2457   {
2458     { series } {} { resume } {} { save-ans } {} { save-ref } {}
2459     { save-key } {} { check-ans } {} { show-ans } {} { show-pos } {}
2460     { mark-ans } {} { mark-pos } {} { mark-sep } {} { wrap-ans } {}
2461     { mark-ans* } {} { mark-pos* } {} { mark-sep* } {} { wrap-ans* } {}
2462     { wrap-opt } {} { save-sep } {} { mark-ref } {} { mini-env } {}
2463     { mini-sep } {} { mini-right } {} { mini-right* } {}
2464   }
2465   { , { \exp_not:n {#1} } } = { \exp_not:n {#2} } }
2466 }

```

(End of definition for `__enumext_filter_save_key:n`, `__enumext_filter_save_key_key:n`, and `__enumext_filter_save_key_pair:nn`.)

13.28.5 Function for storing content in prop list

```

\__enumext_store_addto_prop:n
\__enumext_store_addto_prop:V

```

The function `__enumext_store_addto_prop:n` stores the $\langle content \rangle$ in *prop list* defined by `save-ans` key. The “*stored content*” is retrieved by means of the `\getkeyans` command.

The form in which the $\langle content \rangle$ is “*stored*” in the *prop list* is $\langle position \rangle \langle content \rangle$. This function is used by `\anskey` in `enumext` and `enumext*` environments, `\item*` in `keyans` and `keyans*` environments and `\anspic*` in `keyanspic` environment.

```

2467 \cs_new_protected:Npn \__enumext_store_addto_prop:n #1
2468 {
2469   \prop_gput_if_not_in:cen { g__enumext_ \l__enumext_store_name_tl _prop }
2470   {
2471     \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } + 1 }
2472   }
2473   { #1 }
2474 }
2475 \cs_generate_variant:Nn \__enumext_store_addto_prop:n { V }

```

(End of definition for `__enumext_store_addto_prop:n`.)

13.28.6 Function for storing content in sequence

```

\__enumext_store_addto_seq:n
\__enumext_store_addto_seq:v
\__enumext_store_addto_seq:V

```

The function `__enumext_store_addto_seq:n` stores the $\langle content \rangle$ in *sequence* defined by `save-ans` key. This function is used by `\anskey` in `enumext`, `\item*` in `keyans` and `\anspic` in `keyanspic`.

The form in which the $\langle content \rangle$ is stored in *sequence* is in a internal `enumext` or `enumext*` environments with the “*same structure*” in which the command was executed.

The “*stored content*” is retrieved by means of the `\printkeyans` command.

```

2476 \cs_new_protected:Npn \__enumext_store_addto_seq:n #1
2477 {
2478   \seq_gput_right:cn { g__enumext_ \l__enumext_store_name_tl _seq } { #1 }
2479 }
2480 \cs_generate_variant:Nn \__enumext_store_addto_seq:n { v, V }

```

(End of definition for `__enumext_store_addto_seq:n`.)

13.28.7 Functions for storing structure in the sequence

```

\__enumext_store_level_open:
\__enumext_store_level_close:

```

The “*storing structure*” is handled by the functions `__enumext_store_level_open:` and `__enumext_store_level_close:` which are executed per level within the `enumext` environment.

```

2481 \cs_new_protected:Nn \__enumext_store_level_open:
2482 {
2483   \bool_if:NT \l__enumext_check_answers_bool
2484   {
2485     \tl_if_empty:cTF { l__enumext_store_save_key_ \l__enumext_level: _tl }
2486     {
2487       \__enumext_store_addto_seq:n
2488       {
2489         \item \begin{enumext}
2490       }
2491     }
2492     {
2493       \tl_put_left:cn { l__enumext_store_save_key_ \l__enumext_level: _tl }

```

```

2494         {
2495             \item \begin{enumext} [
2496         }
2497         \tl_put_right:cn { l__enumext_store_save_key_ \__enumext_level: _tl }
2498         {
2499             ]
2500         }
2501         \__enumext_store_addto_seq:v { l__enumext_store_save_key_ \__enumext_level: _tl }
2502     }
2503 }
2504 }
2505 \cs_new_protected:Nn \__enumext_store_level_close:
2506 {
2507     \bool_if:NT \l__enumext_check_answers_bool
2508     {
2509         \__enumext_store_addto_seq:n { \end{enumext} }
2510     }
2511 }

```

(End of definition for __enumext_store_level_open: and __enumext_store_level_close:.)

__enumext_store_level_open_vii:
 __enumext_store_level_close_vii:

The “*storing structure*” is handled by the functions __enumext_store_level_open_vii: and __enumext_store_level_close_vii: which are executed in the `enumext*` environment.

```

2512 \cs_new_protected:Nn \__enumext_store_level_open_vii:
2513 {
2514     \bool_if:NT \l__enumext_check_answers_bool
2515     {
2516         \tl_if_empty:NTF \l__enumext_store_save_key_vii_tl
2517         {
2518             \__enumext_store_addto_seq:n
2519             {
2520                 \item \begin{enumext*}
2521             }
2522         }
2523         {
2524             \tl_put_left:Nn \l__enumext_store_save_key_vii_tl
2525             {
2526                 \item \begin{enumext*}[
2527             }
2528             \tl_put_right:Nn \l__enumext_store_save_key_vii_tl
2529             {
2530                 ]
2531             }
2532             \__enumext_store_addto_seq:V \l__enumext_store_save_key_vii_tl
2533         }
2534     }
2535 }
2536 \cs_new_protected:Nn \__enumext_store_level_close_vii:
2537 {
2538     \bool_if:NT \l__enumext_check_answers_bool
2539     {
2540         \__enumext_store_addto_seq:n { \end{enumext*} }
2541     }
2542 }

```

(End of definition for __enumext_store_level_open_vii: and __enumext_store_level_close_vii:.)

13.28.8 Function for show marks and position

__enumext_print_keyans_box:NN
 __enumext_print_keyans_box:cc

The function __enumext_print_keyans_box:NN print a box in the left margin with \l__enumext_mark_answer_sym_tl used by the `wrap-ans`, `show-ans` and `show-pos` keys. The function takes two arguments:

#1: \l__enumext_labelwidth_X_dim
#2: \l__enumext_labelsep_X_dim

```

2543 \cs_new_protected:Nn \__enumext_print_keyans_box:NN
2544 {
2545     \mode_leave_vertical:
2546     \skip_horizontal:n { -\dim_use:N #2 }
2547     \hbox_overlap_left:n
2548     {
2549         \makebox[ \dim_use:N #1 ] [ \l__enumext_mark_position_str ]
2550         {

```

```

2551         \tl_use:N \l__enumext_mark_answer_sym_tl
2552     }
2553 }
2554 \skip_horizontal:n { \dim_use:N #2 }
2555 }
2556 \cs_generate_variant:Nn \__enumext_print_keyans_box:NN { cc }

```

(End of definition for `__enumext_print_keyans_box:NN`.)

13.29 The internal label and ref

The function `__enumext_store_internal_ref:` handles the “*internal label and ref*” system used by the `save-ref` and `mark-ref` keys for `\anskey` will allow to execute `\ref{⟨store name : position⟩}` and will return `1.(a).i.A`.

`__enumext_store_internal_ref:`

First we will remove the dots “.” from the current `⟨labels⟩`, we do not want to get double dots in our references, then we will place this in the variable `\l__enumext_newlabel_arg_two_tl`.

```

2557 \cs_new_protected:Nn \__enumext_store_internal_ref:
2558 {
2559     \cs_set_protected:Npn \__enumext_tmp:n ##1
2560     {
2561         \tl_set_eq:cc { \l__enumext_label_copy_##1_tl } { \l__enumext_label_##1_tl }
2562         \tl_reverse:c { \l__enumext_label_copy_##1_tl }
2563         \tl_remove_once:cn { \l__enumext_label_copy_##1_tl } { . }
2564         \tl_reverse:c { \l__enumext_label_copy_##1_tl }
2565     }
2566     \clist_map_inline:nn { i, ii, iii, iv, vii } { \__enumext_tmp:n {##1} }
2567     \cs_set:Npn \__enumext_tmp:n ##1
2568     { . \tl_use:c { \l__enumext_label_copy_ \int_to_roman:n {##1} _tl } }

```

Here we need to analyse the cases where the environment is started with `enumext*` and if `\anskey` or `anskey*` is running alone in it or if it is running in a nested `enumext` environment within the starting environment.

```

2569     \bool_lazy_all:nT
2570     {
2571         { \bool_if_p:N \g__enumext_starred_bool }
2572         { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
2573     }
2574     {
2575         \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2576         { \tl_use:N \l__enumext_label_copy_vii_tl }
2577     }
2578     \bool_lazy_all:nT
2579     {
2580         { \bool_not_p:n { \g__enumext_standar_bool } }
2581         { \bool_if_p:N \l__enumext_standar_bool }
2582         { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } }
2583     }
2584     {
2585         \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2586         {
2587             \tl_use:N \l__enumext_label_copy_vii_tl
2588             \int_step_function:nnN { 1 } { \l__enumext_level_int } \__enumext_tmp:n
2589         }
2590     }

```

If started with `enumext` and if `\anskey` or `anskey*` is running alone in it or if it is running in a nested `enumext*` environment within the starting environment.

```

2591     \bool_lazy_all:nT
2592     {
2593         { \bool_if_p:N \g__enumext_standar_bool }
2594         { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } }
2595         { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
2596     }
2597     {
2598         \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2599         {
2600             \tl_use:N \l__enumext_label_copy_i_tl
2601             \int_step_function:nnN { 2 } { \l__enumext_level_int } \__enumext_tmp:n
2602         }
2603     }
2604     \cs_set:Npn \__enumext_tmp:n ##1
2605     { \tl_use:c { \l__enumext_label_copy_ \int_to_roman:n {##1} _tl } . }

```

```

2606 \bool_lazy_all:nT
2607 {
2608   { \bool_if_p:N \g__enumext_standar_bool }
2609   { \bool_if_p:N \l__enumext_starred_bool }
2610   { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } } }
2611 }
2612 {
2613   \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2614   {
2615     \int_step_function:nnN { 1 } { \l__enumext_level_int } \__enumext_tmp:n
2616     \tl_use:N \l__enumext_label_copy_vii_tl
2617   }
2618 }

```

Now we set the variable `\l__enumext_newlabel_arg_one_tl` which will contain $\langle \textit{store name} : \textit{position} \rangle$.

```

2619 \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
2620 {
2621   \l__enumext_store_name_tl \c_colon_str
2622   \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } }
2623 }

```

Now execute the function `__enumext_newlabel:nn` and save the result in the variable `\l__enumext_write_aux_file_tl` and finally we write in the `.aux` file.

```

2624 \tl_put_right:Ne \l__enumext_write_aux_file_tl
2625 {
2626   \__enumext_newlabel:nn
2627   { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2628   { \l__enumext_newlabel_arg_two_tl }
2629 }
2630 \l__enumext_write_aux_file_tl
2631 }

```

(End of definition for `__enumext_store_internal_ref:`)

13.30 Common functions for `\anskey` and `anskey*` environment

`__enumext_store_anskey_arg:n`

The internal function `__enumext_store_anskey_arg:n` first we pass the $\langle \textit{argument} \rangle$ to the *prop list*, then checks the state of the variable `\l__enumext_store_ref_key_bool` handled by the *save-ref* key and will call the function `__enumext_store_internal_ref:` for the “*internal label and ref*” system. Followed by this if the *show-ans* or *show-pos* keys are active we will show the “*wrapped*” $\langle \textit{argument} \rangle$.

```

2632 \cs_new_protected:Npn \__enumext_store_anskey_arg:n #1
2633 {
2634   \int_gincr:N \g__enumext_item_anskey_int
2635   \__enumext_store_addto_prop:n {#1}
2636   \bool_if:NT \l__enumext_store_ref_key_bool
2637   {
2638     \__enumext_store_internal_ref:
2639   }
2640   \__enumext_anskey_show_wrap_left:n { #1 }

```

Now we start processing the $[(key = val)]$ passed to the command to build our `\item` in the variable `\l__enumext_store_anskey_arg_tl` which we will “*store*” in the *sequence*. First we clear the variable `\l__enumext_store_anskey_arg_tl` and process the $\langle \textit{keys} \rangle$, if the *break-col* key is present and the command is running under `enumext` (not in `enumext*`) we will add `\columnbreak` and then `\item`.

```

2641 \tl_clear:N \l__enumext_store_anskey_arg_tl
2642 \bool_lazy_and:nnT
2643 { \bool_if_p:N \l__enumext_store_columns_break_bool }
2644 { \bool_not_p:n { \l__enumext_starred_bool } }
2645 {
2646   \tl_put_left:Nn \l__enumext_store_anskey_arg_tl { \columnbreak }
2647 }
2648 \tl_put_right:Nn \l__enumext_store_anskey_arg_tl { \item }

```

If the *item-join* key is present and the command is running under `enumext*` we will add $\langle \textit{number} \rangle$ to `\l__enumext_store_anskey_arg_tl`.

```

2649 \bool_lazy_and:nnT
2650 { \bool_not_p:n { \l__enumext_starred_bool } }
2651 { \int_compare_p:nNn { \l__enumext_store_item_join_int } > { 1 } }
2652 {
2653   \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2654   {
2655     ( \exp_not:V \l__enumext_store_item_join_int )
2656   }

```

```
2657     }
```

And now we will review the keys `item-star`, `item-sym*` and `item-pos*` and pass them to `\l__enumext_store_anskey_arg_tl` along with the $\langle argument \rangle$ for `\anskey` or $\langle body \rangle$ for `anskey*`.

```
2658     \bool_if:NTF \l__enumext_store_item_star_bool
2659     {
2660         \tl_put_right:Nn \l__enumext_store_anskey_arg_tl { * }
2661         \tl_if_empty:NF \l__enumext_store_item_symbol_tl
2662         {
2663             \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2664             {
2665                 [ \exp_not:V \l__enumext_store_item_symbol_tl ]
2666             }
2667         }
2668         \dim_compare:nT
2669         {
2670             \l__enumext_store_item_symbol_sep_dim != \c_zero_dim
2671         }
2672         {
2673             \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2674             {
2675                 [ \exp_not:V \l__enumext_store_item_symbol_sep_dim ]
2676             }
2677         }
2678         \tl_put_right:Nn \l__enumext_store_anskey_arg_tl {#1}
2679     }
2680     {
2681         \tl_put_right:Nn \l__enumext_store_anskey_arg_tl {#1}
2682     }
```

Finally we check if the `save-ref` key are active along with the `hyperref` package load, if both conditions are met, it will create the `\hyperlink` with “`symbol`” set by `mark-ref` key and then store in *sequence*.

```
2683     \bool_lazy_and:nnT
2684     { \bool_if_p:N \l__enumext_store_ref_key_bool }
2685     { \bool_if_p:N \l__enumext_hyperref_bool }
2686     {
2687         \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2688         {
2689             \hfill \exp_not:N \hyperlink { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2690             { \exp_not:V \l__enumext_mark_ref_sym_tl }
2691         }
2692     }
2693     \__enumext_store_addto_seq:V \l__enumext_store_anskey_arg_tl
2694 }
```

(End of definition for `__enumext_store_anskey_arg:n`)

```
\__enumext_anskey_show_wrap_arg:n
```

The function `__enumext_anskey_show_wrap_arg:n` “wraps” the $\langle argument \rangle$ passed to `\anskey` and the $\langle body \rangle$ for `anskey*` when using the `wrap-ans` and `wrap-sep` keys.

```
2695     \cs_new_protected:Npn \__enumext_anskey_show_wrap_arg:n #1
2696     {
2697         \par
2698         \bool_if:NTF \l__enumext_starred_bool
2699         {
2700             \dim_compare:nNnT { \l__enumext_mark_sym_sep_dim } = { \c_zero_dim }
2701             {
2702                 \dim_set:Nn \l__enumext_mark_sym_sep_dim { \l__enumext_labelsep_vii_dim }
2703             }
2704             \__enumext_print_keyans_box:NN
2705             \l__enumext_labelwidth_vii_dim \l__enumext_mark_sym_sep_dim
2706         }
2707         {
2708             \dim_compare:nNnT { \l__enumext_mark_sym_sep_dim } = { \c_zero_dim }
2709             {
2710                 \dim_set:Nn \l__enumext_mark_sym_sep_dim
2711                 {
2712                     \dim_use:c { \l__enumext_labelsep_ \__enumext_level: _dim }
2713                 }
2714             }
2715             \__enumext_print_keyans_box:cc
2716             { \l__enumext_labelwidth_ \__enumext_level: _dim } { \l__enumext_mark_sym_sep_dim }
2717         }
```

```

2718   \__enumext_anskey_wrapper:n { #1 }
2719 }

```

(End of definition for __enumext_anskey_show_wrap_arg:n.)

__enumext_anskey_show_wrap_left:n

The function __enumext_anskey_show_wrap_left:n will show the “*mark*” defined by the `mark-ans` key or the “*position*” of the $\langle content \rangle$ stored in the *prop list* when using the `show-pos` key on the left margin next to the “*wraps*” $\langle argument \rangle$ passed to `\anskey` and the $\langle body \rangle$ in `anskey*` on the right side when using the `show-ans` key.

```

2720 \cs_new_protected:Npn \__enumext_anskey_show_wrap_left:n #1
2721 {
2722   \bool_if:NT \__enumext_show_answer_bool
2723   {
2724     \__enumext_anskey_show_wrap_arg:n { #1 }
2725   }
2726   \bool_if:NT \__enumext_show_position_bool
2727   {
2728     \tl_set:Nx \__enumext_mark_answer_sym_tl
2729     {
2730       \group_begin:
2731       \exp_not:N \normalfont
2732       \exp_not:N \footnotesize [ \int_eval:n
2733       {
2734         \prop_count:c { g__enumext_ \__enumext_store_name_tl _prop }
2735       }
2736       ]
2737       \group_end:
2738     }
2739     \__enumext_anskey_show_wrap_arg:n { #1 }
2740   }
2741 }

```

(End of definition for __enumext_anskey_show_wrap_left:n.)

13.31 The command \anskey

Since we will be “*storing content*” in a `list` environment within *sequences* and can (more or less) manage the options passed to each level, it is necessary that we have a little more control over `\item` when storing.

The `\anskey` command will cover this point and give it similar behaviour to that of `\item` in the `enumext` and `enumext*` environments executed as follows `\anskey[\key = val]{\langle content \rangle}`.

First we’ll add the keys `break-col`, `item-join`, `item-star`, `item-sym*` and `item-pos*`.

```

break-col
item-join
item-star
item-sym*
item-pos*
unknown
\__enumext_anskey_unknown:n
\__enumext_anskey_unknown:nn
2742 \keys_define:nn { enumext / anskey }
2743 {
2744   break-col .bool_set:N = \__enumext_store_columns_break_bool,
2745   break-col .default:n = true,
2746   break-col .value_forbidden:n = true,
2747   item-join .int_set:N = \__enumext_store_item_join_int,
2748   item-join .value_required:n = true,
2749   item-star .bool_set:N = \__enumext_store_item_star_bool,
2750   item-star .default:n = true,
2751   item-star .value_forbidden:n = true,
2752   item-sym* .tl_set:N = \__enumext_store_item_symbol_tl,
2753   item-sym* .value_required:n = true,
2754   item-pos* .dim_set:N = \__enumext_store_item_symbol_sep_dim,
2755   item-pos* .value_required:n = true,
2756   unknown .code:n = { \__enumext_anskey_unknown:n {#1} },
2757 }

```

The $\langle keys \rangle$ are stored in `\l_keys_key_str` and the value (if any) is passed as an argument to the function `__enumext_anskey_unknown:n`.

```

2758 \cs_new_protected:Npn \__enumext_anskey_unknown:n #1
2759 {
2760   \exp_args:NV \__enumext_anskey_unknown:nn \l_keys_key_str {#1}
2761 }
2762 \cs_new_protected:Npn \__enumext_anskey_unknown:nn #1 #2
2763 {
2764   \tl_if_blank:nTF {#2}
2765   {
2766     \msg_error:nnn { enumext } { anskey-cmd-key-unknown } {#1}
2767   }
2768   {

```



```

2769         \msg_error:nnnn { enumext } { anskey-cmd-key-value-unknown } {#1} {#2}
2770     }
2771 }

```

(End of definition for `break-col` and others.)

- The `\anskey` command will only be present when using the `save-ans` key in `enumext` and `enumext*` environments, otherwise it will return an error.

\anskey We will first call the function `__enumext_anskey_safe_outer:` to be sure where we execute the command, then we will check the state of the variable `\l__enumext_check_answers_bool` set by the key `no-store`, if is true we will increment `\g__enumext_item_anskey_int` for the internal “*check answer*” system and execute the function `__enumext_anskey_safe_inner:n` to ensure that the command is not nested and that the argument is not empty, finally search the `[(key = val)]` and call the function `__enumext_store_-anskey_arg:n`.

```

2772 \NewDocumentCommand \anskey { o +m }
2773 {
2774     \__enumext_anskey_safe_outer:
2775     \group_begin:
2776     \bool_if:NT \l__enumext_check_answers_bool
2777     {
2778         \tl_if_novalue:nF {#1}
2779         {
2780             \keys_set:nn { enumext / anskey } {#1}
2781         }
2782         \tl_if_blank:nTF {#2}
2783         {
2784             \msg_error:nn { enumext } { anskey-empty-arg }
2785         }
2786         {
2787             \__enumext_anskey_safe_inner:
2788             \__enumext_store_anskey_arg:n {#2}
2789         }
2790     }
2791     \group_end:
2792 }

```

(End of definition for `\anskey`. This function is documented on page 14.)

13.31.1 Internal functions for the command

`__enumext_anskey_safe_outer:` The `__enumext_store_anskey_safe_outer:` function will return the appropriate messages when the command is executed outside the environment in which the `save-ans` key was activated.

`__enumext_anskey_safe_inner:`

```

2793 \cs_new_protected:Nn \__enumext_anskey_safe_outer:
2794 {
2795     \bool_if:NF \l__enumext_store_active_bool
2796     {
2797         \msg_error:nnnn { enumext } { anskey-wrong-place } { anskey } { enumext }
2798     }
2799     \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
2800     {
2801         \msg_error:nnnn { enumext } { command-wrong-place } { anskey } { keyans }
2802     }
2803     \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
2804     {
2805         \msg_error:nnnn { enumext } { command-wrong-place } { anskey } { keyans* }
2806     }
2807     \int_compare:nNnT { \l__enumext_keyans_pic_level_int } = { 1 }
2808     {
2809         \msg_error:nnnn { enumext } { command-wrong-place } { anskey } { keyanspic }
2810     }
2811 }

```

The `__enumext_anskey_safe_inner:` function will first check if the command is nested, if preceded by a not numbered `\item` or if it is in *math mode* returning the appropriate messages.

```

2812 \cs_new_protected:Nn \__enumext_anskey_safe_inner:
2813 {
2814     \int_incr:N \l__enumext_anskey_level_int
2815     \int_compare:nNnT { \l__enumext_anskey_level_int } > { 1 }
2816     {
2817         \msg_error:nn { enumext } { anskey-nested }
2818     }
2819     \bool_if:NF \l__enumext_item_number_bool

```

```

2820     {
2821       \msg_error:nn { enumext } { anskey-unnumber-item }
2822     }
2823     \mode_if_math:T
2824     {
2825       \msg_error:nne { enumext } { anskey-math-mode } { \c_backslash_str anskey }
2826     }
2827   }

```

(End of definition for `__enumext_anskey_safe_outer:` and `__enumext_anskey_safe_inner:`)

13.32 The environment `anskey*`

The original implementation of the `anskey*` environment used non-public functions from the `scontents`[4] package, which was not the best approach. Fortunately L^AT_EX release 2025-06-01 implemented the new `c`-type argument in the `lATEXcmd`[13], with which we can record the *body* of the environment in *verbatim mode* and, together with `\scantokens` do the work as the original implementation.

First we add the same keys from the `\anskey` command along with the `force-eol`, `write-env` and `overwrite` keys that were in the original implementation that used the `scontents` support package for these.

```

break-col 2828 \keys_define:nn { enumext / anskey* }
item-join 2829   {
item-star 2830     break-col .bool_set:N = \__enumext_store_columns_break_bool,
item-sym* 2831     break-col .default:n = true,
item-pos* 2832     break-col .value_forbidden:n = true,
force-eol 2833     item-join .int_set:N = \__enumext_store_item_join_int,
write-env 2834     item-join .value_required:n = true,
overwrite 2835     item-star .bool_set:N = \__enumext_store_item_star_bool,
          2836     item-star .default:n = true,
          2837     item-star .value_forbidden:n = true,
          2838     item-sym* .tl_set:N = \__enumext_store_item_symbol_tl,
          2839     item-sym* .value_required:n = true,
          2840     item-pos* .dim_set:N = \__enumext_store_item_symbol_sep_dim,
          2841     item-pos* .value_required:n = true,
          2842     force-eol .bool_set:N = \__enumext_anskey_env_force_eol_bool,
          2843     force-eol .initial:n = false,
          2844     force-eol .default:n = true,
          2845     write-env .code:n = {
2846               \bool_set_true:N \__enumext_write_anskey_env_bool
2847               \tl_set:Nn \__enumext_write_anskey_env_file_name_tl {#1}
2848             },
2849     write-env .value_required:n = true,
2850     overwrite .bool_set:N = \__enumext_anskey_env_overwrite_bool,
2851     overwrite .initial:n = false,
2852     overwrite .default:n = true,
2853     unknown .code:n = { \__enumext_anskey_env_unknown:n {#1} },
2854   }

```

(End of definition for `break-col` and others.)

The *keys* are stored in `\l_keys_key_str` and the value (if any) is passed as an argument to the function `__enumext_anskey_env_unknown:n`.

```

\__enumext_anskey_env_unknown:n 2855 \cs_new_protected:Npn \__enumext_anskey_env_unknown:n #1
\__enumext_anskey_env_unknown:nn 2856   {
2857     \exp_args:NV \__enumext_anskey_env_unknown:nn \l_keys_key_str {#1}
2858   }
2859 \cs_new_protected:Npn \__enumext_anskey_env_unknown:nn #1#2
2860   {
2861     \tl_if_blank:nTF {#2}
2862     {
2863       \msg_error:nnn { enumext } { anskey-env-key-unknown } {#1}
2864     }
2865     {
2866       \msg_error:nnnn { enumext } { anskey-env-key-value-unknown } {#1} {#2}
2867     }
2868   }

```

(End of definition for `__enumext_anskey_env_unknown:n` and `__enumext_anskey_env_unknown:nn`.)

```

\__enumext_anskey_env_file_if_writable:n
\__enumext_anskey_env_file_if_writable:nT
\__enumext_anskey_env_file_if_writable:nF
\__enumext_anskey_env_file_if_writable:nT

```

The conditional function `__enumext_anskey_env_file_if_writable:n` used by the `write-env` and `overwrite` keys in the `anskey*` environment to determine whether the output file is written or overwritten.

```

2869 \prg_new_protected_conditional:Npnn \__enumext_anskey_env_file_if_writable:n #1 { T, F, TF }
2870 {
2871   \bool_if:NTF \l__enumext_write_anskey_env_bool
2872   {
2873     \file_if_exist:nTF {#1}
2874     {
2875       \bool_if:NTF \l__enumext_anskey_env_overwrite_bool
2876       {
2877         \msg_warning:nne { enumext } { overwrite-file } {#1}
2878         \prg_return_true:
2879       }
2880       {
2881         \msg_warning:nne { enumext } { not-writing } {#1}
2882         \prg_return_false:
2883       }
2884     }
2885     {
2886       \msg_warning:nne { enumext } { writing-file } {#1}
2887       \prg_return_true:
2888     }
2889   }
2890   { \prg_return_false: }
2891 }

```

The `__enumext_anskey_env_file_write:nn` function is used by the `write-env` key in the `anskey*` environment to write the output file with the `⟨body⟩` of the environment.

```

2892 \cs_new_protected:Npn \__enumext_anskey_env_file_write:nn #1#2
2893 {
2894   \__enumext_anskey_env_file_if_writable:nT {#1}
2895   {
2896     \iow_open:Nn \l__enumext_write_anskey_env_file_iow {#1}
2897     \iow_now:Nn \l__enumext_write_anskey_env_file_iow {#2}
2898     \iow_close:N \l__enumext_write_anskey_env_file_iow
2899   }
2900 }
2901 \cs_generate_variant:Nn \__enumext_anskey_env_file_write:nn { VV }

```

(End of definition for `__enumext_anskey_env_file_if_writable:n` and others.)

`anskey*`

First, we'll call the function `__enumext_anskey_env_safe_outer:` to make sure where we're running the environment, then, we'll check the state of the variable `\l__enumext_check_answers_bool` set by the key `no-store`. If it's true, we'll look for `[⟨key = val⟩]` and verify that the *argument* `c` `⟨body⟩` is not empty. Finally, we'll run the internal check function `__enumext_anskey_env_safe_inner:n` and call the function `__enumext_store_anskey_arg:n`.

```

2902 \NewDocumentEnvironment{anskey*}{ o c }
2903 {
2904   \__enumext_anskey_env_safe_outer:
2905   \bool_if:NNT \l__enumext_check_answers_bool
2906   {
2907     \tl_if_no_value:nF {#1}
2908     {
2909       \keys_set:nn { enumext / anskey* } {#1}
2910     }
2911     \tl_if_blank:nTF {#2}
2912     {
2913       \msg_error:nn { enumext } { anskey-empty-arg }
2914     }
2915     {
2916       \__enumext_anskey_env_safe_inner:
2917       \__enumext_store_anskey_env:n {#2}
2918     }
2919   }
2920 } { }

```

(End of definition for `anskey*`. This function is documented on page 15.)

13.32.1 Internal functions for the environment

```

\__enumext_anskey_env_safe_outer:
\__enumext_anskey_env_safe_inner:
\__enumext_store_anskey_env:n

```

The function `__enumext_store_anskey_safe_outer:` will return the appropriate messages when `anskey*` is executed outside the environment in which the `save-ans` key was activated or within the `keyans`, `keyans*` or `keyanspic` environments.

```

2921 \cs_new_protected:Nn \__enumext_anskey_env_safe_outer:
2922 {
2923   \bool_if:NF \l__enumext_store_active_bool
2924   {
2925     \msg_error:nnn { enumext } { anskey-env-error } { anskey* }
2926   }
2927   \int_compare:nNt { \l__enumext_keyans_level_int } = { 1 }
2928   {
2929     \msg_error:nnn { enumext } { anskey-env-wrong } { keyans }
2930   }
2931   \int_compare:nNt { \l__enumext_keyans_level_h_int } = { 1 }
2932   {
2933     \msg_error:nnn { enumext } { anskey-env-wrong } { keyans* }
2934   }
2935   \int_compare:nNt { \l__enumext_keyans_pic_level_int } = { 1 }
2936   {
2937     \msg_error:nnn { enumext } { anskey-env-wrong } { keyanspic }
2938   }
2939 }

```

The function `__enumext_anskey_env_safe_inner:` will first check if preceded by a not numbered `\item` or if it is in *math mode* returning the appropriate messages.

```

2940 \cs_new_protected:Nn \__enumext_anskey_env_safe_inner:
2941 {
2942   \bool_if:NF \l__enumext_item_number_bool
2943   {
2944     \msg_error:nn { enumext } { anskey-unnumber-item }
2945   }
2946   \mode_if_math:T
2947   {
2948     \msg_error:nnn { enumext } { anskey-math-mode } { anskey* }
2949   }
2950 }

```

The `__enumext_store_anskey_env:n` function will first pass the argument `c` (*body*) to the variable `\l__enumext_store_anskey_env_tl` and replace the macro `\obeyedline` with `^^J` and then execute the `write-env` and `overwrite` keys, check the state of the variable `\l__enumext_anskey_env_force_eol_bool` managed by the `force-eol` key and we will add `\c__enumext_anskey_env_hidden_space_str` if necessary. Finally we will use `\exp_args:Ne` on the `__enumext_store_anskey_arg:n` to expand the `__enumext_scan_tokens:n` function which rescans the `\l__enumext_store_anskey_env_tl` variable before processing it.

```

2951 \cs_new_protected:Npn \__enumext_store_anskey_env:n #1
2952 {
2953   \tl_set:Nn \l__enumext_store_anskey_env_tl {#1}
2954   \RenewDocumentCommand \obeyedline { } { \iow_char:N ^^J }
2955   \tl_replace_all:Nee \l__enumext_store_anskey_env_tl { \obeyedline } { \iow_char:N ^^J }
2956   \__enumext_anskey_env_file_write:VV
2957   \l__enumext_write_anskey_env_file_name_tl \l__enumext_store_anskey_env_tl
2958   \bool_if:NF \l__enumext_anskey_env_force_eol_bool
2959   {
2960     \tl_put_right:Ne \l__enumext_store_anskey_env_tl
2961     {
2962       \c__enumext_anskey_env_hidden_space_str
2963     }
2964   }
2965   \exp_args:Ne
2966   \__enumext_store_anskey_arg:n
2967   {
2968     \__enumext_scan_tokens:n { \l__enumext_store_anskey_env_tl }
2969   }
2970 }

```

Since `\obeyedline` can be redefined by the user, for example to `\mbox{} \par`, it is necessary to redefine it to `^^J` in order to use `\tl_replace_all:Nee` otherwise it returns an error.

(End of definition for `__enumext_anskey_env_safe_outer:`, `__enumext_anskey_env_safe_inner:`, and `__enumext_store_anskey_env:n`.)

13.33 Executing check-ans system and write .log

`__enumext_execute_after_env:`

The `__enumext_execute_after_env:` function will first return the appropriate message for the end of the environment in which the `save-ans` key is being executed, then call the `__enumext_item_answer_diff:` function and then will write the values of the global variables used to the `.log` file. If the key `check-ans` is active it will execute the function `__enumext_check_ans_show:` and show the result in the terminal, otherwise it will execute the function `__enumext_check_ans_log:` and write the results in the `.log` file and finally we execute the function `__enumext_reset_global_vars:` returning the used variables to their original state.

```

2971 \cs_new_protected:Nn \__enumext_execute_after_env:
2972 {
2973   \int_compare:nNnT { \l__enumext_level_int } = { 0 }
2974   {
2975     \tl_if_empty:NF \g__enumext_store_name_tl
2976     {
2977       \__enumext_stop_save_ans_msg:
2978       \__enumext_item_answer_diff:
2979       \__enumext_log_global_vars:
2980       \__enumext_log_answer_vars:
2981       \bool_if:NTF \g__enumext_check_ans_key_bool
2982       {
2983         \__enumext_check_ans_show:
2984       }
2985       { \__enumext_check_ans_log: }
2986     }
2987     \__enumext_reset_global_vars:
2988   }
2989 }

```

• This function is passed to the function `__enumext_after_env:n` for the environments `enumext` (§13.40) and `enumext*` (§13.45) and it is executed only when the environments are not nested or at some level of these..

(End of definition for `__enumext_execute_after_env:`.)

13.34 Common functions for keyans, keyans* and keyanspic

13.34.1 Storing content in prop list

`__enumext_keyans_addto_prop:n`

The function `__enumext_keyans_addto_prop:n` will pass the the current $\langle label \rangle$ for $\langle item^* \rangle$ in `keyans` environment and the current $\langle label \rangle$ for $\langle anspic^* \rangle$ in `keyanspic` environment followed by the $\langle contents \rangle$ of the *optional argument* of both commands to the `\l__enumext_store_current_label_tl` variable, which will be stored to the *prop list* defined by the `save-ans` key using the function `__enumext_store_addto_prop:V`.

```

2990 \cs_new_protected:Npn \__enumext_keyans_addto_prop:n #1
2991 {
2992   \tl_clear:N \l__enumext_store_current_label_tl
2993   \int_compare:nNnTF { \l__enumext_keyans_pic_level_int } = { 1 }
2994   {
2995     \tl_put_right:Ne \l__enumext_store_current_label_tl { \l__enumext_label_vi_tl }
2996   }
2997   {
2998     \tl_put_right:Ne \l__enumext_store_current_label_tl { \l__enumext_label_v_tl }
2999   }

```

If the *optional argument* is present and the `save-sep` key is not empty, we save it.

```

3000   \tl_if_novalue:NF { #1 }
3001   {
3002     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_v_tl
3003     {
3004       \tl_put_right:NV \l__enumext_store_current_label_tl \l__enumext_store_keyans_item_opt_sep_v_tl
3005     }
3006     \tl_put_right:Nn \l__enumext_store_current_label_tl { #1 }
3007   }
3008   \__enumext_store_addto_prop:V \l__enumext_store_current_label_tl
3009 }

```

(End of definition for `__enumext_keyans_addto_prop:n`.)

13.34.2 The save-ref key for keyans, keyans* and keyanspic

The “*internal label and ref*” system for the `keyans`, `keyans*` and `keyanspic` environments has *slight differences* with the one implemented for `\anskey` basically because in this environments the interest is in the current $\langle label \rangle$ for `\item*` and `\anspic*` with the $\langle contents \rangle$ of the *optional argument*. The mechanism defined here will allow to execute `\ref{\(store name: position\)}` and will return 1. (A).

The function `__enumext_keyans_store_ref:` handles the “*internal label and ref*” system used by the `save-ref` key for `\item*` and `\anspic*` commands. First we will create copies of the current $\langle labels \rangle$ and remove the dots “.” from them, we do not want to get double dots in references.

```

3010 \cs_new_protected:Nn \__enumext_keyans_store_ref:
3011 {
3012   \bool_if:NT \l__enumext_store_ref_key_bool
3013   {
3014     \cs_set_protected:Npn \__enumext_tmp:n ##1
3015     {
3016       \tl_set_eq:cc { \l__enumext_label_copy_##1_tl } { \l__enumext_label_##1_tl }
3017       \tl_reverse:c { \l__enumext_label_copy_##1_tl }
3018       \tl_remove_once:cn { \l__enumext_label_copy_##1_tl } { . }
3019       \tl_reverse:c { \l__enumext_label_copy_##1_tl }
3020     }
3021     \clist_map_inline:nn { i, v, vi, vii, viii } { \__enumext_tmp:n {##1} }
3022     \__enumext_keyans_store_ref_aux_i:
3023   }
3024 }

```

The auxiliary function `__enumext_keyans_store_ref_aux_i:` set the variable `\l__enumext_newlabel_arg_one_tl` which will contain $\{ \langle store name: position \rangle \}$ analyzing whether the environment in which they are executed is `enumext*` or `enumext`.

```

3025 \cs_new_protected:Nn \__enumext_keyans_store_ref_aux_i:
3026 {
3027   \bool_if:NT \g__enumext_starred_bool
3028   {
3029     \tl_set_eq:NN \l__enumext_label_copy_i_tl \l__enumext_label_copy_vii_tl
3030   }
3031   \int_compare:nNnT { \l__enumext_keyans_pic_level_int } = { 1 }
3032   {
3033     \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
3034     { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_vi_tl }
3035   }
3036   \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
3037   {
3038     \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
3039     { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_v_tl }
3040   }
3041   \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
3042   {
3043     \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
3044     { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_viii_tl }
3045   }
3046   \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
3047   {
3048     \l__enumext_store_name_tl \c_colon_str
3049     \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } }
3050   }
3051   \__enumext_keyans_store_ref_aux_ii:
3052 }

```

Now auxiliary function `__enumext_keyans_store_ref_aux_ii:` save the result in the variable `\l__enumext_write_aux_file_tl` and finally we write in the .aux file.

```

3053 \cs_new_protected:Nn \__enumext_keyans_store_ref_aux_ii:
3054 {
3055   \tl_put_right:Ne \l__enumext_write_aux_file_tl
3056   {
3057     \__enumext_newlabel:nn
3058     { \exp_not:V \l__enumext_newlabel_arg_one_tl }
3059     { \l__enumext_newlabel_arg_two_tl }
3060   }
3061   \l__enumext_write_aux_file_tl
3062 }

```

(End of definition for `__enumext_keyans_store_ref:`, `__enumext_keyans_store_ref_aux_i:`, and `__enumext_keyans_store_ref_aux_ii:`.)

13.34.3 Storing content in sequence

```
\__enumext_keyans_addto_seq:n
\__enumext_keyans_addto_seq_link:
```

The function `__enumext_keyans_addto_seq:n` will pass the contents of the current *⟨label⟩* `\l__enumext_label_v_tl` for the *keyans* environment and the `\l__enumext_label_vi_tl` for the *keyanspic* environment when using *\item** and *\anspic**, followed by the *⟨contents⟩* of the *optional argument* of both commands to the `\l__enumext_store_current_label_tl` variable to the sequence defined by the *save-ans* key.

```
3063 \cs_new_protected:Npn \__enumext_keyans_addto_seq:n #1
3064 {
3065   \tl_clear:N \l__enumext_store_current_label_tl
3066   \int_compare:nNnTF { \l__enumext_keyans_pic_level_int } = { 1 }
3067   {
3068     \tl_put_right:Ne \l__enumext_store_current_label_tl { \item \l__enumext_label_vi_tl }
3069   }
3070   {
3071     \tl_put_right:Ne \l__enumext_store_current_label_tl { \item \l__enumext_label_v_tl }
3072   }
3073   \tl_if_novalue:nF { #1 }
3074   {
3075     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_v_tl
3076     {
3077       \tl_put_right:NV \l__enumext_store_current_label_tl \l__enumext_store_keyans_item_opt_
3078     }
3079     \tl_put_right:Nn \l__enumext_store_current_label_tl { #1 }
3080   }
3081   \__enumext_keyans_addto_seq_link:
3082 }
```

Checks if the *save-ref* key is active along with the *hyperref* package load, if both conditions are met, it will create the *\hyperlink* and then store using the `__enumext_store_addto_seq:V` function. Finally, copy the contents of the variable `\l__enumext_store_current_label_tl` into the global variable `\g__enumext_check_ans_item_tl` to be used by the function `__enumext_check_starred_cmd:n` and increment the value of the integer variable `\g__enumext_item_anskey_int` handled by the *check-ans* key.

```
3083 \cs_new_protected:Nn \__enumext_keyans_addto_seq_link:
3084 {
3085   \bool_lazy_and:nnT
3086   { \bool_if_p:N \l__enumext_store_ref_key_bool }
3087   { \bool_if_p:N \l__enumext_hyperref_bool }
3088   {
3089     \tl_put_right:Ne \l__enumext_store_current_label_tl
3090     {
3091       \hfill \exp_not:N \hyperlink
3092       {
3093         \exp_not:V \l__enumext_newlabel_arg_one_tl
3094       }
3095       { \exp_not:V \l__enumext_mark_ref_sym_tl }
3096     }
3097   }
3098   \__enumext_store_addto_seq:V \l__enumext_store_current_label_tl
3099   \bool_if:NT \l__enumext_check_answers_bool
3100   {
3101     \int_gincr:N \g__enumext_item_anskey_int
3102   }
3103 }
```

(End of definition for `__enumext_keyans_addto_seq:n` and `__enumext_keyans_addto_seq_link:.`)

13.34.4 The show-ans and show-pos keys for keyans and keyanspic

```
\__enumext_keyans_save_item_opt:n
\__enumext_keyans_show_item_opt:
\__enumext_keyans_show_item_opt_viii:
```

The function `__enumext_keyans_save_item_opt:n` will save the optional argument of *\item** and *\anspic** in the variable `\l__enumext_store_current_opt_arg_tl`.

```
3104 \cs_new_protected:Npn \__enumext_keyans_save_item_opt:n #1
3105 {
3106   \tl_if_novalue:nF { #1 }
3107   {
3108     \tl_set:Nn \l__enumext_store_current_opt_arg_tl { #1 }
3109   }
3110 }
```

The function `__enumext_keyans_show_item_opt:` will print the optional arguments of *\item** and *\anspic** when the *show-ans* or *show-pos* keys are set next to the key *wrap-opt* in *keyans* and *keyanspic* environments.


```

3111 \cs_new_protected:Nn \__enumext_keyans_show_item_opt:
3112 {
3113   \tl_if_empty:NF \l__enumext_store_current_opt_arg_tl
3114   {
3115     \bool_lazy_or:nnT
3116     { \bool_if_p:N \l__enumext_show_answer_bool }
3117     { \bool_if_p:N \l__enumext_show_position_bool }
3118     {
3119       \__enumext_keyans_wrapper_opt_v:n
3120       { \l__enumext_store_current_opt_arg_tl } \c_space_tl
3121     }
3122   }
3123 }

```

The function `__enumext_keyans_show_item_opt_viii:` will print the optional argument of `\item*` when the `show-ans` or `show-pos` keys are set next to the key `wrap-opt` in `keyans*` environment.

```

3124 \cs_new_protected:Nn \__enumext_keyans_show_item_opt_viii:
3125 {
3126   \tl_if_empty:NF \l__enumext_store_current_opt_arg_tl
3127   {
3128     \bool_lazy_or:nnT
3129     { \bool_if_p:N \l__enumext_show_answer_bool }
3130     { \bool_if_p:N \l__enumext_show_position_bool }
3131     {
3132       \__enumext_keyans_wrapper_opt_viii:n
3133       { \l__enumext_store_current_opt_arg_tl } \c_space_tl
3134     }
3135   }
3136 }

```

(End of definition for `__enumext_keyans_save_item_opt:n`, `__enumext_keyans_show_item_opt:`, and `__enumext_keyans_show_item_opt_viii:`.)

```

\__enumext_keyans_pos_mark_set:
\__enumext_keyans_show_ans:
\__enumext_keyans_show_pos:

```

The function `__enumext_keyans_pos_mark_set:` adjusts the horizontal spaces for the `mark-sep*` key taking into account the value of the `align` key and the width of `\label`.

```

3137 \cs_new_protected:Nn \__enumext_keyans_pos_mark_set:
3138 {
3139   \__enumext_label_width_by_box:Nn
3140   \l__enumext_mark_sep_tmpa_dim { \l__enumext_label_v_tl }
3141   \str_case:Vn \l__enumext_align_label_pos_v_str
3142   {
3143     { l }
3144     {
3145       \dim_set:Nn \l__enumext_mark_sep_tmpb_dim { \c_zero_dim }
3146     }
3147     { r }
3148     {
3149       \dim_set:Nn \l__enumext_mark_sep_tmpb_dim
3150       { \l__enumext_labelwidth_v_dim - \l__enumext_mark_sep_tmpa_dim }
3151     }
3152     { c }
3153     {
3154       \dim_set:Nn \l__enumext_mark_sep_tmpb_dim
3155       { 0.5\l__enumext_labelwidth_v_dim - 0.5\l__enumext_mark_sep_tmpa_dim }
3156     }
3157   }

```

Here we set the default values for the key `mark-ans*`, `mark-sep*` and `mark-pos*`.

```

3158   \dim_compare:nNnT { \l__enumext_mark_sym_sep_v_dim } = { \c_zero_dim }
3159   {
3160     \dim_set:Nn \l__enumext_mark_sym_sep_v_dim { \l__enumext_labelsep_v_dim }
3161   }
3162   \tl_set_eq:NN \l__enumext_mark_answer_sym_tl \l__enumext_mark_answer_sym_v_tl
3163   \dim_add:Nn \l__enumext_mark_sym_sep_v_dim { \l__enumext_mark_sep_tmpb_dim }
3164   \str_set_eq:NN \l__enumext_mark_position_str \l__enumext_mark_position_v_str
3165 }

```

The function `__enumext_keyans_show_ans:` will print the `\symbol` set by the `mark-ans*` key when the `show-ans` key is active.

```

3166 \cs_new_protected:Nn \__enumext_keyans_show_ans:
3167 {
3168   \bool_lazy_all:nT

```

```

3169     {
3170         { \bool_if_p:N \l__enumext_show_answer_bool }
3171         { \bool_if_p:N \l__enumext_item_wrap_key_bool }
3172     }
3173     {
3174         \__enumext_keyans_pos_mark_set:
3175         \__enumext_print_keyans_box:NN
3176         \l__enumext_labelwidth_v_dim \l__enumext_mark_sym_sep_v_dim
3177     }
3178 }

```

The function `__enumext_keyans_show_pos:` will print the *position* of the stored content in *prop list*. Need add `1` to `\g__enumext_⟨store name⟩_prop` for *keyans* environment.

```

3179 \cs_new_protected:Nn \__enumext_keyans_show_pos:
3180 {
3181     \int_compare:nNnTF { \l__enumext_keyans_level_int } = { 1 }
3182     {
3183         \int_incr:N \l__enumext_show_pos_tmp_int
3184     }
3185     {
3186         \int_zero:N \l__enumext_show_pos_tmp_int
3187     }
3188     \bool_lazy_all:nT
3189     {
3190         { \bool_if_p:N \l__enumext_show_position_bool }
3191         { \bool_if_p:N \l__enumext_item_wrap_key_bool }
3192     }
3193     {
3194         \tl_set:Ne \l__enumext_mark_answer_sym_v_tl
3195         {
3196             \group_begin:
3197             \exp_not:N \normalfont
3198             \exp_not:N \footnotesize [ \int_eval:n
3199                 {
3200                     \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
3201                     + \l__enumext_show_pos_tmp_int
3202                 }
3203             ]
3204             \group_end:
3205         }
3206         \__enumext_keyans_pos_mark_set:
3207         \__enumext_print_keyans_box:NN
3208         \l__enumext_labelwidth_v_dim \l__enumext_mark_sym_sep_v_dim
3209     }
3210 }

```

(End of definition for `__enumext_keyans_pos_mark_set:`, `__enumext_keyans_show_ans:`, and `__enumext_keyans_show_pos:`.)

13.35 Redefining `\item` and `\makelabel` in *enumext*

Redefining the `\item` command is not as simple as I thought. This command works in conjunction with the `\makelabel` command so I have to redefine both of them, in addition to this, we will have to use a couple of *global* variables to pass the values from one command to the other.

When *labeling* PDF is active `\makelabel` is redefined as `\hss #1` and the only way to get the *align* key to work correctly is to redefine `\makelabel` using `\makebox`. The best way to implement this is to use the conditional command `\IfDocumentMetadataTF` to force this redefinition and the dedicated *mode-box* key to manually activate it by the user.

The `\item` and `\item[⟨custom⟩]` commands work in the usual way on *enumext* and we will add `\item*`, `\item*[⟨symbol⟩]` and `\item*[⟨symbol⟩][⟨offset⟩]`.

```
\__enumext_default_item:n
```

First we will see if the *optional argument* is present, if it is NOT present we will check the state of the variable `\l__enumext_check_answers_bool` set by the key *no-store*, set the boolean variable `\l__enumext_wrap_label_X_bool` to “true” for the key *wrap-label* and execute `__enumext_item_std:w` and the key *itemindent*, otherwise we will check the state of the boolean variable `\l__enumext_wrap_label_opt_X_bool` set by the key *wrap-label** and execute `__enumext_item_std:w` with the *optional argument* and the key *itemindent*.

```

3211 \cs_new_protected:Npn \__enumext_default_item:n #1
3212 {
3213     \tl_if_novalue:nTF {#1}
3214     {

```

```

3215         \bool_if:NT \l__enumext_check_answers_bool
3216         {
3217             \int_gincr:N \g__enumext_item_number_int
3218             \bool_set_true:N \l__enumext_item_number_bool
3219         }
3220         \bool_set_true:c { l__enumext_wrap_label_ \__enumext_level: _bool }
3221         \__enumext_item_std:w \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
3222     }
3223     {
3224         \bool_set_eq:cc
3225         { l__enumext_wrap_label_ \__enumext_level: _bool }
3226         { l__enumext_wrap_label_opt_ \__enumext_level: _bool }
3227         \__enumext_item_std:w [#1] \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
3228     }
3229 }

```

(End of definition for __enumext_default_item:n.)

__enumext_item_starred_exec:nn
 __enumext_item_starred_exec:

The `\item*`, `\item*[\langle symbol \rangle]` and `\item*[\langle symbol \rangle][\langle offset \rangle]` works like the *numbered* `\item`, but placing a *symbol* to the “left” of the *label* separated from it by the value the second *optional argument* *offset*.

#1: \l__enumext_item_symbol_X_tl

#2: \l__enumext_item_symbol_sep_X_dim

First we will make a copy of `\l__enumext_item_symbol_X_tl` which is set by the key `item-sym*` or passed as “first” *optional argument* in the global variable `\g__enumext_item_symbol_aux_tl`, followed by setting the variable `\l__enumext_item_symbol_sep_X_dim` set by the key `item-pos*` or by the “second” *optional argument*, then we will see the state of the variable `\l__enumext_check_answers_bool` set by the key `no-store`, set the boolean variable `\l__enumext_wrap_label_X_bool` to “true” for the key `wrap-label` and execute `__enumext_item_std:w` and the key `itemindent`.

```

3230 \cs_new_protected:Npn \__enumext_item_starred_exec:nn #1 #2
3231 {
3232     \tl_if_novalue:nTF {#1}
3233     {
3234         \tl_gset_eq:Nc
3235         \g__enumext_item_symbol_aux_tl { l__enumext_item_symbol_ \__enumext_level: _tl }
3236     }
3237     {
3238         \tl_gset:Nn \g__enumext_item_symbol_aux_tl {#1}
3239     }
3240     \tl_if_novalue:nTF {#2}
3241     {
3242         \dim_set_eq:cc
3243         { l__enumext_item_symbol_sep_ \__enumext_level: _dim }
3244         { l__enumext_labelsep_ \__enumext_level: _dim }
3245     }
3246     {
3247         \dim_set:cn { l__enumext_item_symbol_sep_ \__enumext_level: _dim } {#2}
3248     }
3249     \bool_if:NT \l__enumext_check_answers_bool
3250     {
3251         \int_gincr:N \g__enumext_item_number_int
3252         \bool_set_true:N \l__enumext_item_number_bool
3253     }
3254     \bool_set_true:c { l__enumext_wrap_label_ \__enumext_level: _bool }
3255     \__enumext_item_std:w \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
3256 }

```

The function `__enumext_item_starred_exec:` will be responsible for executing `\item*` for the `enumext` environment.

```

3257 \cs_new_protected:Nn \__enumext_item_starred_exec:
3258 {
3259     \tl_if_empty:cF { l__enumext_item_symbol_ \__enumext_level: _tl }
3260     {
3261         \mode_leave_vertical:
3262         \skip_horizontal:n { -\dim_use:c { l__enumext_item_symbol_sep_ \__enumext_level: _dim } }
3263         \hbox_overlap_left:n { \g__enumext_item_symbol_aux_tl }
3264         \skip_horizontal:n { \dim_use:c { l__enumext_item_symbol_sep_ \__enumext_level: _dim } }
3265     }
3266 }

```

(End of definition for __enumext_item_starred_exec:nn and __enumext_item_starred_exec:.)

`__enumext_redefine_item:` The function `__enumext_redefine_item:` will redefine the `\item` command in the `enumext` environment adding `\item*`. This function are passed to `__enumext_list_arg_two_X:` used in the definition of the `enumext` environment (§13.40).

```

3267 \cs_new_protected:Nn \__enumext_redefine_item:
3268 {
3269   \RenewDocumentCommand \item { s o o }
3270   {
3271     \bool_if:NTF {##1}
3272     {
3273       \__enumext_item_starred_exec:nn {##2} {##3}
3274     }
3275     { \__enumext_default_item:n {##2} }
3276   }
3277 }

```

(End of definition for `__enumext_redefine_item:`.)

`__enumext_make_label:` The function `__enumext_make_label:` redefine `\makeLabel` for the keys `mode-box`, `align`, `font`, `wrap-label`, `wrap-label*` and `\item*` for `enumext` environment. This function are passed to `__enumext_list_arg_two_X:` used in the definition of the `enumext` environment (§13.40).

```

3278 \cs_new_protected:Nn \__enumext_make_label:
3279 {
3280   \IfDocumentMetadataTF
3281   {
3282     \__enumext_make_label_box:
3283   }
3284   {
3285     \bool_if:NTF \l__enumext_mode_box_bool
3286     {
3287       \__enumext_make_label_box:
3288     }
3289     {
3290       \__enumext_make_label_std:
3291     }
3292   }
3293 }

```

Standard definition when `\DocumentMetadata` is not active.

```

3294 \cs_new_protected:Nn \__enumext_make_label_std:
3295 {
3296   \RenewDocumentCommand \makeLabel { m }
3297   {
3298     \tl_use:c { l__enumext_label_fill_left_ \__enumext_level: _tl }
3299     \__enumext_item_starred_exec:
3300     \tl_use:c { l__enumext_label_font_style_ \__enumext_level: _tl }
3301     \bool_if:cTF { l__enumext_wrap_label_ \__enumext_level: _bool }
3302     {
3303       \use:c { __enumext_wrapper_label_ \__enumext_level: :n } { ##1 }
3304     }
3305     { ##1 }
3306     \tl_use:c { l__enumext_label_fill_right_ \__enumext_level: _tl }
3307     \tl_gclear:N \g__enumext_item_symbol_aux_tl
3308   }
3309 }

```

Definition using `\makebox` when `\DocumentMetadata` is active or `mode-box` is active.

Here it is necessary to use `\strut\smash` to maintain text *alignment* in case the user wants to use `\labelbx` for example. In my experiments with *mimicking* the `description` environment it was the only way out and it seems to have no adverse effects and may serve in the future as a basis for a more generic `list` environment package than `enumext`.

```

3310 \cs_new_protected:Nn \__enumext_make_label_box:
3311 {
3312   \RenewDocumentCommand \makeLabel { m }
3313   {
3314     \strut\smash
3315     {
3316       \makebox
3317       [ \dim_use:c { l__enumext_labelwidth_ \__enumext_level: _dim } ]
3318       [ \str_use:c { l__enumext_align_label_pos_ \__enumext_level: _str } ]
3319       {
3320         \__enumext_item_starred_exec:

```

```

3321         \tl_use:c { l__enumext_label_font_style_ \__enumext_level: _tl }
3322         \bool_if:cTF { l__enumext_wrap_label_ \__enumext_level: _bool }
3323         {
3324             \use:c { __enumext_wrapper_label_ \__enumext_level: :n } { ##1 }
3325         }
3326         { ##1 }
3327         \tl_gclear:N \g__enumext_item_symbol_aux_tl
3328     }
3329 } % close smash
3330 }
3331 }

```

(End of definition for `__enumext_make_label:`, `__enumext_make_label_std:`, and `__enumext_make_label_box:`.)

13.36 Setting item-sym* and item-pos* keys

In order to have a cleaner implementation of `\item*` for the `enumext` and `enumext*` environments it is best to define a couple of keys that allow us to control and set by default the `<symbol>` and its `<offset>`.

item-sym* Define and set item-sym* and item-pos* keys for `enumext` and `enumext*`.

```

item-pos*
3332 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
3333 {
3334     \keys_define:nn { enumext / #1 }
3335     {
3336         item-sym* .tl_set:c = { l__enumext_item_symbol_#2_tl },
3337         item-sym* .value_required:n = true,
3338         item-sym* .initial:n = {\textborn},
3339         item-pos* .dim_set:c = { l__enumext_item_symbol_sep_#2_dim },
3340         item-pos* .value_required:n = true,
3341     }
3342 }
3343 \clist_map_inline:nn
3344 {
3345     {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {enumext*}{vii}
3346 }
3347 { \__enumext_tmp:nn #1 }

```

(End of definition for item-sym* and item-pos*.)

13.37 Handling unknown keys

At this point in the code I already know that I will NOT add more `<keys>` for and since I have already been quite *paranoid and restrictive* with the definitions of environments and commands, the only thing left to do is do it with the `<keys>` (you have to be consistent in life).

- Well, the paragraph above is not so real, after all I had to add more `<keys>` than I had planned, not everything turns out the way one thinks in life.

13.37.1 Handling unknown keys for keyans, keyans* and keyanspic

unknown Define and set unknown key for `keyans`, `keyans*` and `keyanspic` environments. Here it is necessary to set `\l__enumext_envir_name_tl` in case an unknown key is passed using `\setenumext`.

```

\__enumext_keyans_unknown_keys:n
\__enumext_keyans_unknown_keys:nn
3348 \cs_set_protected:Npn \__enumext_tmp:n #1
3349 {
3350     \keys_define:nn { enumext / #1 }
3351     {
3352         unknown .code:n = {
3353             \tl_set:Nn \l__enumext_envir_name_tl {#1}
3354             \__enumext_keyans_unknown_keys:n {#1}
3355         },
3356     }
3357 }
3358 \clist_map_inline:nn { keyans, keyans*, keyanspic } { \__enumext_tmp:n {#1} }

```

Internal functions for handling unknown key.

```

3359 \cs_new_protected:Npn \__enumext_keyans_unknown_keys:n #1
3360 {
3361     \exp_args:NV \__enumext_keyans_unknown_keys:nn \l_keys_key_str {#1}
3362 }
3363 \cs_new_protected:Npn \__enumext_keyans_unknown_keys:nn #1#2
3364 {
3365     \tl_if_blank:nTF {#2}
3366     {
3367         \msg_error:nne { enumext } { keyans-unknown-key } {#1}

```

```

3368     }
3369     {
3370         \msg_error:nnee { enumext } { keyans-unknown-key-value } {#1} {#2}
3371     }
3372 }

```

(End of definition for `unknown`, `__enumext_keyans_unknown_keys:n`, and `__enumext_keyans_unknown_keys:nn`.)

13.37.2 Handling unknown keys for `enumext*`

`unknown` Define and set `unknown` key for `enumext*` environment.

```

\__enumext_starred_unknown_keys:n
\__enumext_starred_unknown_keys:nn
3373 \keys_define:nn { enumext / enumext* }
3374 {
3375     unknown .code:n = { \__enumext_starred_unknown_keys:n {#1} },
3376 }

```

Internal functions for handling `unknown` key.

```

3377 \cs_new_protected:Npn \__enumext_starred_unknown_keys:n #1
3378 {
3379     \exp_args:NV \__enumext_starred_unknown_keys:nn \l_keys_key_str {#1}
3380 }
3381 \cs_new_protected:Npn \__enumext_starred_unknown_keys:nn #1#2
3382 {
3383     \tl_if_blank:nTF {#2}
3384     {
3385         \msg_error:nnn { enumext } { starred-unknown-key } {#1}
3386     }
3387     {
3388         \msg_error:nnnn { enumext } { starred-unknown-key-value } {#1} {#2}
3389     }
3390 }

```

(End of definition for `unknown`, `__enumext_starred_unknown_keys:n`, and `__enumext_starred_unknown_keys:nn`.)

13.37.3 Handling unknown keys for `enumext`

`unknown` Defines and set the key `unknown` for `enumext` environment.

```

\__enumext_standar_unknown_keys:n
\__enumext_standar_unknown_keys:nn
3391 \cs_set_protected:Npn \__enumext_tmp:n #1
3392 {
3393     \keys_define:nn { enumext / #1 }
3394     {
3395         unknown .code:n = { \__enumext_standar_unknown_keys:n {##1} },
3396     }
3397 }
3398 \clist_map_inline:nn { level-1,level-2,level-3,level-4 } { \__enumext_tmp:n {#1} }

```

Internal functions for handling `unknown` key.

```

3399 \cs_new_protected:Npn \__enumext_standar_unknown_keys:n #1
3400 {
3401     \exp_args:NV \__enumext_standar_unknown_keys:nn \l_keys_key_str {#1}
3402 }
3403 \cs_new_protected:Npn \__enumext_standar_unknown_keys:nn #1#2
3404 {
3405     \tl_if_blank:nTF {#2}
3406     {
3407         \msg_error:nnn { enumext } { standar-unknown-key } {#1}
3408     }
3409     {
3410         \msg_error:nnnn { enumext } { standar-unknown-key-value } {#1} {#2}
3411     }
3412 }

```

(End of definition for `unknown`, `__enumext_standar_unknown_keys:n`, and `__enumext_standar_unknown_keys:nn`.)

13.38 Redefining `\item` and `\makeLabel` in `keyans`

The `\item` and `\item[⟨custom⟩]` commands work in the usual way in `keyans`, but the `\item*` and `\item*[⟨content⟩]` commands *store* the current `⟨label⟩` next to the `⟨content⟩` if it is present in the *sequence* and *prop list* defined by `save-ans` key.

`__enumext_keyans_default_item:n`

The function `__enumext_keyans_default_item:n` executes the original behavior of the `\item` along with the keys `wrap-label`, `wrap-label*` and `itemindent`.

```

3413 \cs_new_protected:Npn \__enumext_keyans_default_item:n #1
3414 {

```

```

3415 \tl_if_novalue:nTF { #1 }
3416 {
3417     \bool_set_true:N \l__enumext_wrap_label_v_bool
3418     \__enumext_item_std:w \tl_use:N \l__enumext_fake_item_indent_v_tl
3419 }
3420 {
3421     \bool_set_eq:NN \l__enumext_wrap_label_v_bool \l__enumext_wrap_label_opt_v_bool
3422     \__enumext_item_std:w [#1] \tl_use:N \l__enumext_fake_item_indent_v_tl
3423 }
3424 }

```

(End of definition for __enumext_keyans_default_item:n.)

__enumext_keyans_starred_item:n

The function __enumext_keyans_starred_item:n will take as argument **#1** the *optional argument* [*content*] passed to **\item*** and save it via the __enumext_keyans_save_item_opt:n function, then activate the **wrap-label** key, execute **\item** using __enumext_item_std:w, the **itemindent** key and print the *optional argument* using the __enumext_keyans_show_item_opt: function handled by the **wrap-opt** key.

```

3425 \cs_new_protected:Npn \__enumext_keyans_starred_item:n #1
3426 {
3427     \__enumext_keyans_save_item_opt:n { #1 }
3428     \bool_set_true:N \l__enumext_wrap_label_v_bool
3429     \__enumext_item_std:w \tl_use:N \l__enumext_fake_item_indent_v_tl
3430     \__enumext_keyans_show_item_opt:

```

Now store the current *label* first in the *prop list* (including the *optional argument*), run the internal “*label and ref*” system if the **save-ref** key is active, then store in the *sequence* and finally increments \g__enumext_check_starred_cmd_int for internal check system.

```

3431     \__enumext_keyans_addto_prop:n { #1 }
3432     \__enumext_keyans_store_ref:
3433     \__enumext_keyans_addto_seq:n { #1 }
3434     \int_gincr:N \g__enumext_check_starred_cmd_int
3435 }

```

(End of definition for __enumext_keyans_starred_item:n.)

\item*

__enumext_keyans_redefine_item:

The function __enumext_keyans_redefine_item: is responsible for adding the *starred argument* and *optional argument* by the __enumext_list_arg_two_v: function in the definition of the **keyans** environment. Here we will set to true the variable \l__enumext_item_wrap_key_bool used by the **wrap-ans*** key only when **\item*** is executed and additionally we need to use **\peek_remove_spaces:n** to avoid an unwanted space when using **\item*** together with the **itemindent** key. This function are passed to __enumext_list_arg_two_v: used in the definition of the **keyans** environment (§13.39).

```

3436 \cs_new_protected:Nn \__enumext_keyans_redefine_item:
3437 {
3438     \RenewDocumentCommand \item { s o }
3439     {
3440         \bool_if:nTF {##1}
3441         {
3442             \bool_set_true:N \l__enumext_item_wrap_key_bool % wrap-ans*
3443             \peek_remove_spaces:n
3444             {
3445                 \__enumext_keyans_starred_item:n {##2}
3446             }
3447         }
3448         {
3449             \bool_set_false:N \l__enumext_item_wrap_key_bool
3450             \__enumext_keyans_default_item:n {##2}
3451         }
3452     }
3453 }

```

(End of definition for \item* and __enumext_keyans_redefine_item:. This function is documented on page 16.)

__enumext_keyans_make_label:
__enumext_keyans_wrapper_label:n
__enumext_keyans_make_label_std:
__enumext_keyans_make_label_box:

The function __enumext_keyans_make_label: redefine **\makeLabel** for the keys **mode-box**, **align**, **font**, **wrap-label**, **wrap-label***, **wrap-ans*** and **\item*** for **keyans** environment. This function are passed to __enumext_list_arg_two_v: used in the definition of the **keyans** environment (§13.39).

```

3454 \cs_new_protected:Nn \__enumext_keyans_make_label:
3455 {
3456     \IfDocumentMetadataTF
3457     {
3458         \__enumext_keyans_make_label_box:

```



```

3459     }
3460     {
3461         \bool_if:NTF \l__enumext_mode_box_bool
3462         {
3463             \__enumext_keyans_make_label_box:
3464         }
3465         {
3466             \__enumext_keyans_make_label_std:
3467         }
3468     }
3469 }

```

We added conditionals to the `__enumext_keyans_wrapper_label:n` function to handle the keys `wrap-ans*`, `wrap-label` and `wrap-label*`.

```

3470 \cs_new_protected:Npn \__enumext_keyans_wrapper_label:n #1
3471 {
3472     \bool_lazy_all:nT
3473     {
3474         { \bool_if_p:N \l__enumext_wrap_label_v_bool }
3475         { \bool_if_p:N \l__enumext_show_answer_bool }
3476         { \bool_if_p:N \l__enumext_item_wrap_key_bool }
3477         { \cs_if_exist_p:N \__enumext_keyans_wrapper_item_v:n }
3478     }
3479     {
3480         \cs_set_eq:NN \__enumext_wrapper_label_v:n \__enumext_keyans_wrapper_item_v:n
3481     }
3482     \bool_if:NTF \l__enumext_wrap_label_v_bool
3483     {
3484         \__enumext_wrapper_label_v:n { #1 }
3485     }
3486     { #1 }
3487 }

```

Standard definition when `\DocumentMetadata` is not active.

```

3488 \cs_new_protected:Nn \__enumext_keyans_make_label_std:
3489 {
3490     \RenewDocumentCommand \makeLabel { m }
3491     {
3492         \tl_use:N \l__enumext_label_fill_left_v_tl
3493         \__enumext_keyans_show_ans:
3494         \__enumext_keyans_show_pos:
3495         \tl_use:N \l__enumext_label_font_style_v_tl
3496         \__enumext_keyans_wrapper_label:n { ##1 }
3497         \tl_use:N \l__enumext_label_fill_right_v_tl
3498     }
3499 }

```

Definition using `\makebox` when `\DocumentMetadata` is active or `mode-box` is active.

```

3500 \cs_new_protected:Nn \__enumext_keyans_make_label_box:
3501 {
3502     \RenewDocumentCommand \makeLabel { m }
3503     {
3504         \strut\smash
3505         {
3506             \makebox[ \l__enumext_labelwidth_v_dim ][ \l__enumext_align_label_pos_v_str ]
3507             {
3508                 \__enumext_keyans_show_ans:
3509                 \__enumext_keyans_show_pos:
3510                 \tl_use:N \l__enumext_label_font_style_v_tl
3511                 \__enumext_keyans_wrapper_label:n { ##1 }
3512             }
3513         }
3514     }
3515 }

```

(End of definition for `__enumext_keyans_make_label:` and others.)

13.39 Second argument of the lists

At this point in the code we have already programmed most of the tools needed to create a *custom list* environment, remember that the `__enumext_start_list:nn` function takes two arguments, we have the “first” one ready, the “second” one we will define for all levels of the `enumext` environment, the `keyans` environment and the `enumext*` and `keyans*` environments.

Here we will implement the `__enumext_list_arg_two_X`: function, which will be responsible for setting all the list parameters, the counter, the redefinition of `\item`, `\makelabel` along with the keys `ref`, `itemindent` and `show-length`.

- In the functions `__enumext_list_arg_two_X`: we will implement the “counter” for the environments, but we do NOT set the “start value” for it to be compatible with *tagged* PDF that should be done later.

13.39.1 Calculation of `\leftmargin` and `\itemindent`

Consider the figure 9 where the default margins (on the left) of a list are represented.

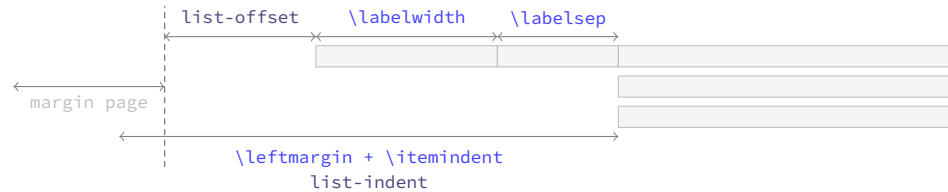


Figure 9: Representation of standard horizontal lengths in `list` environment.

The idea is to have control over these margins so that our list does not overlap the left margin of the page. The key relationship is that the “right edge” of the `\labelsep` equals the “right edge” of the `\itemindent`, so that the left edge of the “label box” is at `\leftmargin + \itemindent` minus `\labelwidth + \labelsep`. Thus, the handling of the margins by the package will be as shown in the figure 10.

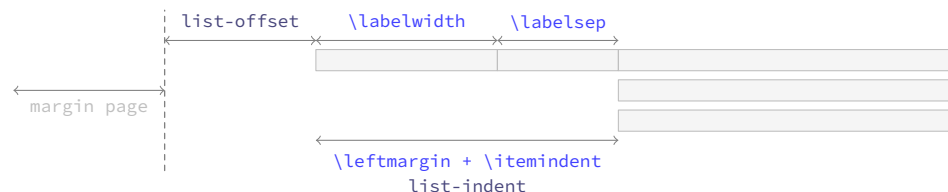


Figure 10: Representation of horizontal lengths concept in list in `enumext`.

Where the default values will look like in the figure 11.

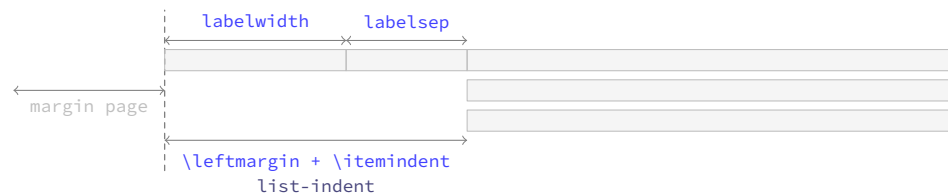


Figure 11: Default horizontal lengths in `enumext`.

```
\__enumext_calc_hspace:NNNNNN
\__enumext_calc_hspace:cccccc
```

The function `__enumext_calc_hspace:NNNNNN` takes seven arguments to be able to determine horizontal spaces for all list environment:

```
#1: \__enumext_labelwidth_X_dim      #2: \__enumext_labelsep_X_dim
#3: \__enumext_listoffset_X_dim      #4: \__enumext_leftmargin_tmp_X_dim
#5: \__enumext_leftmargin_X_dim      #6: \__enumext_itemindent_X_dim
#7: \__enumext_leftmargin_tmp_X_bool
```

And returns the “adjusted” values of `\leftmargin` and `\itemindent`.

```
3516 \cs_new_protected:Npn \__enumext_calc_hspace:NNNNNN #1 #2 #3 #4 #5 #6 #7
3517 {
3518   \dim_compare:nNtT { #1 } < { \c_zero_dim }
3519   {
3520     \msg_warning:nnnV { enumext } { width-non-positive } { labelwidth } { #1 }
3521     \dim_set:Nn #1 { \dim_abs:n { #1 } }
3522   }
3523   \dim_compare:nNtT { #2 } < { \c_zero_dim }
3524   {
3525     \msg_warning:nnnV { enumext } { width-negative } { labelsep } { #2 }
3526     \dim_set:Nn #2 { \dim_abs:n { #2 } }
3527   }
3528 }
```

If no value has been passed to the `labelwidth` and `labelsep` keys we set the default values for `__enumext_leftmargin_tmp_X_dim`.

```
3528 \bool_if:NF #7 { \dim_set:Nn #4 { #1 + #2 } }
```

We now analyze the cases and set the values for `\leftmargin` and `\itemindent`.

```
3529 \dim_compare:nNtTF { #4 } < { \c_zero_dim }
3530 {
3531   \dim_set:Nn #6 { #1 + #2 - #4 }
```

```

3532     \dim_set:Nn #5 { #1 + #2 + #3 - #6 }
3533   }
3534   {
3535     \dim_compare:nNnT { #4 } = { #1 + #2 }
3536       { \dim_set:Nn #6 { \c_zero_dim } }
3537     \dim_compare:nNnT { #4 } < { #1 + #2 }
3538       { \dim_set:Nn #6 { #1 + #2 - #4 } }
3539     \dim_compare:nNnT { #4 } > { #1 + #2 }
3540       {
3541         \dim_set:Nn #6 { -#1 - #2 + #4 }
3542         \dim_set:Nn #6 { #6*-1 }
3543       }
3544     \dim_set:Nn #5 { #1 + #2 + #3 - #6 }
3545   }
3546 }
3547 \cs_generate_variant:Nn \__enumext_calc_hspace:NNNNNNN { cccccc }

```

(End of definition for `__enumext_calc_hspace:NNNNNNN`.)

13.39.2 Setting second argument of the lists

We will “not set” `\leftmargini`, `\leftmarginii`, `\leftmarginiii` or `\leftmarginiv`, in this case, we will directly set the parameters for vertical and horizontal list spacing per level.

```

3548 \cs_set_protected:Npn \__enumext_tmp:n #1
3549   {
3550     \cs_new_protected:cpn { __enumext_list_arg_two_#1: }
3551     {
3552       \__enumext_calc_hspace:ccccc
3553       { l__enumext_labelwidth_#1_dim } { l__enumext_labelsep_#1_dim }
3554       { l__enumext_listoffset_#1_dim } { l__enumext_leftmargin_tmp_#1_dim }
3555       { l__enumext_leftmargin_#1_dim } { l__enumext_itemindent_#1_dim }
3556       { l__enumext_leftmargin_tmp_#1_bool }
3557     \clist_map_inline:nn
3558       { labelsep, labelwidth, itemindent, leftmargin, rightmargin, listparindent }
3559       { \dim_set_eq:cc {####1} { l__enumext_####1_#1_dim } }
3560     \clist_map_inline:nn { topsep, parsep, partopsep, itemsep }
3561       { \skip_set_eq:cc {####1} { l__enumext_####1_#1_skip } }
3562     \clist_map_inline:nn { beginparpenalty, itempenalty, endparpenalty }
3563       { \int_set_eq:cc {@####1} { l__enumext_####1_#1_int } }
3564     \usecounter { enumX#1 }
3565     \str_if_eq:nnTF {#1} { v }
3566     {
3567       \__enumext_keyans_redefine_item:
3568       \__enumext_keyans_make_label:
3569       \__enumext_keyans_ref:
3570       \__enumext_keyans_fake_item_indent:
3571       \bool_if:cT { l__enumext_show_length_#1_bool }
3572       {
3573         \msg_term:nnnn { enumext } { list-lengths-not-nested } { v } { keyans }
3574       }
3575     }
3576     {
3577       \__enumext_redefine_item:
3578       \__enumext_make_label:
3579       \__enumext_standar_ref:
3580       \__enumext_fake_item_indent:
3581       \bool_if:cT { l__enumext_show_length_#1_bool }
3582       {
3583         \msg_term:nnne { enumext } { list-lengths } {#1}
3584         { \int_use:N \l__enumext_level_int }
3585       }
3586     }
3587   }
3588 }
3589 \clist_map_inline:nn { i, ii, iii, iv, v } { \__enumext_tmp:n {#1} }

```

(End of definition for `__enumext_list_arg_two_i:` and others.)

For the horizontal environments `enumext*` and `keyans*` the implementation is similar, but, the value of `\partopsep` is always `0pt`. At this point we will modify the `parsep` key to make it take the value of the `itemsep` key and later, in the environment definition, we will modify `parindent` to make it set the value of `lisparindent` and `parsep` to set the value of `\parskip` locally.

```

3590 \cs_set_protected:Npn \__enumext_tmp:n #1
3591 {
3592   \cs_new_protected:cpn { __enumext_list_arg_two_#1: }
3593   {
3594     \bool_set_true:c { l__enumext_leftmargin_tmp_#1_bool }
3595     \dim_zero:c { l__enumext_leftmargin_tmp_#1_dim }
3596     \__enumext_calc_hspace:ccccc
3597     { l__enumext_labelwidth_#1_dim } { l__enumext_labelsep_#1_dim }
3598     { l__enumext_listoffset_#1_dim } { l__enumext_leftmargin_tmp_#1_dim }
3599     { l__enumext_leftmargin_#1_dim } { l__enumext_itemindent_#1_dim }
3600     { l__enumext_leftmargin_tmp_#1_bool }
3601     \clist_map_inline:nn
3602       { labelsep, labelwidth, itemindent, leftmargin, rightmargin, listparindent }
3603       { \dim_set_eq:cc {####1} { l__enumext_####1_#1_dim } }
3604     \clist_map_inline:nn { topsep, parsep, partopsep, itemsep }
3605       { \skip_set_eq:cc {####1} { l__enumext_####1_#1_skip } }
3606     \clist_map_inline:nn { beginparpenalty, itempenalty, endparpenalty }
3607       { \int_set_eq:cc {@####1} { l__enumext_####1_#1_int } }
3608     \skip_set_eq:Nc \parsep { l__enumext_itemsep_#1_skip }
3609     \skip_zero:N \partopsep
3610     \usecounter { enumX#1 }
3611     \__enumext_starred_ref:
3612     \str_if_eq:nnTF {#1} { vii }
3613       {
3614         \__enumext_fake_item_indent_vii:
3615         \bool_if:cT { l__enumext_show_length_vii_bool }
3616           { \msg_term:nnnn { enumext } { list-lengths-not-nested } { vii } { enumext* } }
3617       }
3618       {
3619         \__enumext_fake_item_indent_viii:
3620         \bool_if:cT { l__enumext_show_length_#1_bool }
3621           { \msg_term:nnnn { enumext } { list-lengths-not-nested } { #1 } { keyans* } }
3622       }
3623   }
3624 }
3625 \clist_map_inline:nn { vii, viii } { \__enumext_tmp:n {#1} }

```

(End of definition for __enumext_list_arg_two_vii: and __enumext_list_arg_two_viii:.)

13.40 The environment enumext

__enumext_safe_exec: The __enumext_safe_exec: function first call the function __enumext_is_not_nested: which sets \g__enumext_standar_bool to “true” if we are NOT nested within `enumext*`, then call the function __enumext_internal_mini_page: to create the environment `__enumext_mini_page`, we will increment \l__enumext_level_int to restrict nesting of the environment, set \l__enumext_standar_bool to “true” and finally call the function __enumext_is_on_first_level: which sets \l__enumext_standar_first_bool to “true” only if the environment is NOT nested and we are at the “first level”.

```

3626 \cs_new_protected:Nn \__enumext_safe_exec:
3627 {
3628   \__enumext_is_not_nested:
3629   \__enumext_internal_mini_page:
3630   \int_incr:N \l__enumext_level_int
3631   \int_compare:nNnT { \l__enumext_level_int } > { 4 }
3632     { \msg_fatal:nn { enumext } { list-too-deep } }
3633   \bool_set_true:N \l__enumext_standar_bool
3634   \bool_set_false:N \l__enumext_starred_bool
3635   \__enumext_is_on_first_level:
3636 }

```

(End of definition for __enumext_safe_exec:.)

__enumext_parse_keys:n The __enumext_parse_store_keys:n function first we will clear the variable \l__enumext_series_str used by the key `series` and then we check if we are at the “first level”, if so we process the `<keys>` and then execute the function __enumext_parse_series:n used by the key `series` and call the function __enumext_nested_base_line_fix: used by the key `base-fix`, otherwise we will pass the `<keys>` to the inner levels of the environment then we execute the function __enumext_store_active_keys:n and reprocess the `<keys>` to pass them to the `sequence` if the key `save-key` is not active.

```

3637 \cs_new_protected:Npn \__enumext_parse_keys:n #1
3638 {
3639   \tl_if_novalue:nF {#1}
3640   {

```

```

3641 \str_clear:N \l__enumext_series_str
3642 \int_compare:nNnTF { \l__enumext_level_int } = { 1 }
3643 {
3644   \keys_set:nn { enumext / level-1 } {#1}
3645   \__enumext_parse_series:n {#1}
3646   \__enumext_nested_base_line_fix:
3647 }
3648 {
3649   \exp_args:Ne \keys_set:nn
3650   { enumext / level-\int_use:N \l__enumext_level_int } {#1}
3651 }
3652 \__enumext_store_active_keys:n {#1}
3653 }
3654 }

```

(End of definition for `__enumext_parse_keys:n`.)

`__enumext_start_store_level:` The `__enumext_start_store_level:` function activate the “*storing structure*” mechanism in the *sequence* for the command `\anskey` and the environment `anskey*`.

```

3655 \cs_new_protected:Nn \__enumext_start_store_level:
3656 {
3657   \bool_lazy_all:nT
3658   {
3659     { \bool_if_p:N \l__enumext_store_active_bool }
3660     { \bool_not_p:n { \l__enumext_keyans_env_bool } }
3661     { \bool_if_p:N \g__enumext_standar_bool }
3662   }
3663   {
3664     \int_compare:nNnT { \l__enumext_level_int } > { 1 }
3665     {
3666       \bool_set_true:c { l__enumext_store_upper_level_ \__enumext_level: _bool }
3667       \__enumext_store_level_open:
3668     }
3669   }

```

If `enumext` are nested in `enumext*` add `__enumext_store_level_open:` to preserve the “*storing structure*”.

```

3670   \bool_lazy_all:nT
3671   {
3672     { \bool_if_p:N \l__enumext_store_active_bool }
3673     { \bool_not_p:n { \l__enumext_keyans_env_bool } }
3674     { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
3675   }
3676   {
3677     \int_compare:nNnT { \l__enumext_level_int } > { 0 }
3678     {
3679       \bool_set_true:c { l__enumext_store_upper_level_ \__enumext_level: _bool }
3680       \__enumext_store_level_open:
3681     }
3682   }
3683 }

```

(End of definition for `__enumext_start_store_level:.`)

`__enumext_stop_store_level:` The `__enumext_stop_store_level:` function stop the “*storing structure*” mechanism in the *sequence* for the command `\anskey` and the environment `anskey*`.

```

3684 \cs_new_protected:Nn \__enumext_stop_store_level:
3685 {
3686   \bool_if:cT { l__enumext_store_upper_level_ \__enumext_level: _bool }
3687   {
3688     \__enumext_store_level_close:
3689   }
3690 }

```

(End of definition for `__enumext_stop_store_level:.`)

`__enumext_multicols_start:` The function `__enumext_multicols_start:` will start the `multicols` environment according to the value passed by the `columns` key, then set the default value for `\columnsep` when `columns-sep=opt` and set the value of `\multicolsep` equal to zero and leave `\columnseprule` equal to zero for inner levels.

```

3691 \cs_new_protected:Nn \__enumext_multicols_start:
3692 {
3693   \int_compare:nNnT

```

```

3694 { \int_use:c { l__enumext_columns_ \__enumext_level: _int } } > { 1 }
3695 {
3696   \dim_compare:nNt
3697   { \dim_use:c { l__enumext_columns_sep_ \__enumext_level: _dim } } = { \c_zero_dim }
3698   {
3699     \dim_set:cn { l__enumext_columns_sep_ \__enumext_level: _dim }
3700     {
3701       ( \dim_use:c { l__enumext_labelwidth_ \__enumext_level: _dim }
3702         + \dim_use:c { l__enumext_labelsep_ \__enumext_level: _dim }
3703       ) / \int_use:c { l__enumext_columns_ \__enumext_level: _int }
3704       - \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim }
3705     }
3706   }
3707   \dim_set_eq:Nc \columnsep { l__enumext_columns_sep_ \__enumext_level: _dim }
3708   \int_compare:nNt { \__enumext_level_int } > { 1 }
3709   {
3710     \dim_zero:N \columnseprule
3711   }

```

We will calculate the *vertical spacing* settings for the `multicols` environment using the function `__enumext_multi_advspace:`, apply our “*vertical adjust spacing*”, then start the `multicols` environment.

```

3712   \bool_if:cF { l__enumext_minipage_active_ \__enumext_level: _bool }
3713   {
3714     \skip_zero:N \multicolsep
3715     \__enumext_multi_advspace:
3716   }
3717   \raggedcolumns
3718   \begin{multicols}{ \int_use:c { l__enumext_columns_ \__enumext_level: _int } }
3719 }
3720 }

```

(End of definition for `__enumext_multicols_start:`)

`__enumext_multicols_stop:`

The function `__enumext_multicols_stop:` will stop the `multicols` environment and apply our “*vertical adjust*” spacing. For compatibility with *tagged* PDF, the closing of the `list` environment is executed here along with `__enumext_stop_store_level:`.

```

3721 \cs_new_protected:Nn \__enumext_multicols_stop:
3722 {
3723   \int_compare:nNtF
3724   { \int_use:c { l__enumext_columns_ \__enumext_level: _int } } > { 1 }
3725   {
3726     \__enumext_stop_list:
3727     \__enumext_stop_store_level:
3728     \end{multicols}
3729     \__enumext_unskip_unkern:
3730     \__enumext_unskip_unkern:
3731     \par\addvspace{ \skip_use:c { l__enumext_multicols_below_ \__enumext_level: _skip } }
3732   }
3733   {
3734     \__enumext_stop_list:
3735     \__enumext_stop_store_level:
3736   }
3737 }

```

(End of definition for `__enumext_multicols_stop:`)

`__enumext_before_list:`

The function `__enumext_before_list:` first calls the function `__enumext_vspace_above:` used by the keys `above` and `above*`, then calls the function `__enumext_before_args_exec:` used by the key `before*` and finally execute the function `__enumext_check_ans_active:` for the check answer mechanism.

```

3738 \cs_new_protected:Nn \__enumext_before_list:
3739 {
3740   \__enumext_vspace_above:
3741   \__enumext_before_args_exec:
3742   \__enumext_check_ans_active:

```

When the `mini-env` key is active it will set the value of the `\l__enumext_minipage_right_X_dim` to be the *width* of the `__enumext_mini_page` environment on the “*right side*”, using this value together with the value of the `\l__enumext_minipage_hsep_X_dim` set by the `mini-sep` key, the value of `\l__enumext_minipage_left_X_dim` will be set, which will be the *width* of `__enumext_mini_page` environment on the “*left side*”, always having a current `\linewidth` as *maximum width* between them.

```

3743   \dim_compare:nNt

```

```

3744     { \dim_use:c { l__enumext_minipage_right_ \__enumext_level: _dim } } > { \c_zero_dim }
3745     {
3746       \dim_set:cn { l__enumext_minipage_left_ \__enumext_level: _dim }
3747       {
3748         \linewidth
3749         - \dim_use:c { l__enumext_minipage_right_ \__enumext_level: _dim }
3750         - \dim_use:c { l__enumext_minipage_hsep_ \__enumext_level: _dim }
3751       }

```

The boolean variable `\l__enumext_minipage_active_X_bool` will be activated and the integer variable `\g__enumext_minipage_stat_int` used by the `\miniright` command will be incremented, then the function `__enumext_minipage_add_space:` is called and the `__enumext_mini_page` environment on the “left side” will be initialized followed by the “vertical spacing” applied to preserve the “baseline” between the *left* and *right* side environments. After these actions, the function `__enumext_multicols_start:` is called to handle the `multicols` environment.

```

3752     \bool_set_true:c { l__enumext_minipage_active_ \__enumext_level: _bool }
3753     \int_gincr:N \g__enumext_minipage_stat_int
3754     \__enumext_minipage_add_space:
3755     \noindent
3756     \__enumext_mini_page{ \dim_use:c { l__enumext_minipage_left_ \__enumext_level: _dim } }
3757   }
3758   \__enumext_multicols_start:
3759 }

```

(End of definition for `__enumext_before_list:`)

`__enumext_second_part:` The function `__enumext_second_part:` first check the state of the boolean variable `\l__enumext_minipage_active_X_bool`, if it is “true” a small test will be executed to check if we have omitted the use of `\miniright` (the `__enumext_mini_page` environment has not been closed), then close `__enumext_mini_page` and add the *adjusted vertical space* `\l__enumext_minipage_after_skip`, otherwise we will close the `multicols` environment.

```

3760 \cs_new_protected:Nn \__enumext_second_part:
3761 {
3762   \bool_if:cTF { l__enumext_minipage_active_ \__enumext_level: _bool }
3763   {
3764     \int_compare:nNT { \g__enumext_minipage_stat_int } = { 1 }
3765     {
3766       \msg_warning:nn { enumext } { missing-miniright }
3767       \miniright
3768     }
3769     \int_gzero:N \g__enumext_minipage_stat_int
3770     \__enumext_unskip_unkern: % remove topsep + [partopsep]
3771     \end__enumext_mini_page
3772   }
3773   {
3774     \__enumext_multicols_stop:
3775   }

```

Now we will execute the functions `__enumext_after_stop_list:` used by the key `after`, `__enumext_check_ans_key_hook:` used by the key `check-ans`, `__enumext_vspace_below:` used by the keys `below` and `below*`. Finally set `\l__enumext_standar_bool` to false and call the function `__enumext_resume_save_counter:` used by the `series`, `resume` and `resume*` keys.

```

3776   \__enumext_after_stop_list:
3777   \__enumext_check_ans_key_hook:
3778   \__enumext_vspace_below:
3779   \bool_set_false:N \l__enumext_standar_bool
3780   \__enumext_resume_save_counter:
3781 }

```

(End of definition for `__enumext_second_part:`)

`__enumext_set_item_width:` The function `__enumext_set_item_width:` will set the value of `\itemwidth` taking into account the value established by the `list-offset` key for each level of the environment.

```

3782 \cs_new_protected:Nn \__enumext_set_item_width:
3783 {
3784   \dim_set:Nn \itemwidth { \linewidth }
3785   \dim_compare:nT
3786   {
3787     \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim } != \c_zero_dim
3788   }
3789   {

```



```

3790         \dim_sub:Nn \itemwidth
3791         {
3792             \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim }
3793         }
3794     }
3795 }

```

(End of definition for __enumext_set_item_width:.)

__enumext_start_counter: For compatibility with *tagged* PDF and since we are using legacy code for the implementation, we must set the initial value of the counters after the second argument to the list environment and before the first execution of `\item`, i.e. `\begin{list}{\langle arg one \rangle}{\langle arg two \rangle}\setcounter{enumX}`.

- This is described in [processing order of legacy setup code in the block templates](#) and we will apply the workaround provided by Frank Mittelbach.

```

3796 \cs_new_protected:Nn \__enumext_start_counter:
3797 {
3798     \setcounter { enumX \__enumext_level: }
3799     {
3800         \int_eval:n { \int_use:c { l__enumext_start_ \__enumext_level: _int } - 1 }
3801     }
3802 }

```

(End of definition for __enumext_start_counter:.)

enumext Now create the `enumext` environment based on `list` environment by levels.

```

3803 \NewDocumentEnvironment{enumext}{ 0{} }
3804 {
3805     \__enumext_safe_exec:
3806     \__enumext_parse_keys:n {#1}
3807     \__enumext_before_list:
3808     \__enumext_start_store_level:
3809     \__enumext_start_list:nn
3810     { \tl_use:c { l__enumext_label_ \__enumext_level: _tl } }
3811     {
3812         \use:c { __enumext_list_arg_two_ \__enumext_level: : }
3813         \__enumext_before_keys_exec:
3814     }
3815     \__enumext_start_counter:
3816     \__enumext_set_item_width:
3817     \__enumext_after_args_exec:
3818 }
3819 {
3820     \__enumext_second_part:
3821 }

```

(End of definition for `enumext`. This function is documented on page 5.)

As we don't want our check to be executed `check-ans` by levels but on the complete list, we will take it out of the `enumext` environment using the “hook” function `__enumext_after_env:nn`.

```

3822 \__enumext_after_env:nn {enumext}
3823 {
3824     \__enumext_execute_after_env:
3825 }

```

13.41 The environment keyans

The environment `keyans` also based on lists. The main differences with the `enumext` environment are the *nesting* and the way the *answers* (choice) will be stored and checked, this environment is intended exclusively for “multiple choice questions”.

__enumext_keyans_safe_exec: The `keyans` environment will only be available if the `save-ans` key is active and can only be used at the “first level” within the `enumext` environment. We do not want the environment to be nested, so we will set a maximum at this point. If the conditions are not met, an error message will be returned.

```

3826 \cs_new_protected:Nn \__enumext_keyans_safe_exec:
3827 {
3828     \bool_if:NF \l__enumext_store_active_bool
3829     {
3830         \msg_error:nnnn { enumext } { wrong-place } { keyans } { save-ans }
3831     }
3832     \int_incr:N \l__enumext_keyans_level_int
3833     \bool_set_true:N \l__enumext_keyans_env_bool

```

```

3834 \__enumext_keyans_name_and_start:
3835 % Set false for interfering with enumext nested in keyans (yes, its possible and crayze)
3836 \bool_set_false:N \__enumext_store_active_bool
3837 \int_compare:nNnT { \__enumext_keyans_level_int } > { 1 }
3838 {
3839   \msg_error:nn { enumext } { keyans-nested }
3840 }
3841 \int_compare:nNnT { \__enumext_level_int } > { 1 }
3842 {
3843   \msg_error:nn { enumext } { keyans-wrong-level }
3844 }
3845 }

```

(End of definition for __enumext_keyans_safe_exec:.)

```

\__enumext_keyans_parse_keys:n Parse [key = val] for keyans environment.
3846 \cs_new_protected:Npn \__enumext_keyans_parse_keys:n #1
3847 {
3848   \keys_set:nn { enumext / keyans } {#1}
3849 }

```

(End of definition for __enumext_keyans_parse_keys:n.)

__enumext_before_list_v: Same implementation as the one used in the enumext environment.

```

\__enumext_keyans_multicols_start:
\__enumext_keyans_multicols_stop:
\__enumext_second_part_v:
3850 \cs_new_protected:Nn \__enumext_before_list_v:
3851 {
3852   \__enumext_vspace_above_v:
3853   \__enumext_before_args_exec_v:
3854   \dim_compare:nNnT { \__enumext_minipage_right_v_dim } > { \c_zero_dim }
3855   {
3856     \dim_set:Nn \__enumext_minipage_left_v_dim
3857     {
3858       \linewidth - \__enumext_minipage_right_v_dim - \__enumext_minipage_hsep_v_dim
3859     }
3860     \bool_set_true:N \__enumext_minipage_active_v_bool
3861     \int_gincr:N \g__enumext_minipage_stat_int
3862     \__enumext_keyans_minipage_add_space:
3863     \__enumext_mini_page{ \__enumext_minipage_left_v_dim }
3864   }
3865   \__enumext_keyans_multicols_start:
3866 }
3867 \cs_new_protected:Nn \__enumext_keyans_multicols_start:
3868 {
3869   \int_compare:nNnT { \__enumext_columns_v_int } > { 1 }
3870   {
3871     \dim_compare:nNnT { \__enumext_columns_sep_v_dim } = { \c_zero_dim }
3872     {
3873       \dim_set:Nn \__enumext_columns_sep_v_dim
3874       {
3875         (
3876           \__enumext_labelwidth_v_dim + \__enumext_labelsep_v_dim
3877         ) / \__enumext_columns_v_int
3878         - \__enumext_listoffset_v_dim
3879       }
3880     }
3881     \dim_set_eq:NN \columnsep \__enumext_columns_sep_v_dim
3882     \dim_zero:N \columnseprule % no rule here
3883     \bool_if:NF \__enumext_minipage_active_v_bool
3884     {
3885       \skip_zero:N \multicolsep
3886       \__enumext_keyans_multi_addvspace:
3887     }
3888     \raggedcolumns
3889     \begin{multicols}{ \__enumext_columns_v_int }
3890   }
3891 }
3892 \cs_new_protected:Nn \__enumext_keyans_multicols_stop:
3893 {
3894   \int_compare:nNnTF { \__enumext_columns_v_int } > { 1 }
3895   {
3896     \__enumext_stop_list:

```

```

3897         \end{multicols}
3898         \__enumext_unskip_unkern:
3899         \__enumext_unskip_unkern:
3900         \par\addvspace{ \l__enumext_multicols_below_v_skip }
3901     }
3902     {
3903         \__enumext_stop_list:
3904     }
3905 }
3906 \cs_new_protected:Nn \__enumext_second_part_v:
3907 {
3908     \bool_if:NTF \l__enumext_minipage_active_v_bool
3909     {
3910         \int_compare:nNnT { \g__enumext_minipage_stat_int } = { 1 }
3911         {
3912             \msg_warning:nn { enumext } { missing-miniright }
3913             \miniright
3914         }
3915         \int_gzero:N \g__enumext_minipage_stat_int
3916         \__enumext_unskip_unkern: % remove \topsep + [\partopsep]
3917         \end__enumext_mini_page
3918         \par\addvspace{ \l__enumext_minipage_after_skip }
3919     }
3920     {
3921         \__enumext_keyans_multicols_stop:
3922     }
3923     \bool_set_false:N \l__enumext_keyans_env_bool
3924     \__enumext_after_stop_list_v:
3925     \__enumext_vspace_below_v:
3926 }

```

(End of definition for __enumext_before_list_v: and others.)

__enumext_keyans_set_item_width:

The function __enumext_keyans_set_item_width: will set the value of \itemwidth taking into account the value established by the list-offset key.

```

3927 \cs_new_protected:Nn \__enumext_keyans_set_item_width:
3928 {
3929     \dim_set:Nn \itemwidth { \linewidth }
3930     \dim_compare:nT
3931     {
3932         \l__enumext_listoffset_v_dim != \c_zero_dim
3933     }
3934     {
3935         \dim_sub:Nn \itemwidth { \l__enumext_listoffset_v_dim }
3936     }
3937 }

```

(End of definition for __enumext_keyans_set_item_width:.)

__enumext_keyans_start_counter:

For compatibility with *tagged* PDF and since we are using legacy code for the implementation, we must set the initial value of the counters after the second argument to the list environment and before the first execution of \item, i.e. \begin{list}{\langle arg one \rangle}{\langle arg two \rangle}\setcounter{enumX}.

```

3938 \cs_new_protected:Nn \__enumext_keyans_start_counter:
3939 {
3940     \setcounter { enumXv } { \int_eval:n { \int_use:c { \l__enumext_start_v_int } - 1 } }
3941 }

```

(End of definition for __enumext_keyans_start_counter:.)

keyans

Now we define the environment *keyans* also based on lists.

```

3942 \NewDocumentEnvironment{keyans}{0}{ }
3943 {
3944     \__enumext_keyans_safe_exec:
3945     \__enumext_keyans_parse_keys:n {#1}
3946     \__enumext_before_list_v:
3947     \__enumext_start_list:nn
3948     { \tl_use:N \l__enumext_label_v_tl }
3949     {
3950         \__enumext_list_arg_two_v:
3951         \__enumext_before_keys_exec_v:
3952     }

```

```

3953     \__enumext_keyans_start_counter:
3954     \__enumext_keyans_set_item_width:
3955     \__enumext_after_args_exec_v:
3956   }
3957   {
3958     \__enumext_check_starred_cmd:n { item }
3959     \__enumext_second_part_v:
3960   }

```

(End of definition for `keyans`. This function is documented on page 16.)

13.42 Tagging PDF support for non-standart list environments

The \TeX release 2022-06-01 brings automatic support for *tagged* PDF in several aspects, including the standard *list environments* and the `list` environment. Unfortunately non-standard *list environments* like `keyanspic` or the horizontal list environments `enumext*` and `keyans*` are not structured in a nice way, i.e. the expected result in the PDF file is the expected one, but the underlying structure is not correct. In simple terms, for *tagged* PDF a `list` environment is a `list` environment, no matter what it looks like in the PDF file.

To maintain a correct `list` structure when `\DocumentMetadata` is active, it is necessary to do some things manually using `tagpdf`[18] and `ltsockets`[20]. This implementation is an adaptation of my answer thanks to Ulrike Fischer's comments in [How can I modify my \item redefinition to be compatible with tagging-pdf](#).

13.42.1 Socket for tagging support in `enumext*` and `keyans*`

We will first define the necessary sockets and their behavior for `enumext*` and `keyans*`.

```

start-list-tags
stop-start-tags
stop-list-tags
\__enumext_start_list_tag:n
\__enumext_stop_start_list_tag:
\__enumext_stop_list_tag:n
3961 \socket_new:nn {tagsupport/__enumext/starred}{ 1 }
3962 \socket_new_plugin:nnn {tagsupport/__enumext/starred} {start-list-tags}
3963 {
3964   \tag_resume:n {#1}
3965   \tag_mc_end_push:
3966     \tag_struct_begin:n {tag=LI}
3967     \tag_struct_begin:n {tag=Lbl}
3968     \tag_mc_begin:n {tag=Lbl}
3969 }
3970 \socket_new_plugin:nnn {tagsupport/__enumext/starred} {stop-start-tags}
3971 {
3972   \tag_mc_end:
3973   \tag_struct_end:n {tag=Lbl}
3974   \tag_struct_begin:n {tag=LBody}
3975   \tag_struct_begin:n {tag=text-unit}
3976   \tag_struct_begin:n {tag=text}
3977 }
3978 \socket_new_plugin:nnn {tagsupport/__enumext/starred} {stop-list-tags}
3979 {
3980   \tag_struct_end:n {tag=text}
3981   \tag_struct_end:n {tag=text-unit}
3982   \tag_struct_end:n {tag=LBody}
3983   \tag_struct_end:n {tag=LI}
3984   \tag_mc_begin_pop:n {}
3985   \tag_suspend:n {#1}
3986 }

```

And now we'll wrap them so that they're only active when `\DocumentMetadata` is present.

```

3987 \cs_new_protected_nopar:Npn \__enumext_start_list_tag:n #1
3988 {
3989   \IfDocumentMetadataT
3990   {
3991     \socket_assign_plugin:nn {tagsupport/__enumext/starred} {start-list-tags}
3992     \socket_use:nn {tagsupport/__enumext/starred} {#1}
3993   }
3994 }
3995 \cs_new_protected_nopar:Npn \__enumext_stop_start_list_tag:
3996 {
3997   \IfDocumentMetadataT
3998   {
3999     \socket_assign_plugin:nn {tagsupport/__enumext/starred} {stop-start-tags}
4000     \socket_use:nn {tagsupport/__enumext/starred} { }
4001   }
4002 }
4003 \cs_new_protected_nopar:Npn \__enumext_stop_list_tag:n #1
4004 {
4005   \IfDocumentMetadataT
4006   {

```

```

4007         \socket_assign_plug:nn {tagsupport/__enumext/starred} {stop-list-tags}
4008         \socket_use:nn {tagsupport/__enumext/starred} {#1}
4009     }
4010 }

```

(End of definition for start-list-tags and others.)

13.42.2 Socket for tagging support in keyanspic

We will first define the necessary sockets and their behavior for `keyanspic` environment.

```

start-list-tags
stop-start-tags
stop-list-tags
\__enumext_anspic_start_list_tag:
\__enumext_anspic_stop_start_list_tag:
\__enumext_anspic_stop_list_tag:
4011 \socket_new:nn {tagsupport/__enumext/keyanspic}{ 0 }
4012 \socket_new_plug:nnn {tagsupport/__enumext/keyanspic} {start-list-tags}
4013 {
4014     \tag_resume:n {keyanspic}
4015     \tag_mc_end_push:
4016         \tag_struct_begin:n {tag=LI}
4017         \tag_struct_begin:n {tag=Lbl}
4018         \tag_mc_begin:n {tag=Lbl}
4019 }
4020 \socket_new_plug:nnn {tagsupport/__enumext/keyanspic} {stop-start-tags}
4021 {
4022     \tag_mc_end:
4023     \tag_struct_end:n {tag=Lbl}
4024     \tag_struct_begin:n {tag=LBody}
4025     \tag_struct_begin:n {tag=text-unit}
4026     \tag_struct_begin:n {tag=text}
4027     \tag_mc_begin:n {tag=text}
4028 }
4029 \socket_new_plug:nnn {tagsupport/__enumext/keyanspic} {stop-list-tags}
4030 {
4031     \tag_mc_end:
4032     \tag_struct_end:n {tag=text}
4033     \tag_struct_end:n {tag=text-unit}
4034     \tag_struct_end:n {tag=LBody}
4035     \tag_struct_end:n {tag=LI}
4036     \tag_mc_begin_pop:n {}
4037     \tag_suspend:n {keyanspic}
4038 }

```

And now we'll wrap them so that they're only active when `\DocumentMetadata` is present.

```

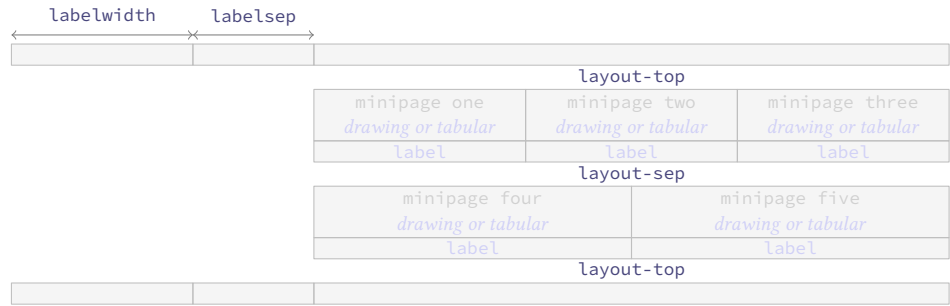
4039 \cs_new_protected_nopar:Nn \__enumext_anspic_start_list_tag:
4040 {
4041     \IfDocumentMetadataT
4042     {
4043         \socket_assign_plug:nn {tagsupport/__enumext/keyanspic} {start-list-tags}
4044         \socket_use:n {tagsupport/__enumext/keyanspic}
4045     }
4046 }
4047 \cs_new_protected_nopar:Nn \__enumext_anspic_stop_start_list_tag:
4048 {
4049     \IfDocumentMetadataT
4050     {
4051         \socket_assign_plug:nn {tagsupport/__enumext/keyanspic} {stop-start-tags}
4052         \socket_use:n {tagsupport/__enumext/keyanspic}
4053     }
4054 }
4055 \cs_new_protected_nopar:Nn \__enumext_anspic_stop_list_tag:
4056 {
4057     \IfDocumentMetadataT
4058     {
4059         \socket_assign_plug:nn {tagsupport/__enumext/keyanspic} {stop-list-tags}
4060         \socket_use:n {tagsupport/__enumext/keyanspic}
4061     }
4062 }

```

(End of definition for start-list-tags and others.)

13.43 The environment keyanspic and \anspic

The `keyanspic` environment is a `list` based environment that uses the same configuration for “*spacing*” and `<label>` as the `keyans` environment, but it does not use `\item`. The `<contents>` are passed to the environment by means of the `\anspic` command as replacement for `\item` command and placed inside `minipage` environments, with the `<label>` centered “*above*” or “*below*”, adjusting *widths* and *position* according to the options passed to the environment.

Figure 12: Representation of the `keyanspic` spacing in `enumext`.

In order for the `keyanspic` environment and the `\anspic` command to work correctly, we need to set and export some variables in the first part of the environment definition and pass them to `\anspic` which is executed in the second part of the environment. This implementation is adapted from the answer given by Enrico Gregorio (@egreg) in [How to process the body of an environment and divide it by a \macro?](#).

13.43.1 The environment `keyanspic`

First we define the key that allows us to process the position of the `(label)` centered “above” or “below” which will be `label-pos`, the vertical separation of these from `drawing or tabular` will be handled with the key `label-sep`. The “*layout style*” will be handled with the key `layout-sty` will take two values separated by comma `{(n° upper; n° lower)}` and will determine the number of `minipage` environments in which all arguments of `\anspic` will be printed at the “upper” and “lower” within the environments separated by the value of the key `layout-sep`. The vertical space “top” and “bottom” of the environment will be handled with the key `layout-top`.

```

label-pos
label-sep
layout-sty
layout-sep
layout-top
mark-ans
mark-pos
mark-sep
save-sep
wrap-opt
wrap-ans*
show-ans
show-pos
4063 \keys_define:nn { enumext / keyanspic }
4064 {
4065   label-pos .choice:,
4066   label-pos / above .code:n =
4067     \bool_set_true:N \l__enumext_anspic_label_above_bool
4068     \str_set:Nn \l__enumext_anspic_mini_pos_str { t },
4069   label-pos / below .code:n =
4070     \bool_set_false:N \l__enumext_anspic_label_above_bool
4071     \str_set:Nn \l__enumext_anspic_mini_pos_str { b },
4072   label-pos / unknown .code:n =
4073     \msg_error:nnee { enumext } { unknown-choice }
4074     { label-pos } { above,~ below } { \exp_not:n {#1} },
4075   label-pos .initial:n = below,
4076   label-pos .value_required:n = true,
4077   label-sep .skip_set:N = \l__enumext_anspic_label_sep_skip,
4078   label-sep .value_required:n = true,
4079   layout-sty .tl_set:N = \l__enumext_anspic_layout_style_tl,
4080   layout-sty .value_required:n = true,
4081   layout-sep .code:n = \keys_set:nn { enumext / keyans } { parsep = #1 },
4082   layout-sep .value_required:n = true,
4083   layout-top .code:n = \keys_set:nn { enumext / keyans } { topsep = #1 },
4084   layout-top .value_required:n = true,
4085   mark-ans .code:n = \keys_set:nn { enumext / keyans } { mark-ans = #1 },
4086   mark-ans .value_required:n = true,
4087   mark-pos .code:n = \keys_set:nn { enumext / keyans } { mark-pos = #1 },
4088   mark-pos .value_required:n = true,
4089   mark-sep .code:n = \keys_set:nn { enumext / keyans } { mark-sep = #1 },
4090   mark-sep .value_required:n = true,
4091   save-sep .code:n = \keys_set:nn { enumext / keyans } { save-sep = #1 },
4092   save-sep .value_required:n = true,
4093   wrap-opt .code:n = \keys_set:nn { enumext / keyans } { wrap-opt = #1 },
4094   wrap-opt .value_required:n = true,
4095   wrap-ans* .code:n = \keys_set:nn { enumext / keyans } { wrap-ans* = #1 },
4096   wrap-ans* .value_required:n = true,
4097   show-ans .code:n = \keys_set:nn { enumext / keyans } { show-ans = #1 },
4098   show-ans .value_required:n = true,
4099   show-pos .code:n = \keys_set:nn { enumext / keyans } { show-pos = #1 },
4100   show-pos .value_required:n = true,
4101   unknown .code:n = {
4102     \tl_set:Nn \l__enumext_envir_name_tl { keyanspic }
4103     \__enumext_keyans_unknown_keys:n {#1}
4104   },
4105 }

```

(End of definition for `label-pos` and others.)

```
\__enumext_keyans_pic_safe_exec:
\__enumext_keyans_pic_parse_keys:n
\__enumext_keyans_pic_skip_abs:N
\__enumext_keyans_pic_arg_two:
```

The function `__enumext_keyans_pic_safe_exec`: check the nested level position inside the `enumext` environment.

```
4106 \cs_new_protected:Nn \__enumext_keyans_pic_safe_exec:
4107 {
4108   \int_incr:N \l__enumext_keyans_pic_level_int
4109   \int_compare:nNtT { \l__enumext_keyans_pic_level_int } > { 1 }
4110   {
4111     \msg_error:nn { enumext } { keyanspic-nested }
4112   }
4113   \__enumext_keyans_name_and_start:
4114 }
```

Parse [`<key = val>`] for `keyanspic` environment.

```
4115 \cs_new_protected:Npn \__enumext_keyans_pic_parse_keys:n #1
4116 {
4117   \tl_if_novalue:nF {#1}
4118   {
4119     \keys_set:nn { enumext / keyanspic } {#1}
4120   }
4121 }
```

The function `__enumext_keyans_pic_skip_abs:N` will return a positive value `\parsep` from `keyans` environment.

```
4122 \cs_new_protected:Npn \__enumext_keyans_pic_skip_abs:N #1
4123 {
4124   \dim_compare:nNtT { #1 } < { \c_zero_dim }
4125   {
4126     \skip_set:Nn #1 { -#1 }
4127   }
4128 }
```

The `__enumext_keyans_pic_arg_two:` function will be used in the *second argument* of the `list` environment that defines the `keyanspic` environment, with this we will take the configuration of the “spaces” and the keys `label`, `wrap-label`, `parsep` and `topsep` from the `keyans` environment. The first thing we need to do is set the boolean variable `\l__enumext_leftmargin_tmp_v_bool` handled by the `list-indent` key to “false”, then copy the definition of the second list argument from the `keyans` environment definition and make sure that `\parsep` does not have a negative value.

```
4129 \cs_new_protected:Npn \__enumext_keyans_pic_arg_two:
4130 {
4131   \bool_set_false:N \l__enumext_leftmargin_tmp_v_bool
4132   \__enumext_list_arg_two_v:
4133   \__enumext_keyans_pic_skip_abs:N \parsep
```

Now we increment the counter `enumXv` of the `keyans` environment and save the *total height* of the `(label)` in `\l__enumext_anspic_label_htdp_dim` used by `\anspic` and we will adjust the values of `\parsep` only if the key `label-pos` is set to *below*.

```
4134   \bool_if:NF \l__enumext_anspic_label_above_bool
4135   {
4136     \stepcounter { enumXv }
4137     \hbox_set:Nn \l__enumext_anspic_label_box { \l__enumext_label_v_tl }
4138     \dim_set:Nn \l__enumext_anspic_label_htdp_dim
4139     {
4140       \box_ht_plus_dp:N \l__enumext_anspic_label_box
4141     }
4142     \skip_add:Nn \parsep
4143     {
4144       \l__enumext_anspic_label_htdp_dim
4145       + \box_dp:N \strutbox
4146       + \l__enumext_anspic_label_sep_skip
4147     }
4148   }
```

Finally we *adjust* the value of `\leftmargin` and `\topsep` then set `\listparindent`, `\partopsep` and `\itemsep` to zero so that the *horizontal* and *vertical* space is not affected.

```
4149   \dim_add:Nn \leftmargin { -\l__enumext_labelwidth_v_dim - \l__enumext_labelsep_v_dim }
4150   \ignorespaces
4151   \skip_add:Nn \topsep { 0.5\box_dp:N \strutbox }
4152   \dim_zero:N \listparindent
4153   \skip_zero:N \partopsep
4154   \skip_zero:N \itemsep
4155 }
```


(End of definition for `__enumext_keyans_pic_safe_exec`: and others.)

`keyanspic` Now we define the environment `keyanspic`. For compatibility with *tagged* PDF we must use the `\begin{list}` form and a lot of conditional code using `\IfDocumentMetadataTF`. We will first stop the code for automatic *tagged* PDF for `list` environments, redefine `\item` so that it cannot be used, and stop the code for automatic *tagged* PDF for the `keyanspic` environment.

```

4156 \NewDocumentEnvironment{keyanspic}{o}
4157 {
4158   \__enumext_keyans_pic_safe_exec:
4159   \__enumext_keyans_pic_parse_keys:n {#1}
4160   \begin{list} {} { \__enumext_keyans_pic_arg_two: }
4161   \IfDocumentMetadataT
4162   {
4163     \tag_suspend:n {list}
4164   }
4165   \item[] \scan_stop:
4166   \RenewDocumentCommand \item {}
4167   {
4168     \msg_error:nn { enumext } { keyanspic-item-cmd }
4169   }
4170   \IfDocumentMetadataT
4171   {
4172     \tag_resume:n {keyanspic}
4173     \tag_tool:n {para/tagging=false}
4174     \tag_suspend:n {keyanspic}
4175   }
4176 }

```

In the second part of the environment definition we will manually place our code for *tagged* PDF and execute the command `\anspic` using the `__enumext_anspic_exec` function.

```

4177 {
4178   \IfDocumentMetadataT
4179   {
4180     \tag_resume:n {keyanspic}
4181     \tag_mc_end_push:
4182     \tag_struct_begin:n {tag=L,attribute=enumerate}
4183   }
4184   \__enumext_anspic_exec:
4185   \IfDocumentMetadataT
4186   {
4187     \tag_suspend:n {keyanspic}
4188   }
4189   \end{list}
4190   \IfDocumentMetadataT
4191   {
4192     \tag_struct_end:n {tag=L}
4193     \tag_mc_begin_pop:n {}
4194     \tag_struct_end:n {tag=L}
4195     \tag_mc_begin_pop:n {}
4196   }

```

Finally we check if `\anspic*` has been used, set the counter `enumXvi` to zero and apply our “adjusted” vertical space bottom.

```

4197   \__enumext_check_starred_cmd:n { anspic }
4198   \setcounter { enumXvi } { 0 }
4199   \bool_if:NTF \__enumext_anspic_label_above_bool
4200   {
4201     \par\addvspace{ 0.5\box_dp:N \strutbox }
4202   }
4203   {
4204     \par
4205     \addvspace
4206     {
4207       \dim_eval:n
4208       {
4209         \__enumext_anspic_label_htdp_dim + \box_ht_plus_dp:N \strutbox
4210         + \__enumext_anspic_label_sep_skip + \__enumext_topsep_v_skip
4211       }
4212     }
4213   }
4214 }

```

(End of definition for `keyanspic`. This function is documented on page 17.)

13.43.2 The command `\anspic`

The `\anspic` command take three arguments, the *starred versions* `\anspic*[\langle content \rangle]` store the current `\label` next to the *optional argument* `[\langle content \rangle]` in the *sequence* and *prop list* defined by `save-ans` key. The third *mandatory argument* `{\langle drawing or tabular \rangle}` is NOT stored in the *sequence* or *prop list*.

- One of the complications here to make the `keyanspic` environment compatible with *tagged PDF* is the position of `\label`, the `\anspic` command processes the arguments in order, where `#1` and `#2` correspond to `\label` and `#3` to the mandatory argument and puts all this inside a `minipage` environment. If `#1` and `#2`, that is `\label`, is above `#3` there are no problems with *tagged PDF*, but if `#3` comes first the list created with *tagged PDF* will not be correct.

`\anspic`

We check that the command is active in the `keyanspic` environment only if the `save-ans` key is present, otherwise we return an error. The three arguments are handled by the function `__enumext_anspic_args:nnn` and stored in the sequence `\l__enumext_anspic_args_seq` which is processed by the `keyanspic` environment.

```

4215 \NewDocumentCommand \anspic { s o +m }
4216 {
4217   \bool_if:NF \l__enumext_store_active_bool
4218   {
4219     \msg_error:nnnn { enumext } { wrong-place } { keyanspic } { save-ans }
4220   }
4221   \int_compare:nNt { \l__enumext_level_int } > { 1 }
4222   {
4223     \msg_error:nn { enumext } { keyanspic-wrong-level }
4224   }
4225   \int_compare:nNt { \l__enumext_keyans_level_int } = { 1 }
4226   {
4227     \msg_error:nnnn { enumext } { command-wrong-place } { anspic } { keyans }
4228   }
4229   \seq_put_right:Nn \l__enumext_anspic_args_seq
4230   {
4231     \__enumext_anspic_args:nnn { #1 } { #2 } { #3 }
4232   }
4233 }

```

The `__enumext_anspic_body_dim:n` function will set the value of `\l__enumext_anspic_body_htdp_dim` equal to the “height plus depth” of the *mandatory argument* if the key `label-pos` is set “below”.

```

4234 \cs_new_protected:Npn \__enumext_anspic_body_dim:n #1
4235 {
4236   \bool_if:NF \l__enumext_anspic_label_above_bool
4237   {
4238     \IfDocumentMetadataT
4239     {
4240       \tag_suspend:n {keyanspic}
4241     }
4242     \vbox_set:Nn \l__enumext_anspic_body_box { #1 }
4243     \dim_set:Nn \l__enumext_anspic_body_htdp_dim
4244     {
4245       \box_ht_plus_dp:N \l__enumext_anspic_body_box
4246     }
4247     \IfDocumentMetadataT
4248     {
4249       \tag_resume:n {keyanspic}
4250     }
4251   }
4252 }

```

The `__enumext_anspic_label:nn` function will process inside `\makebox` the *starred argument* ‘`*`’ and *optional argument* passed to the command. Here we will store the `\label` and *optional argument* in *prop list* and *sequence* and execute the `show-ans`, `show-pos`, `font`, `wrap-label`, `wrap-ans*` and `wrap-opt` keys.

```

4253 \cs_new_protected:Npn \__enumext_anspic_label:nn #1 #2
4254 {
4255   \makebox[ \l__enumext_anspic_mini_width_dim ][ c ]
4256   {
4257     \bool_if:nTF { #1 }
4258     {
4259       \bool_set_true:N \l__enumext_item_wrap_key_bool
4260       \bool_set_true:N \l__enumext_wrap_label_v_bool
4261       \__enumext_keyans_save_item_opt:n { #2 }
4262       \__enumext_keyans_addto_prop:n { #2 }
4263       \__enumext_keyans_store_ref:

```

```

4264     \__enumext_keyans_addto_seq:n { #2 }
4265     \int_gincr:N \g__enumext_check_starred_cmd_int
4266     \__enumext_keyans_show_ans:
4267     \__enumext_keyans_show_pos:
4268     \makebox[ \l__enumext_labelwidth_v_dim ][c]
4269     {
4270         \tl_use:N \l__enumext_label_font_style_v_tl
4271         \__enumext_keyans_wrapper_label:n { \l__enumext_label_vi_tl }
4272     }
4273     \skip_horizontal:n { \l__enumext_labelsep_v_dim }
4274     \__enumext_keyans_show_item_opt:
4275 }
4276 {
4277     \bool_set_false:N \l__enumext_item_wrap_key_bool
4278     \tl_use:N \l__enumext_label_font_style_v_tl
4279     \__enumext_wrapper_label_v:n { \l__enumext_label_vi_tl }
4280 }
4281 }
4282 }

```

The function `__enumext_anspic_label_pos:nnn` will be in charge of handling the “counter” and the position of the `\label`, set by `label-pos` key which will have the same configuration as the `keyans` environment.

```

4283 \cs_new_protected:Npn \__enumext_anspic_label_pos:nnn #1 #2 #3
4284 {
4285     \stepcounter { enumXvi }
4286     \__enumext_anspic_body_dim:n { #3 }
4287     \bool_if:NTF \l__enumext_anspic_label_above_bool
4288     {
4289         \__enumext_anspic_label:nn { #1 } { #2 }
4290     }
4291     {
4292         \raisebox
4293         {
4294             -\dim_eval:n
4295             {
4296                 \l__enumext_anspic_label_htdp_dim
4297                 + \l__enumext_anspic_body_htdp_dim
4298                 + \box_dp:N \strutbox
4299                 + \l__enumext_anspic_label_sep_skip
4300             }
4301         }
4302         [ opt ] [ opt ]
4303         {
4304             \__enumext_anspic_label:nn { #1 } { #2 }
4305         }
4306     }
4307 }
4308 %

```

The `__enumext_anspic_args:nnn` function will be responsible for placing the code compatible with *tagged* PDF and the arguments within the `\l__enumext_anspic_args_seq` sequence which will be processed by the `__enumext_anspic_print:n` function in the second part of the definition of the `keyanspic` environment.

```

4309 \cs_new_protected:Nn \__enumext_anspic_args:nnn
4310 {
4311     \__enumext_anspic_start_list_tag:
4312     \__enumext_anspic_label_pos:nnn { #1 } { #2 } { #3 }
4313     \__enumext_anspic_stop_start_list_tag:
4314     \bool_if:NTF \l__enumext_anspic_label_above_bool
4315     {
4316         \[\l__enumext_anspic_label_sep_skip] #3
4317     }
4318     {
4319         \[ #3
4320     }
4321     \__enumext_anspic_stop_list_tag:
4322 }

```

The value `{\langle n^{\circ upper}, n^{\circ lower} \rangle}` passed to the `layout-sty` key is split by comma and is handled directly by the function `__enumext_anspic_print:n` and passed to the function `__enumext_anspic_row:n`.

```

4323 \cs_new_protected:Nn \__enumext_anspic_print:n
4324 {
4325     \clist_map_function:nN { #1 } \__enumext_anspic_row:n

```

```

4326 }
4327 \cs_generate_variant:Nn \__enumext_anspic_print:n { e, V }

```

The function `__enumext_anspic_row:n` will set the *widths* for the `minipage` environments and place *all arguments* passed to `\anspic` saved in the `__enumext_anspic_args_seq` sequence inside them.

```

4328 \cs_new_protected:Nn \__enumext_anspic_row:n
4329 {
4330   \dim_set:Nn \__enumext_anspic_mini_width_dim { \linewidth / #1 }
4331   \int_set:Nn \__enumext_anspic_above_int { \__enumext_anspic_below_int }
4332   \int_set:Nn \__enumext_anspic_below_int { \__enumext_anspic_above_int + #1 }
4333   \int_step_inline:nnn
4334     { \__enumext_anspic_above_int + 1 }
4335     { \__enumext_anspic_below_int }
4336   {
4337     \IfDocumentMetadataT
4338     {
4339       \tag_suspend:n {minipage}
4340     }
4341     \begin{minipage}[ \__enumext_anspic_mini_pos_str ][ \__enumext_anspic_mini_width_dim ]
4342       \centering
4343       \seq_item:Nn \__enumext_anspic_args_seq { ##1 }
4344       \end{minipage}
4345     \IfDocumentMetadataT
4346     {
4347       \tag_resume:n {minipage}
4348     }
4349   }
4350   \par
4351 }

```

The `__enumext_anspic_exec:` function will execute all the code in the `\anspic` command in the second argument of the `keyanspic` environment definition. If the key `layout-sty` is not set, everything will be printed on a *single line*.

```

4352 \cs_new_protected:Nn \__enumext_anspic_exec:
4353 {
4354   \tl_if_empty:NTF \__enumext_anspic_layout_style_tl
4355   {
4356     \__enumext_anspic_print:e { \seq_count:N \__enumext_anspic_args_seq }
4357   }
4358   {
4359     \__enumext_anspic_print:V \__enumext_anspic_layout_style_tl
4360   }
4361 }

```

(End of definition for `\anspic` and others. This function is documented on page 17.)

13.44 The horizontal environments

Generating *horizontal list environments* is NOT as simple as standard \TeX list environments. The fundamental part of the code is adapted from the `shortlst` package to a more modern version using `expl3`. It is not possible to redefine `\item` and `\makelabel` using `\RenewDocumentCommand` as in the vertical *non starred* versions.

To achieve the *horizontal list environments* we will capture the `\item` command and the $\langle content \rangle$ of this in *horizontal box* using `\makebox` for the `label` and a `minipage` environment for the $\langle content \rangle$ passed to `\item`, we will also add the *optional argument* $\langle number \rangle$ to `\item` to be able to *join columns* horizontally, in simple terms, we want `\item` to behave in the same way as in the `enumext` environment but adding an *first optional argument* $\langle number \rangle$.

A side effect is the limitation of using `\item` in this way *without* using `\RenewDocumentCommand`, which loses the original definition and affects the *standard list environments* provided by \TeX and any environment defined using base `list` environment, including: `itemize`, `enumerate`, `description`, `quote`, `quotation`, `verse`, `center`, `flushleft`, `flushright`, `verbatim`, `tabbing`, `trivlist`, `list` and all environments created with `\newtheorem`.

One way to get around this is to use something like:

```
\AddToHook{env/enumerate/before}{recover original \item definition}
```

inside `minipage`, but in my partial tests this does not have the desired effect and the vertical and horizontal spacing is distorted. For now this will remain as a limitation and I will see if it is feasible to implement it in the future.

For compatibility with the *tagged* PDF we close the environments according to the presence or not of the `mini-env` key.

13.44.1 Functions for item box width

`__enumext_starred_columns_set_vii:`
`__enumext_starred_columns_set_viii:`

We set the default value for the *width of the box* containing the *⟨content⟩* of the items for `enumext*` environment.

```

4362 \cs_new_protected:Nn \__enumext_starred_columns_set_vii:
4363 {
4364   \dim_compare:nNnT { \__enumext_columns_sep_vii_dim } = { \c_zero_dim }
4365   {
4366     \dim_set:Nn \__enumext_columns_sep_vii_dim
4367     {
4368       ( \__enumext_labelwidth_vii_dim + \__enumext_labelsep_vii_dim )
4369       / \__enumext_columns_vii_int
4370     }
4371   }
4372   \int_set:Nn \__enumext_tmpa_vii_int { \__enumext_columns_vii_int - 1 }
4373   \dim_set:Nn \__enumext_item_width_vii_dim
4374   {
4375     ( \linewidth - \__enumext_columns_sep_vii_dim * \__enumext_tmpa_vii_int )
4376     / \__enumext_columns_vii_int
4377     - \__enumext_labelwidth_vii_dim
4378     - \__enumext_labelsep_vii_dim
4379   }

```

When the key `rightmargin` is active we must adjust the values.

```

4380   \dim_compare:nNnT { \__enumext_rightmargin_vii_dim } > { \c_zero_dim }
4381   {
4382     \dim_sub:Nn \__enumext_item_width_vii_dim
4383     {
4384       ( \__enumext_rightmargin_vii_dim * \__enumext_tmpa_vii_int )
4385       / \__enumext_columns_vii_int
4386     }
4387     \dim_add:Nn \__enumext_columns_sep_vii_dim
4388     {
4389       \__enumext_rightmargin_vii_dim
4390     }
4391   }
4392 }

```

Same implementation for the `keyans*` environment.

```

4393 \cs_new_protected:Nn \__enumext_starred_columns_set_viii:
4394 {
4395   \dim_compare:nNnT { \__enumext_columns_sep_viii_dim } = { \c_zero_dim }
4396   {
4397     \dim_set:Nn \__enumext_columns_sep_viii_dim
4398     {
4399       ( \__enumext_labelwidth_viii_dim + \__enumext_labelsep_viii_dim )
4400       / \__enumext_columns_viii_int
4401     }
4402   }
4403   \int_set:Nn \__enumext_tmpa_viii_int { \__enumext_columns_viii_int - 1 }
4404   \dim_set:Nn \__enumext_item_width_viii_dim
4405   {
4406     ( \linewidth - \__enumext_columns_sep_viii_dim * \__enumext_tmpa_viii_int )
4407     / \__enumext_columns_viii_int
4408     - \__enumext_labelwidth_viii_dim
4409     - \__enumext_labelsep_viii_dim
4410   }
4411   \dim_compare:nNnT { \__enumext_rightmargin_viii_dim } > { \c_zero_dim }
4412   {
4413     \dim_sub:Nn \__enumext_item_width_viii_dim
4414     {
4415       ( \__enumext_rightmargin_viii_dim * \__enumext_tmpa_vii_int )
4416       / \__enumext_columns_viii_int
4417     }
4418     \dim_add:Nn \__enumext_columns_sep_viii_dim
4419     {
4420       \__enumext_rightmargin_viii_dim
4421     }
4422   }
4423 }

```

(End of definition for `__enumext_starred_columns_set_vii:` and `__enumext_starred_columns_set_viii:`.)

13.44.2 Functions for join item columns

_enumext_starred_joined_item_vii:n
_enumext_starred_joined_item_viii:n

The functions _enumext_starred_joined_item_vii:n and _enumext_starred_joined_item_viii:n will set the *width* of the box in which the *content* passed to \item(*columns*) will be stored together with the value of \itemwidth for the enumext* environment.

```

4424 \cs_new_protected:Npn \_enumext_starred_joined_item_vii:n #1
4425 {
4426   \int_set:Nn \l__enumext_joined_item_vii_int {#1}
4427   \int_compare:nNnT { \l__enumext_joined_item_vii_int } > { \l__enumext_columns_vii_int }
4428   {
4429     \msg_warning:nnee { enumext } { item-joined }
4430     { \int_use:N \l__enumext_joined_item_vii_int }
4431     { \int_use:N \l__enumext_columns_vii_int }
4432     \int_set:Nn \l__enumext_joined_item_vii_int
4433     {
4434       \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1
4435     }
4436   }
4437   \int_compare:nNnT
4438   { \l__enumext_joined_item_vii_int }
4439   >
4440   { \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1 }
4441   {
4442     \msg_warning:nnee { enumext } { item-joined-columns }
4443     { \int_use:N \l__enumext_joined_item_vii_int }
4444     {
4445       \int_eval:n
4446       { \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1 }
4447     }
4448     \int_set:Nn \l__enumext_joined_item_vii_int
4449     {
4450       \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1
4451     }
4452   }
4453   \int_compare:nNnTF { \l__enumext_joined_item_vii_int } > { 1 }
4454   {
4455     \int_set_eq:NN \l__enumext_joined_item_aux_vii_int \l__enumext_joined_item_vii_int
4456     \int_decr:N \l__enumext_joined_item_aux_vii_int
4457     \int_add:Nn \l__enumext_item_column_pos_vii_int { \l__enumext_joined_item_aux_vii_int }
4458     \int_gadd:Nn \g__enumext_item_count_all_vii_int { \l__enumext_joined_item_aux_vii_int }
4459     \dim_set:Nn \l__enumext_joined_width_vii_dim
4460     {
4461       \l__enumext_item_width_vii_dim * \l__enumext_joined_item_vii_int
4462       + ( \l__enumext_labelwidth_vii_dim + \l__enumext_labelsep_vii_dim
4463         + \l__enumext_columns_sep_vii_dim
4464         ) * \l__enumext_joined_item_aux_vii_int
4465     }
4466     \dim_set_eq:NN \itemwidth \l__enumext_joined_width_vii_dim
4467   }
4468   {
4469     \dim_set_eq:NN \l__enumext_joined_width_vii_dim \l__enumext_item_width_vii_dim
4470     \dim_set_eq:NN \itemwidth \l__enumext_item_width_vii_dim
4471   }
4472 }

```

Same implementation for the keyans* environment.

```

4473 \cs_new_protected:Npn \_enumext_starred_joined_item_viii:n #1
4474 {
4475   \int_set:Nn \l__enumext_joined_item_viii_int {#1}
4476   \int_compare:nNnT { \l__enumext_joined_item_viii_int } > { \l__enumext_columns_viii_int }
4477   {
4478     \msg_warning:nnee { enumext } { item-joined }
4479     { \int_use:N \l__enumext_joined_item_viii_int }
4480     { \int_use:N \l__enumext_columns_viii_int }
4481     \int_set:Nn \l__enumext_joined_item_viii_int
4482     {
4483       \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1
4484     }
4485   }
4486   \int_compare:nNnT
4487   { \l__enumext_joined_item_viii_int }
4488   >

```

```

4489 { \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1 }
4490 {
4491   \msg_warning:nnee { enumext } { item-joined-columns }
4492   { \int_use:N \l__enumext_joined_item_viii_int }
4493   {
4494     \int_eval:n
4495       { \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1 }
4496   }
4497   \int_set:Nn \l__enumext_joined_item_viii_int
4498   {
4499     \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1
4500   }
4501 }
4502 \int_compare:nNnTF { \l__enumext_joined_item_viii_int } > { 1 }
4503 {
4504   \int_set_eq:NN \l__enumext_joined_item_aux_viii_int \l__enumext_joined_item_viii_int
4505   \int_decr:N \l__enumext_joined_item_aux_viii_int
4506   \int_add:Nn \l__enumext_item_column_pos_viii_int { \l__enumext_joined_item_aux_viii_int }
4507   \int_gadd:Nn \g__enumext_item_count_all_viii_int { \l__enumext_joined_item_aux_viii_int }
4508   \dim_set:Nn \l__enumext_joined_width_viii_dim
4509   {
4510     \l__enumext_item_width_viii_dim * \l__enumext_joined_item_viii_int
4511     + ( \l__enumext_labelwidth_viii_dim + \l__enumext_labelsep_viii_dim
4512       + \l__enumext_columns_sep_viii_dim
4513       ) * \l__enumext_joined_item_aux_viii_int
4514   }
4515   \dim_set_eq:NN \itemwidth \l__enumext_joined_width_viii_dim
4516 }
4517 {
4518   \dim_set_eq:NN \l__enumext_joined_width_viii_dim \l__enumext_item_width_viii_dim
4519   \dim_set_eq:NN \itemwidth \l__enumext_item_width_viii_dim
4520 }
4521 }

```

(End of definition for `__enumext_starred_joined_item_vii:n` and `__enumext_starred_joined_item_viii:n`)

13.44.3 Functions for mini-env, mini-right and mini-right* keys

`__enumext_start_mini_vii:`
`__enumext_stop_mini_vii:`

The implementation of the `mini-env` key support is almost identical to the one used in the `enumext` and `keyans` environments, the difference is that the `__enumext_mini_page` environment on the “right side” is executed “after” closing the environment, so it is necessary to make a global copy of the variable `\l__enumext_minipage_right_vii_dim` in the variable `\g__enumext_minipage_right_vii_dim`.

```

4522 \cs_new_protected:Nn \__enumext_start_mini_vii:
4523 {
4524   \dim_compare:nNnTF { \l__enumext_minipage_right_vii_dim } > { \c_zero_dim }
4525   {
4526     \dim_set:Nn \l__enumext_minipage_left_vii_dim
4527     {
4528       \linewidth
4529       - \l__enumext_minipage_right_vii_dim
4530       - \l__enumext_minipage_hsep_vii_dim
4531     }
4532     \bool_set_true:N \l__enumext_minipage_active_vii_bool
4533     \dim_gset_eq:NN
4534       \g__enumext_minipage_right_vii_dim
4535       \l__enumext_minipage_right_vii_dim
4536     \__enumext_mini_addvspace_vii:
4537     \nointerlineskip\noindent
4538     \__enumext_mini_page{ \l__enumext_minipage_left_vii_dim }
4539   }
4540 }

```

The function `__enumext_stop_mini_vii:` closes the `__enumext_mini_page` environment on the “left side”, applies `\hfill` and set the variable `\g__enumext_minipage_active_vii_bool` to “true” which will be used in the function `__enumext_after_env:n` to execute the `minipage` on the “right side”. At this point we will execute the `__enumext_stop_list:` and `__enumext_stop_store_level_vii:` functions stopping the `list` environment and the level saving mechanism for storage in *sequence* of the `\anskey` command and `anskey*` environment. This function is passed to the `__enumext_after_list_vii:` function in the second part of the `enumext*` environment definition (§13.45).

```

4541 \cs_new_protected:Nn \__enumext_stop_mini_vii:
4542 {
4543   \bool_if:NNTF \l__enumext_minipage_active_vii_bool

```



```

4544 {
4545   \__enumext_stop_list:
4546   \__enumext_stop_store_level_vii:
4547   \IfDocumentMetadataT { \tag_resume:n {enumext*} }
4548   \end__enumext_mini_page
4549   \hfill
4550   \bool_gset_true:N \g__enumext_minipage_active_vii_bool
4551 }
4552 {
4553   \__enumext_stop_list:
4554   \__enumext_stop_store_level_vii:
4555 }
4556 }

```

(End of definition for __enumext_start_mini_vii: and __enumext_stop_mini_vii:.)

Finally we execute the `{\code}` passed to the `mini-right` or `mini-right*` keys stored in the variable `\g__enumext_miniright_code_vii_tl` in the `minipage` environment on the “right side”. For compatibility with the `caption` package and possibly other `{\code}` passed to this key, we will pass it to a box and then print it.

```

4557 \__enumext_after_env:nn {enumext*}
4558 {
4559   \bool_if:NT \g__enumext_minipage_active_vii_bool
4560   {
4561     \__enumext_minipage:w [ t ] { \g__enumext_minipage_right_vii_dim }
4562     \legacy_if_gset_false:n { @minipage }
4563     \skip_vertical:N \c_zero_skip
4564     \par\addvspace { \g__enumext_minipage_right_skip }
4565     \bool_if:NF \g__enumext_minipage_center_vii_bool
4566     {
4567       \tl_put_left:Nn \g__enumext_miniright_code_vii_tl
4568       {
4569         \centering
4570       }
4571     }
4572     \vbox_set_top:Nn \l__enumext_miniright_code_vii_box
4573     {
4574       \tl_use:N \g__enumext_miniright_code_vii_tl
4575     }
4576     \box_use_drop:N \l__enumext_miniright_code_vii_box
4577     \skip_vertical:N \c_zero_skip
4578     \__enumext_endminipage:
4579     \par\addvspace{ \g__enumext_minipage_after_skip }
4580   }
4581   \bool_gset_false:N \g__enumext_minipage_active_vii_bool
4582   \bool_gset_true:N \g__enumext_minipage_center_vii_bool
4583   \tl_gclear:N \g__enumext_miniright_code_vii_tl
4584   \dim_gzero:N \g__enumext_minipage_right_vii_dim
4585   \bool_gset_false:N \g__enumext_starred_bool
4586 }

```

`__enumext_start_mini_viii:` The implementation of the `mini-env`, `mini-right` and `mini-right*` keys is identical to the one used in the `enumext*` environment.

```

4587 \cs_new_protected:Nn \__enumext_start_mini_viii:
4588 {
4589   \dim_compare:nNnT { \l__enumext_minipage_right_viii_dim } > { \c_zero_dim }
4590   {
4591     \dim_set:Nn \l__enumext_minipage_left_viii_dim
4592     {
4593       \linewidth
4594       - \l__enumext_minipage_right_viii_dim
4595       - \l__enumext_minipage_hsep_viii_dim
4596     }
4597     \bool_set_true:N \l__enumext_minipage_active_viii_bool
4598     \dim_gset_eq:NN
4599     \g__enumext_minipage_right_viii_dim
4600     \l__enumext_minipage_right_viii_dim
4601     \__enumext_mini_addvspace_viii:
4602     \nointerlineskip\noindent
4603     \__enumext_mini_page{ \l__enumext_minipage_left_viii_dim }
4604   }

```

```

4605     }
4606     \cs_new_protected:Nn \__enumext_stop_mini_viii:
4607     {
4608         \bool_if:NTF \l__enumext_minipage_active_viii_bool
4609         {
4610             \__enumext_stop_list:
4611             \IfDocumentMetadataTF { \tag_resume:n {keyans*} } { }
4612             \end__enumext_mini_page
4613             \hfill
4614             \bool_gset_true:N \g__enumext_minipage_active_viii_bool
4615         }
4616         {
4617             \__enumext_stop_list:
4618         }
4619     }
4620     \__enumext_after_env:nn {keyans*}
4621     {
4622         \bool_if:NT \g__enumext_minipage_active_viii_bool
4623         {
4624             \__enumext_mini_page{ \g__enumext_minipage_right_viii_dim }
4625             \par\addvspace { \g__enumext_minipage_right_skip }
4626             \bool_if:NF \g__enumext_minipage_center_viii_bool
4627             {
4628                 \tl_put_left:Nn \g__enumext_miniright_code_viii_tl
4629                 {
4630                     \centering
4631                 }
4632             }
4633             \vbox_set_top:Nn \l__enumext_miniright_code_viii_box
4634             {
4635                 \tl_use:N \g__enumext_miniright_code_viii_tl
4636             }
4637             \box_use_drop:N \l__enumext_miniright_code_viii_box
4638             \end__enumext_mini_page
4639             \par\addvspace{ \g__enumext_minipage_after_skip }
4640         }
4641         \bool_gset_false:N \g__enumext_minipage_active_viii_bool
4642         \bool_gset_true:N \g__enumext_minipage_center_viii_bool
4643         \tl_gclear:N \g__enumext_miniright_code_viii_tl
4644         \dim_gzero:N \g__enumext_minipage_right_viii_dim
4645     }

```

(End of definition for __enumext_start_mini_viii: and __enumext_stop_mini_viii:.)

13.45 The environment enumext*

enumext* First we will generate the environment and we will give a temporary definition to __enumext_stop_item_tmp_vii: equal to __enumext_first_item_tmp_vii: and next to \item equal to __enumext_start_item_tmp_vii: which we will redefine later. Unlike the implementation used by the **shortlst** package, we will not set the values of \rightskip and \@rightskip equal to \@flushglue whose value is 0.0pt plus 1.0 fil, in the tests I have performed this fails in some circumstances and different results are obtained when using pdfTeX and LuaTeX.

```

4646 \NewDocumentEnvironment{enumext*}{ o }
4647 {
4648     \__enumext_safe_exec_vii:
4649     \__enumext_parse_keys_vii:n {#1}
4650     \__enumext_before_list_vii:
4651     \__enumext_start_store_level_vii:
4652     \__enumext_start_list:nn { }
4653     {
4654         \__enumext_list_arg_two_vii:
4655         \__enumext_before_keys_exec_vii:
4656     }
4657     \setcounter { enumXvii } { \int_eval:n { \int_use:c { \l__enumext_start_vii_int } - 1 } }
4658     \IfDocumentMetadataT { \tag_suspend:n {enumext*} }
4659     \__enumext_starred_columns_set_vii:
4660     \item[] \scan_stop:
4661     \cs_set_eq:NN \__enumext_stop_item_tmp_vii: \__enumext_first_item_tmp_vii:
4662     \cs_set_eq:NN \item \__enumext_start_item_tmp_vii:
4663     \ignorespaces
4664 }

```

```

4665 {
4666     \IfDocumentMetadataT { \tag_struct_end:n {tag=text-unit} }
4667     \__enumext_stop_item_tmp_vii:
4668     \__enumext_remove_extra_parsep_vii:
4669     \__enumext_after_list_vii:
4670 }

```

(End of definition for `enumext*`. This function is documented on page 5.)

`__enumext_safe_exec_vii:` We will first call the function `__enumext_is_not_nested:` which sets `\g__enumext_starred_bool` to true if we are NOT nested within `enumext`, then call the function `__enumext_internal_mini_page:` to create the environment `__enumext_mini_page`, we will increment `\l__enumext_level_h_int` to restrict nesting of the environment, set `\l__enumext_starred_bool` to true and finally call the function `__enumext_is_on_first_level:` which sets `\l__enumext_starred_first_bool` to true if we are not nested, allowing the “storage system” to be used.

```

4671 \cs_new_protected:Nn \__enumext_safe_exec_vii:
4672 {
4673     \__enumext_is_not_nested:
4674     \__enumext_internal_mini_page:
4675     \int_incr:N \l__enumext_level_h_int
4676     \int_compare:nNnT { \l__enumext_level_h_int } > { 1 }
4677     {
4678         \msg_error:nn { enumext } { nested }
4679     }
4680     \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
4681     {
4682         \msg_error:nnn { enumext } { nested-horizontal } { keyans*}
4683     }
4684     \bool_set_true:N \l__enumext_starred_bool
4685     \bool_set_false:N \l__enumext_standar_bool
4686     \__enumext_is_on_first_level:
4687 }

```

(End of definition for `__enumext_safe_exec_vii:.`)

`__enumext_parse_keys_vii:n` First we will clear the variable `\l__enumext_series_str` used by the key `series`, process the environment `[⟨key = val⟩]` and execute the function `__enumext_parse_series:n` and used by the key `series`, then we execute the function `__enumext_store_active_keys_vii:n` and reprocess the `(keys)` to pass them to the storage `sequence` if the key `save-key` is not active.

```

4688 \cs_new_protected:Npn \__enumext_parse_keys_vii:n #1
4689 {
4690     \tl_if_novalue:nF {#1}
4691     {
4692         \str_clear:N \l__enumext_series_str
4693         \keys_set:nn { enumext / enumext* } {#1}
4694         \__enumext_parse_series:n {#1}
4695         \__enumext_store_active_keys_vii:n {#1}
4696     }
4697 }

```

(End of definition for `__enumext_parse_keys_vii:n.`)

`__enumext_before_list_vii:` The function `__enumext_before_list_vii:` first calls the function `__enumext_vspace_above_vii:` used by the keys `above` and `above*`, then calls the function `__enumext_check_ans_active:` for the check answer mechanism and finally calls the functions `__enumext_before_args_exec:` and `__enumext_start_mini_vii:` used by the keys `before*`, `mini-env`, `mini-right` and `mini-right*`.

```

4698 \cs_new_protected:Nn \__enumext_before_list_vii:
4699 {
4700     \__enumext_vspace_above_vii:
4701     \__enumext_check_ans_active:
4702     \__enumext_before_args_exec_vii:
4703     \__enumext_start_mini_vii:
4704 }

```

(End of definition for `__enumext_before_list_vii:.`)

`__enumext_after_list_vii:` The function `__enumext_after_list_vii:` first calls the function `__enumext_stop_mini_vii:` which internally calls `__enumext_stop_list:` and `__enumext_stop_store_level_vii:` (§13.44.3) used by the keys `mini-env`, `mini-right` and `mini-right*`, then to the functions `__enumext_after_stop_list_vii:` used by the key `after`, `__enumext_check_ans_key_hook:` used by the key `check-ans`,

`__enumext_vspace_below_vii:` used by the keys `below` and `below*`. Finally set `\l__enumext_starred_bool` to false and call the `__enumext_resume_save_counter:` function used by the `series`, `resume` and `resume*` keys.

```

4705 \cs_new_protected:Nn \__enumext_after_list_vii:
4706 {
4707     \__enumext_stop_mini_vii:
4708     \__enumext_after_stop_list_vii:
4709     \__enumext_check_ans_key_hook:
4710     \__enumext_vspace_below_vii:
4711     \bool_set_false:N \l__enumext_starred_bool
4712     \__enumext_resume_save_counter:
4713 }

```

(End of definition for `__enumext_after_list_vii:`.)

```

\__enumext_start_store_level_vii:
\__enumext_stop_store_level_vii:

```

The `__enumext_start_store_level_vii:` and `__enumext_stop_store_level_vii:` functions activate the “*storing structure*” mechanism in *sequence* for `\anskey` command and `anskey*` environment if `enumext*` are nested in `enumext`.

```

4714 \cs_new_protected:Nn \__enumext_start_store_level_vii:
4715 {
4716     \bool_if:NT \l__enumext_store_active_bool
4717     {
4718         \int_compare:nNnT { \l__enumext_level_int } > { 0 }
4719         {
4720             \__enumext_store_level_open_vii:
4721         }
4722     }
4723 }
4724 \cs_new_protected:Nn \__enumext_stop_store_level_vii:
4725 {
4726     \bool_if:NT \l__enumext_store_active_bool
4727     {
4728         \int_compare:nNnT { \l__enumext_level_int } > { 0 }
4729         {
4730             \__enumext_store_level_close_vii:
4731         }
4732     }
4733 }

```

(End of definition for `__enumext_start_store_level_vii:` and `__enumext_stop_store_level_vii:`.)

13.45.1 The command `\item` in `enumext*`

```
\__enumext_first_item_tmp_vii:
```

The `__enumext_first_item_tmp_vii:` function will remove horizontal space equal to `\labelwidth` plus `\labelsep` to the left of the “*first*” `\item` in the environment at the point of execution of this function, where it is equal to the `__enumext_stop_item_tmp_vii:` function inside the environment body definition.

```

4734 \cs_new_protected_nopar:Nn \__enumext_first_item_tmp_vii:
4735 {
4736     \skip_horizontal:n
4737     {
4738         -\l__enumext_labelwidth_vii_dim - \l__enumext_labelsep_vii_dim
4739     }
4740     \ignorespaces
4741 }

```

(End of definition for `__enumext_first_item_tmp_vii:`.)

```

\__enumext_start_item_tmp_vii:
\__enumext_item_peek_args_vii:
\__enumext_joined_item_vii:w
\__enumext_standar_item_vii:w
\__enumext_starred_item_vii:w
\__enumext_starred_item_vii_aux_i:w
\__enumext_starred_item_vii_aux_ii:w
\__enumext_starred_item_vii_aux_iii:w

```

First we will call the function `__enumext_stop_item_tmp_vii:` that we will redefine later, we will increment the value of `\l__enumext_item_column_pos_vii_int` that will count the item’s by rows and the value of `\g__enumext_item_count_all_vii_int` that will count the total of item’s in the environment. After that we will call the function `__enumext_item_peek_args_vii:` that will handle the arguments passed to `\item`.

```

4742 \cs_new_protected_nopar:Nn \__enumext_start_item_tmp_vii:
4743 {
4744     \__enumext_stop_item_tmp_vii:
4745     \int_incr:N \l__enumext_item_column_pos_vii_int
4746     \int_gincr:N \g__enumext_item_count_all_vii_int
4747     \__enumext_item_peek_args_vii:
4748 }

```

The function `__enumext_item_peek_args_vii:` will handle the `\item(<number>)`. Look for the argument “(”, if it is present we will call the function `__enumext_joined_item_vii:w (<number>)`, which is in charge of joining the item’s in the same row, in case they are not present we will set the default value (1).

```
4749 \cs_new_protected:Nn \__enumext_item_peek_args_vii:
4750 {
4751   \peek_meaning:NTF (
4752     { \__enumext_joined_item_vii:w }
4753     { \__enumext_joined_item_vii:w (1) }
4754   }
```

The function `__enumext_joined_item_vii:w` will first call the function `__enumext_starred_joined_item_vii:n` in charge of setting the *width* of the box that will store the content passed to `\item`. Then we will look for the argument “*”, if it is present we will call the function `__enumext_starred_item_vii:w` otherwise we will call the function `__enumext_standar_item_vii:w`.

```
4755 \cs_new_protected:Npn \__enumext_joined_item_vii:w (#1)
4756 {
4757   \__enumext_starred_joined_item_vii:n {#1}
4758   \peek_meaning_remove:NTF *
4759     { \__enumext_starred_item_vii:w }
4760     { \__enumext_standar_item_vii:w }
4761 }
```

The function `__enumext_standar_item_vii:w` will first look for the argument “[”, if present it will set the state of the variable `\l__enumext_wrap_label_opt_vii_bool` equal to the state of the variable `\l__enumext_wrap_label_opt_vii_bool` handled by the key `wrap-label*` and finally execute the *non-enumerated* version `\item[<custom>]` by means of the function `__enumext_start_item_vii:w`, otherwise we will set the value of the variable `\l__enumext_wrap_label_vii_bool` handled by the `wrap-label` key to true and set the switch `\if@noitemarg` to true to execute the enumerated version of `\item` by means of the function `__enumext_start_item_vii:w [\l__enumext_label_vii_tl]`.

```
4762 \cs_new_protected:Npn \__enumext_standar_item_vii:w
4763 {
4764   \bool_set_false:N \l__enumext_item_starred_vii_bool
4765   \peek_meaning:NTF [
4766     {
4767       \bool_set_eq:NN \l__enumext_wrap_label_vii_bool \l__enumext_wrap_label_opt_vii_bool
4768       \__enumext_start_item_vii:w
4769     }
4770     {
4771       \bool_set_true:N \l__enumext_wrap_label_vii_bool
4772       \legacy_if_set_true:n { @noitemarg }
4773       \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ] \ignorespaces
4774     }
4775   }
```

The function `__enumext_starred_item_vii:w` together with the specified auxiliary functions `aux_i:w`, `aux_ii:w`, and `aux_iii:w` execute `\item*`, `\item* [<symbol>]` and `\item* [<symbol>] [<offset>]`.

```
4776 \cs_new_protected:Npn \__enumext_starred_item_vii:w
4777 {
4778   \bool_set_true:N \l__enumext_item_starred_vii_bool
4779   \bool_set_true:N \l__enumext_wrap_label_vii_bool
4780   \peek_meaning:NTF [
4781     { \__enumext_starred_item_vii_aux_i:w }
4782     { \__enumext_starred_item_vii_aux_ii:w }
4783   }
4784   \cs_new_protected:Npn \__enumext_starred_item_vii_aux_i:w [#1]
4785   {
4786     \tl_gset:Nn \g__enumext_item_symbol_aux_vii_tl {#1}
4787     \__enumext_starred_item_vii_aux_ii:w
4788   }
4789   \cs_new_protected:Npn \__enumext_starred_item_vii_aux_ii:w
4790   {
4791     \peek_meaning:NTF [
4792       { \__enumext_starred_item_vii_aux_iii:w }
4793       {
4794         \dim_set_eq:NN \l__enumext_item_symbol_sep_vii_dim \l__enumext_labelsep_vii_dim
4795         \legacy_if_set_true:n { @noitemarg }
4796         \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ] \ignorespaces
4797       }
4798     }
4799   \cs_new_protected:Npn \__enumext_starred_item_vii_aux_iii:w [#1]
4800   {
```

```

4801 \dim_set:Nn \l__enumext_item_symbol_sep_vii_dim {#1}
4802 \legacy_if_set_true:n { @noitemarg }
4803 \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ] \ignorespaces
4804 }

```

(End of definition for `__enumext_start_item_tmp_vii:` and others.)

`__enumext_fake_make_label_vii:n`

The `__enumext_fake_make_label_vii:n` function will be in charge of handling our definition of `\item`. First we increment the counter `enumXvii` for the enumerated items and activate support for the *check answers* mechanism, followed by support for `\item*[(symbol)] [⟨offset⟩]` if present, then the `wrap-label` and `wrap-label*` keys which we execute using `\makebox` whose width will be given by the `labelwidth` key and position by the `align` key, inside the argument of this we will execute the `font` key together with the function defined by the `wrap-label` or `wrap-label*` keys. Finally we execute the `labelsep` key applying a `\skip_horizontal:N` and `\ignorespaces`.

- For compatibility with *tagged* PDF and `hyperref` when an environment `enumext` is nested in `enumext*` and the key `save-ans` is not active need setting the `\if@hyper@item` switch to “true”. The explanation for this is given by the master Heiko Oberdiek on `\refstepcounter{enumi} twice (or more) creates destination with the same identifier`. This patch is only needed if you are running pdf_latex and not if you are running lua_latex

```

4805 \cs_new_protected_nopar:Npn \__enumext_fake_make_label_vii:n #1
4806 {
4807   \legacy_if:nT { @noitemarg }
4808   {
4809     \legacy_if_set_false:n { @noitemarg }
4810     \legacy_if:nT { @nmbolist }
4811     {
4812       \IfDocumentMetadataT
4813       {
4814         \bool_if:NT \l__enumext_hyperref_bool
4815         {
4816           \legacy_if_set_true:n { @hyper@item }
4817         }
4818       }
4819       \refstepcounter{enumXvii}
4820       \bool_if:NT \l__enumext_check_answers_bool
4821       {
4822         \int_gincr:N \g__enumext_item_number_int
4823         \bool_set_true:N \l__enumext_item_number_bool
4824       }
4825     }
4826   }
4827   \bool_if:NT \l__enumext_item_starred_vii_bool
4828   {
4829     \tl_if_blank:VT \g__enumext_item_symbol_aux_vii_tl
4830     {
4831       \tl_gset_eq:NN
4832       \g__enumext_item_symbol_aux_vii_tl \l__enumext_item_symbol_vii_tl
4833     }
4834     \mode_leave_vertical:
4835     \skip_horizontal:n { -\l__enumext_item_symbol_sep_vii_dim }
4836     \hbox_overlap_left:n { \g__enumext_item_symbol_aux_vii_tl }
4837     \skip_horizontal:N \l__enumext_item_symbol_sep_vii_dim
4838     \tl_gclear:N \g__enumext_item_symbol_aux_vii_tl
4839   }
4840   \makebox[ \l__enumext_labelwidth_vii_dim ][ \l__enumext_align_label_vii_str ]
4841   {
4842     \tl_use:N \l__enumext_label_font_style_vii_tl
4843     \bool_if:NTF \l__enumext_wrap_label_vii_bool
4844     {
4845       \__enumext_wrapper_label_vii:n {#1}
4846     }
4847     { #1 }
4848   }
4849   \skip_horizontal:N \l__enumext_labelsep_vii_dim \ignorespaces
4850 }

```

(End of definition for `__enumext_fake_make_label_vii:n`.)

13.45.2 Real definition of `\item` in `enumext*`

The functions `__enumext_start_item_vii:w` and `__enumext_stop_item_vii:` executing the true definition of `\item` inside the `enumext*` environment, unlike the implementation in `shortlst` we will NOT use an extra group and the plain form of the `lrbox` environment.

```
\__enumext_start_item_vii:w
  \__enumext_stop_item_vii:
```

The first thing we will do is set the value of `__enumext_stop_item_tmp_vii:` equal to `__enumext_stop_item_vii:` which we will define later, after that we will start capturing `\item` and “*item content*” in a *horizontal box* where the width will be `\itemwidth` plus `\labelwidth` plus `\labelsep`.

```
4851 \cs_new_protected_nopar:Npn \__enumext_start_item_vii:w [#1]
4852 {
4853   \cs_set_eq:NN \__enumext_stop_item_tmp_vii: \__enumext_stop_item_vii:
4854   \hbox_set_to_wd:Nnw \l__enumext_item_text_vii_box
4855   {
4856     \l__enumext_joined_width_vii_dim
4857     + \l__enumext_labelwidth_vii_dim
4858     + \l__enumext_labelsep_vii_dim
4859   }
```

Redefine the `\footnote` command.

```
4860   \__enumext_renew_footnote_starred:
```

Now we insert our *sockets* for *tagging* PDF support and run `\item`.

```
4861   \__enumext_start_list_tag:n {enumext*}
4862   \__enumext_fake_make_label_vii:n {#1}
4863   \__enumext_stop_start_list_tag:
```

Finally we open the `minipage` environment, capture the “*item content*”, make `\parindent` take the value of the key `listparindent` and `\parskip` take the value of the key `parsep`, then execute the keys `itemindent` and `first`.

Here the use of `\unskip` and `\skip_horizontal:n` with the value of `listparindent` is necessary, otherwise an unwanted space is created when using `\item[⟨opt⟩]` and the value passed to the key `itemindent` is incremented.

```
4864   \__enumext_minipage:w [ t ]{ \l__enumext_joined_width_vii_dim }
4865   \dim_set_eq:NN \parindent \l__enumext_listparindent_vii_dim
4866   \skip_set_eq:NN \parskip \l__enumext_parsep_vii_skip
4867   \__enumext_unskip_unkern:
4868   \__enumext_unskip_unkern:
4869   \skip_horizontal:n { -\l__enumext_listparindent_vii_dim } \ignorespaces
4870   \tl_use:N \l__enumext_fake_item_indent_vii_tl
4871   \tl_use:N \l__enumext_after_list_args_vii_tl
4872 }
```

The `__enumext_stop_item_vii:` function will finish the fetching `\item` and “*item content*” by closing the `minipage` environment, the *sockets* for *tagging* PDF and the *horizontal box*.

```
4873 \cs_new_protected_nopar:Nn \__enumext_stop_item_vii:
4874 {
4875   \__enumext_endminipage:
4876   \__enumext_stop_list_tag:n {enumext*}
4877   \hbox_set_end:
```

Here we will reduce the *warnings* a bit by setting the value of `\hbadness` to `10000`, print `\item` and “*item content*” from the *horizontal box*.

```
4878   \int_set:Nn \hbadness { 10000 }
4879   \box_use_drop:N \l__enumext_item_text_vii_box
```

Finally apply the *vertical space* between rows set by `itemsep` key passed to `\parsep` using `\par\noindent` and *horizontal space* between columns set by `columns-sep` key using `\skip_horizontal:N`.

```
4880   \int_compare:nNnTF
4881   { \l__enumext_item_column_pos_vii_int } = { \l__enumext_columns_vii_int }
4882   {
4883     \par\noindent
4884     \int_zero:N \l__enumext_item_column_pos_vii_int
4885   }
4886   {
4887     \skip_horizontal:N \l__enumext_columns_sep_vii_dim
4888   }
4889 }
```

(End of definition for `__enumext_start_item_vii:w` and `__enumext_stop_item_vii:`)

`__enumext_remove_extra_parsep_vii:` Remove the extra *vertical space* equal to `\parsep=\itemsep` when the total number of `\item` is divisible by the number of `\item` in the last row of the environment. Here the use of `\unskip` or `\removeatlastskip` fails and does not obtain the expected result, using `\vspace` is the option and in this case, we can use a simplified version since we are always in *(vertical mode)*.

```

4890 \cs_new_protected:Nn \__enumext_remove_extra_parsep_vii:
4891 {
4892   \int_compare:nNnT
4893   {
4894     \int_mod:nn
4895     { \g__enumext_item_count_all_vii_int } { \l__enumext_columns_vii_int }
4896   }
4897   =
4898   { 0 }
4899   {
4900     \para_end:
4901     \skip_vertical:n { -\l__enumext_itemsep_vii_skip }
4902     \skip_vertical:N \c_zero_skip
4903     \int_gzero:N \g__enumext_item_count_all_vii_int
4904   }
4905 }

```

(End of definition for `__enumext_remove_extra_parsep_vii:`.)

As we don't want our check to be executed `check-ans` by levels but on the complete list, we will take it out of the `enumext*` environment using the “hook” function `__enumext_after_env:nn`.

```

4906 \__enumext_after_env:nn {enumext*}
4907 {
4908   \__enumext_execute_after_env:
4909 }

```

13.46 The environment `keyans*`

`keyans*` The implementation of `keyans*` environment is the similar as that used by the `enumext*` environment except for the `__enumext_check_starred_cmd:n` function added in the second part.

```

4910 \NewDocumentEnvironment{keyans*}{o}
4911 {
4912   \__enumext_safe_exec_viii:
4913   \__enumext_parse_keys_viii:n {#1}
4914   \__enumext_before_list_viii:
4915   \__enumext_start_list:nn { }
4916   {
4917     \__enumext_list_arg_two_viii:
4918     \__enumext_before_keys_exec_viii:
4919   }
4920   \setcounter { enumxviii } { \int_eval:n { \int_use:c { \l__enumext_start_viii_int } - 1 } }
4921   \IfDocumentMetadataT { \tag_suspend:n {keyans*} }
4922   \__enumext_starred_columns_set_viii:
4923   \item[] \scan_stop:
4924   \cs_set_eq:NN \__enumext_stop_item_tmp_viii: \__enumext_first_item_tmp_viii:
4925   \cs_set_eq:NN \item \__enumext_start_item_tmp_viii:
4926   \ignorespaces
4927 }
4928 {
4929   \IfDocumentMetadataT { \tag_struct_end:n {tag=text-unit} }
4930   \__enumext_stop_item_tmp_viii:
4931   \__enumext_remove_extra_parsep_viii:
4932   \__enumext_check_starred_cmd:n { item }
4933   \__enumext_after_list_viii:
4934 }

```

(End of definition for `keyans*`. This function is documented on page 16.)

`__enumext_safe_exec_viii:` The `__enumext_safe_exec_viii:` function will first check if the `save-ans` key is active and only when this is true the environment will be available, it will increment the value of `\l__enumext_keyans_level_h_int` and return an error message when we are nesting the environment, then it will call the `__enumext_keyans_name_and_start:` function in charge of saving the name of the environment and the line it is running on, then it will check if we are trying to nest `keyans*` in `enumext*` returning an error and we will set `\l__enumext_starred_bool` to true, finally we will check if we are within the appropriate level within the `enumext` environment.

```

4935 \cs_new_protected:Nn \__enumext_safe_exec_viii:
4936 {

```

```

4937 \bool_if:NF \l__enumext_store_active_bool
4938 {
4939   \msg_error:nnnn { enumext } { wrong-place } { keyans* } { save-ans }
4940 }
4941 \int_incr:N \l__enumext_keyans_level_h_int
4942 \int_compare:nNnT { \l__enumext_keyans_level_h_int } > { 1 }
4943 {
4944   \msg_error:nn { enumext } { nested }
4945 }
4946 \__enumext_keyans_name_and_start:
4947 \bool_if:NT \l__enumext_starred_bool
4948 {
4949   \msg_error:nnn { enumext } { nested-horizontal } { enumext* }
4950 }
4951 \bool_set_true:N \l__enumext_starred_bool
4952 % Set false for interfering with enumext nested in keyans* (yes, its possible and crayze)
4953 \bool_set_false:N \l__enumext_store_active_bool
4954 \int_compare:nNnT { \l__enumext_level_int } > { 1 }
4955 {
4956   \msg_error:nn { enumext } { keyans-wrong-level }
4957 }
4958 }

```

(End of definition for `__enumext_safe_exec_viii:`)

```

\__enumext_parse_keys_viii:n Parse [key = val] for keyans*.
4959 \cs_new_protected:Npn \__enumext_parse_keys_viii:n #1
4960 {
4961   \tl_if_novalue:nF {#1}
4962   {
4963     \keys_set:nn { enumext / keyans* } {#1}
4964   }
4965 }

```

(End of definition for `__enumext_parse_keys_viii:n`)

`__enumext_before_list_viii:` The function `__enumext_before_list_viii:` will add the vertical spacing on the environment if the `above` key is active next to the `{\code}` defined by the `before*` key if it is active, the call the function `__enumext_start_mini_viii:` handle by `mini-env`.

```

4966 \cs_new_protected:Nn \__enumext_before_list_viii:
4967 {
4968   \__enumext_vspace_above_viii:
4969   \__enumext_before_args_exec_viii:
4970   \__enumext_start_mini_viii:
4971 }

```

(End of definition for `__enumext_before_list_viii:`)

`__enumext_after_list_viii:` The function `__enumext_after_list_viii:` first call the function `__enumext_stop_mini_viii:`, then apply the `{\code}` handled by the `after` key together with the *vertical space* handled by the `below` key if they are present.

```

4972 \cs_new_protected:Nn \__enumext_after_list_viii:
4973 {
4974   \__enumext_stop_mini_viii:
4975   \__enumext_after_stop_list_viii:
4976   \__enumext_vspace_below_viii:
4977 }

```

(End of definition for `__enumext_after_list_viii:`)

13.46.1 The command `\item` in `keyans*`

The idea here is to make the `\item` command behave in the same way as in the `keyans` environment with the difference of the *optional argument* (`\number`) which works in the same way as in the `enumext*` environment. In simple terms we want to store the `\label` next to the `[\content]` if it is present in the *sequence* and *prop list* defined by `save-ans` key for `\item*`, `\item*[\content]`, `\item(\number)*` and `\item(\number)*[\content]` commands.

`__enumext_first_item_tmp_viii:` The `__enumext_first_item_tmp_viii:` function will remove horizontal space equal to `\labelwidth` plus `\labelsep` to the left of the “*first*” `\item` in the environment at the point of execution of this function, where it is equal to the `__enumext_stop_item_tmp_viii:` function inside the environment body definition.

```

4978 \cs_new_protected_nopar:Nn \__enumext_first_item_tmp_viii:
4979 {
4980   \skip_horizontal:n
4981   {
4982     -\__enumext_labelwidth_viii_dim - \__enumext_labelsep_viii_dim
4983   }
4984   \ignorespaces
4985 }

```

(End of definition for `__enumext_first_item_tmp_viii:`)

`__enumext_start_item_tmp_viii:` First we will call the function `__enumext_stop_item_tmp_viii:` that we will redefine later, we will increment the value of `\l__enumext_item_column_pos_viii_int` that will count the item’s by rows and `\g__enumext_item_count_all_viii_int` that will count the total of item’s in the environment. `__enumext_item_peek_args_viii:` After that we will call the function `__enumext_item_peek_args_viii:` that will handle the arguments passed to `\item`. `__enumext_joined_item_viii:w` `__enumext_standar_item_viii:w`

```

4986 \cs_new_protected_nopar:Nn \__enumext_start_item_tmp_viii:
4987 {
4988   \__enumext_stop_item_tmp_viii:
4989   \int_incr:N \l__enumext_item_column_pos_viii_int
4990   \int_gincr:N \g__enumext_item_count_all_viii_int
4991   \__enumext_item_peek_args_viii:
4992 }

```

The function `__enumext_item_peek_args_viii:` will handle the `\item(<number>)`. Look for the argument “(”, if it is present we will call the function `__enumext_joined_item_viii:w (<number>)`, which is in charge of joining the item’s in the same row, in case they are not present we will set the default value (1).

```

4993 \cs_new_protected:Nn \__enumext_item_peek_args_viii:
4994 {
4995   \peek_meaning:NTF (
4996     { \__enumext_joined_item_viii:w }
4997     { \__enumext_joined_item_viii:w (1) }
4998   }

```

The function `__enumext_joined_item_viii:w` will first call the function `__enumext_starred_joined_item_viii:n` in charge of setting the *width* of the box that will store the content passed to `\item`. Then we will look for the argument “*”, if it is present we will call the function `__enumext_starred_item_viii:w` otherwise we will call the function `__enumext_standar_item_viii:w`.

```

4999 \cs_new_protected:Npn \__enumext_joined_item_viii:w (#1)
5000 {
5001   \__enumext_starred_joined_item_viii:n {#1}
5002   \peek_meaning_remove:NTF *
5003     { \__enumext_starred_item_viii:w }
5004     { \__enumext_standar_item_viii:w }
5005 }

```

The function `__enumext_standar_item_viii:w` will first look for the argument “[”, if present it will set the state of the variable `\l__enumext_wrap_label_opt_viii_bool` equal to the state of the variable `\l__enumext_wrap_label_opt_viii_bool` handled by the key `wrap-label*` and finally execute the *non-enumerated* version `\item[<custom>]` by means of the function `__enumext_start_item_viii:w`, otherwise we will set the value of the variable `\l__enumext_wrap_label_viii_bool` handled by the `wrap-label` key to true and set the switch `\if@noitemarg` to true to execute the enumerated version of `\item` by means of the function `__enumext_start_item_viii:w [\l__enumext_label_viii_tl]`.

```

5006 \cs_new_protected:Npn \__enumext_standar_item_viii:w
5007 {
5008   \bool_set_false:N \l__enumext_item_starred_viii_bool
5009   \bool_set_false:N \l__enumext_item_wrap_key_bool
5010   \peek_meaning:NTF [
5011     {
5012       \bool_set_eq:NN \l__enumext_wrap_label_viii_bool \l__enumext_wrap_label_opt_viii_bool
5013       \__enumext_start_item_viii:w
5014     }
5015     {
5016       \bool_set_true:N \l__enumext_wrap_label_viii_bool
5017       \legacy_if_set_true:n { @noitemarg }
5018       \__enumext_start_item_viii:w [ \l__enumext_label_viii_tl ] \ignorespaces
5019     }
5020 }

```

(End of definition for `__enumext_start_item_tmp_viii:` and others.)

```
\__enumext_starred_item_viii:w
\__enumext_starred_item_viii_aux_i:w
\__enumext_starred_item_viii_aux_ii:w
\__enumext_keyans_starred_item_star:
```

The function `__enumext_starred_item_viii:w` together with the specified auxiliary functions `aux_i:w` and `aux_ii:w` execute `\item*` and `\item*[\langle content \rangle]`.

```
5021 \cs_new_protected:Npn \__enumext_starred_item_viii:w
5022 {
5023   \bool_set_true:N \l__enumext_item_starred_viii_bool
5024   \bool_set_true:N \l__enumext_item_wrap_key_bool
5025   \bool_set_true:N \l__enumext_wrap_label_viii_bool
5026   \peek_meaning:NTF [
5027     { \__enumext_starred_item_viii_aux_i:w }
5028     { \__enumext_starred_item_viii_aux_ii:w }
5029   ]
```

The function `__enumext_starred_item_viii_aux_i:w` will save the *optional argument* to `\item*` in `\l__enumext_store_current_opt_arg_tl` and will save this argument along with the spacing set by the key `save-sep` in variable `\l__enumext_store_current_label_tl` if present, then call the function `__enumext_starred_item_viii_aux_ii:w`.

```
5030 \cs_new_protected:Npn \__enumext_starred_item_viii_aux_i:w [#1]
5031 {
5032   \tl_clear:N \l__enumext_store_current_label_tl
5033   \tl_if_no_value:nF { #1 }
5034   {
5035     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_viii_tl
5036     {
5037       \tl_put_right:NV \l__enumext_store_current_label_tl \l__enumext_store_keyans_item_opt_
5038       \tl_put_right:Nn \l__enumext_store_current_label_tl { #1 }
5039     }
5040     \tl_set:Nn \l__enumext_store_current_opt_arg_tl { #1 }
5041   }
5042   \__enumext_starred_item_viii_aux_ii:w
5043 }
5044 \cs_new_protected:Npn \__enumext_starred_item_viii_aux_ii:w
5045 {
5046   \legacy_if_set_true:n { @noitemarg }
5047   \__enumext_start_item_viii:w [ \l__enumext_label_viii_tl ] \ignorespaces
5048 }
```

The function `__enumext_keyans_starred_item_star:` will be in charge of storing the current *label* for `\item*` followed by the `[\langle content \rangle]` for `\item*[\langle content \rangle]` if present in the *sequence* and *prop list* set by the `save-ans` key. In this same function the keys `show-ans`, `show-pos`, `mark-sep` and `save-ref` are implemented.

```
5049 \cs_new_protected:Nn \__enumext_keyans_starred_item_star:
5050 {
5051   \tl_put_left:Ne \l__enumext_store_current_label_tl { \l__enumext_label_viii_tl }
5052   \__enumext_store_addto_prop:V \l__enumext_store_current_label_tl
5053   \__enumext_keyans_store_ref:
5054   \tl_put_left:Nn \l__enumext_store_current_label_tl { \item }
5055   \__enumext_keyans_addto_seq_link:
5056   \int_gincr:N \g__enumext_check_starred_cmd_int
5057   \dim_compare:nNnT { \l__enumext_mark_sym_sep_viii_dim } = { \c_zero_dim }
5058   {
5059     \dim_set:Nn \l__enumext_mark_sym_sep_viii_dim { \l__enumext_labelsep_viii_dim }
5060   }
5061   \bool_if:NT \l__enumext_show_answer_bool
5062   {
5063     \tl_set_eq:NN \l__enumext_mark_answer_sym_tl \l__enumext_mark_answer_sym_viii_tl
5064     \str_set_eq:NN \l__enumext_mark_position_str \l__enumext_mark_position_viii_str
5065     \__enumext_print_keyans_box:NN
5066     \l__enumext_labelwidth_viii_dim \l__enumext_mark_sym_sep_viii_dim
5067   }
5068   \bool_if:NT \l__enumext_show_position_bool
5069   {
5070     \tl_set:Ne \l__enumext_mark_answer_sym_tl
5071     {
5072       \group_begin:
5073       \exp_not:N \normalfont
5074       \exp_not:N \footnotesize [ \int_eval:n
5075         {
5076           \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
5077         }
5078     ]
5079   }
```

```

5078         ]
5079     \group_end:
5080 }
5081 \str_set_eq:NN \l__enumext_mark_position_str \l__enumext_mark_position_viii_str
5082 \__enumext_print_keyans_box:NN
5083     \l__enumext_labelwidth_viii_dim \l__enumext_mark_sym_sep_viii_dim
5084 }
5085 }

```

(End of definition for `__enumext_starred_item_viii:w` and others.)

```

\__enumext_keyans_wrapper_label_viii:n
\__enumext_fake_make_label_viii:n

```

The implementation at this is very similar to that of the `enumext*` environment.

```

5086 \cs_new_protected:Npn \__enumext_keyans_wrapper_label_viii:n #1
5087 {
5088     \bool_lazy_all:nT
5089     {
5090         { \bool_if_p:N \l__enumext_wrap_label_viii_bool }
5091         { \bool_if_p:N \l__enumext_show_answer_bool }
5092         { \bool_if_p:N \l__enumext_item_wrap_key_bool }
5093         { \cs_if_exist_p:N \__enumext_keyans_wrapper_item_viii:n }
5094     }
5095     {
5096         \cs_set_eq:NN
5097             \__enumext_wrapper_label_viii:n \__enumext_keyans_wrapper_item_viii:n
5098     }
5099     \bool_if:NTF \l__enumext_wrap_label_viii_bool
5100     {
5101         \__enumext_wrapper_label_viii:n {#1}
5102     }
5103     { #1 }
5104 }
5105 \cs_new_protected_nopar:Npn \__enumext_fake_make_label_viii:n #1
5106 {
5107     \legacy_if:nT { @noitemarg }
5108     {
5109         \legacy_if_set_false:n { @noitemarg }
5110         \legacy_if:nT { @nmbrrlist }
5111         {
5112             \refstepcounter{enumXviii}
5113         }
5114     }
5115     \bool_if:NT \l__enumext_item_starred_viii_bool
5116     {
5117         \__enumext_keyans_starred_item_star:
5118     }
5119     \makebox[ \l__enumext_labelwidth_viii_dim ][ \l__enumext_align_label_viii_str ]
5120     {
5121         \tl_use:N \l__enumext_label_font_style_viii_tl
5122         \__enumext_keyans_wrapper_label_viii:n {#1}
5123     }
5124     \skip_horizontal:N \l__enumext_labelsep_viii_dim \ignorespaces
5125 }

```

(End of definition for `__enumext_keyans_wrapper_label_viii:n` and `__enumext_fake_make_label_viii:n`.)

13.46.2 Real definition of `\item` in `keyans*`

```

\__enumext_start_item_viii:w
\__enumext_stop_item_viii:

```

The implementation at this is very similar to that of the `enumext*` environment.

```

5126 \cs_new_protected_nopar:Npn \__enumext_start_item_viii:w [#1]
5127 {
5128     \cs_set_eq:NN \__enumext_stop_item_tmp_viii: \__enumext_stop_item_viii:
5129     \hbox_set_to_wd:Nnw \l__enumext_item_text_viii_box
5130     {
5131         \l__enumext_joined_width_viii_dim
5132         + \l__enumext_labelwidth_viii_dim
5133         + \l__enumext_labelsep_viii_dim
5134     }
5135     \__enumext_renew_footnote_starred:
5136     \__enumext_start_list_tag:n {keyans*}
5137     \__enumext_fake_make_label_viii:n {#1}
5138     \__enumext_stop_start_list_tag:
5139     \__enumext_minipage:w [ t ]{ \l__enumext_joined_width_viii_dim }

```

```

5140     \dim_set_eq:NN \parindent \l__enumext_listparindent_viii_dim
5141     \skip_set_eq:NN \parskip \l__enumext_parsep_viii_skip
5142     \__enumext_unskip_unkern:
5143     \__enumext_unskip_unkern:
5144     \skip_horizontal:n { -\l__enumext_listparindent_viii_dim } \ignorespaces
5145     \tl_use:N \l__enumext_fake_item_indent_viii_tl
5146     \bool_if:NT \l__enumext_item_starred_viii_bool
5147     {
5148         \__enumext_keyans_show_item_opt_viii:
5149     }
5150     \tl_use:N \l__enumext_after_list_args_viii_tl
5151 }
5152 \cs_new_protected_nopar:Nn \__enumext_stop_item_viii:
5153 {
5154     \__enumext_endminipage:
5155     \__enumext_stop_list_tag:n {keyans*}
5156     \hbox_set_end:
5157     \int_set:Nn \hbadness { 10000 }
5158     \box_use_drop:N \l__enumext_item_text_viii_box
5159     \int_compare:nNnTF
5160     { \l__enumext_item_column_pos_viii_int } = { \l__enumext_columns_viii_int }
5161     {
5162         \par\noindent
5163         \int_zero:N \l__enumext_item_column_pos_viii_int
5164     }
5165     {
5166         \skip_horizontal:N \l__enumext_columns_sep_viii_dim
5167     }
5168 }

```

(End of definition for __enumext_start_item_viii:w and __enumext_stop_item_viii:.)

__enumext_remove_extra_parsep_viii:

The implementation at this is very similar to that of the `enumext*` environment.

```

5169 \cs_new_protected:Nn \__enumext_remove_extra_parsep_viii:
5170 {
5171     \int_compare:nNnT
5172     {
5173         \int_mod:nn
5174         { \g__enumext_item_count_all_viii_int }
5175         { \l__enumext_columns_viii_int }
5176     }
5177     =
5178     { 0 }
5179     {
5180         \para_end:
5181         \skip_vertical:n { -\l__enumext_itemsep_viii_skip }
5182         \skip_vertical:N \c_zero_skip
5183         \int_gzero:N \g__enumext_item_count_all_viii_int
5184     }
5185 }

```

(End of definition for __enumext_remove_extra_parsep_viii:.)

13.47 The command \getkeyans

\getkeyans
 __enumext_getkeyans_aux:n
 __enumext_getkeyans:n

The `\getkeyans` command takes a *mandatory argument* of the form $\langle \textit{store name} : \textit{position} \rangle$. Retrieve a “*single content*” stored by `\anskey`, `\anspic*` and `\item*` and `anskey*` from *prop list* defined by `save-ans` key.

```

5186 \NewDocumentCommand \getkeyans { m }
5187 {
5188     \exp_args:Ne \__enumext_getkeyans_aux:n
5189     { \tl_to_str:e { \text_expand:n {#1} } }
5190 }

```

The internal function `__enumext_getkeyans_aux:n` is in charge of *splitting* the *mandatory argument* using “.”. If “.” is omitted it will return an error.

```

5191 \cs_new_protected:Npn \__enumext_getkeyans_aux:n #1
5192 {
5193     \str_if_in:nnTF {#1} { : }
5194     {
5195         \use:e
5196         {

```

```

5197         \cs_set:Npn \exp_not:N \__enumext_tmp:w ##1 \c_colon_str ##2 \scan_stop:
5198         { {##1} {##2} }
5199     }
5200     \exp_after:wN \__enumext_getkeyans:nn \__enumext_tmp:w #1 \scan_stop:
5201 }
5202 { \msg_error:nnn { enumext } { missing-colon } {#1} }
5203 }

```

The internal function `__enumext_getkeyans:nn` will check for the existence of the *prop list*, if it does not exist it will return an error message, then it will fetch the content specified by the *second argument* from *prop list*.

```

5204 \cs_new_protected:Npn \__enumext_getkeyans:nn #1 #2
5205 {
5206     \prop_if_exist:cTF { g__enumext_#1_prop }
5207     {
5208         \prop_item:cn { g__enumext_#1_prop }{#2}
5209     }
5210     {
5211         \msg_error:nnn { enumext } { undefined-storage-anskey } {#1}
5212     }
5213 }

```

(End of definition for `\getkeyans`, `__enumext_getkeyans_aux:n`, and `__enumext_getkeyans:nn`. This function is documented on page 19.)

13.48 The command `\printkeyans`

The `\printkeyans` command prints “all stored content” in the *sequence* defined by the `save-ans` key. The first thing we will do is define a set of *filtered keys* with which we will control the options of the different nesting levels for the environment `enumext` and `enumext*` by storing their values in the list of tokens `\l__enumext_print_keyans_X_tl`.

The variable `\l__enumext_print_keyans_starred_tl` will have the default *keys* for `\printkeyans*` and will be set by `\setenumext[⟨print*⟩]` and the variable `\l__enumext_print_keyans_vii_tl` will have the default keys for the environment `enumext*` nested within the *sequence* and will be set by `\setenumext[⟨print,*⟩]`, the rest of the variables will be for the environment `enumext` and will be set by `\setenumext[⟨print,level⟩]`.

```

5214 \keys_define:nn { enumext / print }
5215 {
5216     print* .code:n      = \keys_precompile:neN { enumext / enumext* }
5217                       { \__enumext_filter_save_key:n {#1} }
5218                       \l__enumext_print_keyans_starred_tl, % starred cmd
5219     print* .initial:n   = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
5220                           rightmargin=0pt, listparindent=0pt, nosep, label=\arabic*,
5221                           columns=2, first=\small, font=\small },
5222     print-1 .code:n     = \keys_precompile:neN { enumext / level-1 }
5223                       { \__enumext_filter_save_key:n {#1} }
5224                       \l__enumext_print_keyans_i_tl,
5225     print-1 .initial:n  = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
5226                           rightmargin=0pt, listparindent=0pt, nosep, label=\arabic*,
5227                           columns=2, first=\small, font=\small },
5228     print-2 .code:n     = \keys_precompile:neN { enumext / level-2 }
5229                       { \__enumext_filter_save_key:n {#1} }
5230                       \l__enumext_print_keyans_ii_tl,
5231     print-2 .initial:n  = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
5232                           rightmargin=0pt, listparindent=0pt, nosep, label=(\alph*),
5233                           first=\small, font=\small },
5234     print-3 .code:n     = \keys_precompile:neN { enumext / level-3 }
5235                       { \__enumext_filter_save_key:n {#1} }
5236                       \l__enumext_print_keyans_iii_tl,
5237     print-3 .initial:n  = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
5238                           rightmargin=0pt, listparindent=0pt, nosep, label=\roman*,
5239                           first=\small, font=\small },
5240     print-4 .code:n     = \keys_precompile:neN { enumext / level-4 }
5241                       { \__enumext_filter_save_key:n {#1} }
5242                       \l__enumext_print_keyans_iv_tl,
5243     print-4 .initial:n  = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
5244                           rightmargin=0pt, listparindent=0pt, nosep, label=\Alph*,
5245                           first=\small, font=\small },
5246     print-* .code:n     = \keys_precompile:neN { enumext / enumext* }
5247                       { \__enumext_filter_save_key:n {#1} }
5248                       \l__enumext_print_keyans_vii_tl, % starred nested

```



```

5249     print-* .initial:n = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
5250                           rightmargin=0pt, listparindent=0pt, nosep, label=\arabic*,
5251                           first=\small, font=\small },
5252   }

```

- The reason for storing $\langle keys \rangle$ in token lists using `\keys_precompile:neN` is because the keys are set via `\setenumext` but are later executed by running the command `\printkeyans` and they are not handled directly by its *optional argument*, except those related to the *first* opening level.

`\printkeyans`

`__enumext_printkeyans:nnn`

Create a user command to print “*all stored content*” in *sequence* for `\anskey`, `anskey*`, `\item*` and `\anspic*`. Within a group we will run our “*precompiled keys*” and then call the internal function `__enumext_printkeyans:nnn`.

```

5253 \NewDocumentCommand \printkeyans { s O{} m }
5254 {
5255   \group_begin:
5256     \tl_use:N \l__enumext_print_keyans_i_tl
5257     \tl_use:N \l__enumext_print_keyans_ii_tl
5258     \tl_use:N \l__enumext_print_keyans_iii_tl
5259     \tl_use:N \l__enumext_print_keyans_iv_tl
5260     \tl_use:N \l__enumext_print_keyans_vii_tl
5261     \__enumext_printkeyans:nnn { #1 } { #2 } { #3 }
5262   \group_end:
5263 }

```

The internal function `__enumext_printkeyans:nnn` will check for the existence of the *sequence*, if it does not exist it will return an error message, then it will check if not empty.

```

5264 \cs_new_protected:Npn \__enumext_printkeyans:nnn #1 #2 #3
5265 {
5266   \seq_if_exist:cTF { g__enumext_#3_seq }
5267   {
5268     \seq_if_empty:cF { g__enumext_#3_seq }
5269     {

```

If the *starred argument* ‘***’ is present we will check that the environment `enumext*` is not saved in the *sequence*, then execute the variable `\l__enumext_print_keyans_starred_tl` that contains the default $\langle keys \rangle$ for the environment `enumext*`, we set `\l__enumext_base_line_fix_bool` and `\l__enumext_print_keyans_star_bool` to true for *baseline correction*, open the `enumext*` environment passing the *optional argument* and map the *sequence*, then set `\l__enumext_base_line_fix_bool` and `\l__enumext_print_keyans_star_bool` to false.

```

5270     \bool_if:nTF {#1}
5271     {
5272       \seq_if_in:cnTF { g__enumext_#3_seq } { \end{enumext*} }
5273       {
5274         \msg_error:nnnn { enumext } { print-starred } {#3} { enumext* }
5275       }
5276       {
5277         \tl_use:N \l__enumext_print_keyans_starred_tl
5278         \bool_set_true:N \l__enumext_base_line_fix_bool
5279         \bool_set_true:N \l__enumext_print_keyans_star_bool
5280         \begin{enumext*}[#2]
5281           \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
5282           \end{enumext*}
5283           \bool_set_false:N \l__enumext_base_line_fix_bool
5284           \bool_set_false:N \l__enumext_print_keyans_star_bool
5285         }
5286       }

```

Otherwise it will open the environment `enumext` passing the *optional argument* to the “*first level*” then map the *sequence*.

```

5287       {
5288         \begin{enumext}[#2]
5289         \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
5290         \end{enumext}
5291       }
5292     }
5293   }
5294   {
5295     \msg_error:nnn { enumext } { undefined-storage-anskey } {#3}
5296   }
5297 }

```

(End of definition for `\printkeyans` and `__enumext_printkeyans:nnn`. This function is documented on page 20.)

13.49 The command \setenumext

The command `\setenumext` will be in charge of managing the $\langle keys \rangle$ passed to all environments and to the `\printkeyans` command. We must take precautions with the `enumext*` environment and “*first level*” of the `enumext` environment so as not to capture $\langle keys \rangle$ that complicate us.

```

\__enumext_filter_first_level:n
\__enumext_filter_first_level_key:n
\__enumext_filter_first_level_pair:nn

```

The function `__enumext_filter_first_level:n` will be in charge of filtering the $\langle keys \rangle$ passed to the environment `enumext*` and “*first level*” of the environment `enumext`.

```

5298 \cs_new:Npn \__enumext_filter_first_level:n #1
5299 {
5300   \use:e
5301   {
5302     \keyval_parse:NNn
5303     \__enumext_filter_first_level_key:n
5304     \__enumext_filter_first_level_pair:nn {#1}
5305   }
5306 }

```

The function `__enumext_filter_first_level_key:n` will be responsible for filtering the $\langle keys \rangle$ that are passed “*without value*” by excluding the keys `resume` and `resume*`.

```

5307 \cs_new:Npn \__enumext_filter_first_level_key:n #1
5308 {
5309   \str_case:nnF {#1}
5310   {
5311     { resume } {}
5312     { resume* } {}
5313   }
5314   { , { \exp_not:n {#1} } }
5315 }

```

The function `__enumext_filter_first_level_pair:nn` will be responsible for filtering the $\langle keys \rangle$ that are passed “*with value*” by excluding the `series`, `resume` and `save-ans` keys.

```

5316 \cs_new:Npn \__enumext_filter_first_level_pair:nn #1#2
5317 {
5318   \str_case:nnF {#1}
5319   {
5320     { series } {}
5321     { resume } {}
5322     { save-ans } {}
5323   }
5324   { , { \exp_not:n {#1} } = { \exp_not:n {#2} } }
5325 }

```

(End of definition for `__enumext_filter_first_level:n`, `__enumext_filter_first_level_key:n`, and `__enumext_filter_first_level_pair:nn`.)

Now define a “*meta families*” of $\langle keys \rangle$ to access from `\setenumext`.

```

5326 \keys_define:nn { enumext / meta-families }
5327 {
5328   enumext-1 .code:n =
5329   {
5330     \keys_set:ne { enumext / level-1 }
5331     {
5332       \__enumext_filter_first_level:n {#1}
5333     }
5334   } ,
5335   enumext-2 .code:n = { \keys_set:nn { enumext / level-2 } {#1} } ,
5336   enumext-3 .code:n = { \keys_set:nn { enumext / level-3 } {#1} } ,
5337   enumext-4 .code:n = { \keys_set:nn { enumext / level-4 } {#1} } ,
5338   keyans .code:n = { \keys_set:nn { enumext / keyans } {#1} } ,
5339   enumext* .code:n =
5340   {
5341     \keys_set:ne { enumext / enumext* }
5342     {
5343       \__enumext_filter_first_level:n {#1}
5344     }
5345   } ,
5346   keyans* .code:n = { \keys_set:nn { enumext / keyans* } {#1} } ,
5347   print* .code:n = { \keys_set:nn { enumext / print } { print* = {#1} } } ,
5348   print-1 .code:n = { \keys_set:nn { enumext / print } { print-1 = {#1} } } ,
5349   print-2 .code:n = { \keys_set:nn { enumext / print } { print-2 = {#1} } } ,
5350   print-3 .code:n = { \keys_set:nn { enumext / print } { print-3 = {#1} } } ,
5351   print-4 .code:n = { \keys_set:nn { enumext / print } { print-4 = {#1} } } ,

```

```

5352     print-* .code:n = { \keys_set:nn { enumext / print } { print-* = {#1} } } ,
5353     unknown .code:n = { \msg_error:nn { enumext } { unknown-key-family } } ,
5354 }

```

We store them in the constant sequence `\c__enumext_all_families_seq` separated by commas.

```

5355 \seq_const_from_clist:Nn \c__enumext_all_families_seq
5356 {
5357     enumext-1, enumext-2, enumext-3, enumext-4, keyans, enumext*,
5358     keyans*, print-1, print-2, print-3, print-4, print-*, print*,
5359 }

```

`\setenumext` Now we define the user command `\setenumext`.

```

\__enumext_set_parse:n
\__enumext_set_error:nn
5360 \NewDocumentCommand \setenumext { 0{enumext,1} +m }
5361 {
5362     \seq_clear:N \l__enumext_setkey_tmpa_seq
5363     \seq_set_from_clist:Nn \l__enumext_setkey_tmpb_seq {#1}
5364     \int_set:Nn \l__enumext_setkey_tmpa_int
5365     {
5366         \seq_count:N \l__enumext_setkey_tmpb_seq
5367     }
5368     \int_compare:nNnTF { \l__enumext_setkey_tmpa_int } > { 1 }
5369     {
5370         \seq_pop_left:NN \l__enumext_setkey_tmpb_seq \l__enumext_setkey_tmpa_tl
5371         \seq_map_function:NN \l__enumext_setkey_tmpb_seq \__enumext_set_parse:n
5372         \seq_set_map_e:NNn \l__enumext_setkey_tmpa_seq \l__enumext_setkey_tmpa_seq
5373         {
5374             \tl_use:N \l__enumext_setkey_tmpa_tl - ##1
5375         }
5376     }
5377     {
5378         \seq_put_right:Ne \l__enumext_setkey_tmpa_seq { \tl_trim_spaces:n {#1} }
5379     }
5380     \seq_if_empty:NNTF \l__enumext_setkey_tmpa_seq
5381     { \seq_map_inline:Nn \c__enumext_all_families_seq }
5382     { \seq_map_inline:Nn \l__enumext_setkey_tmpa_seq }
5383     {
5384         \keys_set:nn { enumext / meta-families } { ##1 = {#2} }
5385     }
5386 }

```

Internal functions used by the `\setenumext` command.

```

5387 \cs_new_protected:Npn \__enumext_set_parse:n #1
5388 {
5389     \tl_set:Ne \l__enumext_setkey_tmpb_tl { \tl_trim_spaces:n {#1} }
5390     \clist_map_inline:nn { 0, 1, 2, 3, 4, * } % <- max level
5391     { \tl_remove_all:Nn \l__enumext_setkey_tmpb_tl {##1} }
5392     \tl_if_empty:NNTF \l__enumext_setkey_tmpb_tl
5393     {
5394         \seq_put_right:Ne \l__enumext_setkey_tmpa_seq
5395         { \tl_trim_spaces:n {#1} }
5396     }
5397     { \__enumext_set_error:nn {#1} { } }
5398 }
5399 \cs_new_protected:Npn \__enumext_set_error:nn #1 #2
5400 { \msg_error:nnn { enumext } { invalid-key } {#1} {#2} }

```

(End of definition for `\setenumext`, `__enumext_set_parse:n`, and `__enumext_set_error:nn`. This function is documented on page 6.)

13.50 The command `\setenumextmeta`

The command `\setenumextmeta` will be responsible for adding new “meta-keys” for the `enumext` and `enumext*` environments. The implementation code was given by Jonathan P. Spratte (@Skillmon) answer in [Add .meta key to existing keys \(l3keys\)](#).

`\setenumextmeta` First we will create a prop list `\c__enumext_meta_paths_prop` to handle the *optional argument*.

```

\c__enumext_meta_paths_prop
\__enumext_add_meta_key:nnn
\__enumext_def_meta_key:nnn
\__enumext_def_meta_key:Vnn
5401 \prop_const_from_keyval:Nn \c__enumext_meta_paths_prop
5402 {
5403     {enumext,1} = level-1,
5404     {enumext,2} = level-2,
5405     {enumext,3} = level-3,
5406     {enumext,4} = level-4,

```

```

5407     {enumext*} = enumext*
5408 }

```

Now we create the user command taking care that unknown cannot be passed as an argument.

```

5409 \NewDocumentCommand \setenumextmeta { s O{enumext,1} m +m }
5410 {
5411   \str_if_eq:eeTF { \tl_trim_spaces:n {#3} } { unknown }
5412   { \msg_error:nn { enumext } { prohibited-unknown } }
5413   {
5414     \bool_if:nTF {#1}
5415     {
5416       \int_step_inline:nn { 4 }
5417       { \__enumext_add_meta_key:nnn { enumext, ##1 } {#3} {#4} }
5418       \__enumext_add_meta_key:nnn { enumext* } {#3} {#4}
5419     }
5420     { \__enumext_add_meta_key:nnn {#2} {#3} {#4} }
5421   }
5422 }

```

The internal functions `__enumext_add_meta_key:nnn` and `__enumext_def_meta_key:nnn` will check the *optional argument* and create the “*meta-key*”.

```

5423 \cs_new_protected:Npn \__enumext_add_meta_key:nnn #1
5424 {
5425   \tl_set:Nn \l__enumext_meta_path_tl {#1}
5426   \tl_replace_all:Nnn \l__enumext_meta_path_tl {~} {}
5427   \prop_get:NVNTF
5428   \c__enumext_meta_paths_prop \l__enumext_meta_path_tl \l__enumext_meta_path_tl
5429   { \__enumext_def_meta_key:Vnn \l__enumext_meta_path_tl }
5430   {
5431     \msg_error:nnn { enumext } { unknown-set } {#1}
5432     \use_none:nn
5433   }
5434 }
5435 \cs_new_protected:Npn \__enumext_def_meta_key:nnn #1#2#3
5436 {
5437   \bool_lazy_or:nnTF
5438   { \keys_if_exist_p:nn { enumext / #1 } {#2} }
5439   { \keys_if_exist_p:nn { enumext / enumext* } {#2} }
5440   { \msg_error:nnn { enumext } { already-defined } {#2} }
5441   {
5442     \keys_define:nn { enumext / #1 }
5443     {
5444       #2 .meta:n = {#3},
5445       #2 .value_forbidden:n = true
5446     }
5447   }
5448 }
5449 \cs_generate_variant:Nn \__enumext_def_meta_key:nnn { V }

```

(End of definition for `\setenumextmeta` and others. This function is documented on page 6.)

13.51 The command `\foreachkeyans`

The command `\foreachkeyans` will execute a *loop* over the *prop list* and return its contents. The implementation code is adapted from the answer provided by Enrico Gregorio (@egreg) in [Expand a .cs defined by key inside the function](#).

`\foreachkeyans`

```

\__enumext_parse_foreach_keys:nn
\__enumext_parse_foreach_keys:n
\__enumext_foreach_keyans:nn
\__enumext_foreach_add_body:n

```

We define a set of *⟨keys⟩* for command and we will save the default values of these in `\g__enumext_foreach_default_keys_tl` to avoid the use of group.

```

5450 \keys_define:nn { enumext / foreach }
5451 {
5452   before .tl_set:N = \l__enumext_foreach_before_tl,
5453   before .value_required:n = true,
5454   after .tl_set:N = \l__enumext_foreach_after_tl,
5455   after .value_required:n = true,
5456   start .int_set:N = \l__enumext_foreach_start_int,
5457   start .value_required:n = true,
5458   stop .int_set:N = \l__enumext_foreach_stop_int,
5459   stop .value_required:n = true,
5460   step .int_set:N = \l__enumext_foreach_step_int,
5461   step .value_required:n = true,
5462   wrapper .cs_set_protected:Np = \__enumext_foreach_wrapper:n #1,
5463   wrapper .value_required:n = true,

```

```

5464     sep      .tl_set:N = \l__enumext_foreach_sep_tl,
5465     sep      .value_required:n = true,
5466     unknown .code:n    = { \l__enumext_parse_foreach_keys:n {#1} }
5467   }
5468   \keys_precompile:nnN { enumext / foreach }
5469   {
5470     before={},after={},start=1,step=1,stop=0,wrapper=#1,sep={; }
5471   }
5472   \l__enumext_foreach_default_keys_tl

```

Functions for handling unknown $\langle keys \rangle$.

```

5473   \cs_new_protected:Npn \l__enumext_parse_foreach_keys:nn #1#2
5474   {
5475     \tl_if_blank:nTF {#2}
5476     {
5477       \msg_error:nnn { enumext } { for-key-unknown } {#1}
5478     }
5479     {
5480       \msg_error:nnnn { enumext } { for-key-value-unknown } {#1} {#2}
5481     }
5482   }
5483   \cs_new_protected:Npn \l__enumext_parse_foreach_keys:n #1
5484   {
5485     \exp_args:NV \l__enumext_parse_foreach_keys:nn \l_keys_key_str {#1}
5486   }

```

We create the command.

```

5487   \NewDocumentCommand \foreachkeyans { +0{ } m }
5488   {
5489     \l__enumext_foreach_keyans:nn {#1} {#2}
5490   }

```

Finally the internal functions $\l__enumext_foreach_keyans:nn$ and $\l__enumext_foreach_add_body:n$ will loop through the prop list and print the contents.

```

5491   \cs_new_protected:Npn \l__enumext_foreach_keyans:nn #1 #2
5492   {
5493     \tl_use:N \l__enumext_foreach_default_keys_tl
5494     \keys_set:nn { enumext / foreach } {#1}
5495     \tl_set:Nn \l__enumext_foreach_name_prop_tl {#2}
5496     \prop_if_exist:cF { g__enumext_#2_prop }
5497     {
5498       \msg_error:nnn { enumext } { undefined-storage-anskey } {#2}
5499     }
5500     \int_compare:nNnT { \l__enumext_foreach_stop_int } = { 0 }
5501     {
5502       \int_set:Nn \l__enumext_foreach_stop_int
5503       { \prop_count:c { g__enumext_#2_prop } }
5504     }
5505     \seq_clear:N \l__enumext_foreach_print_seq
5506     \int_step_function:nnnN
5507     { \l__enumext_foreach_start_int }
5508     { \l__enumext_foreach_step_int }
5509     { \l__enumext_foreach_stop_int }
5510     \l__enumext_foreach_add_body:n
5511     \seq_use:NV \l__enumext_foreach_print_seq \l__enumext_foreach_sep_tl
5512   }
5513   \cs_new_protected:Npn \l__enumext_foreach_add_body:n #1
5514   {
5515     \seq_put_right:Ne \l__enumext_foreach_print_seq
5516     {
5517       \exp_not:V \l__enumext_foreach_before_tl
5518       \l__enumext_foreach_wrapper:n
5519       {
5520         \prop_item:cn { g__enumext_ \l__enumext_foreach_name_prop_tl _prop }{#1}
5521       }
5522       \exp_not:V \l__enumext_foreach_after_tl
5523     }
5524   }

```

(End of definition for \lforeachkeyans and others. This function is documented on page 19.)

13.52 Messages

Message used by package-load for **multicol** and **hyperref** packages.

```

5525 \msg_new:nnn { enumext } { package-load }
5526 {
5527   The~'#1'~package~is~already~loaded.
5528 }
5529 \msg_new:nnn { enumext } { package-not-load }
5530 {
5531   The~'#1'~package~will~be~loaded~as~a~dependency.
5532 }
5533 \msg_new:nnn { enumext } { package-load-foot }
5534 {
5535   The~'#1'~package~is~loaded~with~the~option~'#2'.
5536 }
```

Message used in the creation of counters by **enumext** package.

```

5537 \msg_new:nnn { enumext } { counters }
5538 {
5539   The~counter~'#1'~is~already~defined~by~some~\\
5540   package~or~macro,~it~cannot~be~continued.
5541 }
```

Message used by **align** and **mark-pos** keys.

```

5542 \msg_new:nnn { enumext } { unknown-choice }
5543 {
5544   The~value~'#3'~for~'#1'~key~is~invalid~use~('#2').
5545 }
```

Message used by reserved **anskey*** environment by **enumext** package.

```

5546 \msg_new:nnnn { enumext } { anskey-env-error }
5547 {
5548   The~environment~'#1'~is~reserved~by ~\\
5549   'enumext'~package,~It~is~already~defined.
5550 }
5551 {
5552   The~environment~'#1'~is~defined~internally ~
5553   for~the~'save-ans'~key~with~save-ans~key~active.~See~documentation.\\
5554 }
5555 \msg_new:nnn { enumext } { anskey-env-nested }
5556 {
5557   The~#1~'#2'~can't~be~nested~\msg_line_context:.
5558 }
```

Message used in the creation of *prop list* by **enumext** package.

```

5559 \msg_new:nnn { enumext } { store-prop }
5560 {
5561   *~Package~enumext:~Creating ~
5562   \c_backslash_str g__enumext_#1_prop~\msg_line_context:.
5563 }
5564 \msg_new:nnn { enumext } { store-seq }
5565 {
5566   *~Package~enumext:~Creating ~
5567   \c_backslash_str g__enumext_#1_seq~\msg_line_context:.
5568 }
5569 \msg_new:nnn { enumext } { store-int }
5570 {
5571   *~Package~enumext:~Creating ~
5572   \c_backslash_str g__enumext_resume_#1_int~\msg_line_context:.
5573 }
5574 \msg_new:nnn { enumext } { prop-seq-int-hook }
5575 {
5576   *~Package~enumext:~Elements~in ~
5577   \c_backslash_str g__enumext_#1_prop~=#2.\\
5578   *~Package~enumext:~Elements~in ~
5579   \c_backslash_str g__enumext_#1_seq~=#3.\\
5580   *~Package~enumext:~Value~off ~
5581   \c_backslash_str g__enumext_resume_#1_int~=#4.
5582 }
5583 \msg_new:nnn { enumext } { item-answer-hook }
5584 {
5585   *~Package~enumext:~Value~off ~
5586   \c_backslash_str g__enumext_item_number_int~=#1.\\
```

```

5587     *~Package~enumext:~Value~off ~
5588     \c_backslash_str g__enumext_item_anskey_int~=#2.\\
5589     *~Package~enumext:~Difference~item_number_int~-~item_anskey_int~=#3.
5590 }

```

Message used by [*key = val*] system and `\setenumext` command.

```

5591 \msg_new:nnn { enumext } { invalid-key }
5592 {
5593     The~key~'#1'~is~not~know~the~level~#2.
5594 }
5595 \msg_new:nnn { enumext } { unknown-key-family }
5596 {
5597     Unknown~key~family~`\l_keys_key_str'~for~enumext.
5598 }

```

Messages used in length calculation.

```

5599 \msg_new:nnn { enumext } { width-negative }
5600 {
5601     Ignoring~negative~value~'#1=#2'~\msg_line_context:.\
5602     The~key~'#1'~ accepts~values ~>~0pt.
5603 }
5604 \msg_new:nnn { enumext } { width-zero }
5605 {
5606     Invalid~'#1=#2'~\msg_line_context:.\
5607     The~key~'#1'~ accepts~values ~>~0pt.
5608 }

```

Messages used by `show-length` key in `enumext`.

```

5609 \msg_new:nnn { enumext } { list-lengths }
5610 {
5611     ****~Lengths~used~by~'enumext'~level~'#2'~\msg_line_context:~\c_space_tl ****\\
5612     \__enumext_show_length:nnn { dim } { labelsep } {#1}
5613     \__enumext_show_length:nnn { dim } { labelwidth } {#1}
5614     \__enumext_show_length:nnn { dim } { itemindent } {#1}
5615     \__enumext_show_length:nnn { dim } { leftmargin } {#1}
5616     \__enumext_show_length:nnn { dim } { rightmargin } {#1}
5617     \__enumext_show_length:nnn { dim } { listparindent } {#1}
5618     \__enumext_show_length:nnn { skip } { topsep } {#1}
5619     \__enumext_show_length:nnn { skip } { parsep } {#1}
5620     \__enumext_show_length:nnn { skip } { partopsep } {#1}
5621     \__enumext_show_length:nnn { skip } { itemsep } {#1}
5622     ****~
5623 }

```

Messages used by `show-length` key in `enumext*`, `keyans*` and `keyans`.

```

5624 \msg_new:nnn { enumext } { list-lengths-not-nested }
5625 {
5626     ****~Lengths~used~by~'#2'~environment~\msg_line_context:~\c_space_tl ****\\
5627     \__enumext_show_length:nnn { dim } { labelsep } {#1}
5628     \__enumext_show_length:nnn { dim } { labelwidth } {#1}
5629     \__enumext_show_length:nnn { dim } { itemindent } {#1}
5630     \__enumext_show_length:nnn { dim } { leftmargin } {#1}
5631     \__enumext_show_length:nnn { dim } { rightmargin } {#1}
5632     \__enumext_show_length:nnn { dim } { listparindent } {#1}
5633     \__enumext_show_length:nnn { skip } { topsep } {#1}
5634     \__enumext_show_length:nnn { skip } { parsep } {#1}
5635     \__enumext_show_length:nnn { skip } { partopsep } {#1}
5636     \__enumext_show_length:nnn { skip } { itemsep } {#1}
5637     ****~
5638 }

```

Messages used by `ref` key.

```

5639 \msg_new:nnn { enumext } { key-ref-empty }
5640 {
5641     Key~'ref'~need~a~value~in~'#1'~ \msg_line_context:.
5642 }

```

Messages used by `save-ans` key.

```

5643 \msg_new:nnn { enumext } { save-ans-empty }
5644 {
5645     Key~'save-ans'~need~a~value~in~'#1'~ \msg_line_context:.
5646 }
5647 \msg_new:nnn { enumext } { save-ans-log }
5648 {

```



```

5649     *~Package~enumext:~Start~#1\c_space_tl with~save-ans=#2~\msg_line_context:.
5650   }
5651   \msg_new:nnn { enumext } { save-ans-log-hook }
5652   {
5653     *~Package~enumext:~Stop~#1\c_space_tl with~save-ans=#2~\msg_line_context:.
5654   }
5655   \msg_new:nnn { enumext } { save-ans-hook }
5656   {
5657     Stop~storing~for~'save-ans=#1'~\msg_line_context:.
5658   }

```

Messages used by the internal system to check answer used by `check-ans` key.

```

5659   \msg_new:nnn { enumext } { need-save-ans }
5660   {
5661     Key~'#1'~ works~only~with~the~'save-ans'~key~in~'#2'~ \msg_line_context:.
5662   }
5663   \msg_new:nnn { enumext } { items-same-answer }
5664   {
5665     *****\
5666     *~Package~enumext:~Checking~answers~in~'#1' ~
5667     for~\c_left_brace_str #2 \c_right_brace_str\
5668     *~started~#3~and~close~\msg_line_context: : ~
5669     'OK',~all~items~with~answer.\
5670     *****
5671   }
5672   \msg_new:nnn { enumext } { item-greater-answer }
5673   {
5674     Checking~answers~in~'#1'~for~\c_left_brace_str #2 \c_right_brace_str\
5675     started~#3~and~close~\msg_line_context: : ~'NOT~OK'\
5676     Items~>~Answers.
5677   }
5678   \msg_new:nnn { enumext } { item-less-answer }
5679   {
5680     Checking~answers~in~'#1'~for~\c_left_brace_str #2 \c_right_brace_str\
5681     started~#3~and~close~\msg_line_context: : ~'NOT~OK'\
5682     Items~<~Answers.
5683   }

```

Messages used by the internal system to check for “starred” `\item*` and `\anspic*` commands.

```

5684   \msg_new:nnn { enumext } { missing-starred }
5685   {
5686     Missing~'\c_backslash_str #1'~#2.
5687   }
5688   \msg_new:nnn { enumext } { many-starred }
5689   {
5690     Many~'\c_backslash_str #1'~#2.
5691   }

```

Messages used by `\printkeyans*` command.

```

5692   \msg_new:nnn { enumext } { print-starred }
5693   {
5694     \c_backslash_str printkeyans*:~ The~sequence~'#1'~already~contains ~
5695     #2~environment~ \msg_line_context:.
5696   }

```

Message for the nesting depth of the environment `enumext`.

```

5697   \msg_new:nnn { enumext } { list-too-deep }
5698   {
5699     Too~deep~nesting ~for~'enumext'~\msg_line_context:~ \
5700     The~maximum ~level ~of ~nesting ~is~4.
5701   }

```

Messages used by `\anskey`, `anskey*` and `\anspic` commands.

```

5702   \msg_new:nnn { enumext } { anskey-unnumber-item }
5703   {
5704     Can't~store~with~a~unnumbered~\c_backslash_str item~\msg_line_context:.
5705   }
5706   \msg_new:nnn { enumext } { anskey-already-stored }
5707   {
5708     Content~already~stored~for~this~\c_backslash_str item~\msg_line_context:.
5709   }
5710   \msg_new:nnn { enumext } { anskey-empty-arg }
5711   {

```

```

5712     Can't~store~empty~content~\msg_line_context:.
5713 }
5714 \msg_new:nnn { enumext } { anskey-wrong-place }
5715 {
5716     Wrong~place~for~command~'\c_backslash_str #1'~\msg_line_context:.~ \\
5717     '\c_backslash_str #1'~works~in~the~environment~'#2'.
5718 }
5719 \msg_new:nnn { enumext } { anskey-nested }
5720 {
5721     The~command~\c_backslash_str anskey~ can't~be~nested~\msg_line_context:.
5722 }
5723 \msg_new:nnn { enumext } { anskey-math-mode }
5724 {
5725     #1~can't~work~in~math~mode~\msg_line_context:.
5726 }
5727 \msg_new:nnn { enumext } { anskey-env-wrong }
5728 {
5729     The~environment~anskey*~cannot~use~in~'#1'~\msg_line_context:.
5730 }
5731 \msg_new:nnn { enumext } { anskey-wrong-place }
5732 {
5733     Wrong~place~for~command~'\c_backslash_str #1'~\msg_line_context:.~ \\
5734     '\c_backslash_str #1'~works~in~the~environment~'#2'.
5735 }
5736 \msg_new:nnn { enumext } { command-wrong-place }
5737 {
5738     Wrong~place~for~command~'\c_backslash_str #1'~\msg_line_context:.~ \\
5739     '\c_backslash_str #1'~works~outside~the~environment~'#2'.
5740 }
5741 \msg_new:nnnn { enumext } { anskey-env-key-unknown }
5742 {
5743     The~key~'#1'~is~unknown~by~environment~
5744     'anskey*~and~is~being~ignored.
5745 }
5746 {
5747     The~environment~'anskey*~does~not~have~a~key~called ~'#1'.\\
5748     Check~that~you~have~spelled~the~key~name~correctly.
5749 }
5750 \msg_new:nnnn { enumext } { anskey-env-key-value-unknown }
5751 {
5752     The~key~'#1=#2'~is~unknown~by~environment ~
5753     'anskey*~and~is~being~ignored.
5754 }
5755 {
5756     The~environment~'anskey*~does~not~have~a~key~called ~'#1'.\\
5757     Check~that~you~have~spelled~the~key~name~correctly.
5758 }
5759 \msg_new:nnnn { enumext } { anskey-cmd-key-unknown }
5760 { The~key~'#1'~is~unknown~by~'\c_backslash_str anskey'~and~is~being~ignored. }
5761 {
5762     The~command ~'\c_backslash_str anskey'~does~not~have~a~key~called ~'#1'.\\
5763     Check~that~you~have~spelled~the~key~name~correctly.
5764 }
5765 \msg_new:nnnn { enumext } { anskey-cmd-key-value-unknown }
5766 { The~key~'#1=#2'~is~unknown~by~'\c_backslash_str anskey'~and~is~being~ignored. }
5767 {
5768     The~command~'\c_backslash_str anskey'~does~not~have~a~key~called ~'#1'.\\
5769     Check~that~you~have~spelled~the~key~name~correctly.
5770 }
5771 \msg_new:nnn { enumext } { overwrite-file }
5772 {
5773     Overwriting~file~'#1'.
5774 }
5775 \msg_new:nnn { enumext } { writing-file }
5776 {
5777     Writing~file~'#1'.
5778 }
5779 \msg_new:nnn { enumext } { not-writing }
5780 {
5781     File~`#1'~already~exists.~Not~writing.
5782 }

```

Messages used by `keyans`, `keyans*` and `keyanspic` environment.

```

5783 \msg_new:nnn { enumext } { keyans-nested }
5784 {
5785   The~environment~'keyans'~can't~be ~nested ~\msg_line_context:.
5786 }
5787 \msg_new:nnn { enumext } { keyans-wrong-level }
5788 {
5789   Wrong~level~position~for~'keyans'~\msg_line_context:.~ \\
5790   The~environment~'keyans'~can~only~be~in~the~first~level.
5791 }
5792 \msg_new:nnn { enumext } { wrong-place }
5793 {
5794   Wrong~place~for~'#1'~environment ~\msg_line_context:.~ \\
5795   '#1'~is~only~found~with~'#2'~ in ~ 'enumext.
5796 }
5797 \msg_new:nnn { enumext } { keyanspic-nested }
5798 {
5799   The~environment~'keyanspic'~can't~be ~nested~ \msg_line_context:.~.
5800 }
5801 \msg_new:nnn { enumext } { keyanspic-wrong-level }
5802 {
5803   Wrong~level~position~for~'keyanspic'~\msg_line_context:.~ \\
5804   The~environment~'keyans'~can~only~be~in~the~first~level.
5805 }
5806 \msg_new:nnn { enumext } { keyanspic-item-cmd }
5807 {
5808   Can't~use ~\c_backslash_str item~in~keyanspic~\msg_line_context:.
5809 }
5810 \msg_new:nnnn { enumext } { keyans-unknown-key }
5811 {
5812   The~key~'#1'~is~unknown~by~environment~
5813   '\l__enumext_envir_name_tl'~and~is~being~ignored.
5814 }
5815 {
5816   The~environment~'\l__enumext_envir_name_tl'~does~not
5817   ~have~a~key~called ~'#1'.\\
5818   Check~that~you~have~spelled~the~key~name~correctly.
5819 }
5820 \msg_new:nnnn { enumext } { keyans-unknown-key-value }
5821 {
5822   The~key~'#1=#2'~is~unknown~by~environment ~
5823   '\l__enumext_envir_name_tl'~and~is~being~ignored.
5824 }
5825 {
5826   The~environment~'\l__enumext_envir_name_tl'~does~not
5827   ~have~a~key~called ~'#1'.\\
5828   Check~that~you~have~spelled~the~key~name~correctly.
5829 }

```

Message used by unknown *(keys)* in `enumext*`. environment.

```

5830 \msg_new:nnnn { enumext } { starred-unknown-key }
5831 {
5832   The~key~'#1'~is~unknown~by~environment~
5833   '\l__enumext_envir_name_tl'~and~is~being~ignored.
5834 }
5835 {
5836   The~environment~'\l__enumext_envir_name_tl'~does~not
5837   ~have~a~key~called ~'#1'.\\
5838   Check~that~you~have~spelled~the~key~name~correctly.
5839 }
5840 \msg_new:nnnn { enumext } { starred-unknown-key-value }
5841 {
5842   The~key~'#1=#2'~is~unknown~by~environment ~
5843   '\l__enumext_envir_name_tl'~and~is~being~ignored.
5844 }
5845 {
5846   The~environment~'\l__enumext_envir_name_tl'~does~not
5847   ~have~a~key~called ~'#1'.\\
5848   Check~that~you~have~spelled~the~key~name~correctly.
5849 }

```

Message used by unknown *(keys)* in `enumext` environment.

```

5850 \msg_new:nnnn { enumext } { standar-unknown-key }
5851 {
5852   The~key~'#1'~is~unknown~by~environment~'\l__enumext_envir_name_tl' \c_space_tl
5853   ~on~level~\int_use:N \l__enumext_level_int \c_space_tl and~is~being~ignored.
5854 }
5855 {
5856   The~environment~'\l__enumext_envir_name_tl'~does~not
5857   ~have~a~key~called ~'#1'~on~level~\int_use:N \l__enumext_level_int.\\
5858   Check~that~you~have~spelled~the~key~name~correctly.
5859 }
5860 \msg_new:nnnn { enumext } { standar-unknown-key-value }
5861 {
5862   The~key~'#1=#2'~is~unknown~by~environment~'\l__enumext_envir_name_tl' \c_space_tl
5863   ~on~level~\int_use:N \l__enumext_level_int \c_space_tl and~is~being~ignored.
5864 }
5865 {
5866   The~environment~'\l__enumext_envir_name_tl'~does~not
5867   ~have~a~key~called ~'#1'~on~level~\int_use:N \l__enumext_level_int.\\
5868   Check~that~you~have~spelled~the~key~name~correctly.
5869 }

```

Message used by unknown *(keys)* in `\foreachkeyans`.

```

5870 \msg_new:nnnn { enumext } { for-key-unknown }
5871 { The~key~'#1'~is~unknown~by~'\c_backslash_str foreachkeyans'~and~is~being~ignored.}
5872 {
5873   The~command~'\c_backslash_str foreachkeyans'~does~not~have~a~key~called~'#1'.\\
5874   Check~that~you~have~spelled~the~key~name~correctly.
5875 }
5876 \msg_new:nnnn { enumext } { for-key-value-unknown }
5877 { The~key~'#1=#2'~is~unknown~by~'\c_backslash_str foreachkeyans'~and~is~being~ignored. }
5878 {
5879   The~command~'\c_backslash_str foreachkeyans'~does~not~have~a~key~called~'#1'.\\
5880   Check~that~you~have~spelled~the~key~name~correctly.
5881 }

```

Messages used by `\getkeyans` command.

```

5882 \msg_new:nnn { enumext } { undefined-storage-anskey }
5883 {
5884   Storage~named~'#1'~is~not~defined~\msg_line_context:.
5885 }

```

Messages used by `\miniright` command.

```

5886 \msg_new:nnn { enumext } { missing-miniright }
5887 {
5888   Missing~'\c_backslash_str miniright'~in~\msg_line_context:.\\
5889   The~key~'mini-env'~need~'\c_backslash_str miniright'.
5890 }
5891 \msg_new:nnn { enumext } { wrong-miniright-place }
5892 {
5893   Wrong~place~for~'\c_backslash_str miniright'~\msg_line_context:~ \\
5894   Works~in~'enumext'~and~'keyans'~with~key~'mini-env'.
5895 }
5896 \msg_new:nnn { enumext } { wrong-miniright-use }
5897 {
5898   Wrong~use~for~'\c_backslash_str miniright'~\msg_line_context:~ \\
5899   '\c_backslash_str miniright'~need~a~key~'mini-env'.
5900 }
5901 \msg_new:nnn { enumext } { wrong-miniright-starred }
5902 {
5903   Can't~use ~\c_backslash_str miniright~in~starred~environments~\msg_line_context:.
5904 }
5905 \msg_new:nnn { enumext } { many-miniright-used }
5906 {
5907   Can't~use ~\c_backslash_str miniright~more~than~once~ \msg_line_context:.
5908 }

```

Messages used by `\setenumextmeta` command.

```

5909 \msg_new:nnn { enumext } { unknown-set }
5910 {
5911   Argument~[#1]~is~unknown~by~ \c_backslash_str setenumextmeta~\msg_line_context:.
5912 }
5913 \msg_new:nnn { enumext } { already-defined }
5914 {

```

```

5915     The~key~'#1'~is~already~defined~\msg_line_context:.
5916   }
5917   \msg_new:nnn { enumext } { prohibited-unknown }
5918   {
5919     The~name~'unknown'~can't~be~chosen~ for~a~meta~key~\msg_line_context:.
5920   }

```

Messages used by `enumext*` and `keyans*` environments.

```

5921   \msg_new:nnn { enumext } { nested }
5922   {
5923     The~environment~\l__enumext_envir_name_tl \c_space_tl can't~be~nested~\msg_line_context:.
5924   }
5925   \msg_new:nnn { enumext } { nested-horizontal }
5926   {
5927     The~environment~\l__enumext_envir_name_tl \c_space_tl can't~be~nested~in~'#1'~ \msg_line_cont
5928   }
5929   \msg_new:nnn { enumext } { item-joined }
5930   {
5931     Items~joined~(#1)~>~#2 ~columns ~\msg_line_context:.
5932   }
5933   \msg_new:nnn { enumext } { item-joined-columns }
5934   {
5935     Not~space~to~join~items~(#1)~>~#2 ~\msg_line_context:.
5936   }

```

13.53 Finish package

Finish package implementation.

```

5937   \file_input_stop:
5938   </package>

```

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