

# enumext

ENUMERATE EXERCISE SHEETS

V1.3 2025-06-01<sup>\*</sup>

©2024–2025 by Pablo González<sup>†</sup>

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  $\text{\LaTeX}$  team for their great work and to the different members of the  $\text{\TeX-SX}$  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 (lpl), version 1.3 or later (<https://www.latex-project.org/lpl.txt>). The software has the status “maintained”.  
The enumext package loads and requires multicol[3] package, need to have a modern T<sub>E</sub>X distribution such as T<sub>E</sub>X Live or MiK<sub>T</sub>TeX. It has been tested with the standard classes provided by L<sup>A</sup>T<sub>E</sub>X: book, report, article and letter on 10pt, 11pt and 12pt.

The minimum requirement is L<sup>A</sup>T<sub>E</sub>X release 2025-06-01.

1 Introduction

In the L<sup>A</sup>T<sub>E</sub>X 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

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  $x^2 - 2x + 1$

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

3. True False

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

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

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

2. Second type of questions

3. Third type of questions
4. Question with image and label below:

5. Question with image on right side:

- A) value

B) correct

C) value

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

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

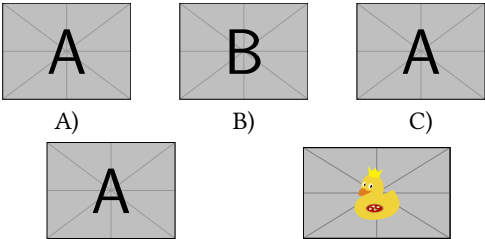
A) value

B) value

C) value

D) value

E) value



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  $\text{\TeX}$ , 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  $\text{\TeX}$  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.

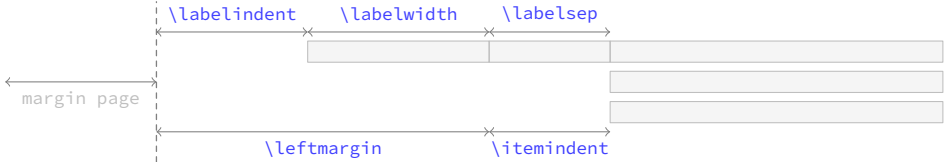


Figure 1: Representation of horizontal lengths in `enumitem`.

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.

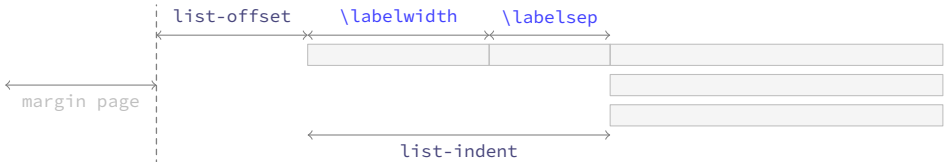


Figure 2: Representation of horizontal lengths concept in `enumext`.

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 §5.5).

- 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 §5.6).

#### 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  $\TeX$  `\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:

```
\IfDocumentMetadataTF{ }
{
  \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  $\text{\LaTeX}$ , `\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 `shortenumerate` or `tasks` environments provided by the `shortlst`[15] and `tasks`[16] 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{&lt;key = val&gt;}</code>	<code>\setenumext[&lt;keyans*&gt;]{&lt;key = val&gt;}</code>
	<code>\setenumext[&lt;enumext, level&gt;]{&lt;key = val&gt;}</code>	<code>\setenumext[&lt;print, level&gt;]{&lt;key = val&gt;}</code>
	<code>\setenumext[&lt;enumext*&gt;]{&lt;key = val&gt;}</code>	<code>\setenumext[&lt;print, *&gt;]{&lt;key = val&gt;}</code>
	<code>\setenumext[&lt;keyans&gt;]{&lt;key = val&gt;}</code>	<code>\setenumext[&lt;print*&gt;]{&lt;key = val&gt;}</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 {&lt;key name&gt;}{&lt;key-one = val, key-two = val, ...&gt;}</code>
	<code>\setenumextmeta*{&lt;key name&gt;}{&lt;key-one = val, key-two = val, ...&gt;}</code>
	<code>\setenumextmeta [ &lt;enumext*&gt; ]{&lt;key name&gt;}{&lt;key-one = val, key-two = val, ...&gt;}</code>
	<code>\setenumextmeta [ &lt;enumext, level&gt; ]{&lt;key name&gt;}{&lt;key-one = val, key-two = val, ...&gt;}</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`  $\langle value \text{ forbidden} \rangle$  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` = {  $\langle \backslash\alpha^* \mid \backslash\Alpha^* \mid \backslash\arabic^* \mid \backslash\roman^* \mid \backslash\Roman^* \rangle$  } 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` = {  $\langle rigid \text{ length} \rangle$  } 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` = {  $\langle rigid \text{ length} \rangle$  } 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` = {  $\langle integer \mid string \rangle$  } 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` = {  $\langle font \text{ commands} \rangle$  } default: *empty*

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

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

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

`wrap-label` = {  $\langle code \{ \#1 \} \text{ more code} \rangle$  } 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*` = {  $\langle code \{ \#1 \} \text{ more code} \rangle$  } 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 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`.

### 5.2.1 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. T<sub>E</sub>X 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` *⟨value forbidden⟩* 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` *⟨value forbidden⟩* 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` *⟨value forbidden⟩* 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.



- The following  $\langle keys \rangle$  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 ‘\*’  $\langle keys \rangle$  applies `\vspace*` so that  $\LaTeX$  does *not discard* this space at page break.

`above = {  $\langle rubber length \mid rigid length \rangle$  }` 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 “discordable”.

`above* = {  $\langle rubber length \mid rigid length \rangle$  }` 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 discordable”.

`below = {  $\langle rubber length \mid rigid length \rangle$  }` default: *not used*

Set the *extra vertical space* 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 “discordable”.

`below* = {  $\langle rubber length \mid rigid length \rangle$  }` default: *not used*

Set the *extra vertical space* 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 discordable”.

### 5.2.2 Horizontal spaces

`list-offset = {  $\langle rigid length \rangle$  }` default: *opt*

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 = {  $\langle rigid length \rangle$  }` 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=opt` is set in the environments `enumext` and `keyans` the  $\langle label \rangle$  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 `labewidth` plus `labelsep`. Passing a value to this key is equivalent to setting the value for the `list-offset` key.

`itemindent = {  $\langle rigid length \rangle$  }` default: *opt*

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 *opt* 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 = {  $\langle rigid length \rangle$  }` default: *opt*

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 *opt*. Internally sets the value of `\rightmargin` for the current level.

`listparindent = {  $\langle rigid length \rangle$  }` default: *opt*

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.

## 5.3 Keys for add code

The following  $\langle keys \rangle$  should be used with “caution”, they are intended to inject  $\{ \langle code \rangle \}$  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  $\LaTeX$  which is defined (simplified) as plain form `\list{ $\langle arg one \rangle$ }{ $\langle arg two \rangle$ }`. Using the `before*` key does not allow access to the `list` parameters defined by  $[ \langle key = val \rangle ]$ .

`before = {  $\langle code \rangle$  }` default: *not used*

Execute  $\{ \langle code \rangle \}$  “before” the environment starts. The  $\{ \langle code \rangle \}$  must be passed between braces, is executed “after” performing all calculations related to the *list parameters* in the environment and the parameters sets by  $[ \langle key = val \rangle ]$  that is, in the second argument of the list after setting all the parameters `\begin{list}{ $\langle arg one \rangle$ }{ $\langle arg two \rangle$ }{ $\langle code \rangle$ }`.

`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 [`key = val`] sets in the environment that is, before the arguments defining the 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` environment. 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.

## 5.4 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`.

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 {⟨series name⟩} the keys `series`, `resume`, `resume*`, `save-ans`, `save-key`, `start*` and `start`. When using the key `resume={⟨series name⟩}` it will have hierarchy in the ⟨keys⟩ that are saved in {⟨series name⟩}, in order to establish the value of a ⟨key⟩ already saved in {⟨series name⟩} it must be placed to the “right” of `resume={⟨series name⟩}`, 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*.

## 5.5 Keys for multicol

`columns = {⟨integer⟩}` default: `1`  
 Set the *number of columns* to be used by the `multicol` 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 = {⟨rigid length⟩}` default: *by level*  
 Set the *space between columns* used by the `multicol` 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`.

## 5.6 Keys for minipage

`mini-env = {⟨rigid length⟩}`

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 = {⟨rigid length⟩}`

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`.

### 5.6.1 The command `\miniright`

---

```
\miniright \begin{enumext}[mini-env={⟨rigid length⟩}] ⟨item's before⟩ \item \miniright ⟨content⟩ \end{enumext}
\begin{enumext}[mini-env={⟨rigid length⟩}] ⟨item's before⟩ \item \miniright*⟨content⟩ \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  $\TeX$  justification is maintained in the `minipage` on the “right side”.

### 5.6.2 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 = {⟨content⟩}`

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 `{⟨content⟩}` must be passed between braces.

`mini-right* = {⟨content⟩}`

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 `⟨key⟩` is “*active*” the `\anskey` command and the environments `anskey*`, `keyans`, `keyans*` and `keyanspic` are available.

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

By executing the key `save-ans={⟨store name⟩}` 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 `⟨content⟩` passed to `\anskey` or `anskey*`, the current `⟨labels⟩` for `\item*` and `\anspic*` in the environments `keyans`, `keyans*` and `keyanspic` will be “*stored*” in a *sequence* `{⟨store name⟩}` and at the same time will be “*stored*” (without the “*structure*” or *optional argument*) in a *prop list* `{⟨store name⟩}`.

For security reasons the *optional argument* of the inner levels or the nested environment are *filtered* by excluding all `⟨keys⟩` 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* `{⟨store name⟩}` set by `save-ans` key.

### 6.1 Keys for storage system

The only `⟨keys⟩` available for all levels of the `enumext` environment and the `enumext*` environment are `no-store` and `save-key`, the rest of the `⟨keys⟩` 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 = {⟨store name⟩}`

default: *not set*

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

`save-key = {⟨key list⟩}`

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 `⟨key list⟩` passed to this key ignores any `⟨keys⟩` 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 `\item*` and `\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 `\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 `\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 `\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 `\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 `\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 `\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 = {⟨rigid length⟩}` default: `labelsep`  
 Sets the *horizontal space* between the box containing the “symbol” defined by `mark-ans` key and the *mandatory argument* ⟨*content*⟩ passed to the `\anskey` command and the *body* in `anskey*` environment.

`wrap-ans = {⟨code {#1} more code⟩}` default: `\fbox+\parbox{#1}`  
 Wraps the *mandatory argument* ⟨*content*⟩ passed to the `\anskey` and the ⟨*body*⟩ in `anskey*` environment referenced by {#1} when using the `show-ans` or `show-pos` keys. The {⟨*code*⟩} 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* {⟨*store name*⟩} 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* = {⟨symbol⟩}` 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* = {⟨left | right | center⟩}` 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* = {⟨rigid length⟩}` default: `labelsep`  
 Sets the *horizontal space* between the box containing the “symbol” defined by `mark-ans*` key and the current ⟨*label*⟩ for `\item*` and `\anspic*` in the `keyans`, `keyans*` and `keyanspic` environments.

`wrap-ans* = {⟨code {#1} more code⟩}` default: `not used`  
 Wraps the *current* ⟨*label*⟩ 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 {⟨*code*⟩} must be passed between braces and *only* affects how the ⟨*label*⟩ is displayed and NOT the “stored label” in the *sequence* and *prop list* {⟨*store name*⟩} 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 ⟨*label*⟩ to be displayed in red when using `show-ans` you just set `wrap-ans*={\textcolor{red}{#1}}`.

`wrap-opt = {⟨code {#1} more code⟩}` 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 {⟨*code*⟩} must be passed between braces and only affects the current *optional argument* and NOT the “stored content” in the *sequence* and *prop list* {⟨*store name*⟩} 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<sup>A</sup>T<sub>E</sub>X 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*  $\langle content \rangle$  passed to `\anskey` when “storing” in the *sequence*  $\{\langle store name \rangle\}$  has the form `\item  $\langle content \rangle$` , the following *keys* allow modifying the way in which it is “stored” in the *sequence*.

`break-col`  $\langle value forbidden \rangle$  default: *not used*

Stores  $\{\langle content \rangle\}$  in the *sequence*  $\{\langle store name \rangle\}$  of the form `\columnbreak \item  $\langle content \rangle$` .

`item-join` =  $\{\langle columns \rangle\}$  default: *not set*

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

`item-star`  $\langle value forbidden \rangle$  default: *not used*

Stores  $\{\langle content \rangle\}$  in the *sequence*  $\{\langle store name \rangle\}$  of the form `\item*  $\langle content \rangle$` .

`item-sym*` =  $\{\langle symbol \rangle\}$  default: *not set*

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

`item-pos*` =  $\{\langle rigid length \rangle\}$  default: *not set*

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

#### 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}
```

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>★ 1. Text containing our instructions or questions.</li> <li>* <span style="border: 1px solid black; padding: 2px;">first answer</span></li> <li>2. Text containing our instructions or questions.</li> <li>  (a) Question.</li> <li>    * <span style="border: 1px solid black; padding: 2px;">second answer</span></li> </ul> | <ul style="list-style-type: none"> <li>3. Text containing our instructions or questions.</li> <li>* <span style="border: 1px solid black; padding: 2px;">third answer</span></li> <li>4. Text containing our instructions or questions.</li> <li>* <span style="border: 1px solid black; padding: 2px;">fourth answer</span></li> </ul> |
|--|---|

## 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  $\text{\LaTeX}$  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 argument `c` “*collect code*” implemented in the `ltxcmd` module, part of  $\text{\LaTeX}$  release 2025-06-01. `\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,  $\text{\LaTeX}$  will return an “*error*” message if this happens. In a similar way comments “*%*” or “*any character*” after `\end{anskey*}` on the same line  $\text{\LaTeX}$  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 = { $\langle true \mid false \rangle$ }

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]
    \first answer
  \end{anskey*}

  \item Text containing our instructions or questions.

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

  \item Text containing our instructions or questions.

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

  \item Text containing our instructions or questions.

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

```
\begin{enumext}[save-ans=test]
  \item \item content
  \begin{keyans*}[\langle key = val \rangle]
    \item \item content
    \item [\langle custom \rangle] \item content
    \item* \item content
    \item*[\langle content \rangle] \item content
  \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 `\label` 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*[\note] Correct choice
    \miniright
    \includegraphics[scale=0.25]{example-image-a}
    Some text
  \end{keyans}
\end{enumext}
```

1. Text containing a question.  
A) Choice                      \* B) Correct choice  
C) Choice                      D) Choice  
E) 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 `\label`s 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.

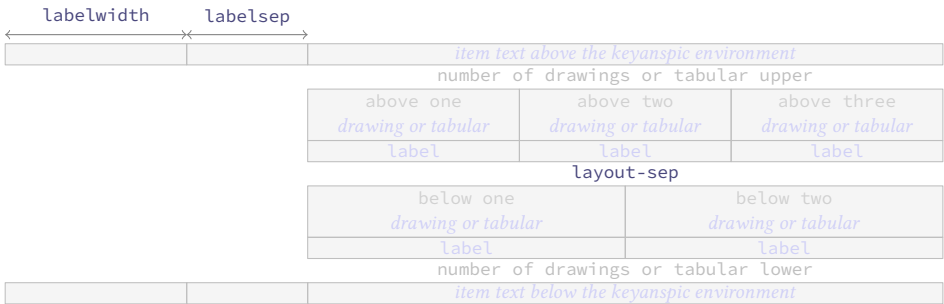


Figure 6: Representation of the `keyanspic` environment with `layout-sty={\langle 3, 2 \rangle}` in `enumext`.

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 = {⟨above | below⟩}` default: *below*

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

`label-sep = {⟨rubber length | rigid length⟩}` 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 = {⟨n° upper , n° lower⟩}` 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 = {⟨rubber length | rigid length⟩}` 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 = {⟨rubber length | rigid length⟩}` 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{⟨drawing or tabular⟩}`  
`\anspic*` `\anspic*[⟨content⟩]{⟨drawing or tabular⟩}`

---

The `\anspic` command take three arguments, the *starred argument* ‘`*`’ store the current ⟨*label*⟩ next to the *optional argument* ⟨*content*⟩ in *sequence* and *prop list* {⟨*store name*⟩} 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.



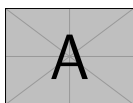
A)



B)



C)

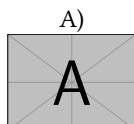


D)

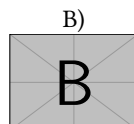


\* E) [note]

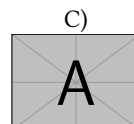
2. Question with images and labels above.



A)



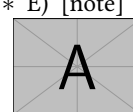
B)



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 <code> \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 <code> \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~~Xe 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 [arara](#)<sup>1</sup> 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:  $1 \text{ \AA} = 1 \times 10^{-10} \text{ m}$ ) e il fermi o femtometro ( $1 \text{ fm} = 1 \times 10^{-15} \text{ m}$ ). 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:  $1 \text{ \AA} = 1 \times 10^{-10} \text{ m}$ ) e il fermi o femtometro ( $1 \text{ fm} = 1 \times 10^{-15} \text{ m}$ ). 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 \(cross mark\)](#) .

<sup>1</sup>The 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

✖ 2. A

✖

3. B

✖ 4. A

✖
- Example 3
- A “simple multiple choice” test .
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

Test keys

1. B,  $x = 5$

✖ 4. E, A duck

✖

2. D


✖ 5. D, other note


✖


3. C, some 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)  $\text{\LaTeX}$ e is cool?

 Related to Linux

(a) You use linux?

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- (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 .

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

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,
  testphase = {phase-III, math, title, table, firstaid},
}
```

♥ 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 `multicols` 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  $\text{\LaTeX}$ , 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

- v1.3 (ctan), 2025-06-01**
  - Removed dependency on the `scontents` package.
  - The `anskey`\* environment has been rewritten using the new `c` argument from `ltxcmd` module.
- v1.2 (ctan), 2025-03-28**
  - Replace signature (prevent expansion for optional arg).
  - 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.

12 Index of Documentation

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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<sup>A</sup>T<sub>E</sub>X3 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<sup>A</sup>T<sub>E</sub>X to work correctly.

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

Now declare the `enumext` package.

```
4 \ProvidesExplPackage {enumext} {2025-06-01} {1.3} {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}[2024-05-23]
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_counters: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.)

```

\c__enumext_counter_style_tl
\l__enumext_ref_key_arg_tl
\l__enumext_ref_the_count_tl
\l__enumext_the_counter_X_tl
  \l_enumext_renew_the_count_X_tl

```

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

```

37 \tl_const:Nn \c__enumext_counter_style_tl
38 { { arabic } { roman } { Roman } { alph } { Alph } }
39 \tl_new:N \l__enumext_ref_key_arg_tl
40 \tl_new:N \l__enumext_ref_the_count_tl
41 \cs_set_protected:Npn \__enumext_tmp:n #1
42 {
43   \tl_new:c { l__enumext_renew_the_count_#1_tl }
44   \tl_new:c { l__enumext_the_counter_#1_tl }
45   \tl_set:ce { l__enumext_the_counter_#1_tl } { \exp_not:c { theenumX#1 } }
46 }
47 \clist_map_inline:nn { i, ii, iii, iv, v, vi, vii, viii } { \__enumext_tmp:n {#1} }

```

(End of definition for `\c__enumext_counter_style_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 (§13.25).

```

48 \int_new:N \g__enumext_resume_int
49 \int_new:N \g__enumext_resume_vii_int
50 \tl_new:N \l__enumext_resume_name_tl
51 \bool_new:N \l__enumext_resume_active_bool
52 \tl_new:N \g__enumext_standar_series_tl
53 \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.

```

54 \dim_new:N \l__enumext_current_widest_dim
55 \tl_new:N \g__enumext_counter_styles_tl
56 \tl_new:N \g__enumext_widest_label_tl
57 \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 (§13.18). The variables `\l__enumext_leftmargin_X_dim` and `\l__enumext_itemindent_X_dim` are used and set by the function `\__enumext_calc_hspace:Nnnnnnnnnnn` (§13.38.1).

```

58 \cs_set_protected:Npn \__enumext_tmp:n #1
59 {
60   \bool_new:c { l__enumext_leftmargin_tmp_#1_bool }

```

```

61      \dim_new:c { \__enumext_leftmargin_tmp_#1_dim }
62      \dim_new:c { \__enumext_leftmargin_#1_dim }
63      \dim_new:c { \__enumext_itemindent_#1_dim }
64  }
65  \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.)

```

\__enumext_multicols_above_X_skip
\__enumext_multicols_below_X_skip
\__enumext_multicols_right_X_skip
\__enumext_align_label_pos_X_str

```

Internal variables used by `columns` key (§13.22) and `align` key (§13.13).

```

66  \cs_set_protected:Npn \__enumext_tmp:n #1
67  {
68      \skip_new:c { \__enumext_multicols_above_#1_skip }
69      \skip_new:c { \__enumext_multicols_below_#1_skip }
70      \skip_new:c { \__enumext_multicols_right_#1_skip }
71      \str_new:c { \__enumext_align_label_pos_#1_str }
72  }
73  \clist_map_inline:nn { i, ii, iii, iv, v } { \__enumext_tmp:n {#1} }

```

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

```

\__enumext_minipage_stat_int
\__enumext_minipage_temp_skip
\__enumext_minipage_left_skip
\__enumext_minipage_right_skip
\__enumext_minipage_after_skip
\__enumext_minipage_right_skip
\__enumext_minipage_after_skip
\__enumext_minipage_left_X_dim
\__enumext_minipage_active_X_bool

```

Internal variables used by `\miniright` command (§13.23.4) and the keys `mini-right`, `mini-right*`, `mini-env` and `mini-sep` (§13.21, §13.23).

```

74  \int_new:N \__enumext_minipage_stat_int
75  \skip_new:N \__enumext_minipage_temp_skip
76  \skip_new:N \__enumext_minipage_left_skip
77  \skip_new:N \__enumext_minipage_right_skip
78  \skip_new:N \__enumext_minipage_after_skip
79  \skip_new:N \__enumext_minipage_right_skip
80  \skip_new:N \__enumext_minipage_after_skip
81  \cs_set_protected:Npn \__enumext_tmp:n #1
82  {
83      \dim_new:c { \__enumext_minipage_left_#1_dim }
84      \bool_new:c { \__enumext_minipage_active_#1_bool }
85  }
86  \clist_map_inline:nn { i, ii, iii, iv, v, vii, viii } { \__enumext_tmp:n {#1} }

```

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

```

\__enumext_wrap_label_X_bool
\__enumext_wrap_label_opt_X_bool
\__enumext_start_X_int
\__enumext_fake_item_indent_X_tl
\__enumext_label_fill_left_X_tl
\__enumext_label_fill_right_X_tl
\__enumext_vspace_a_star_X_bool
\__enumext_vspace_b_star_X_bool

```

The bool vars `\__enumext_wrap_label_X_bool` and `\__enumext_wrap_label_opt_X_bool` are used by `wrap-label` and `wrap-label*` keys (§13.13), the integer `\__enumext_start_X_int` are used by the `start` and `start*` keys (§13.15), the token list `\__enumext_fake_item_indent_X_tl` is used by `itemindent` key (§13.18.1), the variables `\__enumext_label_fill_left_X_tl` and `\__enumext_label_fill_right_X_tl` are used by the `align` key (§13.13). The boolean vars `\__enumext_vspace_a_star_X_bool`, `\__enumext_vspace_b_star_X_bool` are used by `above`, `above*`, `below` and `below*` keys (§13.20).

```

87  \cs_set_protected:Npn \__enumext_tmp:n #1
88  {
89      \bool_new:c { \__enumext_wrap_label_#1_bool }
90      \bool_new:c { \__enumext_wrap_label_opt_#1_bool }
91      \int_new:c { \__enumext_start_#1_int }
92      \tl_new:c { \__enumext_fake_item_indent_#1_tl }
93      \tl_new:c { \__enumext_label_fill_left_#1_tl }
94      \tl_new:c { \__enumext_label_fill_right_#1_tl }
95      \bool_new:c { \__enumext_vspace_a_star_#1_bool }
96      \bool_new:c { \__enumext_vspace_b_star_#1_bool }
97  }
98  \clist_map_inline:nn { i, ii, iii, iv, v, vii, viii } { \__enumext_tmp:n {#1} }

```

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

```

\__enumext_store_active_bool
\__enumext_store_name_tl
\__enumext_store_name_tl
\__enumext_store_current_label_tl
\__enumext_store_current_opt_arg_tl
\__enumext_store_current_label_tmp_tl

```

The variable `\__enumext_store_active_bool` setting by `save-ans` key (§13.26.1) activates all the mechanism related to `\anskey`, `anskey*`, `keyans`, `keyans*` and `keyanspic` environments.

The variable `\__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 `\__enumext_store_name_tl` it's just a global copy of `{⟨store name⟩}` used by different functions.

The variables `\__enumext_store_current_label_tl` and `\__enumext_store_current_opt_arg_tl` save the *current label* and *optional argument* of `\item*` (§13.37) and `\anspic*` (§13.42.2) for the `keyans`, `keyans*` and `keyanspic` environments.

The variable `\l__enumext_store_current_label_tmp_tl` is a temporary variable used by `keyans`, `keyans*` and `keyanspic` at various points.

```

99 \bool_new:N \l__enumext_store_active_bool
100 \tl_new:N \l__enumext_store_name_tl
101 \tl_new:N \g__enumext_store_name_tl
102 \tl_new:N \l__enumext_store_current_label_tl
103 \tl_new:N \l__enumext_store_current_opt_arg_tl
104 \tl_new:N \l__enumext_store_current_label_tmp_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` (§13.30) and the variables `\l__enumext_store_anskey_env_tl` save the *body* of the environment `anskey*` (§13.31).

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.

```

105 \tl_new:N \l__enumext_store_anskey_arg_tl
106 \tl_new:N \l__enumext_store_anskey_env_tl
107 \bool_new:N \l__enumext_write_anskey_env_bool
108 \tl_new:N \l__enumext_write_anskey_env_file_name_tl
109 \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<sub>E</sub>X 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.

```

110 \str_const:Ne \c__enumext_anskey_env_hidden_space_str
111 { \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` (§13.48).

```

112 \tl_new:N \l__enumext_setkey_tmpa_tl
113 \tl_new:N \l__enumext_setkey_tmpb_tl
114 \int_new:N \l__enumext_setkey_tmpa_int
115 \seq_new:N \l__enumext_setkey_tmpa_seq
116 \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 (§13.47) and `\foreachkeyans` command (§13.50).

```

117 \tl_new:N \l__enumext_meta_path_tl
118 \seq_new:N \l__enumext_foreach_print_seq
119 \tl_new:N \l__enumext_foreach_name_prop_tl
120 \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` (§13.47), `show-pos`, `show-ans`, `mark-pos`, `mark-sep` keys (§13.27), `item-sym*` key (§13.35), `save-key` key (§13.27.3) and “*storing structure*”.

```

121 \tl_new:N \l__enumext_print_keyans_starred_tl
122 \bool_new:N \l__enumext_print_keyans_star_bool
123 \str_new:N \l__enumext_mark_position_str
124 \str_new:N \l__enumext_mark_position_v_str
125 \str_new:N \l__enumext_mark_position_viii_str
126 \dim_new:N \l__enumext_mark_sep_tmpa_dim
127 \dim_new:N \l__enumext_mark_sep_tmpb_dim
128 \int_new:N \l__enumext_show_pos_tmp_int
129 \tl_new:N \g__enumext_item_symbol_aux_tl
130 \cs_set_protected:Npn \l__enumext_tmp:n #1
131 {
132   \tl_new:c { \l__enumext_print_keyans_#1_tl }
133   \tl_new:c { \l__enumext_store_save_key_#1_tl }
134   \bool_new:c { \l__enumext_store_save_key_#1_bool }
135   \bool_new:c { \l__enumext_store_upper_level_#1_bool }
136 }
137 \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 (§13.42.1).

```

138 \seq_new:N \l__enumext_anspic_args_seq
139 \dim_new:N \l__enumext_anspic_mini_width_dim
140 \int_new:N \l__enumext_anspic_above_int
141 \int_new:N \l__enumext_anspic_below_int
142 \bool_new:N \l__enumext_anspic_label_above_bool
143 \str_new:N \l__enumext_anspic_mini_pos_str
144 \box_new:N \l__enumext_anspic_label_box
145 \box_new:N \l__enumext_anspic_body_box
146 \dim_new:N \l__enumext_anspic_label_htdp_dim
147 \dim_new:N \l__enumext_anspic_body_htdp_dim

```

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

```

  \l__enumext_check_answers_bool
  \g__enumext_check_ans_key_bool
\l__enumext_check_start_line_env_tl
  \l__enumext_item_wrap_key_bool
  \g__enumext_check_starred_cmd_int
\g__enumext_item_anskey_int
\g__enumext_item_number_int
\g__enumext_item_number_bool
  \g__enumext_item_answer_diff_int

```

Internal variables used by “*internal check answer*” mechanism (§13.26.3) 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.

```

148 \bool_new:N \l__enumext_check_answers_bool
149 \bool_new:N \g__enumext_check_ans_key_bool
150 \tl_new:N \l__enumext_check_start_line_env_tl
151 \bool_new:N \l__enumext_item_wrap_key_bool
152 \int_new:N \g__enumext_check_starred_cmd_int
153 \int_new:N \g__enumext_item_anskey_int
154 \int_new:N \g__enumext_item_number_int
155 \bool_new:N \l__enumext_item_number_bool
156 \int_new:N \g__enumext_item_answer_diff_int

```

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

```

\l__enumext_hyperref_bool
  \l__enumext_footnotes_key_bool

```

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`.

```

157 \bool_new:N \l__enumext_hyperref_bool
158 \bool_new:N \l__enumext_footnotes_key_bool

```

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

```

\l__enumext_newlabel_arg_one_tl
\l__enumext_newlabel_arg_two_tl
  \l__enumext_write_aux_file_tl
\l__enumext_label_copy_X_tl

```

Internal variables used by `save-ref` key (§13.27). 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.

```

159 \tl_new:N \l__enumext_newlabel_arg_one_tl
160 \tl_new:N \l__enumext_newlabel_arg_two_tl
161 \tl_new:N \l__enumext_write_aux_file_tl
162 \cs_set_protected:Npn \__enumext_tmp:n #1
163 {
164   \tl_new:c { \l__enumext_label_copy_#1_tl }
165 }
166 \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.)

```

\g__enumext_footnote_standar_int
\g__enumext_footnote_starred_int
\g__enumext_footnote_standar_arg_seq
\g__enumext_footnote_starred_arg_seq
\g__enumext_footnote_standar_int_seq
\g__enumext_footnote_starred_int_seq

```

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

```

167 \int_new:N \g__enumext_footnote_standar_int
168 \int_new:N \g__enumext_footnote_starred_int
169 \seq_new:N \g__enumext_footnote_standar_arg_seq
170 \seq_new:N \g__enumext_footnote_starred_arg_seq
171 \seq_new:N \g__enumext_footnote_standar_int_seq
172 \seq_new:N \g__enumext_footnote_starred_int_seq

```

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

```

\l__enumext_item_starred_X_bool
\l__enumext_item_column_pos_X_int
\g__enumext_item_count_all_X_int
  \l__enumext_joined_item_X_int
\l__enumext_joined_item_aux_X_int
  \l__enumext_tmpa_X_int
  \l__enumext_tmpa_X_dim
\l__enumext_item_text_X_box

```

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

```

173 \cs_set_protected:Npn \__enumext_tmp:n #1
174 {
175   \bool_new:c { \l__enumext_item_starred_#1_bool }
176   \int_new:c { \l__enumext_item_column_pos_#1_int }
177   \int_new:c { \g__enumext_item_count_all_#1_int }
178   \int_new:c { \l__enumext_joined_item_#1_int }

```

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```

179 \int_new:c { \__enumext_joined_item_aux_#1_int }
180 \int_new:c { \__enumext_tmpa_#1_int }
181 \dim_new:c { \__enumext_tmpa_#1_dim }
182 \box_new:c { \__enumext_item_text_#1_box }
183 \dim_new:c { \__enumext_joined_width_#1_dim }
184 \dim_new:c { \__enumext_item_width_#1_dim }
185 \tl_new:c { g__enumext_item_symbol_aux_#1_tl }
186 \str_new:c { \__enumext_align_label_#1_str }
187 \bool_new:c { g__enumext_minipage_active_#1_bool }
188 \box_new:c { \__enumext_miniright_code_#1_box }
189 \bool_new:c { g__enumext_minipage_center_#1_bool }
190 \dim_new:c { g__enumext_minipage_right_#1_dim }
191 \skip_new:c { g__enumext_minipage_right_#1_skip }
192 }
193 \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`.

```

194 \clist_const:Nn \c__enumext_all_envs_clist
195 {
196   {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv},
197   {keyans}{v}, {enumext*}{vii}, {keyans*}{viii}
198 }

```

(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 (§13.47) and `\foreachkeyans` command (§13.50).

```

199 \cs_generate_variant:Nn \keys_precompile:nnN { neN }
200 \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?](#).

```

201 \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.

```

202 \cs_new_protected:Npn \__enumext_at_begin_document:n #1
203 {
204   \hook_gput_code:nnn {begindocument} {enumext} { #1 }
205 }

```

(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.

```

206 \cs_new_protected:Npn \__enumext_after_env:nn #1 #2
207 {
208   \hook_gput_code:nnn {env/#1/after} {enumext} {#2}
209 }
210 \cs_new_protected:Npn \__enumext_before_env:nn #1 #2
211 {
212   \hook_gput_code:nnn {env/#1/before} {enumext} {#2}
213 }

```

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

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

```

214 \cs_new:Nn \__enumext_level:
215 {
216   \int_to_roman:n { \l__enumext_level_int }
217 }

```



(End of definition for `\__enumext_level:`.)

`\__enumext_if_is_int:nT` 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?](#)

`\__enumext_if_is_int:nF`

`\__enumext_if_is_int:nTF`

```

218 \prg_new_protected_conditional:Npnn \__enumext_if_is_int:n #1 { T, F, TF }
219 {
220   \regex_match:nnTF { ^[\+|-]?[\d]+$ } {#1} % $
221   { \prg_return_true: }
222   { \prg_return_false: }
223 }

```

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

`\__enumext_regex_counter_style:` The internal function `\__enumext_regex_counter_style:` replace the ‘`*`’ with the actual counter of the running level and is used by the `ref` key. It loops through the defined counter styles in `\c__enumext_counter_style_tl` and replace ‘`*`’ by real command, for example, looking for `\arabic*` and replacing that by `\arabic{<counter>}` defined on the current level.

```

224 \cs_new_protected:Nn \__enumext_regex_counter_style:
225 {
226   \tl_map_inline:Nn \c__enumext_counter_style_tl
227   {
228     \regex_replace_once:nnN { \c{##1}\* }
229     { \c{##1}\cB{\u{\l__enumext_ref_the_count_tl}\cE} } \l__enumext_ref_key_arg_tl
230   }
231 }

```

(End of definition for `\__enumext_regex_counter_style:`.)

`\__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.

```

232 \cs_new:Npn \__enumext_show_length:nnn #1 #2 #3
233 {
234   *~#2
235   \prg_replicate:nn { 14 - \str_count:n {#2} } {~}
236   =~\use:c { #1_use:c } { \l__enumext_#2_#3_#1 } \\
237 }

```

(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.

```

238 \cs_new_protected:Nn \__enumext_unskip_unkern:
239 {
240   \int_case:nnT { \lastnodetype }
241   {
242     { 11 }{ \unskip }
243     { 12 }{ \unkern }
244   }
245 }

```

(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:`

```

246 \cs_new_protected:Nn \__enumext_is_not_nested:
247 {
248   \str_case:en { \@currentenv }
249   {
250     {enumext}
251     {
252       \tl_set:Nn \l__enumext_envir_name_tl { enumext }
253       \bool_lazy_and:nnT
254       { \bool_not_p:n { \g__enumext_standar_bool } }
255       { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
256       {
257         \bool_gset_true:N \g__enumext_standar_bool
258       }
259     }
260   }

```

```

259     }
260     {enumext*}
261     {
262         \tl_set:Nn \l__enumext_envir_name_tl { enumext* }
263         \bool_lazy_and:nnT
264         { \bool_not_p:n { \g__enumext_starred_bool } }
265         { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
266         {
267             \bool_gset_true:N \g__enumext_starred_bool
268         }
269     }
270 }
271 }

```

The function `\__enumext_is_on_first_level:` will set the variables `\l__enumext_standar_first_bool` (§13.26.1), `\l__enumext_starred_first_bool` (§13.26.1) 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.

```

272 \cs_new_protected:Nn \__enumext_is_on_first_level:
273 {
274     \bool_lazy_all:nT
275     {
276         { \bool_if_p:N \g__enumext_standar_bool }
277         { \int_compare_p:nNn { \l__enumext_level_int } = { 1 } }
278         { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
279     }
280     {
281         \bool_set_true:N \l__enumext_standar_first_bool
282         \tl_gset:Nn \g__enumext_envir_name_tl { enumext }
283         \tl_gset:Ne \g__enumext_start_line_tl
284         {
285             on~line~\exp_not:V \inputlineno
286         }
287     }
288     \bool_lazy_all:nT
289     {
290         { \bool_if_p:N \g__enumext_starred_bool }
291         { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
292         { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
293     }
294     {
295         \bool_set_true:N \l__enumext_starred_first_bool
296         \tl_gset:Nn \g__enumext_envir_name_tl { enumext* }
297         \tl_gset:Ne \g__enumext_start_line_tl
298         {
299             on~line~\exp_not:V \inputlineno
300         }
301     }
302 }

```

(End of definition for `\__enumext_is_not_nested:` and `\__enumext_is_on_first_level:`)

`\__enumext_keyans_name_and_start:`

The function `\__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 `\__enumext_check_starred_cmd:n` function.

```

303 \cs_new_protected:Nn \__enumext_keyans_name_and_start:
304 {
305     \str_case:en { \@currenvir }
306     {
307         {keyans}
308         {
309             \tl_set:Nn \l__enumext_envir_name_tl { keyans }
310             \tl_set:Ne \l__enumext_check_start_line_env_tl
311             {
312                 in~'keyans'~start~on~line~\exp_not:V \inputlineno
313             }
314         }
315         {keyans*}
316         {
317             \tl_set:Nn \l__enumext_envir_name_tl { keyans* }

```

```

318         \tl_set:Nc \l__enumext_check_start_line_env_tl
319         {
320             in~'keyans*'~start~on~line~\exp_not:V \inputlineno
321         }
322     }
323     {keyanspic}
324     {
325         \tl_set:Nn \l__enumext_envir_name_tl { keyanspic }
326         \tl_set:Nc \l__enumext_check_start_line_env_tl
327         {
328             in~'keyanspic'~start~on~line~\exp_not:V \inputlineno
329         }
330     }
331 }
332 }

```

(End of definition for `\__enumext_keyans_name_and_start:`.)

### 13.5.2 Utilities for log and terminal

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

```

\__enumext_reset_global_vars:
\__enumext_reset_global_int:
\__enumext_reset_global_bool:
\__enumext_reset_global_tl:
333 \cs_new_protected:Nn \__enumext_reset_global_vars:
334 {
335     \__enumext_reset_global_int:
336     \__enumext_reset_global_bool:
337     \__enumext_reset_global_tl:
338 }
339 \cs_new_protected:Nn \__enumext_reset_global_int:
340 {
341     \int_gzero:N \g__enumext_item_number_int
342     \int_gzero:N \g__enumext_item_anskey_int
343     \int_gzero:N \g__enumext_item_answer_diff_int
344 }
345 \cs_new_protected:Nn \__enumext_reset_global_bool:
346 {
347     \bool_gset_false:N \g__enumext_check_ans_key_bool
348     \bool_gset_false:N \g__enumext_standar_bool
349     \bool_gset_false:N \g__enumext_starred_bool
350 }
351 \cs_new_protected:Nn \__enumext_reset_global_tl:
352 {
353     \tl_gclear:N \g__enumext_store_name_tl
354     \tl_gclear:N \g__enumext_start_line_tl
355     \tl_gclear:N \g__enumext_envir_name_tl
356 }

```

(End of definition for `\__enumext_reset_global_vars:` and others.)

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.

```

357 \cs_new_protected:Nn \__enumext_log_global_vars:
358 {
359     \msg_log:nneeee { enumext } { prop-seq-int-hook }
360     { \g__enumext_store_name_tl }
361     { \prop_count:c { g__enumext_ \g__enumext_store_name_tl _prop } }
362     { \seq_count:c { g__enumext_ \g__enumext_store_name_tl _seq } }
363     { \int_use:c { g__enumext_resume_ \g__enumext_store_name_tl _int } }
364 }

```

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.

```

365 \cs_new_protected:Nn \__enumext_log_answer_vars:
366 {
367     \msg_log:nneeee { enumext } { item-answer-hook }
368     { \int_use:N \g__enumext_item_number_int }
369     { \int_use:N \g__enumext_item_anskey_int }
370     { \int_eval:n { \g__enumext_item_number_int - \g__enumext_item_anskey_int } }
371 }

```

(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  $\text{\LaTeX}$  has the following plain form:

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

And `minipage` environment provided by  $\text{\LaTeX}$  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`[18]).

```
\__enumext_start_list:nn
  \__enumext_stop_list:
  \__enumext_item_std:w
  \__enumext_minipage:w
  \__enumext_endminipage:
```

The functions `\__enumext_start_list:nn` and `\__enumext_stop_list:` correspond to copies of `\list` and `\endlist` from plain definition of `list` environment, the function `\__enumext_item_std:w` is a copy of the `\item` command.

```
372 \__enumext_at_begin_document:n
373 {
374   \cs_new_eq:NN \__enumext_start_list:nn \list
375   \cs_new_eq:NN \__enumext_stop_list: \endlist
376   \NewCommandCopy \__enumext_item_std:w \item
377 }
```

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

```
378 \__enumext_at_begin_document:n
379 {
380   \cs_new_eq:NN \__enumext_minipage:w \minipage
381   \cs_new_eq:NN \__enumext_endminipage: \endminipage
382 }
```

(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:
```

```
383 \hook_gput_code:nnn { begindocument } { enumext } { \__enumext_after_hyperref: }
384 \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”.

```
385 \cs_new_protected:Nn \__enumext_after_hyperref:
386 {
387   \IfPackageLoadedTF { hyperref }
388   {
389     \msg_info:nnn { enumext } { package-load } { hyperref }
390     \bool_set_true:N \l__enumext_hyperref_bool
391     \IfHyperBoolean{hyperfootnotes}
392     {
393       \bool_set_true:N \l__enumext_footnotes_key_bool
394     }
395     { }
396   }
397   { }
```

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`.

```
398 \bool_if:NT \l__enumext_footnotes_key_bool
399 {
400   \IfPackageLoadedTF { footnotehyper }
401   {
402     \msg_info:nnn { enumext } { package-load } { footnotehyper }
403   }
404   { }
```

```

405         \bool_set_false:N \l__enumext_footnotes_key_bool
406     }
407 }

```

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.

```

408 \bool_if:NTF \l__enumext_hyperref_bool
409 {
410     \cs_new_eq:NN \__enumext_hypertarget:nn \hypertarget
411     \cs_new_eq:NN \__enumext_phantomsection: \phantomsection
412 }
413 {
414     \cs_new_eq:NN \__enumext_hypertarget:nn \use_none:nn
415     \cs_new_eq:NN \__enumext_phantomsection: \prg_do_nothing:
416 }
417 }

```

(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.

```

418 \cs_new_protected:Npn \__enumext_newlabel:nn #1 #2
419 {
420     \protected@write \@auxout { }
421     {
422         \token_to_str:N \newlabel {#1}
423         {
424             {#2}
425             \bool_if:NT \l__enumext_hyperref_bool
426             { { \thepage } {#2} {#1} }
427             { }
428         }
429     }
430     \__enumext_hypertarget:nn {#1} { }
431     \__enumext_phantomsection:
432 }

```

(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.

```

433 \cs_new_protected:Nn \__enumext_footnotetext:nn
434 {
435     \footnotetext[#1]{#2}
436 }
437 \cs_new_protected:Nn \__enumext_renew_footnote:
438 {
439     \RenewDocumentCommand \footnote { o +m }
440     {
441         \tl_if_novalue:nTF {##1}
442         {
443             \stepcounter{footnote}
444             \int_gset_eq:Nc \g__enumext_footnote_standar_int { c@footnote }
445         }
446         {
447             \int_gset:Nn \g__enumext_footnote_standar_int { ##1 }
448         }
449         \footnotemark [ \g__enumext_footnote_standar_int ]
450         \seq_gput_right:Nn \g__enumext_footnote_standar_arg_seq { ##2 }
451         \seq_gput_right:NV

```

```

452         \g__enumext_footnote_standar_int_seq \g__enumext_footnote_standar_int
453     }
454 }
455 \cs_new_protected:Nn \__enumext_print_footnote:
456 {
457     \seq_if_empty:NF \g__enumext_footnote_standar_int_seq
458     {
459         \seq_map_pairwise_function:NNN
460         \g__enumext_footnote_standar_int_seq
461         \g__enumext_footnote_standar_arg_seq
462         \__enumext_footnotetext:nn
463     }
464     \seq_gclear:N \g__enumext_footnote_standar_arg_seq
465     \seq_gclear:N \g__enumext_footnote_standar_int_seq
466 }

```

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.

```

467 \cs_new_protected:Nn \__enumext_renew_footnote_mini:
468 {
469     \RenewDocumentCommand \footnote { o +m }
470     {
471         \tl_if_novalue:nTF {##1}
472         {
473             \stepcounter{footnote}
474             \int_gset_eq:Nc \g__enumext_footnote_starred_int { c@footnote }
475         }
476         {
477             \int_gset:Nn \g__enumext_footnote_starred_int { ##1 }
478         }
479         \footnotemark [ \g__enumext_footnote_starred_int ]
480         \seq_gput_right:Nn \g__enumext_footnote_starred_arg_seq { ##2 }
481         \seq_gput_right:NV
482         \g__enumext_footnote_starred_int_seq \g__enumext_footnote_starred_int
483     }
484 }
485 \cs_new_protected:Nn \__enumext_print_footnote_mini:
486 {
487     \seq_if_empty:NF \g__enumext_footnote_starred_int_seq
488     {
489         \seq_map_pairwise_function:NNN
490         \g__enumext_footnote_starred_int_seq
491         \g__enumext_footnote_starred_arg_seq
492         \__enumext_footnotetext:nn
493     }
494     \seq_gclear:N \g__enumext_footnote_starred_arg_seq
495     \seq_gclear:N \g__enumext_footnote_starred_int_seq
496 }

```

*(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.

```

497 \cs_new_protected:Nn \__enumext_renew_footnote_standar:
498 {
499     \bool_if:NT \g__enumext_standar_bool
500     {
501         \IfDocumentMetadataTF
502         {
503             \__enumext_renew_footnote:
504         }
505         {
506             \bool_if:NF \l__enumext_footnotes_key_bool
507             {
508                 \__enumext_renew_footnote:
509             }
510         }
511     }
512 }
513 \cs_new_protected:Nn \__enumext_print_footnote_standar:

```



```

514 {
515   \bool_if:NT \g__enumext_standar_bool
516   {
517     \IfDocumentMetadataTF
518     {
519       \__enumext_print_footnote:
520     }
521     {
522       \bool_if:NF \l__enumext_footnotes_key_bool
523       {
524         \__enumext_print_footnote:
525       }
526     }
527   }
528 }

```

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.

```

529 \cs_new_protected:Nn \__enumext_renew_footnote_starred:
530 {
531   \IfDocumentMetadataTF
532   {
533     \__enumext_renew_footnote_mini:
534   }
535   {
536     \bool_if:NF \l__enumext_footnotes_key_bool
537     {
538       \__enumext_renew_footnote_mini:
539     }
540   }
541 }
542 \cs_new_protected:Nn \__enumext_print_footnote_starred:
543 {
544   \IfDocumentMetadataTF
545   {
546     \__enumext_print_footnote_mini:
547   }
548   {
549     \bool_if:NF \l__enumext_footnotes_key_bool
550     {
551       \__enumext_print_footnote_mini:
552     }
553   }
554 }

```

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

```

555 \__enumext_after_env:nn { enumext* }
556 {
557   \__enumext_print_footnote_starred:
558 }
559 \__enumext_after_env:nn { keyans* }
560 {
561   \__enumext_print_footnote_starred:
562 }

```

(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 (§13.39) and `\__enumext_safe_exec_vii:` in the `enumext*` environment definition (§13.44)

```

563 \cs_new_protected:Nn \__enumext_internal_mini_page:
564 {
565   \int_compare:nNt { \__enumext_level_int } = { 0 }

```

```

566     {
567         \DeclareDocumentEnvironment{__enumext_mini_page}{ m }
568         {
569             \__enumext_renew_footnote_standar:
570             \__enumext_minipage:w [ t ] { ##1 }
571             \legacy_if_gset_false:n { @minipage }
572             \skip_vertical:N \c_zero_skip
573         }
574         {
575             \skip_vertical:N \c_zero_skip
576             \__enumext_endminipage:
577             \__enumext_print_footnote_standar:
578         }
579     }
580 }

```

(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.

```

581 \dim_zero_new:N \itemwidth

```

### 13.11 Definition of counters

```

\__enumext_define_counters:Nn
enumXi
enumXii
enumXiii
enumXiv
enumXv
enumXvi
enumXvii
enumXviii

```

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.

```

582 \cs_new_protected:Npn \__enumext_define_counters:Nn #1 #2
583 {
584     \cs_if_exist:cTF { c@ #2 }
585     { \msg_fatal:nnn { enumext } { counters }{ #2 } }
586     {
587         \tl_set:Nn #1 { #2 }
588         \newcounter { #2 }
589     }
590 }

```

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.

```

591 \__enumext_define_counters:Nn \__enumext_counter_i_tl { enumXi }
592 \__enumext_define_counters:Nn \__enumext_counter_ii_tl { enumXii }
593 \__enumext_define_counters:Nn \__enumext_counter_iii_tl { enumXiii }
594 \__enumext_define_counters:Nn \__enumext_counter_iv_tl { enumXiv }
595 \__enumext_define_counters:Nn \__enumext_counter_v_tl { enumXv }
596 \__enumext_define_counters:Nn \__enumext_counter_vi_tl { enumXvi }
597 \__enumext_define_counters:Nn \__enumext_counter_vii_tl { enumXvii }
598 \__enumext_define_counters:Nn \__enumext_counter_viii_tl { enumXviii }

```

(End of definition for `\__enumext_define_counters: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.

```

\__enumext_register_counter_style:Nn

```

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.

```

599 \cs_new_protected:Npn \__enumext_register_counter_style:Nn #1 #2
600 {
601     \tl_const:cn { c__enumext_widest_ \cs_to_str:N #1 _tl } {#2}
602     \tl_gput_right:Nn \g__enumext_counter_styles_tl {#1}
603 }
604 \__enumext_register_counter_style:Nn \arabic { 0 }
605 \__enumext_register_counter_style:Nn \Alph { M }
606 \__enumext_register_counter_style:Nn \alph { m }

```

```

607 \__enumext_register_counter_style:Nn \Roman { VIII }
608 \__enumext_register_counter_style:Nn \roman { viii }

```

(End of definition for \\_\_enumext\_register\_counter\_style:Nn.)

```

\__enumext_label_width_by_box:Nn
\__enumext_label_width_by_box:cv

```

The function \\_\_enumext\_label\_width\_by\_box:Nn set the default \labelwidth using a box width if no \labelwidth key is passed.

```

609 \cs_new_protected:Npn \__enumext_label_width_by_box:Nn #1 #2
610 {
611   \hbox_set:Nn \l__enumext_label_width_by_box {#2}
612   \dim_set:Nn #1 { \box_wd:N \l__enumext_label_width_by_box }
613 }
614 \cs_generate_variant:Nn \__enumext_label_width_by_box:Nn { cv }

```

(End of definition for \\_\_enumext\_label\_width\_by\_box:Nn.)

```

\__enumext_label_style:Nnn
\__enumext_label_style:cvn

```

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.

```

615 \cs_new_protected:Npn \__enumext_label_style:Nnn #1 #2 #3
616 {
617   \tl_clear_new:N #1
618   \tl_put_right:Ne #1 { \tl_trim_spaces:n {#3} }
619   \tl_gset_eq:NN \g__enumext_widest_label_tl #1
620   \tl_map_inline:Nn \g__enumext_counter_styles_tl
621   {
622     \tl_replace_all:Nne #1 { ##1* } { \exp_not:N ##1 {#2} }
623     \tl_greplace_all:Nne \g__enumext_widest_label_tl { ##1* }
624     { \tl_use:c { c__enumext_widest_ \cs_to_str:N ##1 _tl } }
625   }
626   \__enumext_label_width_by_box:Nn \l__enumext_current_widest_dim
627   { \tl_use:N \g__enumext_widest_label_tl }
628   \tl_set_eq:cN { the #2 } #1
629 }
630 \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 (§13.34). 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.

```

631 \cs_set_protected:Npn \__enumext_tmp:n #1
632 {
633   \keys_define:nn { enumext / #1 }
634   {
635     mode-box .bool_set:N = \l__enumext_mode_box_bool,
636     mode-box .initial:n = false,
637     mode-box .value_forbidden:n = true,
638   }
639 }
640 \clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }

```

(End of definition for mode-box.)

```

font
labelsep
labelwidth
wrap-label
wrap-label*

```

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

```

641 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
642 {
643   \keys_define:nn { enumext / #1 }
644   {
645     font .tl_set:c = { l__enumext_label_font_style_#2_tl },
646     font .value_required:n = true,
647     labelsep .dim_set:c = { l__enumext_labelsep_#2_dim },
648     labelsep .initial:n = { 0.3333em },
649     labelsep .value_required:n = true,

```

```

650     labelwidth .dim_set:c = { l__enumext_labelwidth_#2_dim },
651     labelwidth .value_required:n = true,
652     wrap-label .cs_set_protected:cp = { __enumext_wrapper_label_#2:n } ##1,
653     wrap-label .initial:n = {##1},
654     wrap-label .value_required:n = true,
655     wrap-label* .code:n = {
656         \bool_set_true:c { l__enumext_wrap_label_opt_#2_bool }
657         \keys_set:nn { enumext / #1 } { wrap-label = {##1} }
658     },
659     wrap-label* .value_required:n = true,
660 }
661 }
662 \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.

```

663 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
664 {
665     \keys_define:nn { enumext / #1 }
666     {
667         align .choice:,
668         align / left .code:n =
669             {
670                 \tl_clear:c { l__enumext_label_fill_left_#2_tl }
671                 \tl_set:cn { l__enumext_label_fill_right_#2_tl } { \hfill }
672                 \str_set:cn { l__enumext_align_label_pos_#2_str } { l }
673             },
674         align / right .code:n =
675             {
676                 \tl_set:cn { l__enumext_label_fill_left_#2_tl } { \hfill }
677                 \tl_clear:c { l__enumext_label_fill_right_#2_tl }
678                 \str_set:cn { l__enumext_align_label_pos_#2_str } { r }
679             },
680         align / center .code:n =
681             {
682                 \tl_set:cn { l__enumext_label_fill_left_#2_tl } { \hfill }
683                 \tl_set:cn { l__enumext_label_fill_right_#2_tl } { \hfill }
684                 \str_set:cn { l__enumext_align_label_pos_#2_str } { c }
685             },
686         align / unknown .code:n =
687             \msg_error:nnee { enumext } { unknown-choice }
688             { align } { left,~right,~ center } { \exp_not:n {##1} },
689         align .initial:n = left,
690         align .value_required:n = true,
691     }
692 }
693 \clist_map_inline:nn
694 {
695     {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {keyans}{v}
696 }
697 { \__enumext_tmp:nn #1 }
698 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
699 {
700     \keys_define:nn { enumext / #1 }
701     {
702         align .choice:,
703         align / left .code:n = \str_set:cn { l__enumext_align_label_#2_str } { l },
704         align / right .code:n = \str_set:cn { l__enumext_align_label_#2_str } { r },
705         align / center .code:n = \str_set:cn { l__enumext_align_label_#2_str } { c },
706         align / unknown .code:n =
707             \msg_error:nnee { enumext } { unknown-choice }
708             { align } { left,~right,~ center } { \exp_not:n {##1} },
709         align .initial:n = left,
710         align .value_required:n = true,
711     }
712 }
713 \clist_map_inline:nn { {enumext*}{vii}, {keyans*}{viii} } { \__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.

```

label
ref
\l__enumext_label_i_tl 714 \cs_set_protected:Npn \__enumext_tmp:nnn #1 #2 #3
\l__enumext_label_ii_tl 715 {
\l__enumext_label_iii_tl 716   \keys_define:nn { enumext / #1 }
\l__enumext_label_iv_tl 717   {
718     label .code:n = {
719       \__enumext_label_style:cvn { \l__enumext_label_#2_tl }
720       { \l__enumext_counter_#2_tl } {##1}
721       \dim_set_eq:cN { \l__enumext_labelwidth_#2_dim }
722       \l__enumext_current_widest_dim
723     },
724     label .initial:n = #3,
725     label .value_required:n = true,
726     ref .code:n = \__enumext_standar_ref:n {##1},
727     ref .value_required:n = true,
728   }
729 }
730 \__enumext_tmp:nnn { level-1 } { i } { \arabic*. }
731 \__enumext_tmp:nnn { level-2 } { ii } { (\alph*. ) }
732 \__enumext_tmp:nnn { level-3 } { iii } { \roman*. }
733 \__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` first we will pass the key argument to `\l__enumext_ref_key_arg_tl` and we will analyze its state, if it is not *empty* we will make a copy of the current counter in `\l__enumext_ref_the_count_tl` and we will execute the function `\__enumext_regex_counter_style:` which will return the modified `\l__enumext_ref_key_arg_tl` and we make the value of `\l__enumext_ref_the_count_tl` the same as that `\l__enumext_the_counter_X_tl` which contains `\theenumX` and finally we set `\l__enumext_renew_the_count_X_tl` with the renewed command.

```

734 \cs_new_protected:Npn \__enumext_standar_ref:n #1
735 {
736   \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
737   \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
738   {
739     \msg_error:nnn { enumext } { key-ref-empty } { enumext }
740   }
741   {
742     \tl_set_eq:Nc
743     \l__enumext_ref_the_count_tl { \l__enumext_counter_ \__enumext_level: _tl }
744     \__enumext_regex_counter_style:
745     \tl_set_eq:Nc
746     \l__enumext_ref_the_count_tl { \l__enumext_the_counter_ \__enumext_level: _tl }
747     \tl_put_right:ce { \l__enumext_renew_the_count_ \__enumext_level: _tl }
748     {
749       \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V \l__
750     }
751   }
752 }
```

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

```

753 \cs_new_protected:Npn \__enumext_standar_ref:
754 {
755   \tl_if_empty:cF { \l__enumext_renew_the_count_ \__enumext_level: _tl }
756   {
757     \tl_use:c { \l__enumext_renew_the_count_ \__enumext_level: _tl }
758   }
759 }
```

(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

label Here we set the default  $\langle labels \rangle$  for `enumext*` and `keyans*` environments, along with the default value for  
ref `labelwidth` key and `ref` key.

```

\l__enumext_label_vii_tl 760 \cs_set_protected:Npn \l__enumext_tmp:nnn #1 #2 #3
\l__enumext_label_viii_tl 761 {
762   \keys_define:nn { enumext / #1 }
763   {
764     label .code:n = {
765       \__enumext_label_style:cvn { l__enumext_label_#2_tl }
766       { l__enumext_counter_#2_tl } {##1}
767       \dim_set_eq:cN { l__enumext_labelwidth_#2_dim }
768       \l__enumext_current_widest_dim
769     },
770     label .initial:n = #3,
771     label .value_required:n = true,
772     ref .code:n = \l__enumext_starred_ref:n {##1},
773     ref .value_required:n = true,
774   }
775 }
776 \l__enumext_tmp:nnn { enumext* } { vii } { \arabic*.}
777 \l__enumext_tmp:nnn { keyans* } { viii } { \Alph*.}

```

(End of definition for label and others.)

\\_\_enumext\_starred\_ref:n The implementation of `\__enumext_starred_ref:n` is the same as that used for the environment `enumext`.  
\\_\_enumext\_starred\_ref:

```

778 \cs_new_protected:Npn \l__enumext_starred_ref:n #1
779 {
780   \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
781   \int_compare:nNnT { \l__enumext_level_h_int } = { 1 }
782   {
783     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
784     {
785       \msg_error:nnn { enumext } { key-ref-empty } { enumext* }
786     }
787     {
788       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_counter_vii_tl
789       \__enumext_regex_counter_style:
790       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_vii_tl
791       \tl_put_right:Ne \l__enumext_renew_the_count_vii_tl
792       {
793         \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V
794       }
795     }
796   }
797   \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
798   {
799     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
800     {
801       \msg_error:nnn { enumext } { key-ref-empty } { keyans* }
802     }
803     {
804       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_counter_viii_tl
805       \__enumext_regex_counter_style:
806       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_viii_tl
807       \tl_put_right:Ne \l__enumext_renew_the_count_viii_tl
808       {
809         \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V
810       }
811     }
812   }
813 }

```

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.

```

814 \cs_new_protected:Nn \__enumext_starred_ref:
815 {
816   \int_compare:nNnT { \l__enumext_level_h_int } = { 1 }
817   {
818     \tl_if_empty:NF \l__enumext_renew_the_count_vii_tl
819     {
820       \tl_use:N \l__enumext_renew_the_count_vii_tl

```



```

821     }
822   }
823   \int_compare:nNt { \l__enumext_keyans_level_h_int } = { 1 }
824   {
825     \tl_if_empty:NF \l__enumext_renew_the_count_viii_tl
826     {
827       \tl_use:N \l__enumext_renew_the_count_viii_tl
828     }
829   }
830 }

```

(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

`label` 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
831 \keys_define:nn { enumext / keyans }
832 {
833   label .code:n = {
834     \__enumext_label_style:cvn { \l__enumext_label_v_tl }
835     { \__enumext_counter_v_tl } {#1}
836     \__enumext_label_style:cvn { \l__enumext_label_vi_tl }
837     { \__enumext_counter_vi_tl } {#1}
838     \dim_set_eq:NN
839     \l__enumext_labelwidth_v_dim \l__enumext_current_widest_dim
840   },
841   label .initial:n = \Alph*,
842   label .value_required:n = true,
843   ref .code:n = \__enumext_keyans_ref:n {#1},
844   ref .value_required:n = true,
845 }

```

(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:`

```

846 \cs_new_protected:Npn \__enumext_keyans_ref:n #1
847 {
848   \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
849   \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
850   {
851     \msg_error:nnn { enumext } { key-ref-empty } { keyans }
852   }
853   {
854     \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_counter_v_tl
855     \__enumext_regex_counter_style:
856     \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_v_tl
857     \tl_put_right:Ne \l__enumext_renew_the_count_v_tl
858     {
859       \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V \l__
860     }
861   }
862 }

```

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

```

863 \cs_new_protected:Npn \__enumext_keyans_ref:
864 {
865   \tl_if_empty:NF \l__enumext_renew_the_count_v_tl
866   {
867     \tl_use:N \l__enumext_renew_the_count_v_tl
868   }
869 }

```

(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.

```
870 \cs_new_protected:Npn \__enumext_start_from:NNn #1 #2 #3
871 {
872   \__enumext_if_is_int:nTF { #3 }
873   {
874     \int_set:Nn #2 {#3}
875   }
876   {
877     \regex_match:nVT { \c{Alph} | \c{alph} } {#1}
878     { \int_set:Nn #2 { \int_from_alph:n {#3} } }
879     \regex_match:nVT { \c{Roman} | \c{roman} } {#1}
880     { \int_set:Nn #2 { \int_from_roman:n {#3} } }
881   }
882 }
883 \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 four argument can be an ⟨integer⟩ or ⟨string⟩ of the form `\Alph`, `\alph`, `\Roman` or `\roman`. The value of the four 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.

```
884 \cs_new_protected:Npn \__enumext_widest_from:nNNn #1 #2 #3 #4
885 {
886   \__enumext_if_is_int:nTF {#4}
887   {
888     \setcounter{enumX#1} { #4 }
889   }
890   {
891     \regex_match:nVT { \c{Alph} | \c{alph} } {#2}
892     { \setcounter{enumX#1} { \int_from_alph:n {#4} } }
893     \regex_match:nVT { \c{Roman} | \c{roman} } {#2}
894     { \setcounter{enumX#1} { \int_from_roman:n {#4} } }
895   }
896   \__enumext_label_width_by_box:cv
897   { \l__enumext_labelwidth_#1_dim } { \l__enumext_label_#1_tl }
898 }
899 \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.

```
start
start*
widest
```

```
900 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
901 {
902   \keys_define:nn { enumext / #1 }
903   {
904     start* .code:n = {
905       \__enumext_start_from:ccn
906       { \l__enumext_label_#2_tl }
907       { \l__enumext_start_#2_int } {##1}
908     },
909     start* .value_required:n = true,
910     start .code:n = {
911       \__enumext_start_from:cce
912       { \l__enumext_label_#2_tl }
913       { \l__enumext_start_#2_int } { \int_eval:n {##1} }
```

```

914         },
915         start .initial:n = 1,
916         start .value_required:n = true,
917         widest .code:n = {
918             \__enumext_widest_from:nccn {#2}
919             { \__enumext_label_#2_tl }
920             { \__enumext_labelwidth_#2_dim } {##1}
921         },
922         widest .value_required:n = true,
923     }
924 }
925 \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 vertical spaces

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

```

926 \cs_set_protected:Npn \__enumext_tmp:nnnnnn #1 #2 #3 #4 #5 #6
927 {
928     \keys_define:nn { enumext / #1 }
929     {
930         topsep .skip_set:c = { \__enumext_topsep_#2_skip },
931         topsep .initial:n = {#3},
932         topsep .value_required:n = true,
933         partopsep .skip_set:c = { \__enumext_partopsep_#2_skip },
934         partopsep .initial:n = {#4},
935         partopsep .value_required:n = true,
936         parsep .skip_set:c = { \__enumext_parsep_#2_skip },
937         parsep .initial:n = {#5},
938         parsep .value_required:n = true,
939         itemsep .skip_set:c = { \__enumext_itemsep_#2_skip },
940         itemsep .initial:n = {#6},
941         itemsep .value_required:n = true,
942         noitemsep .meta:n = { itemsep = 0pt, parsep = 0pt },
943         noitemsep .value_forbidden:n = true,
944         nosepp .meta:n = {
945             itemsep = 0pt, parsep = 0pt,
946             topsep = 0pt, partopsep = 0pt,
947         },
948         nosepp .value_forbidden:n = true,
949     }
950 }

```

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

```

951 \__enumext_tmp:nnnnnn { level-1 } { i } { 8.0pt plus 2.0pt minus 4.0pt }
952 { 2.0pt plus 1.0pt minus 1.0pt } { 4.0pt plus 2.0pt minus 1.0pt }
953 { 4.0pt plus 2.0pt minus 1.0pt }
954 \__enumext_tmp:nnnnnn { level-2 } { ii } { 4.0pt plus 2.0pt minus 1.0pt }
955 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
956 { 2.0pt plus 1.0pt minus 1.0pt }
957 \__enumext_tmp:nnnnnn { level-3 } { iii } { 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 { level-4 } { iv } { 2.0pt plus 1.0pt minus 1.0pt }
960 { 1.0pt minus 1.0pt } { 0pt } { 2.0pt plus 1.0pt minus 1.0pt }
961 \__enumext_tmp:nnnnnn { keyans } { v } { 4.0pt plus 2.0pt minus 1.0pt }
962 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
963 { 2.0pt plus 1.0pt minus 1.0pt }
964 \__enumext_tmp:nnnnnn { enumext* } { vii } { 8.0pt plus 2.0pt minus 4.0pt }
965 { 2.0pt plus 1.0pt minus 1.0pt } { 4.0pt plus 2.0pt minus 1.0pt }
966 { 4.0pt plus 2.0pt minus 1.0pt }
967 \__enumext_tmp:nnnnnn { keyans* } { viii } { 4.0pt plus 2.0pt minus 1.0pt }
968 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
969 { 2.0pt plus 1.0pt minus 1.0pt }

```

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

### 13.17 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.

`base-fix`  
`\__enumext_nested_base_line_fix:`

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

```

970 \keys_define:nn { enumext / level-1 }
971 {
972   base-fix .bool_set:N = \__enumext_base_line_fix_bool,
973   base-fix .initial:n = false,
974   base-fix .value_forbidden:n = true,
975 }

```

The function `\__enumext_nested_base_line_fix:` passed to the `\__enumext_parse_keys:n` function in the definition of the `enumext` environment (§13.39) will be responsible for applying the *baseline correction* and adjusting the `\keys` for the `enumext` environment and the `\printkeyans` with *starred argument* “\*” (§13.47).

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.

```

976 \cs_new_protected:Nn \__enumext_nested_base_line_fix:
977 {
978   \bool_lazy_all:nT
979   {
980     { \bool_if_p:N \__enumext_starred_first_bool }
981     { \bool_if_p:N \__enumext_base_line_fix_bool }
982     { \bool_not_p:n { \__enumext_print_keyans_star_bool } }
983   }
984   {
985     \mode_leave_vertical:
986     \vspace { -\dim_eval:n { \baselineskip + \parsep } }
987     \keys_set:nn { enumext / level-1 }
988     {
989       topsep = 0pt, above = 0pt, above* = 0pt,
990     }
991   }

```

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`.

```

992   \bool_lazy_and:nnT
993   { \bool_if_p:N \__enumext_starred_first_bool }
994   { \bool_if_p:N \__enumext_print_keyans_star_bool }
995   {
996     \mode_leave_vertical:
997     \skip_vertical:n { -\baselineskip }
998     \skip_vertical:N \c_zero_skip
999     \keys_set:nn { enumext / level-1 }
1000     {
1001       topsep = 0pt, above = 0pt, above* = 0pt,
1002     }
1003   }
1004   \bool_set_false:N \__enumext_base_line_fix_bool
1005 }

```

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

### 13.18 Setting keys for horizontal spaces

`itemindent`  
`rightmargin`  
`listparindent`  
`list-offset`  
`list-indent`

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

```

1006 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1007 {
1008   \keys_define:nn { enumext / #1 }
1009   {
1010     itemindent .dim_set:c = { \__enumext_fake_item_indent_#2_dim },
1011     itemindent .value_required:n = true,
1012     rightmargin .dim_set:c = { \__enumext_rightmargin_#2_dim },
1013     rightmargin .value_required:n = true,
1014     listparindent .dim_set:c = { \__enumext_listparindent_#2_dim },

```

```

1015         listparindent .value_required:n = true,
1016         list-offset   .dim_set:c = { l__enumext_listoffset_#2_dim },
1017         list-offset   .value_required:n = true,
1018         list-indent   .code:n      =
1019                     \bool_set_true:c { l__enumext_leftmargin_tmp_#2_bool }
1020                     \dim_set:cn { l__enumext_leftmargin_tmp_#2_dim } {##1},
1021         list-indent   .value_required:n = true,
1022     }
1023 }
1024 \clist_map_inline:nn
1025 {
1026     {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {keyans}{v}
1027 }
1028 { \__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.

```

1029 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1030 {
1031     \keys_define:nn { enumext / #1 }
1032     {
1033         itemindent .dim_set:c = { l__enumext_fake_item_indent_#2_dim },
1034         itemindent .value_required:n = true,
1035         rightmargin .dim_set:c = { l__enumext_rightmargin_#2_dim },
1036         rightmargin .value_required:n = true,
1037         listparindent .dim_set:c = { l__enumext_listparindent_#2_dim },
1038         listparindent .value_required:n = true,
1039         list-offset .dim_set:c = { l__enumext_listoffset_#2_dim },
1040         list-offset .value_required:n = true,
1041         list-indent .meta:n      = { list-offset = ##1 },
1042         list-indent .value_required:n = true,
1043     }
1044 }
1045 \clist_map_inline:nn
1046 {
1047     {enumext*}{vii}, {keyans*}{viii}
1048 }
1049 { \__enumext_tmp:nn #1 }

```

### 13.18.1 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.

```

1050 \cs_set_protected:Nn \__enumext_fake_item_indent:
1051 {
1052     \dim_compare:nNnT
1053     { \dim_use:c { l__enumext_fake_item_indent_ \__enumext_level: _dim } }
1054     >
1055     { \c_zero_dim }
1056     {
1057         \tl_set:ce { l__enumext_fake_item_indent_ \__enumext_level: _tl }
1058         {
1059             \exp_not:N \mode_leave_vertical:
1060             \exp_not:n { \skip_horizontal:n }
1061             { \dim_use:c { l__enumext_fake_item_indent_ \__enumext_level: _dim } }
1062             \exp_not:N \ignorespaces
1063         }
1064     }
1065 }
1066 \cs_set_protected:Nn \__enumext_keyans_fake_item_indent:
1067 {
1068     \dim_compare:nNnT
1069     { \l__enumext_fake_item_indent_v_dim } > { \c_zero_dim }
1070     {
1071         \tl_set:Ne \l__enumext_fake_item_indent_v_tl
1072         {
1073             \exp_not:N \mode_leave_vertical:
1074             \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_v_dim

```

```

1075         \exp_not:N \ignorespaces
1076     }
1077 }
1078 }
1079 \cs_set_protected:Nn \__enumext_fake_item_indent_vii:
1080 {
1081     \dim_compare:nNnT
1082     { \l__enumext_fake_item_indent_vii_dim } > { \c_zero_dim }
1083     {
1084         \tl_set:Nc \l__enumext_fake_item_indent_vii_tl
1085         {
1086             \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_vii_dim
1087             \exp_not:N \ignorespaces
1088         }
1089     }
1090 }
1091 \cs_set_protected:Nn \__enumext_fake_item_indent_viii:
1092 {
1093     \dim_compare:nNnT
1094     { \l__enumext_fake_item_indent_viii_dim } > { \c_zero_dim }
1095     {
1096         \tl_set:Nc \l__enumext_fake_item_indent_viii_tl
1097         {
1098             \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_viii_dim
1099             \exp_not:N \ignorespaces
1100         }
1101     }
1102 }

```

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

### 13.19 Setting show-length key

show-length

Define and set `show-length` key for `enumext`, `enumext*`, `keyans` and `keyans*` environments. The function sets the boolean variable `\l__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.

```

1103 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1104 {
1105     \keys_define:nn { enumext / #1 }
1106     {
1107         show-length .bool_set:c = { \l__enumext_show_length_#2_bool },
1108         show-length .initial:n = false,
1109     }
1110 }
1111 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

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

### 13.20 Setting before, after and first keys

before

before\*

after

first

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

```

1112 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1113 {
1114     \keys_define:nn { enumext / #1 }
1115     {
1116         before .tl_set:c = { \l__enumext_before_no_starred_key_#2_tl },
1117         before .value_required:n = true,
1118         before* .tl_set:c = { \l__enumext_before_starred_key_#2_tl },
1119         before* .value_required:n = true,
1120         after .tl_set:c = { \l__enumext_after_stop_list_#2_tl },
1121         after .value_required:n = true,
1122         first .tl_set:c = { \l__enumext_after_list_args_#2_tl },
1123         first .value_required:n = true,
1124     }
1125 }
1126 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

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



### 13.20.1 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⟩}`.

```
1127 \cs_new_protected:Nn \__enumext_before_args_exec:
1128 {
1129     \tl_use:c { l__enumext_before_starred_key_ \__enumext_level: _tl }
1130 }
```

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⟩}}`

```
1131 \cs_new_protected:Nn \__enumext_before_keys_exec:
1132 {
1133     \tl_use:c { l__enumext_before_no_starred_key_ \__enumext_level: _tl }
1134 }
```

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

```
1135 \cs_new_protected:Nn \__enumext_after_stop_list:
1136 {
1137     \tl_use:c { l__enumext_after_stop_list_ \__enumext_level: _tl }
1138 }
```

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.`

```
1139 \cs_new_protected:Nn \__enumext_after_args_exec:
1140 {
1141     \tl_use:c { l__enumext_after_list_args_ \__enumext_level: _tl }
1142 }
```

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

### 13.20.2 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:

1143 \cs_new_protected:Nn \__enumext_before_args_exec_v:
1144 {
1145     \tl_use:N \l__enumext_before_starred_key_v_tl
1146 }
1147 \cs_new_protected:Nn \__enumext_before_keys_exec_v:
1148 {
1149     \tl_use:N \l__enumext_before_no_starred_key_v_tl
1150 }
1151 \cs_new_protected:Nn \__enumext_after_stop_list_v:
1152 {
1153     \tl_use:N \l__enumext_after_stop_list_v_tl
1154 }
1155 \cs_new_protected:Nn \__enumext_after_args_exec_v:
1156 {
1157     \tl_use:N \l__enumext_after_list_args_v_tl
1158 }
```

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

### 13.20.3 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:

1159 \cs_new_protected:Nn \__enumext_before_args_exec_vii:
1160 {
1161     \tl_use:N \l__enumext_before_starred_key_vii_tl
1162 }
1163 \cs_new_protected:Nn \__enumext_before_args_exec_viii:
1164 {
1165     \tl_use:N \l__enumext_before_starred_key_viii_tl
1166 }
1167 \cs_new_protected:Nn \__enumext_before_keys_exec_vii:
1168 {
1169     \tl_use:N \l__enumext_before_no_starred_key_vii_tl
1170 }
1171 \cs_new_protected:Nn \__enumext_before_keys_exec_viii:
1172 {
```

```

1173     \tl_use:N \l__enumext_before_no_starred_key_viii_tl
1174   }
1175   \cs_new_protected:Nn \__enumext_after_stop_list_vii:
1176   {
1177     \tl_use:N \l__enumext_after_stop_list_vii_tl
1178   }
1179   \cs_new_protected:Nn \__enumext_after_stop_list_viii:
1180   {
1181     \tl_use:N \l__enumext_after_stop_list_viii_tl
1182   }
1183   \cs_new_protected:Nn \__enumext_after_args_exec_vii:
1184   {
1185     \tl_use:N \l__enumext_after_list_args_vii_tl
1186   }
1187   \cs_new_protected:Nn \__enumext_after_args_exec_viii:
1188   {
1189     \tl_use:N \l__enumext_after_list_args_viii_tl
1190   }

```

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

### 13.21 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.

```

1191 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1192 {
1193   \keys_define:nn { enumext / #1 }
1194   {
1195     mini-env .dim_set:c = { l__enumext_minipage_right_#2_dim },
1196     mini-env .value_required:n = true,
1197     mini-sep .dim_set:c = { l__enumext_minipage_hsep_#2_dim },
1198     mini-sep .initial:n = 0.3333em,
1199     mini-sep .value_required:n = true,
1200     columns-sep .dim_set:c = { l__enumext_columns_sep_#2_dim },
1201     columns-sep .value_required:n = true,
1202     columns .int_set:c = { l__enumext_columns_#2_int },
1203     columns .initial:n = 1,
1204     columns .value_required:n = true,
1205   }
1206 }
1207 \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.

```

1208 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1209 {
1210   \keys_define:nn { enumext / #1 }
1211   {
1212     mini-right .tl_gset:c = { g__enumext_miniright_code_#2_tl },
1213     mini-right .value_required:n = true,
1214     mini-right* .code:n = {
1215       \bool_gset_true:c { g__enumext_minipage_center_#2_bool }
1216       \keys_set:nn { enumext / #1 } { mini-right = {##1} }
1217     },
1218     mini-right* .value_required:n = true,
1219   }
1220 }
1221 \clist_map_inline:nn { {enumext*}{vii}, {keyans*}{viii} } { \__enumext_tmp:nn #1 }

```

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

### 13.22 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.

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`.

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

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.

### 13.22.1 Adjustment of vertical spaces for multicols 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 T<sub>E</sub>X 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*.

```

1222 \cs_new_protected:Nn \__enumext_multi_set_vskip:
1223 {
1224   \skip_set:cn { \l__enumext_multicols_above_ \__enumext_level: _skip }
1225   {
1226     \skip_use:c { \l__enumext_topsep_ \__enumext_level: _skip }
1227   }
1228   \skip_set:cn { \l__enumext_multicols_below_ \__enumext_level: _skip }
1229   {
1230     \skip_use:c { \l__enumext_topsep_ \__enumext_level: _skip }
1231   }
1232   \__enumext_add_pre_parsep:
1233 }

```

(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*.

```

1234 \cs_new_protected:Nn \__enumext_add_pre_parsep:
1235 {
1236   \int_case:nn { \l__enumext_level_int }
1237   {
1238     { 2 }{
1239       \skip_if_eq:nnF { \l__enumext_parsep_i_skip } { \c_zero_skip }
1240       {
1241         \skip_add:Nn \l__enumext_multicols_above_ii_skip
1242         {
1243           \l__enumext_parsep_i_skip
1244         }
1245       }
1246     }
1247     { 3 }{
1248       \skip_if_eq:nnF { \l__enumext_parsep_ii_skip } { \c_zero_skip }
1249       {
1250         \skip_add:Nn \l__enumext_multicols_above_iii_skip
1251         {
1252           \l__enumext_parsep_ii_skip
1253         }
1254       }
1255     }
1256     { 4 }{
1257       \skip_if_eq:nnF { \l__enumext_parsep_iii_skip } { \c_zero_skip }
1258       {
1259         \skip_add:Nn \l__enumext_multicols_above_iv_skip
1260         {
1261           \l__enumext_parsep_iii_skip
1262         }
1263       }
1264     }
1265   }

```

```

1263         }
1264     }
1265 }
1266 }

```

(End of definition for `\__enumext_add_pre_parse:`)

`\__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*.

```

1267 \cs_new_protected:Nn \__enumext_multi_addvspace:
1268 {
1269     \__enumext_multi_set_vskip:
1270     \mode_if_vertical:T
1271     {
1272         \skip_add:cn { l__enumext_multicols_above_ \__enumext_level: _skip }
1273         {
1274             \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
1275         }
1276         \skip_add:cn { l__enumext_multicols_below_ \__enumext_level: _skip }
1277         {
1278             \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
1279         }
1280     }
1281     \par\nopagebreak
1282     \addvspace{ \skip_use:c { l__enumext_multicols_above_ \__enumext_level: _skip } }
1283 }

```

(End of definition for `\__enumext_multi_addvspace:`)

### 13.22.2 Adjustment of vertical spaces for multicols in keyans

`\__enumext_keyans_multi_set_vskip:` 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`.

`\__enumext_keyans_multi_addvspace:`

```

1284 \cs_new_protected:Nn \__enumext_keyans_multi_set_vskip:
1285 {
1286     \skip_set:Nn \l__enumext_multicols_above_v_skip
1287     {
1288         \l__enumext_topsep_v_skip
1289     }
1290     \skip_set:Nn \l__enumext_multicols_below_v_skip
1291     {
1292         \l__enumext_topsep_v_skip
1293     }
1294 }
1295 \cs_new_protected:Nn \__enumext_keyans_multi_addvspace:
1296 {
1297     \__enumext_keyans_multi_set_vskip:
1298     \mode_if_vertical:T
1299     {
1300         \skip_add:Nn \l__enumext_multicols_above_v_skip
1301         {
1302             \skip_use:N \l__enumext_partopsep_v_skip
1303         }
1304         \skip_add:Nn \l__enumext_multicols_below_v_skip
1305         {
1306             \skip_use:N \l__enumext_partopsep_v_skip
1307         }
1308     }
1309     \par\nopagebreak
1310     \addvspace{ \l__enumext_multicols_above_v_skip }
1311 }

```

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

### 13.23 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.

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.

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

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  $\text{\TeX}$  is in  $\langle horizontal\ mode \rangle$  or  $\langle vertical\ mode \rangle$ . 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` is nested. The setting of the values was more “trial and error” (aprox to `\strutbox`), using the help of the `lua-visual-debug`[14] package, again my attempts to find the correct values using `\showoutput` and `\showboxdepth` absolutely failed.

### 13.23.1 Adjustment of vertical spaces for minipage in enumext

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

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

```

1312 \cs_new_protected:Nn \__enumext_minipage_set_skip:
1313 {
1314   \skip_set:Nn \__enumext_minipage_right_skip
1315   {
1316     \skip_use:c { \__enumext_topsep_ \__enumext_level: _skip }
1317   }
1318   \mode_if_vertical:T
1319   {
1320     \skip_add:Nn \__enumext_minipage_right_skip
1321     {
1322       \skip_use:c { \__enumext_partopsep_ \__enumext_level: _skip }
1323     }
1324   }
1325   \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:`.

```

1326   \skip_set_eq:cN
1327   { \__enumext_multicols_above_ \__enumext_level: _skip } \__enumext_minipage_right_skip
1328   \skip_set_eq:cN
1329   { \__enumext_multicols_below_ \__enumext_level: _skip } \__enumext_minipage_right_skip
1330   \__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`.

```

1331   \int_compare:nNt
1332   { \int_use:c { \__enumext_columns_ \__enumext_level: _int } } > { 1 }
1333   {
1334     \skip_zero:N \topskip
1335     \skip_set_eq:Nc \multicolsep { \__enumext_multicols_above_ \__enumext_level: _skip }
1336   }
1337 }

```

The function `\__enumext_minipage_add_space:` will apply the spaces on the “left side” using `\addvspace` “above” the `\__enumext_minipage` environment, taking into account whether  $\text{\TeX}$  is in  $\langle horizontal\ mode \rangle$  or  $\langle vertical\ mode \rangle$ . Here we use the plain  $\text{\TeX}$  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*.

```

1338 \cs_new_protected:Nn \__enumext_minipage_add_space:
1339 {
1340   \__enumext_minipage_set_skip:
1341   \__enumext_unskip_unkern:
1342   \mode_if_vertical:TF
1343   {
1344     \nopagebreak\nointerlineskip

```

```

1345     }
1346     {
1347         \par\nopagebreak\nointerlineskip
1348         \skip_zero:c { \l__enumext_partopsep_ \l__enumext_level: _skip }
1349     }
1350     \int_compare:nNnTF
1351     { \int_use:c { \l__enumext_columns_ \l__enumext_level: _int } } > { 1 }
1352     {
1353         \addvspace{ 0.445\box_ht:N \strutbox }
1354     }
1355     {
1356         \addvspace{ 0.250\box_ht:N \strutbox }
1357     }
1358 }

```

(End of definition for `\l__enumext_minipage_set_skip:` and `\l__enumext_minipage_add_space:`.)

`\l__enumext_pre_itemsep_skip:` The function `\l__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.

```

1359 \cs_new_protected:Nn \l__enumext_pre_itemsep_skip:
1360 {
1361     \int_case:nn { \l__enumext_level_int }
1362     {
1363         { 2 }{
1364             \skip_if_eq:nnTF
1365             { \l__enumext_itemsep_i_skip } { \l__enumext_minipage_after_skip }
1366             {
1367                 \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1368                 \skip_set:Nn \l__enumext_multicols_below_ii_skip { 0.350\box_ht:N \strutbox }
1369             }
1370             {
1371                 \dim_compare:nNnT
1372                 { \l__enumext_itemsep_i_skip } < { \l__enumext_minipage_after_skip }
1373                 {
1374                     \skip_sub:Nn
1375                     \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1376                     \skip_sub:Nn
1377                     \l__enumext_multicols_below_ii_skip { \l__enumext_itemsep_i_skip }
1378                     \skip_add:Nn
1379                     \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1380                     \skip_add:Nn
1381                     \l__enumext_multicols_below_ii_skip { 0.350\box_ht:N \strutbox }
1382                 }
1383                 \dim_compare:nNnT
1384                 { \l__enumext_itemsep_i_skip } > { \l__enumext_minipage_after_skip }
1385                 {
1386                     \skip_set:Nn \l__enumext_minipage_temp_skip
1387                     {
1388                         \l__enumext_itemsep_i_skip - \l__enumext_minipage_after_skip
1389                     }
1390                     \skip_sub:Nn
1391                     \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1392                     \skip_sub:Nn
1393                     \l__enumext_multicols_below_ii_skip { \l__enumext_itemsep_i_skip }
1394                     \skip_add:Nn
1395                     \l__enumext_minipage_after_skip
1396                     { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1397                     \skip_add:Nn
1398                     \l__enumext_multicols_below_ii_skip
1399                     { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1400                 }
1401             }
1402         }
1403         { 3 }{
1404             \skip_if_eq:nnTF
1405             { \l__enumext_itemsep_ii_skip } { \c_zero_skip }
1406             {
1407                 \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1408                 \skip_set:Nn \l__enumext_multicols_below_iii_skip { 0.350\box_ht:N \strutbox }
1409             }

```



```

1410 {
1411     \dim_compare:nNnT
1412     { \l__enumext_itemsep_ii_skip } < { \l__enumext_minipage_after_skip }
1413     {
1414         \skip_sub:Nn
1415         \l__enumext_minipage_after_skip { \l__enumext_itemsep_ii_skip }
1416         \skip_sub:Nn
1417         \l__enumext_multicols_below_iii_skip { \l__enumext_itemsep_ii_skip }
1418         \skip_add:Nn
1419         \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1420         \skip_add:Nn
1421         \l__enumext_multicols_below_iii_skip { 0.350\box_ht:N \strutbox }
1422     }
1423     \dim_compare:nNnT
1424     { \l__enumext_itemsep_ii_skip } > { \l__enumext_minipage_after_skip }
1425     {
1426         \skip_set:Nn \l__enumext_minipage_temp_skip
1427         {
1428             \l__enumext_itemsep_ii_skip - \l__enumext_minipage_after_skip
1429         }
1430         \skip_sub:Nn
1431         \l__enumext_minipage_after_skip { \l__enumext_itemsep_ii_skip }
1432         \skip_sub:Nn
1433         \l__enumext_multicols_below_iii_skip { \l__enumext_itemsep_ii_skip }
1434         \skip_add:Nn
1435         \l__enumext_minipage_after_skip
1436         { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1437         \skip_add:Nn
1438         \l__enumext_multicols_below_iii_skip
1439         { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1440     }
1441 }
1442 }
1443 { 4 }{
1444     \skip_if_eq:nnTF { \l__enumext_itemsep_iii_skip } { \c_zero_skip }
1445     {
1446         \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1447         \skip_set:Nn \l__enumext_multicols_below_iv_skip { 0.350\box_ht:N \strutbox }
1448     }
1449     {
1450         \dim_compare:nNnT
1451         { \l__enumext_itemsep_iii_skip } < { \l__enumext_minipage_after_skip }
1452         {
1453             \skip_sub:Nn
1454             \l__enumext_minipage_after_skip { \l__enumext_itemsep_iii_skip }
1455             \skip_sub:Nn
1456             \l__enumext_multicols_below_iv_skip { \l__enumext_itemsep_iii_skip }
1457             \skip_add:Nn
1458             \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1459             \skip_add:Nn
1460             \l__enumext_multicols_below_iv_skip { 0.350\box_ht:N \strutbox }
1461         }
1462         \dim_compare:nNnT
1463         { \l__enumext_itemsep_iii_skip } > { \l__enumext_minipage_after_skip }
1464         {
1465             \skip_set:Nn \l__enumext_minipage_temp_skip
1466             {
1467                 \l__enumext_itemsep_iii_skip - \l__enumext_minipage_after_skip
1468             }
1469             \skip_sub:Nn
1470             \l__enumext_minipage_after_skip { \l__enumext_itemsep_iii_skip }
1471             \skip_sub:Nn
1472             \l__enumext_multicols_below_iv_skip { \l__enumext_itemsep_iii_skip }
1473             \skip_add:Nn
1474             \l__enumext_minipage_after_skip
1475             { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1476             \skip_add:Nn
1477             \l__enumext_multicols_below_iv_skip
1478             { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1479         }
1480     }

```

```

1481         }
1482     }
1483 }

```

(End of definition for `\__enumext_pre_itemsep_skip:`)

### 13.23.2 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 implementation of this function is the same as the one used in [enumext](#).

```

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

```

```

1545         \skip_add:Nn \l__enumext_multicols_below_v_skip { 0.350\box_ht:N \strutbox }
1546     }
1547 \dim_compare:nNnT
1548 { \l__enumext_itemsep_i_skip } > { \l__enumext_minipage_after_skip }
1549 {
1550     \skip_set:Nn \l__enumext_minipage_temp_skip
1551     {
1552         \l__enumext_itemsep_i_skip - \l__enumext_minipage_after_skip
1553     }
1554     \skip_sub:Nn \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1555     \skip_sub:Nn \l__enumext_multicols_below_v_skip { \l__enumext_itemsep_i_skip }
1556     \skip_add:Nn \l__enumext_minipage_after_skip
1557     { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1558     \skip_add:Nn \l__enumext_multicols_below_v_skip
1559     { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1560 }
1561 }
1562 }

```

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

### 13.23.3 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*`.

```

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

```

```

1608         0.5875\box_dp:N \strutbox
1609     }
1610     \skip_set:Nn \l__enumext_minipage_right_skip
1611     {
1612         \l__enumext_topsep_viii_skip
1613     }
1614     \skip_set:Nn \l__enumext_minipage_after_skip
1615     {
1616         0.325\box_dp:N \strutbox + \l__enumext_topsep_viii_skip
1617     }
1618 }
1619 }

```

(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 T<sub>E</sub>X is in *(horizontal mode)* or *(vertical mode)*, since `\partopsep` is equal to `0pt` in both environments.

```

1620 \cs_new_protected:Nn \__enumext_mini_addvspace_vii:
1621 {
1622     \__enumext_mini_set_vskip_vii:
1623     \par\nopagebreak
1624     \addvspace { \l__enumext_minipage_left_skip }
1625 }
1626 \cs_new_protected:Nn \__enumext_mini_addvspace_viii:
1627 {
1628     \__enumext_mini_set_vskip_viii:
1629     \par\nopagebreak
1630     \addvspace { \l__enumext_minipage_left_skip }
1631 }

```

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

#### 13.23.4 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 L<sup>A</sup>T<sub>E</sub>X 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.

```

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

```

```

1657     { \__enumext_mini_right_cmd:n {#1} }
1658 }

```

(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.

```

1659 \cs_new_protected:Npn \__enumext_mini_right_cmd:n #1
1660 {
1661   \dim_compare:nNnTF
1662   { \dim_use:c { \l__enumext_minipage_right_ \__enumext_level: _dim } } > { \c_zero_dim }
1663   {
1664     \__enumext_multicols_stop:
1665     \int_compare:nNnT
1666     { \int_use:c { \l__enumext_columns_ \__enumext_level: _int } } = { 1 }
1667     {
1668       \par\addvspace{ \l__enumext_minipage_after_skip }
1669     }
1670     \end__enumext_mini_page
1671     \hfill
1672     \__enumext_mini_page{ \dim_use:c { \l__enumext_minipage_right_ \__enumext_level: _dim } }
1673     \par\nointerlineskip
1674     \addvspace { \l__enumext_minipage_right_skip }
1675     \bool_if:nF {#1}
1676     {
1677       \centering
1678     }
1679     \int_gzero:N \g__enumext_minipage_stat_int
1680   }
1681   { \msg_error:nnn { enumext } { wrong-miniright-use } }
1682   % paranoia
1683   \RenewDocumentCommand \miniright { s }
1684   {
1685     \msg_error:nn { enumext } { many-miniright-used }
1686   }
1687 }

```

(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.

```

1688 \cs_new_protected:Npn \__enumext_keyans_mini_right_cmd:n #1
1689 {
1690   \dim_compare:nNnTF { \l__enumext_minipage_right_v_dim } > { \c_zero_dim }
1691   {
1692     \__enumext_keyans_multicols_stop:
1693     \int_compare:nNnT { \l__enumext_columns_v_int } = { 1 }
1694     {
1695       \par\addvspace{ \l__enumext_minipage_after_skip }
1696     }
1697     \end__enumext_mini_page
1698     \hfill
1699     \__enumext_mini_page{ \l__enumext_minipage_right_v_dim }
1700     \par\nointerlineskip
1701     \addvspace { \l__enumext_minipage_right_skip }
1702     \bool_if:nF {#1}
1703     {
1704       \centering
1705     }
1706     \int_gzero:N \g__enumext_minipage_stat_int
1707   }
1708   { \msg_error:nnn { enumext } { wrong-miniright-use } }
1709   % paranoia
1710   \RenewDocumentCommand \miniright { s }
1711   {
1712     \msg_error:nn { enumext } { many-miniright-used }
1713   }

```

```

1713     }
1714 }

```

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

### 13.24 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.

```

above* 1715 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
below  1716 {
below* 1717   \keys_define:nn { enumext / #1 }
        1718   {
        1719     above .skip_set:c = { \__enumext_vspace_above_#2_skip },
        1720     above .value_required:n = true,
        1721     above* .code:n = \bool_set_true:c { \__enumext_vspace_a_star_#2_bool }
        1722               \keys_set:nn { enumext / #1 } { above = {##1} },
        1723     above* .value_required:n = true,
        1724     below .skip_set:c = { \__enumext_vspace_below_#2_skip },
        1725     below .value_required:n = true,
        1726     below* .code:n = \bool_set_true:c { \__enumext_vspace_b_star_#2_bool }
        1727               \keys_set:nn { enumext / #1 } { below = {##1} },
        1728     below* .value_required:n = true,
        1729   }
        1730 }
1731 \clist_map_inline:Nn \__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

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

#### 13.24.1 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.

```

1732 \cs_new_protected:Nn \__enumext_vspace_above:
1733 {
1734   \skip_if_eq:nnF
1735   { \skip_use:c { \__enumext_vspace_above_ \__enumext_level: _skip } } { \c_zero_skip }
1736   {
1737     \bool_if:cTF { \__enumext_vspace_a_star_ \__enumext_level: _bool }
1738     {
1739       \vspace*{ \skip_use:c { \__enumext_vspace_above_ \__enumext_level: _skip } }
1740     }
1741     {
1742       \vspace { \skip_use:c { \__enumext_vspace_above_ \__enumext_level: _skip } }
1743     }
1744   }
1745 }

```

(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.

```

1746 \cs_new_protected:Nn \__enumext_vspace_below:
1747 {
1748   \skip_if_eq:nnF
1749   { \skip_use:c { \__enumext_vspace_below_ \__enumext_level: _skip } } { \c_zero_skip }
1750   {
1751     \bool_if:cTF { \__enumext_vspace_b_star_ \__enumext_level: _bool }
1752     {
1753       \vspace*{ \skip_use:c { \__enumext_vspace_below_ \__enumext_level: _skip } }
1754     }
1755     {
1756       \vspace { \skip_use:c { \__enumext_vspace_below_ \__enumext_level: _skip } }
1757     }
1758   }
1759 }

```

(End of definition for `\__enumext_vspace_below:`.)



### 13.24.2 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.

```

1760 \cs_new_protected:Nn \__enumext_vspace_above_v:
1761 {
1762   \skip_if_eq:nnF { \l__enumext_vspace_above_v_skip } { \c_zero_skip }
1763   {
1764     \bool_if:NTF \l__enumext_vspace_a_star_v_bool
1765     {
1766       \vspace*{ \l__enumext_vspace_above_v_skip }
1767     }
1768     { \vspace { \l__enumext_vspace_above_v_skip } }
1769   }
1770 }

```

(End of definition for `\__enumext_vspace_above_v:`.)

`\__enumext_vspace_below_v:`

The function `\__enumext_vspace_below_v:` apply the *vertical space below* the **keyans** environment set by the **below\*** and **below** keys.

```

1771 \cs_new_protected:Nn \__enumext_vspace_below_v:
1772 {
1773   \skip_if_eq:nnF { \l__enumext_vspace_below_v_skip } { \c_zero_skip }
1774   {
1775     \bool_if:NTF \l__enumext_vspace_b_star_v_bool
1776     {
1777       \vspace*{ \l__enumext_vspace_below_v_skip }
1778     }
1779     { \vspace { \l__enumext_vspace_below_v_skip } }
1780   }
1781 }

```

(End of definition for `\__enumext_vspace_below_v:`.)

### 13.24.3 Functions for above and below keys in enumext\* keyans\*

`\__enumext_vspace_above_vii:`

The functions `\__enumext_vspace_above_vii:` and `\__enumext_vspace_above_viii:` apply the *vertical space above* the **enumext\*** and **keyans\*** environments set by the **above** and **above\*** keys.

`\__enumext_vspace_above_viii:`

```

1782 \cs_new_protected:Nn \__enumext_vspace_above_vii:
1783 {
1784   \skip_if_eq:nnF { \l__enumext_vspace_above_vii_skip } { \c_zero_skip }
1785   {
1786     \bool_if:NTF \l__enumext_vspace_a_star_vii_bool
1787     {
1788       \vspace*{ \l__enumext_vspace_above_vii_skip }
1789     }
1790     { \vspace { \l__enumext_vspace_above_vii_skip } }
1791   }
1792 }
1793 \cs_new_protected:Nn \__enumext_vspace_above_viii:
1794 {
1795   \skip_if_eq:nnF { \l__enumext_vspace_above_viii_skip } { \c_zero_skip }
1796   {
1797     \bool_if:NTF \l__enumext_vspace_a_star_viii_bool
1798     {
1799       \vspace*{ \l__enumext_vspace_above_viii_skip }
1800     }
1801     { \vspace { \l__enumext_vspace_above_viii_skip } }
1802   }
1803 }

```

(End of definition for `\__enumext_vspace_above_vii:` and `\__enumext_vspace_above_viii:`.)

`\__enumext_vspace_below_vii:`

The functions `\__enumext_vspace_below_vii:` and `\__enumext_vspace_below_viii:` apply the *vertical space below* the **enumext\*** and **keyans\*** environments set by the **below\*** and **below** keys.

`\__enumext_vspace_below_viii:`

```

1804 \cs_new_protected:Nn \__enumext_vspace_below_vii:
1805 {
1806   \skip_if_eq:nnF { \l__enumext_vspace_below_vii_skip } { \c_zero_skip }
1807   {
1808     \bool_if:NTF \l__enumext_vspace_b_star_vii_bool
1809     {
1810       \vspace*{ \l__enumext_vspace_below_vii_skip }

```

```

1811     }
1812     { \vspace { \l__enumext_vspace_below_vii_skip } }
1813   }
1814 }
1815 \cs_new_protected:Nn \__enumext_vspace_below_viii:
1816 {
1817   \skip_if_eq:nnF { \l__enumext_vspace_below_viii_skip } { \c_zero_skip }
1818   {
1819     \bool_if:NTF \l__enumext_vspace_b_star_viii_bool
1820     {
1821       \vspace*{ \l__enumext_vspace_below_viii_skip }
1822     }
1823     { \vspace { \l__enumext_vspace_below_viii_skip } }
1824   }
1825 }

```

(End of definition for `\__enumext_vspace_below_vii:` and `\__enumext_vspace_below_viii:`.)

### 13.25 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](#)

We define the keys `series`, `resume` and `resume*` only for the “first level” of `enumext` and `enumext*`.

```

series
resume
resume*
1826 \cs_set_protected:Npn \__enumext_tmp:n #1
1827 {
1828   \keys_define:nn { enumext / #1 }
1829   {
1830     series .str_set:N = \l__enumext_series_str,
1831     series .value_required:n = true,
1832     resume .code:n = \__enumext_resume_series:n {##1},
1833     resume* .code:n = \__enumext_resume_starred:,
1834     resume* .value_forbidden:n = true,
1835   }
1836 }
1837 \clist_map_inline:nn { level-1, enumext* } { { \__enumext_tmp:n {#1} } }

```

(End of definition for `series`, `resume`, and `resume*`.)

#### 13.25.1 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.

```

\__enumext_filter_series:n
  \__enumext_filter_series_key:n
  \__enumext_filter_series_pair:nn
1838 \cs_new:Npn \__enumext_filter_series:n #1
1839 {
1840   \use:e
1841   {
1842     \keyval_parse:NNn
1843     \__enumext_filter_series_key:n
1844     \__enumext_filter_series_pair:nn {#1}
1845   }
1846 }

```

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.

```

1847 \cs_new:Npn \__enumext_filter_series_key:n #1
1848 {
1849   \str_case:nnF {#1}
1850   {
1851     { resume } {} { resume* } {} { base-fix } {}
1852   }
1853   { , { \exp_not:n {#1} } }
1854 }

```

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.

```

1855 \cs_new:Npn \__enumext_filter_series_pair:nn #1#2
1856 {
1857   \str_case:nnF {#1}
1858   {
1859     { series } {} { resume } {} { start } {}

```

```

1860         { start* } {} { save-ans } {} { save-key } {}
1861     }
1862     { , { \exp_not:n {#1} } = { \exp_not:n {#2} } }
1863 }

```

(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 (§13.39) and to the function `\__enumext_parse_keys_vii:n` in the `enumext*` environment definition (§13.44).

```

1864 \cs_new_protected:Npn \__enumext_parse_series:n #1
1865 {
1866     \str_if_empty:NTF \l__enumext_series_str
1867     {
1868         \bool_if:NF \l__enumext_resume_active_bool
1869         {
1870             \__enumext_resume_last:n {#1}
1871         }
1872     }
1873     {
1874         \tl_gclear_new:c { g__enumext_series_ \l__enumext_series_str_tl }
1875         \tl_gset:ce { g__enumext_series_ \l__enumext_series_str_tl }
1876         { \__enumext_filter_series:n {#1} }
1877         \int_if_exist:cF { g__enumext_series_ \l__enumext_series_str_int }
1878         {
1879             \int_new:c { g__enumext_series_ \l__enumext_series_str_int }
1880         }
1881     }
1882 }

```

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.

```

1883 \cs_new_protected:Npn \__enumext_resume_last:n #1
1884 {
1885     \bool_if:NT \l__enumext_standar_first_bool
1886     {
1887         \tl_gclear:N \g__enumext_standar_series_tl
1888         \tl_gset:Ne \g__enumext_standar_series_tl { \__enumext_filter_series:n {#1} }
1889     }
1890     \bool_if:NT \l__enumext_starred_first_bool
1891     {
1892         \tl_gclear:N \g__enumext_starred_series_tl
1893         \tl_gset:Ne \g__enumext_starred_series_tl { \__enumext_filter_series:n {#1} }
1894     }
1895 }

```

(End of definition for `\__enumext_parse_series:n` and `\__enumext_resume_last:n`.)

### 13.25.2 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 (§13.39) and the `enumext*` environment definition (§13.44).

```

1896 \cs_new_protected:Nn \__enumext_resume_save_counter:
1897 {

```

```

1898 \bool_if:NT \g__enumext_standar_bool
1899 {
1900   \tl_if_empty:NF \l__enumext_series_str
1901   {
1902     \int_gset_eq:cN
1903     { g__enumext_series_ \l__enumext_series_str_int } \value{enumXi}
1904   }
1905   \tl_if_empty:NTF \l__enumext_resume_name_tl
1906   {
1907     \str_if_empty:NT \l__enumext_series_str
1908     {
1909       \int_gset_eq:NN \g__enumext_resume_int \value{enumXi}
1910     }
1911   }
1912   {
1913     \int_if_exist:cT { g__enumext_series_ \l__enumext_resume_name_tl_int }
1914     {
1915       \int_gset_eq:cN
1916       { g__enumext_series_ \l__enumext_resume_name_tl_int } \value{enumXi}
1917     }
1918   }
1919   \int_if_exist:cT { g__enumext_resume_ \l__enumext_store_name_tl_int }
1920   {
1921     \int_gset_eq:cN
1922     { g__enumext_resume_ \l__enumext_store_name_tl_int } \value{enumXi}
1923   }
1924 }
1925 \bool_if:NT \g__enumext_starred_bool
1926 {
1927   \tl_if_empty:NF \l__enumext_series_str
1928   {
1929     \int_gset_eq:cN
1930     { g__enumext_series_ \l__enumext_series_str_int } \value{enumXvii}
1931   }
1932   \tl_if_empty:NTF \l__enumext_resume_name_tl
1933   {
1934     \str_if_empty:NT \l__enumext_series_str
1935     {
1936       \int_gset_eq:NN \g__enumext_resume_vii_int \value{enumXvii}
1937     }
1938   }
1939   {
1940     \int_if_exist:cT { g__enumext_series_ \l__enumext_resume_name_tl_int }
1941     {
1942       \int_gset_eq:cN
1943       { g__enumext_series_ \l__enumext_resume_name_tl_int } \value{enumXvii}
1944     }
1945   }
1946   \int_if_exist:cT { g__enumext_resume_ \l__enumext_store_name_tl_int }
1947   {
1948     \int_gset_eq:cN
1949     { g__enumext_resume_ \l__enumext_store_name_tl_int } \value{enumXvii}
1950   }
1951 }
1952 }

```

(End of definition for `\__enumext_resume_save_counter:`.)

### 13.25.3 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.

```

1953 \cs_new_protected:Npn \__enumext_resume_series:n #1
1954 {
1955   \tl_if_empty:NTF {#1}
1956   {
1957     \__enumext_resume_counter:n { }

```

```

1958     }
1959     {
1960         \tl_if_exist:cTF { g__enumext_series_ \tl_to_str:n {#1} _tl }
1961         {
1962             \__enumext_resume_counter:n {#1}
1963             \bool_if:NT \g__enumext_standar_bool
1964             {
1965                 \keys_set:nv { enumext / level-1 }
1966                 { g__enumext_series_ \tl_to_str:n {#1} _tl }
1967             }
1968             \bool_if:NT \g__enumext_starred_bool
1969             {
1970                 \keys_set:nv { enumext / enumext* }
1971                 { g__enumext_series_ \tl_to_str:n {#1} _tl }
1972             }
1973         }
1974     }
1975     \bool_if:NT \g__enumext_standar_bool
1976     {
1977         \msg_error:nnn { enumext } { unknown-series } {#1}
1978     }
1979     \bool_if:NT \g__enumext_starred_bool
1980     {
1981         \msg_error:nnn { enumext } { unknown-series } {#1}
1982     }
1983 }
1984 }
1985 }

```

(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 `\l__enumext_resume_active_bool` to true and pass the value of the key `resume` to the variable `\l__enumext_series_name_tl` which will contain the `{\series name}`. If the variable `\l__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`.

```

1986 \cs_new_protected:Npn \__enumext_resume_counter:n #1
1987 {
1988     \bool_set_true:N \l__enumext_resume_active_bool
1989     \tl_set:Nn \l__enumext_resume_name_tl {#1}
1990     \tl_if_empty:NTF \l__enumext_resume_name_tl
1991     {
1992         \__enumext_resume_counter:
1993     }
1994     {
1995         \__enumext_resume_counter_series:
1996     }
1997     \__enumext_resume_counter_save_ans:
1998 }

```

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.

```

1999 \cs_new_protected:Nn \__enumext_resume_counter:
2000 {
2001     \bool_if:NT \g__enumext_standar_bool
2002     {
2003         \int_gincr:N \g__enumext_resume_int
2004         \int_set_eq:NN \l__enumext_start_i_int \g__enumext_resume_int
2005     }
2006     \bool_if:NT \g__enumext_starred_bool
2007     {
2008         \int_gincr:N \g__enumext_resume_vii_int
2009         \int_set_eq:NN \l__enumext_start_vii_int \g__enumext_resume_vii_int
2010     }
2011 }

```

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.

```

2012 \cs_new_protected:Nn \__enumext_resume_counter_series:
2013 {
2014   \bool_if:NT \g__enumext_standar_bool
2015   {
2016     \int_set:Nn \l__enumext_start_i_int
2017     {
2018       \int_use:c { g__enumext_series_ \l__enumext_resume_name_tl _int } + 1
2019     }
2020   }
2021   \bool_if:NT \g__enumext_starred_bool
2022   {
2023     \int_set:Nn \l__enumext_start_vii_int
2024     {
2025       \int_use:c { g__enumext_series_ \l__enumext_resume_name_tl _int } + 1
2026     }
2027   }
2028 }

```

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.

```

2029 \cs_new_protected:Nn \__enumext_resume_counter_save_ans:
2030 {
2031   \bool_lazy_and:nnT
2032   { \bool_if_p:N \l__enumext_standar_first_bool }
2033   { \bool_if_p:N \l__enumext_store_active_bool }
2034   {
2035     \int_set:Nn \l__enumext_start_i_int
2036     {
2037       \int_use:c { g__enumext_resume_ \l__enumext_store_name_tl _int } + 1
2038     }
2039   }
2040   \bool_lazy_and:nnT
2041   { \bool_if_p:N \l__enumext_starred_first_bool }
2042   { \bool_if_p:N \l__enumext_store_active_bool }
2043   {
2044     \int_set:Nn \l__enumext_start_vii_int
2045     {
2046       \int_use:c { g__enumext_resume_ \l__enumext_store_name_tl _int } + 1
2047     }
2048   }
2049 }

```

(End of definition for `\__enumext_resume_counter:n` and others.)

### 13.25.4 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.

```

2050 \cs_new_protected:Nn \__enumext_resume_starred:
2051 {
2052   \bool_if:NT \g__enumext_standar_bool
2053   {
2054     \tl_if_empty:NF \g__enumext_standar_series_tl
2055     {
2056       \__enumext_resume_counter:n { }
2057       \keys_set:nV { enumext / level-1 } \g__enumext_standar_series_tl
2058     }
2059   }
2060   \bool_if:NT \g__enumext_starred_bool
2061   {
2062     \tl_if_empty:NF \g__enumext_starred_series_tl
2063     {
2064       \__enumext_resume_counter:n { }
2065       \keys_set:nV { enumext / enumext* } \g__enumext_starred_series_tl
2066     }
2067   }
2068 }

```

(End of definition for `\__enumext_resume_starred:`.)



### 13.26 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.

#### 13.26.1 Setting save-ans key

`save-ans` We define the keys `save-ans` only for the “first level” of `enumext` and `enumext*`.

```
2069 \cs_set_protected:Npn \__enumext_tmp:n #1
2070 {
2071   \keys_define:nn { enumext / #1 }
2072   {
2073     save-ans .code:n = \__enumext_storing_set:n {##1},
2074     save-ans .value_required:n = true,
2075   }
2076 }
2077 \clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }
```

(End of definition for `save-ans`.)

#### 13.26.2 Internal functions for save-ans key

`\__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:`.

```
2078 \cs_new_protected:Nn \__enumext_start_save_ans_msg:
2079 {
2080   \msg_term:nnVV { enumext } { save-ans-log }
2081   \g__enumext_envir_name_tl \l__enumext_store_name_tl
2082 }
2083 \cs_new_protected:Nn \__enumext_stop_save_ans_msg:
2084 {
2085   \msg_term:nnVV { enumext } { save-ans-log-hook }
2086   \g__enumext_envir_name_tl \g__enumext_store_name_tl
2087 }
```

(End of definition for `\__enumext_start_save_ans_msg:` and `\__enumext_stop_save_ans_msg:`.)

`\__enumext_storing_set:n` and `\__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.

```
2088 \cs_new_protected:Npn \__enumext_storing_set:n #1
2089 {
2090   \tl_set:Nx \l__enumext_store_name_tl {#1}
2091   \tl_if_empty:NTF \l__enumext_store_name_tl
2092   {
2093     \bool_lazy_or:nnT
2094     { \l__enumext_standar_first_bool } { \l__enumext_starred_first_bool }
2095     {
2096       \msg_error:nnV { enumext } { save-ans-empty } \g__enumext_envir_name_tl
2097     }
2098   }
2099   {
2100     \bool_lazy_or:nnT
2101     { \l__enumext_standar_first_bool } { \l__enumext_starred_first_bool }
2102     {
2103       \__enumext_start_save_ans_msg:
2104       \__enumext_storing_exec:
2105     }
2106   }
2107 }
```

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`.

```
2108 \cs_new_protected:Nn \__enumext_storing_exec:
2109 {
```

```

2110     \bool_set_true:N \l__enumext_store_active_bool
2111     \bool_set_true:N \l__enumext_check_answers_bool
2112     \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*`.

```

2113     \prop_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _prop }
2114     {
2115         \msg_log:nnV { enumext } { store-prop } \l__enumext_store_name_tl
2116         \prop_new:c { g__enumext_ \l__enumext_store_name_tl _prop }
2117     }
2118     \seq_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _seq }
2119     {
2120         \msg_log:nnV { enumext } { store-seq } \l__enumext_store_name_tl
2121         \seq_new:c { g__enumext_ \l__enumext_store_name_tl _seq }
2122     }
2123     \int_if_exist:cF { g__enumext_resume_ \l__enumext_store_name_tl _int }
2124     {
2125         \msg_log:nnV { enumext } { store-int } \l__enumext_store_name_tl
2126         \int_new:c { g__enumext_resume_ \l__enumext_store_name_tl _int }
2127     }
2128 }

```

(End of definition for `\__enumext_storing_set:n` and `\__enumext_storing_exec:.`)

### 13.26.3 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.

### 13.26.4 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
2129 \cs_set_protected:Npn \__enumext_tmp:n #1
2130 {
2131     \keys_define:nn { enumext / #1 }
2132     {
2133         check-ans .bool_set:N = \l__enumext_check_ans_key_bool,
2134         check-ans .initial:n = false,
2135         check-ans .value_required:n = true,
2136         no-store .code:n = {
2137             \bool_set_false:N \l__enumext_check_answers_bool
2138             \bool_set_false:N \l__enumext_check_ans_key_bool
2139         },

```

```

2140         no-store .value_forbidden:n = true,
2141     }
2142 }
2143 \clist_map_inline:nn
2144 {
2145     level-1, level-2, level-3, level-4, enumext*
2146 }
2147 { \__enumext_tmp:n {#1} }

```

(End of definition for *check-ans* and *no-store*.)

### 13.26.5 Set-up check answer mechanism

`\__enumext_check_ans_active:` The function `\__enumext_check_ans_active:` will first check the state of the variable `\__enumext_store_name_tl`, that is, the *save-ans* key is active, if so it will check the state of the variable `\__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.

```

2148 \cs_new_protected:Nn \__enumext_check_ans_active:
2149 {
2150     \tl_if_empty:NF \__enumext_store_name_tl
2151     {
2152         \bool_if:NT \__enumext_check_answers_bool
2153         {
2154             \__enumext_check_ans_level:
2155         }
2156     }
2157 }

```

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 `\__enumext_item_number_bool` to “*false*”.

```

2158 \cs_new_protected:Nn \__enumext_check_ans_level:
2159 {
2160     \int_case:nn { \__enumext_level_int }
2161     {
2162         { 1 }{
2163             \bool_lazy_all:nT
2164             {
2165                 { \bool_if_p:N \g__enumext_starred_bool }
2166                 { \int_compare_p:nNn { \__enumext_level_h_int } = { 1 } }
2167             }
2168             {
2169                 \int_gdecr:N \g__enumext_item_number_int
2170                 \bool_set_false:N \__enumext_item_number_bool
2171             }
2172         }
2173         { 2 }{
2174             \int_gdecr:N \g__enumext_item_number_int
2175             \bool_set_false:N \__enumext_item_number_bool
2176         }
2177         { 3 }{
2178             \int_gdecr:N \g__enumext_item_number_int
2179             \bool_set_false:N \__enumext_item_number_bool
2180         }
2181         { 4 }{
2182             \int_gdecr:N \g__enumext_item_number_int
2183             \bool_set_false:N \__enumext_item_number_bool
2184         }
2185     }

```

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.

```

2186     \int_case:nn { \__enumext_level_h_int }
2187     {
2188         { 1 }{
2189             \bool_lazy_all:nT
2190             {
2191                 { \bool_if_p:N \g__enumext_standar_bool }
2192                 { \int_compare_p:nNn { \__enumext_level_int } = { 1 } }
2193             }
2194             {

```

```

2195         \int_gdecr:N \g__enumext_item_number_int
2196         \bool_set_false:N \l__enumext_item_number_bool
2197     }
2198 }
2199 }
2200 }

```

(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.

```

2201 \cs_new_protected:Nn \__enumext_check_ans_key_hook:
2202 {
2203     \bool_lazy_and:nnT
2204     { \bool_if_p:N \l__enumext_check_ans_key_bool }
2205     { \bool_if_p:N \g__enumext_standar_bool }
2206     {
2207         \bool_gset_true:N \g__enumext_check_ans_key_bool
2208     }
2209     \bool_lazy_and:nnT
2210     { \bool_if_p:N \l__enumext_check_ans_key_bool }
2211     { \bool_if_p:N \g__enumext_starred_bool }
2212     {
2213         \bool_gset_true:N \g__enumext_check_ans_key_bool
2214     }
2215 }

```

(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:.

```

2216 \cs_new_protected:Nn \__enumext_item_answer_diff:
2217 {
2218     \int_gset:Nn \g__enumext_item_answer_diff_int
2219     {
2220         \int_sign:n { \g__enumext_item_number_int - \g__enumext_item_anskey_int }
2221     }
2222 }

```

(End of definition for \\_\_enumext\_item\_answer\_diff:.)

\\_\_enumext\_check\_ans\_show:

\\_\_enumext\_check\_ans\_msg\_less:

\\_\_enumext\_check\_ans\_msg\_same\_ok:

\\_\_enumext\_check\_ans\_msg\_greater:

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:.

```

2223 \cs_new_protected:Nn \__enumext_check_ans_show:
2224 {
2225     \int_case:nn { \g__enumext_item_answer_diff_int }
2226     {
2227         { -1 } { \__enumext_check_ans_msg_less: }
2228         { 0 } { \__enumext_check_ans_msg_same_ok: }
2229         { 1 } { \__enumext_check_ans_msg_greater: }
2230     }
2231 }
2232 \cs_new_protected:Nn \__enumext_check_ans_msg_less:
2233 {
2234     \msg_warning:nneee { enumext } { item-less-answer } { \g__enumext_store_name_tl }
2235     { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2236 }
2237 \cs_new_protected:Nn \__enumext_check_ans_msg_same_ok:
2238 {
2239     \msg_term:nneee { enumext } { items-same-answer } { \g__enumext_store_name_tl }
2240     { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2241 }
2242 \cs_new_protected:Nn \__enumext_check_ans_msg_greater:
2243 {
2244     \msg_warning:nneee { enumext } { item-greater-answer } { \g__enumext_store_name_tl }
2245     { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2246 }

```

(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:`.

```

2247 \cs_new_protected:Nn \__enumext_check_ans_log:
2248 {
2249   \int_case:nn { \g__enumext_item_answer_diff_int }
2250   {
2251     { -1 } { \__enumext_check_ans_log_msg_less: }
2252     { 0 } { \__enumext_check_ans_log_msg_same_ok: }
2253     { 1 } { \__enumext_check_ans_log_msg_greater: }
2254   }
2255 }
2256 \cs_new_protected:Nn \__enumext_check_ans_log_msg_less:
2257 {
2258   \msg_log:nneee { enumext } { item-less-answer } { \g__enumext_store_name_tl }
2259   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2260 }
2261 \cs_new_protected:Nn \__enumext_check_ans_log_msg_same_ok:
2262 {
2263   \msg_log:nneee { enumext } { items-same-answer } { \g__enumext_store_name_tl }
2264   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2265 }
2266 \cs_new_protected:Nn \__enumext_check_ans_log_msg_greater:
2267 {
2268   \msg_log:nneee { enumext } { item-greater-answer } { \g__enumext_store_name_tl }
2269   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2270 }

```

(End of definition for `\__enumext_check_ans_log:` and others.)

### 13.26.6 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.

```

2271 \cs_new_protected:Npn \__enumext_check_starred_cmd:n #1
2272 {
2273   \int_compare:nNtT
2274   { \g__enumext_check_starred_cmd_int } = { 0 }
2275   {
2276     \msg_warning:nnnV
2277     { enumext } { missing-starred } { #1 } \l__enumext_check_start_line_env_tl
2278   }
2279   \int_compare:nNtT
2280   { \g__enumext_check_starred_cmd_int } > { 1 }
2281   {
2282     \msg_warning:nnnV
2283     { enumext } { many-starred } { #1 } \l__enumext_check_start_line_env_tl
2284   }
2285   \int_gzero:N \g__enumext_check_starred_cmd_int
2286   \tl_clear:N \l__enumext_check_start_line_env_tl
2287 }

```

(End of definition for `\__enumext_check_starred_cmd:n`.)

## 13.27 Keys and functions associated with storage

### 13.27.1 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.

`mark-ans*` 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`.

```

2288 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
2289 {
2290   \keys_define:nn { enumext / #1 }
2291   {
2292     mark-ans* .tl_set:c = { \l__enumext_mark_answer_sym_#2_tl },
2293     mark-ans* .initial:n = \textasteriskcentered,

```

```

2294     mark-ans*   .value_required:n = true,
2295     mark-pos*   .choice:,
2296     mark-pos* / left   .code:n = \str_set:cn { \__enumext_mark_position_#2_str } { l },
2297     mark-pos* / right  .code:n = \str_set:cn { \__enumext_mark_position_#2_str } { r },
2298     mark-pos* / center .code:n = \str_set:cn { \__enumext_mark_position_#2_str } { c },
2299     mark-pos* / unknown .code:n =
2300         \msg_error:nnee { enumext } { unknown-choice }
2301         { mark-pos } { left,~right,~center } { \exp_not:n {##1} },
2302     mark-pos*   .initial:n = right,
2303     mark-pos*   .value_required:n = true,
2304     mark-sep*   .dim_set:c = { \__enumext_mark_sym_sep_#2_dim },
2305     mark-sep*   .value_required:n = true,
2306     wrap-ans*   .cs_set_protected:cp = { __enumext_keyans_wrapper_item_#2:n } ##1,
2307     wrap-ans*   .value_required:n = true,
2308     wrap-opt    .cs_set_protected:cp = { __enumext_keyans_wrapper_opt_#2:n } ##1,
2309     wrap-opt    .initial:n = [{##1}],
2310     wrap-opt    .value_required:n = true,
2311     save-sep    .tl_set:c = { \__enumext_store_keyans_item_opt_sep_#2_tl },
2312     save-sep    .initial:n = {,~},
2313     save-sep    .value_required:n = true,
2314     show-ans    .bool_set:N = \__enumext_show_answer_bool,
2315     show-ans    .initial:n = false,
2316     show-ans    .value_required:n = true,
2317     show-pos    .bool_set:N = \__enumext_show_position_bool,
2318     show-pos    .initial:n = false,
2319     show-pos    .value_required:n = true,
2320 }
2321 }
2322 \clist_map_inline:nn { {keyans}{v}, {keyans*}{viii} } { \__enumext_tmp:n #1 }

```

(End of definition for `mark-ans*` and others.)

We add the `<keys>` `mark-ref` and `save-ref` related to the “storage system” and internal mechanism of “*label and ref*” along with the `<keys>` `show-ans`, `show-pos` and the `<keys>` `mark-ans`, `mark-pos`, `mark-sep` and `wrap-ans` for the command `\anskey`, the environment `anskey*` and the the `<keys>` for environments `keyans` and `keyans*` only at the *first level* of `enumext` and `enumext*`.

```

2323 \cs_set_protected:Npn \__enumext_tmp:n #1
2324 {
2325     \keys_define:nn { enumext / #1 }
2326     {
2327         mark-ref   .tl_set:N   = \__enumext_mark_ref_sym_tl,
2328         mark-ref   .initial:n   = \textreferencemark,
2329         mark-ref   .value_required:n = true,
2330         save-ref   .bool_set:N = \__enumext_store_ref_key_bool,
2331         save-ref   .initial:n   = false,
2332         save-ref   .value_required:n = true,
2333         show-ans   .bool_set:N = \__enumext_show_answer_bool,
2334         show-ans   .initial:n   = false,
2335         show-ans   .value_required:n = true,
2336         show-pos   .bool_set:N = \__enumext_show_position_bool,
2337         show-pos   .initial:n   = false,
2338         show-pos   .value_required:n = true,
2339         mark-ans   .tl_set:N   = \__enumext_mark_answer_sym_tl,
2340         mark-ans   .initial:n   = \textasteriskcentered,
2341         mark-ans   .value_required:n = true,
2342         mark-sep   .dim_set:N   = \__enumext_mark_sym_sep_dim,
2343         mark-sep   .value_required:n = true,
2344         mark-pos   .choice:,
2345         mark-pos / left   .code:n = \str_set:Nn \__enumext_mark_position_str { l },
2346         mark-pos / right  .code:n = \str_set:Nn \__enumext_mark_position_str { r },
2347         mark-pos / center .code:n = \str_set:Nn \__enumext_mark_position_str { c },
2348         mark-pos / unknown .code:n =
2349             \msg_error:nnee { enumext } { unknown-choice }
2350             { mark-pos } { left,~right,~center } { \exp_not:n {##1} },
2351         mark-pos   .initial:n = right,
2352         mark-pos   .value_required:n = true,
2353
2354         wrap-ans   .cs_set_protected:Np = \__enumext_anskey_wrapper:n ##1,
2355         wrap-ans   .initial:n =
2356             {
2357                 \fbox{\parbox[t]{\dimeval{\itemwidth -2\fboxsep -2\fboxrule}}{##1}}

```

```

2358         },
2359         wrap-ans .value_required:n = true,
2360         mark-ans* .code:n = {
2361             \keys_set:nn { enumext / keyans } { mark-ans* = {##1} }
2362             \keys_set:nn { enumext / keyans* } { mark-ans* = {##1} }
2363         },
2364         mark-ans* .value_required:n = true,
2365         mark-pos* .code:n = {
2366             \keys_set:nn { enumext / keyans } { mark-pos* = {##1} }
2367             \keys_set:nn { enumext / keyans* } { mark-pos* = {##1} }
2368         },
2369         mark-pos* .value_required:n = true,
2370         mark-sep* .code:n = {
2371             \keys_set:nn { enumext / keyans } { mark-sep* = {##1} }
2372             \keys_set:nn { enumext / keyans* } { mark-sep* = {##1} }
2373         },
2374         mark-sep* .value_required:n = true,
2375         wrap-ans* .code:n = {
2376             \keys_set:nn { enumext / keyans } { wrap-ans* = {##1} }
2377             \keys_set:nn { enumext / keyans* } { wrap-ans* = {##1} }
2378         },
2379         wrap-ans* .value_required:n = true,
2380         wrap-opt .code:n = {
2381             \keys_set:nn { enumext / keyans } { wrap-opt = {##1} }
2382             \keys_set:nn { enumext / keyans* } { wrap-opt = {##1} }
2383         },
2384         wrap-opt .value_required:n = true,
2385         save-sep .code:n = {
2386             \keys_set:nn { enumext / keyans } { save-sep = {##1} }
2387             \keys_set:nn { enumext / keyans* } { save-sep = {##1} }
2388         },
2389         save-sep .value_required:n = true,
2390     }
2391 }
2392 \clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }

```

(End of definition for mark-ref and others.)

### 13.27.2 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>`.

```

2393 \cs_new_protected:Npn \__enumext_store_active_keys:n #1
2394 {
2395     \bool_if:cF { \__enumext_store_save_key_ \__enumext_level: _bool }
2396     {
2397         \tl_clear:c { \__enumext_store_save_key_ \__enumext_level: _tl }
2398         \tl_set:ce
2399             { \__enumext_store_save_key_ \__enumext_level: _tl }
2400             { \__enumext_filter_save_key:n {#1} }
2401     }
2402 }
2403 \cs_new_protected:Npn \__enumext_store_active_keys_vii:n #1
2404 {
2405     \bool_if:NF \__enumext_store_save_key_vii_bool
2406     {
2407         \tl_clear:N \__enumext_store_save_key_vii_tl
2408         \tl_set:Ne \__enumext_store_save_key_vii_tl { \__enumext_filter_save_key:n {#1} }
2409     }
2410 }

```

(End of definition for `\__enumext_store_active_keys:n` and `\__enumext_store_active_keys_vii:n`.)



### 13.27.3 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.

```

2411 \cs_set_protected:Npn \__enumext_tmp:n #1
2412 {
2413   \keys_define:nn { enumext / enumext* }
2414   {
2415     save-key .code:n = \__enumext_parse_save_key_vii:n {##1},
2416     save-key .value_required:n = true,
2417   }
2418   \keys_define:nn { enumext / #1 }
2419   {
2420     save-key .code:n = \__enumext_parse_save_key:n {##1},
2421     save-key .value_required:n = true,
2422   }
2423 }
2424 \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*`.

```

2425 \cs_new_protected:Npn \__enumext_parse_save_key:n #1
2426 {
2427   \bool_set_true:c { l__enumext_store_save_key_ \__enumext_level: _bool }
2428   \tl_clear:c { l__enumext_save_key_ \__enumext_level: _tl }
2429   \tl_set:ce
2430   { l__enumext_store_save_key_ \__enumext_level: _tl }
2431   { \__enumext_filter_save_key:n {#1} }
2432 }
2433 \cs_new_protected:Npn \__enumext_parse_save_key_vii:n #1
2434 {
2435   \bool_set_true:N \l__enumext_store_save_key_vii_bool
2436   \tl_clear:N \l__enumext_store_save_key_vii_tl
2437   \tl_set:Ne \l__enumext_store_save_key_vii_tl { \__enumext_filter_save_key:n {#1} }
2438 }

```

(End of definition for `\__enumext_parse_save_key:n` and `\__enumext_parse_save_key_vii:n`.)

### 13.27.4 Internal functions to store optional arguments

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.

```

2439 \cs_new:Npn \__enumext_filter_save_key:n #1
2440 {
2441   \use:e
2442   {
2443     \keyval_parse:NNn
2444     \__enumext_filter_save_key_key:n
2445     \__enumext_filter_save_key_pair:nn {#1}
2446   }
2447 }

```

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.

```

2448 \cs_new:Npn \__enumext_filter_save_key_key:n #1
2449 {
2450   \str_case:nnF {#1}
2451   {
2452     { resume } {} { resume* } {} { no-store } {} { base-fix } {}
2453   }
2454   { , { \exp_not:n {#1} } }
2455 }

```

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.

```

2456 \cs_new:Npn \__enumext_filter_save_key_pair:nn #1#2
2457 {
2458   \str_case:nnF {#1}
2459   {
2460     { series } {} { resume } {} { save-ans } {} { save-ref } {}
2461     { save-key } {} { check-ans } {} { show-ans } {} { show-pos } {}
2462     { mark-ans } {} { mark-pos } {} { mark-sep } {} { wrap-ans } {}
2463     { mark-ans* } {} { mark-pos* } {} { mark-sep* } {} { wrap-ans* } {}
2464     { wrap-opt } {} { save-sep } {} { mark-ref } {} { mini-env } {}
2465     { mini-sep } {} { mini-right } {} { mini-right* } {}
2466   }
2467   { , { \exp_not:n {#1} } } = { \exp_not:n {#2} } }
2468 }

```

(End of definition for `\__enumext_filter_save_key:n`, `\__enumext_filter_save_key_key:n`, and `\__enumext_filter_save_key_pair:nn`.)

### 13.27.5 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.

```

2469 \cs_new_protected:Npn \__enumext_store_addto_prop:n #1
2470 {
2471   \prop_gput_if_not_in:cen { g__enumext_ \l__enumext_store_name_tl _prop }
2472   {
2473     \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } + 1 }
2474   }
2475   { #1 }
2476 }
2477 \cs_generate_variant:Nn \__enumext_store_addto_prop:n { V }

```

(End of definition for `\__enumext_store_addto_prop:n`.)

### 13.27.6 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.

```

2478 \cs_new_protected:Npn \__enumext_store_addto_seq:n #1
2479 {
2480   \seq_gput_right:cn { g__enumext_ \l__enumext_store_name_tl _seq } { #1 }
2481 }
2482 \cs_generate_variant:Nn \__enumext_store_addto_seq:n { v, V }

```

(End of definition for `\__enumext_store_addto_seq:n`.)

### 13.27.7 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.

```

2483 \cs_new_protected:Nn \__enumext_store_level_open:
2484 {
2485   \bool_if:NT \l__enumext_check_answers_bool
2486   {
2487     \tl_if_empty:cTF { l__enumext_store_save_key_ \l__enumext_level: _tl }
2488     {
2489       \__enumext_store_addto_seq:n
2490       {
2491         \item \begin{enumext}
2492       }
2493     }
2494     {
2495       \tl_put_left:cn { l__enumext_store_save_key_ \l__enumext_level: _tl }

```

```

2496         {
2497             \item \begin{enumext} [
2498         }
2499         \tl_put_right:cn { l__enumext_store_save_key_ \__enumext_level: _tl }
2500         {
2501             ]
2502         }
2503         \__enumext_store_addto_seq:v { l__enumext_store_save_key_ \__enumext_level: _tl }
2504     }
2505 }
2506 }
2507 \cs_new_protected:Nn \__enumext_store_level_close:
2508 {
2509     \bool_if:NT \l__enumext_check_answers_bool
2510     {
2511         \__enumext_store_addto_seq:n { \end{enumext} }
2512     }
2513 }

```

(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.

```

2514 \cs_new_protected:Nn \__enumext_store_level_open_vii:
2515 {
2516     \bool_if:NT \l__enumext_check_answers_bool
2517     {
2518         \tl_if_empty:NTF \l__enumext_store_save_key_vii_tl
2519         {
2520             \__enumext_store_addto_seq:n
2521             {
2522                 \item \begin{enumext*}
2523             }
2524         }
2525         {
2526             \tl_put_left:Nn \l__enumext_store_save_key_vii_tl
2527             {
2528                 \item \begin{enumext*}[
2529             }
2530             \tl_put_right:Nn \l__enumext_store_save_key_vii_tl
2531             {
2532                 ]
2533             }
2534             \__enumext_store_addto_seq:V \l__enumext_store_save_key_vii_tl
2535         }
2536     }
2537 }
2538 \cs_new_protected:Nn \__enumext_store_level_close_vii:
2539 {
2540     \bool_if:NT \l__enumext_check_answers_bool
2541     {
2542         \__enumext_store_addto_seq:n { \end{enumext*} }
2543     }
2544 }

```

(End of definition for \\_\_enumext\_store\_level\_open\_vii: and \\_\_enumext\_store\_level\_close\_vii:.)

### 13.27.8 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

```

2545 \cs_new_protected:Nn \__enumext_print_keyans_box:NN
2546 {
2547     \mode_leave_vertical:
2548     \skip_horizontal:n { -\dim_use:N #2 }
2549     \hbox_overlap_left:n
2550     {
2551         \makebox[ \dim_use:N #1 ][ \l__enumext_mark_position_str ]
2552         {

```

```

2553         \tl_use:N \l__enumext_mark_answer_sym_tl
2554     }
2555 }
2556 \skip_horizontal:n { \dim_use:N #2 }
2557 }
2558 \cs_generate_variant:Nn \__enumext_print_keyans_box:NN { cc }

```

(End of definition for `\__enumext_print_keyans_box:NN`.)

### 13.28 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`.

```

2559 \cs_new_protected:Nn \__enumext_store_internal_ref:
2560 {
2561     \cs_set_protected:Npn \__enumext_tmp:n ##1
2562     {
2563         \tl_set_eq:cc { \l__enumext_label_copy_##1_tl } { \l__enumext_label_##1_tl }
2564         \tl_reverse:c { \l__enumext_label_copy_##1_tl }
2565         \tl_remove_once:cn { \l__enumext_label_copy_##1_tl } { . }
2566         \tl_reverse:c { \l__enumext_label_copy_##1_tl }
2567     }
2568     \clist_map_inline:nn { i, ii, iii, iv, vii } { \__enumext_tmp:n {##1} }
2569     \cs_set:Npn \__enumext_tmp:n ##1
2570     { . \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.

```

2571     \bool_lazy_all:nT
2572     {
2573         { \bool_if_p:N \g__enumext_starred_bool }
2574         { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
2575     }
2576     {
2577         \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2578         { \tl_use:N \l__enumext_label_copy_vii_tl }
2579     }
2580     \bool_lazy_all:nT
2581     {
2582         { \bool_not_p:n { \g__enumext_standar_bool } }
2583         { \bool_if_p:N \l__enumext_standar_bool }
2584         { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } }
2585     }
2586     {
2587         \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2588         {
2589             \tl_use:N \l__enumext_label_copy_vii_tl
2590             \int_step_function:nnN { 1 } { \l__enumext_level_int } \__enumext_tmp:n
2591         }
2592     }

```

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.

```

2593     \bool_lazy_all:nT
2594     {
2595         { \bool_if_p:N \g__enumext_standar_bool }
2596         { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } }
2597         { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
2598     }
2599     {
2600         \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2601         {
2602             \tl_use:N \l__enumext_label_copy_i_tl
2603             \int_step_function:nnN { 2 } { \l__enumext_level_int } \__enumext_tmp:n
2604         }
2605     }
2606     \cs_set:Npn \__enumext_tmp:n ##1
2607     { \tl_use:c { \l__enumext_label_copy_ \int_to_roman:n {##1} _tl } . }

```

```

2608 \bool_lazy_all:nT
2609 {
2610   { \bool_if_p:N \g__enumext_standar_bool }
2611   { \bool_if_p:N \l__enumext_starred_bool }
2612   { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } } }
2613 }
2614 {
2615   \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2616   {
2617     \int_step_function:nnN { 1 } { \l__enumext_level_int } \__enumext_tmp:n
2618     \tl_use:N \l__enumext_label_copy_vii_tl
2619   }
2620 }

```

Now we set the variable `\l__enumext_newlabel_arg_one_tl` which will contain  $\langle \textit{store name} : \textit{position} \rangle$ .

```

2621 \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
2622 {
2623   \l__enumext_store_name_tl \c_colon_str
2624   \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } }
2625 }

```

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.

```

2626 \tl_put_right:Ne \l__enumext_write_aux_file_tl
2627 {
2628   \__enumext_newlabel:nn
2629   { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2630   { \l__enumext_newlabel_arg_two_tl }
2631 }
2632 \l__enumext_write_aux_file_tl
2633 }

```

(End of definition for `\__enumext_store_internal_ref:.`)

### 13.29 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*”  $\langle \textit{argument} \rangle$ .

```

2634 \cs_new_protected:Npn \__enumext_store_anskey_arg:n #1
2635 {
2636   \int_gincr:N \g__enumext_item_anskey_int
2637   \__enumext_store_addto_prop:n {#1}
2638   \bool_if:NT \l__enumext_store_ref_key_bool
2639   {
2640     \__enumext_store_internal_ref:
2641   }
2642   \__enumext_anskey_show_wrap_left:n { #1 }

```

Now we start processing the  $[(\textit{key} = \textit{val})]$  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`.

```

2643 \tl_clear:N \l__enumext_store_anskey_arg_tl
2644 \bool_lazy_and:nnT
2645 { \bool_if_p:N \l__enumext_store_columns_break_bool }
2646 { \bool_not_p:n { \l__enumext_starred_bool } }
2647 {
2648   \tl_put_left:Nn \l__enumext_store_anskey_arg_tl { \columnbreak }
2649 }
2650 \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`.

```

2651 \bool_lazy_and:nnT
2652 { \bool_not_p:n { \l__enumext_starred_bool } }
2653 { \int_compare_p:nNn { \l__enumext_store_item_join_int } > { 1 } }
2654 {
2655   \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2656   {
2657     ( \exp_not:V \l__enumext_store_item_join_int )
2658   }

```

```
2659     }
```

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*`.

```
2660     \bool_if:NTF \l__enumext_store_item_star_bool
2661     {
2662       \tl_put_right:Nn \l__enumext_store_anskey_arg_tl { * }
2663       \tl_if_empty:NF \l__enumext_store_item_symbol_tl
2664       {
2665         \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2666         {
2667           [ \exp_not:V \l__enumext_store_item_symbol_tl ]
2668         }
2669       }
2670       \dim_compare:nT
2671       {
2672         \l__enumext_store_item_symbol_sep_dim != \c_zero_dim
2673       }
2674       {
2675         \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2676         {
2677           [ \exp_not:V \l__enumext_store_item_symbol_sep_dim ]
2678         }
2679       }
2680       \tl_put_right:Nn \l__enumext_store_anskey_arg_tl {#1}
2681     }
2682     {
2683       \tl_put_right:Nn \l__enumext_store_anskey_arg_tl {#1}
2684     }
}
```

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*.

```
2685     \bool_lazy_and:nnT
2686     { \bool_if_p:N \l__enumext_store_ref_key_bool }
2687     { \bool_if_p:N \l__enumext_hyperref_bool }
2688     {
2689       \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2690       {
2691         \hfill \exp_not:N \hyperlink { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2692         { \exp_not:V \l__enumext_mark_ref_sym_tl }
2693       }
2694     }
2695     \__enumext_store_addto_seq:V \l__enumext_store_anskey_arg_tl
2696 }
```

(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.

```
2697 \cs_new_protected:Npn \__enumext_anskey_show_wrap_arg:n #1
2698 {
2699   \par
2700   \bool_if:NTF \l__enumext_starred_bool
2701   {
2702     \dim_compare:nNnT { \l__enumext_mark_sym_sep_dim } = { \c_zero_dim }
2703     {
2704       \dim_set:Nn \l__enumext_mark_sym_sep_dim { \l__enumext_labelsep_vii_dim }
2705     }
2706     \__enumext_print_keyans_box:NN
2707     \l__enumext_labelwidth_vii_dim \l__enumext_mark_sym_sep_dim
2708   }
2709   {
2710     \dim_compare:nNnT { \l__enumext_mark_sym_sep_dim } = { \c_zero_dim }
2711     {
2712       \dim_set:Nn \l__enumext_mark_sym_sep_dim
2713       {
2714         \dim_use:c { \l__enumext_labelsep_ \__enumext_level: _dim }
2715       }
2716     }
2717     \__enumext_print_keyans_box:cc
2718     { \l__enumext_labelwidth_ \__enumext_level: _dim } { \l__enumext_mark_sym_sep_dim }
2719   }
}
```

```

2720   \__enumext_anskey_wrapper:n { #1 }
2721 }

```

(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.

```

2722 \cs_new_protected:Npn \__enumext_anskey_show_wrap_left:n #1
2723 {
2724   \bool_if:NT \__enumext_show_answer_bool
2725   {
2726     \__enumext_anskey_show_wrap_arg:n { #1 }
2727   }
2728   \bool_if:NT \__enumext_show_position_bool
2729   {
2730     \tl_set:Nx \__enumext_mark_answer_sym_tl
2731     {
2732       \group_begin:
2733       \exp_not:N \normalfont
2734       \exp_not:N \footnotesize [ \int_eval:n
2735       {
2736         \prop_count:c { g__enumext_ \__enumext_store_name_tl _prop }
2737       }
2738       ]
2739       \group_end:
2740     }
2741     \__enumext_anskey_show_wrap_arg:n { #1 }
2742   }
2743 }

```

(End of definition for \\_\_enumext\_anskey\_show\_wrap\_left:n.)

### 13.30 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
2744 \keys_define:nn { enumext / anskey }
2745 {
2746   break-col .bool_set:N = \__enumext_store_columns_break_bool,
2747   break-col .default:n = true,
2748   break-col .value_forbidden:n = true,
2749   item-join .int_set:N = \__enumext_store_item_join_int,
2750   item-join .value_required:n = true,
2751   item-star .bool_set:N = \__enumext_store_item_star_bool,
2752   item-star .default:n = true,
2753   item-star .value_forbidden:n = true,
2754   item-sym* .tl_set:N = \__enumext_store_item_symbol_tl,
2755   item-sym* .value_required:n = true,
2756   item-pos* .dim_set:N = \__enumext_store_item_symbol_sep_dim,
2757   item-pos* .value_required:n = true,
2758   unknown .code:n = { \__enumext_anskey_unknown:n {#1} },
2759 }

```

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`.

```

2760 \cs_new_protected:Npn \__enumext_anskey_unknown:n #1
2761 {
2762   \exp_args:NV \__enumext_anskey_unknown:nn \l_keys_key_str {#1}
2763 }
2764 \cs_new_protected:Npn \__enumext_anskey_unknown:nn #1 #2
2765 {
2766   \tl_if_blank:nTF {#2}
2767   {
2768     \msg_error:nnn { enumext } { anskey-cmd-key-unknown } {#1}
2769   }
2770 }

```



```

2771         \msg_error:nnnn { enumext } { anskey-cmd-key-value-unknown } {#1} {#2}
2772     }
2773 }

```

(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`.

```

2774 \NewDocumentCommand \anskey { o +m }
2775 {
2776     \__enumext_anskey_safe_outer:
2777     \group_begin:
2778     \bool_if:NT \l__enumext_check_answers_bool
2779     {
2780         \tl_if_novalue:nF {#1}
2781         {
2782             \keys_set:nn { enumext / anskey } {#1}
2783         }
2784         \tl_if_blank:nTF {#2}
2785         {
2786             \msg_error:nn { enumext } { anskey-empty-arg }
2787         }
2788         {
2789             \__enumext_anskey_safe_inner:
2790             \__enumext_store_anskey_arg:n {#2}
2791         }
2792     }
2793     \group_end:
2794 }

```

(End of definition for `\anskey`. This function is documented on page 13.)

### 13.30.1 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:`

```

2795 \cs_new_protected:Nn \__enumext_anskey_safe_outer:
2796 {
2797     \bool_if:NF \l__enumext_store_active_bool
2798     {
2799         \msg_error:nnnn { enumext } { anskey-wrong-place } { anskey } { enumext }
2800     }
2801     \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
2802     {
2803         \msg_error:nnnn { enumext } { command-wrong-place } { anskey } { keyans }
2804     }
2805     \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
2806     {
2807         \msg_error:nnnn { enumext } { command-wrong-place } { anskey } { keyans* }
2808     }
2809     \int_compare:nNnT { \l__enumext_keyans_pic_level_int } = { 1 }
2810     {
2811         \msg_error:nnnn { enumext } { command-wrong-place } { anskey } { keyanspic }
2812     }
2813 }

```

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.

```

2814 \cs_new_protected:Nn \__enumext_anskey_safe_inner:
2815 {
2816     \int_incr:N \l__enumext_anskey_level_int
2817     \int_compare:nNnT { \l__enumext_anskey_level_int } > { 1 }
2818     {
2819         \msg_error:nn { enumext } { anskey-nested }
2820     }
2821     \bool_if:NF \l__enumext_item_number_bool

```

```

2822     {
2823       \msg_error:nn { enumext } { anskey-unnumber-item }
2824     }
2825     \mode_if_math:T
2826     {
2827       \msg_error:nne { enumext } { anskey-math-mode } { \c_backslash_str anskey }
2828     }
2829   }

```

(End of definition for `\__enumext_anskey_safe_outer:` and `\__enumext_anskey_safe_inner:`)

### 13.31 The environment anskey\*

The original implementation of the `anskey*` environment used non-public functions from the `scontents` package, which was not the best approach. Fortunately L<sup>A</sup>T<sub>E</sub>X release 2025-06-01 implemented the new `c` argument in the `ltcmd` module, 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 2830 \keys_define:nn { enumext / anskey* }
item-join 2831 {
item-star 2832   break-col .bool_set:N = \__enumext_store_columns_break_bool,
item-sym* 2833   break-col .default:n = true,
item-pos* 2834   break-col .value_forbidden:n = true,
force-eol 2835   item-join .int_set:N = \__enumext_store_item_join_int,
write-env 2836   item-join .value_required:n = true,
overwrite 2837   item-star .bool_set:N = \__enumext_store_item_star_bool,
          2838   item-star .default:n = true,
          2839   item-star .value_forbidden:n = true,
          2840   item-sym* .tl_set:N = \__enumext_store_item_symbol_tl,
          2841   item-sym* .value_required:n = true,
          2842   item-pos* .dim_set:N = \__enumext_store_item_symbol_sep_dim,
          2843   item-pos* .value_required:n = true,
          2844   force-eol .bool_set:N = \__enumext_anskey_env_force_eol_bool,
          2845   force-eol .initial:n = false,
          2846   force-eol .default:n = true,
          2847   write-env .code:n = {
          2848     \bool_set_true:N \__enumext_write_anskey_env_bool
          2849     \tl_set:Nn \__enumext_write_anskey_env_file_name_tl {#1}
          2850   },
          2851   write-env .value_required:n = true,
          2852   overwrite .bool_set:N = \__enumext_anskey_env_overwrite_bool,
          2853   overwrite .initial:n = false,
          2854   overwrite .default:n = true,
          2855   unknown .code:n = { \__enumext_anskey_env_unknown:n {#1} },
          2856 }

```

(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
\__enumext_anskey_env_unknown:nn

2857 \cs_new_protected:Npn \__enumext_anskey_env_unknown:n #1
2858 {
2859   \exp_args:NV \__enumext_anskey_env_unknown:nn \l_keys_key_str {#1}
2860 }
2861 \cs_new_protected:Npn \__enumext_anskey_env_unknown:nn #1#2
2862 {
2863   \tl_if_blank:nTF {#2}
2864   {
2865     \msg_error:nnn { enumext } { anskey-env-key-unknown } {#1}
2866   }
2867   {
2868     \msg_error:nnnn { enumext } { anskey-env-key-value-unknown } {#1} {#2}
2869   }
2870 }

```

(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.

```

2871 \prg_new_protected_conditional:Npnn \__enumext_anskey_env_file_if_writable:n #1 { T, F, TF }
2872 {
2873   \bool_if:NTF \l__enumext_write_anskey_env_bool
2874   {
2875     \file_if_exist:nTF {#1}
2876     {
2877       \bool_if:NTF \l__enumext_anskey_env_overwrite_bool
2878       {
2879         \msg_warning:nne { enumext } { overwrite-file } {#1}
2880         \prg_return_true:
2881       }
2882       {
2883         \msg_warning:nne { enumext } { not-writing } {#1}
2884         \prg_return_false:
2885       }
2886     }
2887     {
2888       \msg_warning:nne { enumext } { writing-file } {#1}
2889       \prg_return_true:
2890     }
2891   }
2892   { \prg_return_false: }
2893 }

```

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.

```

2894 \cs_new_protected:Npn \__enumext_anskey_env_file_write:nn #1#2
2895 {
2896   \__enumext_anskey_env_file_if_writable:nT {#1}
2897   {
2898     \iow_open:Nn \l__enumext_write_anskey_env_file_iow {#1}
2899     \iow_now:Nn \l__enumext_write_anskey_env_file_iow {#2}
2900     \iow_close:N \l__enumext_write_anskey_env_file_iow
2901   }
2902 }
2903 \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`.

```

2904 \NewDocumentEnvironment{anskey*}{ o c }
2905 {
2906   \__enumext_anskey_env_safe_outer:
2907   \bool_if:NNT \l__enumext_check_answers_bool
2908   {
2909     \tl_if_no_value:nF {#1}
2910     {
2911       \keys_set:nn { enumext / anskey* } {#1}
2912     }
2913     \tl_if_blank:nTF {#2}
2914     {
2915       \msg_error:nn { enumext } { anskey-empty-arg }
2916     }
2917     {
2918       \__enumext_anskey_env_safe_inner:
2919       \__enumext_store_anskey_env:n {#2}
2920     }
2921   }
2922 } { }

```

(End of definition for `anskey*`. This function is documented on page 14.)

### 13.31.1 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.

```

2923 \cs_new_protected:Nn \__enumext_anskey_env_safe_outer:
2924 {
2925   \bool_if:NF \l__enumext_store_active_bool
2926   {
2927     \msg_error:nnn { enumext } { anskey-env-error } { anskey* }
2928   }
2929   \int_compare:nNt { \l__enumext_keyans_level_int } = { 1 }
2930   {
2931     \msg_error:nnn { enumext } { anskey-env-wrong } { keyans }
2932   }
2933   \int_compare:nNt { \l__enumext_keyans_level_h_int } = { 1 }
2934   {
2935     \msg_error:nnn { enumext } { anskey-env-wrong } { keyans* }
2936   }
2937   \int_compare:nNt { \l__enumext_keyans_pic_level_int } = { 1 }
2938   {
2939     \msg_error:nnn { enumext } { anskey-env-wrong } { keyanspic }
2940   }
2941 }

```

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.

```

2942 \cs_new_protected:Nn \__enumext_anskey_env_safe_inner:
2943 {
2944   \bool_if:NF \l__enumext_item_number_bool
2945   {
2946     \msg_error:nn { enumext } { anskey-unnumber-item }
2947   }
2948   \mode_if_math:T
2949   {
2950     \msg_error:nnn { enumext } { anskey-math-mode } { anskey* }
2951   }
2952 }

```

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.

```

2953 \cs_new_protected:Npn \__enumext_store_anskey_env:n #1
2954 {
2955   \tl_set:Nn \l__enumext_store_anskey_env_tl {#1}
2956   \RenewDocumentCommand \obeyedline { } { \iow_char:N ^^J }
2957   \tl_replace_all:Nee \l__enumext_store_anskey_env_tl { \obeyedline } { \iow_char:N ^^J }
2958   \__enumext_anskey_env_file_write:VV
2959   \l__enumext_write_anskey_env_file_name_tl \l__enumext_store_anskey_env_tl
2960   \bool_if:NF \l__enumext_anskey_env_force_eol_bool
2961   {
2962     \tl_put_right:Ne \l__enumext_store_anskey_env_tl
2963     {
2964       \c__enumext_anskey_env_hidden_space_str
2965     }
2966   }
2967   \exp_args:Ne
2968   \__enumext_store_anskey_arg:n
2969   {
2970     \__enumext_scan_tokens:n { \l__enumext_store_anskey_env_tl }
2971   }
2972 }

```

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`.)

### 13.32 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.

```

2973 \cs_new_protected:Nn \__enumext_execute_after_env:
2974 {
2975   \int_compare:nNnT { \l__enumext_level_int } = { 0 }
2976   {
2977     \tl_if_empty:NF \g__enumext_store_name_tl
2978     {
2979       \__enumext_stop_save_ans_msg:
2980       \__enumext_item_answer_diff:
2981       \__enumext_log_global_vars:
2982       \__enumext_log_answer_vars:
2983       \bool_if:NTF \g__enumext_check_ans_key_bool
2984       {
2985         \__enumext_check_ans_show:
2986       }
2987       { \__enumext_check_ans_log: }
2988     }
2989     \__enumext_reset_global_vars:
2990   }
2991 }

```

• This function is passed to the function `\__enumext_after_env:nn` for the environments `enumext` (§13.39) and `enumext*` (§13.44) 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:`.)

### 13.33 Common functions for keyans, keyans\* and keyanspic

#### 13.33.1 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`.

```

2992 \cs_new_protected:Npn \__enumext_keyans_addto_prop:n #1
2993 {
2994   \tl_clear:N \l__enumext_store_current_label_tl
2995   \int_compare:nNnTF { \l__enumext_keyans_pic_level_int } = { 1 }
2996   {
2997     \tl_put_right:Ne \l__enumext_store_current_label_tl { \l__enumext_label_vi_tl }
2998   }
2999   {
3000     \tl_put_right:Ne \l__enumext_store_current_label_tl { \l__enumext_label_v_tl }
3001   }

```

If the *optional argument* is present and the `save-sep` key is not empty, we save it.

```

3002   \tl_if_novalue:NF { #1 }
3003   {
3004     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_v_tl
3005     {
3006       \tl_put_right:Nn \l__enumext_store_current_label_tl
3007       {
3008         \l__enumext_store_keyans_item_opt_sep_v_tl
3009       }
3010     }
3011     \tl_put_right:Nn \l__enumext_store_current_label_tl { #1 }
3012   }
3013   \__enumext_store_addto_prop:V \l__enumext_store_current_label_tl
3014 }

```

(End of definition for `\__enumext_keyans_addto_prop:n`.)

### 13.33.2 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.

```

3015 \cs_new_protected:Nn \__enumext_keyans_store_ref:
3016 {
3017   \bool_if:NT \l__enumext_store_ref_key_bool
3018   {
3019     \cs_set_protected:Npn \__enumext_tmp:n ##1
3020     {
3021       \tl_set_eq:cc { \l__enumext_label_copy_##1_tl } { \l__enumext_label_##1_tl }
3022       \tl_reverse:c { \l__enumext_label_copy_##1_tl }
3023       \tl_remove_once:cn { \l__enumext_label_copy_##1_tl } { . }
3024       \tl_reverse:c { \l__enumext_label_copy_##1_tl }
3025     }
3026     \clist_map_inline:nn { i, v, vi, vii, viii } { \__enumext_tmp:n {##1} }
3027     \__enumext_keyans_store_ref_aux_i:
3028   }
3029 }

```

The auxiliary function `\__enumext_keyans_store_ref_aux_i:` set the variable `\l__enumext_newlabel_arg_one_tl` which will contain  $\{ (store name: position) \}$  analyzing whether the environment in which they are executed is `enumext*` or `enumext`.

```

3030 \cs_new_protected:Nn \__enumext_keyans_store_ref_aux_i:
3031 {
3032   \bool_if:NT \g__enumext_starred_bool
3033   {
3034     \tl_set_eq:NN \l__enumext_label_copy_i_tl \l__enumext_label_copy_vii_tl
3035   }
3036   \int_compare:nNnT { \l__enumext_keyans_pic_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_vi_tl }
3040   }
3041   \int_compare:nNnT { \l__enumext_keyans_level_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_v_tl }
3045   }
3046   \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
3047   {
3048     \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
3049     { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_viii_tl }
3050   }
3051   \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
3052   {
3053     \l__enumext_store_name_tl \c_colon_str
3054     \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } }
3055   }
3056   \__enumext_keyans_store_ref_aux_ii:
3057 }

```

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.

```

3058 \cs_new_protected:Nn \__enumext_keyans_store_ref_aux_ii:
3059 {
3060   \tl_put_right:Ne \l__enumext_write_aux_file_tl
3061   {
3062     \__enumext_newlabel:nn
3063     { \exp_not:V \l__enumext_newlabel_arg_one_tl }
3064     { \l__enumext_newlabel_arg_two_tl }
3065   }
3066   \l__enumext_write_aux_file_tl
3067 }

```

(End of definition for `\__enumext_keyans_store_ref:`, `\__enumext_keyans_store_ref_aux_i:`, and `\__enumext_keyans_store_ref_aux_ii:`.)

### 13.33.3 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.

```
3068 \cs_new_protected:Npn \__enumext_keyans_addto_seq:n #1
3069 {
3070   \tl_clear:N \l__enumext_store_current_label_tl
3071   \int_compare:nNnTF { \l__enumext_keyans_pic_level_int } = { 1 }
3072   {
3073     \tl_put_right:Ne \l__enumext_store_current_label_tl { \item \l__enumext_label_vi_tl }
3074   }
3075   {
3076     \tl_put_right:Ne \l__enumext_store_current_label_tl { \item \l__enumext_label_v_tl }
3077   }
3078   \tl_if_novalue:nF { #1 }
3079   {
3080     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_v_tl
3081     {
3082       \tl_put_right:Nn \l__enumext_store_current_label_tl { \l__enumext_store_keyans_item_opt_sep_v_tl }
3083     }
3084     \tl_put_right:Nn \l__enumext_store_current_label_tl { #1 }
3085   }
3086   \__enumext_keyans_addto_seq_link:
3087 }
```

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.

```
3088 \cs_new_protected:Nn \__enumext_keyans_addto_seq_link:
3089 {
3090   \bool_lazy_and:nnT
3091   { \bool_if_p:N \l__enumext_store_ref_key_bool }
3092   { \bool_if_p:N \l__enumext_hyperref_bool }
3093   {
3094     \tl_put_right:Ne \l__enumext_store_current_label_tl
3095     {
3096       \hfill \exp_not:N \hyperlink
3097       {
3098         \exp_not:V \l__enumext_newlabel_arg_one_tl
3099       }
3100       { \exp_not:V \l__enumext_mark_ref_sym_tl }
3101     }
3102   }
3103   \__enumext_store_addto_seq:V \l__enumext_store_current_label_tl
3104   \bool_if:NT \l__enumext_check_answers_bool
3105   {
3106     \int_gincr:N \g__enumext_item_anskey_int
3107   }
3108 }
```

(End of definition for `\__enumext_keyans_addto_seq:n` and `\__enumext_keyans_addto_seq_link:.`)

### 13.33.4 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`.

```
3109 \cs_new_protected:Npn \__enumext_keyans_save_item_opt:n #1
3110 {
3111   \tl_if_novalue:nF { #1 }
3112   {
3113     \tl_set:Nn \l__enumext_store_current_opt_arg_tl { #1 }
3114   }
3115 }
```

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.



```

3116 \cs_new_protected:Nn \__enumext_keyans_show_item_opt:
3117 {
3118   \tl_if_empty:NF \l__enumext_store_current_opt_arg_tl
3119   {
3120     \bool_lazy_or:nnT
3121     { \bool_if_p:N \l__enumext_show_answer_bool }
3122     { \bool_if_p:N \l__enumext_show_position_bool }
3123     {
3124       \__enumext_keyans_wrapper_opt_v:n
3125       { \l__enumext_store_current_opt_arg_tl } \c_space_tl
3126     }
3127   }
3128 }

```

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.

```

3129 \cs_new_protected:Nn \__enumext_keyans_show_item_opt_viii:
3130 {
3131   \tl_if_empty:NF \l__enumext_store_current_opt_arg_tl
3132   {
3133     \bool_lazy_or:nnT
3134     { \bool_if_p:N \l__enumext_show_answer_bool }
3135     { \bool_if_p:N \l__enumext_show_position_bool }
3136     {
3137       \__enumext_keyans_wrapper_opt_viii:n
3138       { \l__enumext_store_current_opt_arg_tl } \c_space_tl
3139     }
3140   }
3141 }

```

(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`.

```

3142 \cs_new_protected:Nn \__enumext_keyans_pos_mark_set:
3143 {
3144   \__enumext_label_width_by_box:Nn
3145   \l__enumext_mark_sep_tmpa_dim { \l__enumext_label_v_tl }
3146   \str_case:Vn \l__enumext_align_label_pos_v_str
3147   {
3148     { l }
3149     {
3150       \dim_set:Nn \l__enumext_mark_sep_tmpb_dim { \c_zero_dim }
3151     }
3152     { r }
3153     {
3154       \dim_set:Nn \l__enumext_mark_sep_tmpb_dim
3155       { \l__enumext_labelwidth_v_dim - \l__enumext_mark_sep_tmpa_dim }
3156     }
3157     { c }
3158     {
3159       \dim_set:Nn \l__enumext_mark_sep_tmpb_dim
3160       { 0.5\l__enumext_labelwidth_v_dim - 0.5\l__enumext_mark_sep_tmpa_dim }
3161     }
3162   }

```

Here we set the default values for the key `mark-ans*`, `mark-sep*` and `mark-pos*`.

```

3163   \dim_compare:nNnT { \l__enumext_mark_sym_sep_v_dim } = { \c_zero_dim }
3164   {
3165     \dim_set:Nn \l__enumext_mark_sym_sep_v_dim { \l__enumext_labelsep_v_dim }
3166   }
3167   \tl_set_eq:NN \l__enumext_mark_answer_sym_tl \l__enumext_mark_answer_sym_v_tl
3168   \dim_add:Nn \l__enumext_mark_sym_sep_v_dim { \l__enumext_mark_sep_tmpb_dim }
3169   \str_set_eq:NN \l__enumext_mark_position_str \l__enumext_mark_position_v_str
3170 }

```

The function `\__enumext_keyans_show_ans:` will print the `\symbol` set by the `mark-ans*` key when the `show-ans` key is active.

```

3171 \cs_new_protected:Nn \__enumext_keyans_show_ans:
3172 {
3173   \bool_lazy_all:nT

```

```

3174     {
3175         { \bool_if_p:N \l__enumext_show_answer_bool }
3176         { \bool_if_p:N \l__enumext_item_wrap_key_bool }
3177     }
3178     {
3179         \__enumext_keyans_pos_mark_set:
3180         \__enumext_print_keyans_box:NN
3181         \l__enumext_labelwidth_v_dim \l__enumext_mark_sym_sep_v_dim
3182     }
3183 }

```

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.

```

3184 \cs_new_protected:Nn \__enumext_keyans_show_pos:
3185 {
3186     \int_compare:nNnTF { \l__enumext_keyans_level_int } = { 1 }
3187     {
3188         \int_incr:N \l__enumext_show_pos_tmp_int
3189     }
3190     {
3191         \int_zero:N \l__enumext_show_pos_tmp_int
3192     }
3193     \bool_lazy_all:nT
3194     {
3195         { \bool_if_p:N \l__enumext_show_position_bool }
3196         { \bool_if_p:N \l__enumext_item_wrap_key_bool }
3197     }
3198     {
3199         \tl_set:Ne \l__enumext_mark_answer_sym_v_tl
3200         {
3201             \group_begin:
3202             \exp_not:N \normalfont
3203             \exp_not:N \footnotesize [ \int_eval:n
3204             {
3205                 \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
3206                 + \l__enumext_show_pos_tmp_int
3207             }
3208             ]
3209             \group_end:
3210         }
3211         \__enumext_keyans_pos_mark_set:
3212         \__enumext_print_keyans_box:NN
3213         \l__enumext_labelwidth_v_dim \l__enumext_mark_sym_sep_v_dim
3214     }
3215 }

```

(End of definition for `\__enumext_keyans_pos_mark_set:`, `\__enumext_keyans_show_ans:`, and `\__enumext_keyans_show_pos:`.)

### 13.34 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`.

```

3216 \cs_new_protected:Npn \__enumext_default_item:n #1
3217 {
3218     \tl_if_novalue:nTF {#1}
3219     {

```

```

3220         \bool_if:NT \l__enumext_check_answers_bool
3221         {
3222             \int_gincr:N \g__enumext_item_number_int
3223             \bool_set_true:N \l__enumext_item_number_bool
3224         }
3225         \bool_set_true:c { \l__enumext_wrap_label_ \__enumext_level: _bool }
3226         \__enumext_item_std:w \tl_use:c { \l__enumext_fake_item_indent_ \__enumext_level: _tl }
3227     }
3228     {
3229         \bool_set_eq:cc
3230         { \l__enumext_wrap_label_ \__enumext_level: _bool }
3231         { \l__enumext_wrap_label_opt_ \__enumext_level: _bool }
3232         \__enumext_item_std:w [#1] \tl_use:c { \l__enumext_fake_item_indent_ \__enumext_level: _tl }
3233     }
3234 }

```

(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 *\langle symbol \rangle* to the “left” of the *\langle label \rangle* separated from it by the value the second *optional argument \langle offset \rangle*.

```
#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`.

```

3235 \cs_new_protected:Npn \__enumext_item_starred_exec:nn #1 #2
3236 {
3237     \tl_if_novalue:nTF {#1}
3238     {
3239         \tl_gset_eq:Nc
3240         \g__enumext_item_symbol_aux_tl { \l__enumext_item_symbol_ \__enumext_level: _tl }
3241     }
3242     {
3243         \tl_gset:Nn \g__enumext_item_symbol_aux_tl {#1}
3244     }
3245     \tl_if_novalue:nTF {#2}
3246     {
3247         \dim_set_eq:cc
3248         { \l__enumext_item_symbol_sep_ \__enumext_level: _dim }
3249         { \l__enumext_labelsep_ \__enumext_level: _dim }
3250     }
3251     {
3252         \dim_set:cn { \l__enumext_item_symbol_sep_ \__enumext_level: _dim } {#2}
3253     }
3254     \bool_if:NT \l__enumext_check_answers_bool
3255     {
3256         \int_gincr:N \g__enumext_item_number_int
3257         \bool_set_true:N \l__enumext_item_number_bool
3258     }
3259     \bool_set_true:c { \l__enumext_wrap_label_ \__enumext_level: _bool }
3260     \__enumext_item_std:w \tl_use:c { \l__enumext_fake_item_indent_ \__enumext_level: _tl }
3261 }

```

The function `\__enumext_item_starred_exec:` will be responsible for executing `\item*` for the `enumext` environment.

```

3262 \cs_new_protected:Nn \__enumext_item_starred_exec:
3263 {
3264     \tl_if_empty:cF { \l__enumext_item_symbol_ \__enumext_level: _tl }
3265     {
3266         \mode_leave_vertical:
3267         \skip_horizontal:n { -\dim_use:c { \l__enumext_item_symbol_sep_ \__enumext_level: _dim } }
3268         \hbox_overlap_left:n { \g__enumext_item_symbol_aux_tl }
3269         \skip_horizontal:n { \dim_use:c { \l__enumext_item_symbol_sep_ \__enumext_level: _dim } }
3270     }
3271 }

```

(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 (§13.39).

```

3272 \cs_new_protected:Nn \__enumext_redefine_item:
3273 {
3274   \RenewDocumentCommand \item { s o o }
3275   {
3276     \bool_if:NTF {##1}
3277     {
3278       \__enumext_item_starred_exec:nn {##2} {##3}
3279     }
3280     { \__enumext_default_item:n {##2} }
3281   }
3282 }

```

(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 (§13.39).

```

3283 \cs_new_protected:Nn \__enumext_make_label:
3284 {
3285   \IfDocumentMetadataTF
3286   {
3287     \__enumext_make_label_box:
3288   }
3289   {
3290     \bool_if:NTF \l__enumext_mode_box_bool
3291     {
3292       \__enumext_make_label_box:
3293     }
3294     {
3295       \__enumext_make_label_std:
3296     }
3297   }
3298 }

```

Standard definition when `\DocumentMetadata` is not active.

```

3299 \cs_new_protected:Nn \__enumext_make_label_std:
3300 {
3301   \RenewDocumentCommand \makeLabel { m }
3302   {
3303     \tl_use:c { l__enumext_label_fill_left_ \__enumext_level: _tl }
3304     \__enumext_item_starred_exec:
3305     \tl_use:c { l__enumext_label_font_style_ \__enumext_level: _tl }
3306     \bool_if:cTF { l__enumext_wrap_label_ \__enumext_level: _bool }
3307     {
3308       \use:c { __enumext_wrapper_label_ \__enumext_level: :n } { ##1 }
3309     }
3310     { ##1 }
3311     \tl_use:c { l__enumext_label_fill_right_ \__enumext_level: _tl }
3312     \tl_gclear:N \g__enumext_item_symbol_aux_tl
3313   }
3314 }

```

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`.

```

3315 \cs_new_protected:Nn \__enumext_make_label_box:
3316 {
3317   \RenewDocumentCommand \makeLabel { m }
3318   {
3319     \strut\smash
3320     {
3321       \makebox
3322       [ \dim_use:c { l__enumext_labelwidth_ \__enumext_level: _dim } ]
3323       [ \str_use:c { l__enumext_align_label_pos_ \__enumext_level: _str } ]
3324       {
3325         \__enumext_item_starred_exec:

```

```

3326         \tl_use:c { l__enumext_label_font_style_ \__enumext_level: _tl }
3327         \bool_if:cTF { l__enumext_wrap_label_ \__enumext_level: _bool }
3328         {
3329             \use:c { __enumext_wrapper_label_ \__enumext_level: :n } { ##1 }
3330         }
3331         { ##1 }
3332         \tl_gclear:N \g__enumext_item_symbol_aux_tl
3333     }
3334 } % close smash
3335 }
3336 }

```

(End of definition for `\__enumext_make_label:`, `\__enumext_make_label_std:`, and `\__enumext_make_label_box:`.)

### 13.35 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*`

```

3337 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
3338 {
3339     \keys_define:nn { enumext / #1 }
3340     {
3341         item-sym* .tl_set:c = { l__enumext_item_symbol_#2_tl },
3342         item-sym* .value_required:n = true,
3343         item-sym* .initial:n = {\textborn},
3344         item-pos* .dim_set:c = { l__enumext_item_symbol_sep_#2_dim },
3345         item-pos* .value_required:n = true,
3346     }
3347 }
3348 \clist_map_inline:nn
3349 {
3350     {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {enumext*}{vii}
3351 }
3352 { \__enumext_tmp:nn #1 }

```

(End of definition for `item-sym*` and `item-pos*`.)

### 13.36 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.

#### 13.36.1 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:n
3353 \cs_set_protected:Npn \__enumext_tmp:n #1
3354 {
3355     \keys_define:nn { enumext / #1 }
3356     {
3357         unknown .code:n = {
3358             \tl_set:Nn \l__enumext_envir_name_tl {#1}
3359             \__enumext_keyans_unknown_keys:n {#1}
3360         },
3361     }
3362 }
3363 \clist_map_inline:nn { keyans, keyans*, keyanspic } { \__enumext_tmp:n {#1} }

```

Internal functions for handling `unknown` key.

```

3364 \cs_new_protected:Npn \__enumext_keyans_unknown_keys:n #1
3365 {
3366     \exp_args:NV \__enumext_keyans_unknown_keys:nn \l_keys_key_str {#1}
3367 }
3368 \cs_new_protected:Npn \__enumext_keyans_unknown_keys:nn #1#2
3369 {
3370     \tl_if_blank:nTF {#2}
3371     {
3372         \msg_error:nne { enumext } { keyans-unknown-key } {#1}

```

```

3373     }
3374     {
3375         \msg_error:nnee { enumext } { keyans-unknown-key-value } {#1} {#2}
3376     }
3377 }

```

(End of definition for `unknown`, `\__enumext_keyans_unknown_keys:n`, and `\__enumext_keyans_unknown_keys:nn`.)

### 13.36.2 Handling unknown keys for `enumext*`

Define and set `unknown` key for `enumext*` environment.

```

\__enumext_starred_unknown_keys:n
\__enumext_starred_unknown_keys:nn
3378 \keys_define:nn { enumext / enumext* }
3379 {
3380     unknown .code:n = { \__enumext_starred_unknown_keys:n {#1} },
3381 }

```

Internal functions for handling `unknown` key.

```

3382 \cs_new_protected:Npn \__enumext_starred_unknown_keys:n #1
3383 {
3384     \exp_args:NV \__enumext_starred_unknown_keys:nn \l_keys_key_str {#1}
3385 }
3386 \cs_new_protected:Npn \__enumext_starred_unknown_keys:nn #1#2
3387 {
3388     \tl_if_blank:nTF {#2}
3389     {
3390         \msg_error:nnn { enumext } { starred-unknown-key } {#1}
3391     }
3392     {
3393         \msg_error:nnnn { enumext } { starred-unknown-key-value } {#1} {#2}
3394     }
3395 }

```

(End of definition for `unknown`, `\__enumext_starred_unknown_keys:n`, and `\__enumext_starred_unknown_keys:nn`.)

### 13.36.3 Handling unknown keys for `enumext`

Defines and set the key `unknown` for `enumext` environment.

```

\__enumext_standar_unknown_keys:n
\__enumext_standar_unknown_keys:nn
3396 \cs_set_protected:Npn \__enumext_tmp:n #1
3397 {
3398     \keys_define:nn { enumext / #1 }
3399     {
3400         unknown .code:n = { \__enumext_standar_unknown_keys:n {##1} },
3401     }
3402 }
3403 \clist_map_inline:nn { level-1,level-2,level-3,level-4 } { \__enumext_tmp:n {#1} }

```

Internal functions for handling `unknown` key.

```

3404 \cs_new_protected:Npn \__enumext_standar_unknown_keys:n #1
3405 {
3406     \exp_args:NV \__enumext_standar_unknown_keys:nn \l_keys_key_str {#1}
3407 }
3408 \cs_new_protected:Npn \__enumext_standar_unknown_keys:nn #1#2
3409 {
3410     \tl_if_blank:nTF {#2}
3411     {
3412         \msg_error:nnn { enumext } { standar-unknown-key } {#1}
3413     }
3414     {
3415         \msg_error:nnnn { enumext } { standar-unknown-key-value } {#1} {#2}
3416     }
3417 }

```

(End of definition for `unknown`, `\__enumext_standar_unknown_keys:n`, and `\__enumext_standar_unknown_keys:nn`.)

## 13.37 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.

The function `\__enumext_keyans_default_item:n` executes the original behavior of the `\item` along with the keys `wrap-label`, `wrap-label*` and `itemindent`.

```

3418 \cs_new_protected:Npn \__enumext_keyans_default_item:n #1
3419 {

```

```

3420 \tl_if_novalue:nTF { #1 }
3421 {
3422   \bool_set_true:N \l__enumext_wrap_label_v_bool
3423   \__enumext_item_std:w \tl_use:N \l__enumext_fake_item_indent_v_tl
3424 }
3425 {
3426   \bool_set_eq:NN \l__enumext_wrap_label_v_bool \l__enumext_wrap_label_opt_v_bool
3427   \__enumext_item_std:w [#1] \tl_use:N \l__enumext_fake_item_indent_v_tl
3428 }
3429 }

```

(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.

```

3430 \cs_new_protected:Npn \__enumext_keyans_starred_item:n #1
3431 {
3432   \__enumext_keyans_save_item_opt:n { #1 }
3433   \bool_set_true:N \l__enumext_wrap_label_v_bool
3434   \__enumext_item_std:w \tl_use:N \l__enumext_fake_item_indent_v_tl
3435   \__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.

```

3436   \__enumext_keyans_addto_prop:n { #1 }
3437   \__enumext_keyans_store_ref:
3438   \__enumext_keyans_addto_seq:n { #1 }
3439   \int_gincr:N \g__enumext_check_starred_cmd_int
3440 }

```

(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 (§13.38).

```

3441 \cs_new_protected:Nn \__enumext_keyans_redefine_item:
3442 {
3443   \RenewDocumentCommand \item { s o }
3444   {
3445     \bool_if:nTF {##1}
3446     {
3447       \bool_set_true:N \l__enumext_item_wrap_key_bool % wrap-ans*
3448       \peek_remove_spaces:n
3449       {
3450         \__enumext_keyans_starred_item:n {##2}
3451       }
3452     }
3453     {
3454       \bool_set_false:N \l__enumext_item_wrap_key_bool
3455       \__enumext_keyans_default_item:n {##2}
3456     }
3457   }
3458 }

```

(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 (§13.38).

```

3459 \cs_new_protected:Nn \__enumext_keyans_make_label:
3460 {
3461   \IfDocumentMetadataTF
3462   {
3463     \__enumext_keyans_make_label_box:

```



```

3464     }
3465     {
3466         \bool_if:NTF \l__enumext_mode_box_bool
3467         {
3468             \__enumext_keyans_make_label_box:
3469         }
3470         {
3471             \__enumext_keyans_make_label_std:
3472         }
3473     }
3474 }

```

We added conditionals to the `\__enumext_keyans_wrapper_label:n` function to handle the keys `wrap-ans*`, `wrap-label` and `wrap-label*`.

```

3475 \cs_new_protected:Npn \__enumext_keyans_wrapper_label:n #1
3476 {
3477     \bool_lazy_all:nT
3478     {
3479         { \bool_if_p:N \l__enumext_wrap_label_v_bool }
3480         { \bool_if_p:N \l__enumext_show_answer_bool }
3481         { \bool_if_p:N \l__enumext_item_wrap_key_bool }
3482         { \cs_if_exist_p:N \__enumext_keyans_wrapper_item_v:n }
3483     }
3484     {
3485         \cs_set_eq:NN \__enumext_wrapper_label_v:n \__enumext_keyans_wrapper_item_v:n
3486     }
3487     \bool_if:NTF \l__enumext_wrap_label_v_bool
3488     {
3489         \__enumext_wrapper_label_v:n { #1 }
3490     }
3491     { #1 }
3492 }

```

Standard definition when `\DocumentMetadata` is not active.

```

3493 \cs_new_protected:Nn \__enumext_keyans_make_label_std:
3494 {
3495     \RenewDocumentCommand \makeLabel { m }
3496     {
3497         \tl_use:N \l__enumext_label_fill_left_v_tl
3498         \__enumext_keyans_show_ans:
3499         \__enumext_keyans_show_pos:
3500         \tl_use:N \l__enumext_label_font_style_v_tl
3501         \__enumext_keyans_wrapper_label:n { ##1 }
3502         \tl_use:N \l__enumext_label_fill_right_v_tl
3503     }
3504 }

```

Definition using `\makebox` when `\DocumentMetadata` is active or `mode-box` is active.

```

3505 \cs_new_protected:Nn \__enumext_keyans_make_label_box:
3506 {
3507     \RenewDocumentCommand \makeLabel { m }
3508     {
3509         \strut\smash
3510         {
3511             \makebox[ \l__enumext_labelwidth_v_dim ][ \l__enumext_align_label_pos_v_str ]
3512             {
3513                 \__enumext_keyans_show_ans:
3514                 \__enumext_keyans_show_pos:
3515                 \tl_use:N \l__enumext_label_font_style_v_tl
3516                 \__enumext_keyans_wrapper_label:n { ##1 }
3517             }
3518         }
3519     }
3520 }

```

(End of definition for `\__enumext_keyans_make_label:` and others.)

### 13.38 Second argument of the lists

At this point of the code we have already programmed most the necessary tools to create a custom `list` environment, remember that the function `\__enumext_start_list:nn` takes two arguments, the first one we have ready, the second one we will define for all the levels of the environment `enumext` and the environment `keyans`.

### 13.38.1 Calculation of `\leftmargin` and `\itemindent`

Consider the figure 9 where the default margins (on the left) of a list are represented.

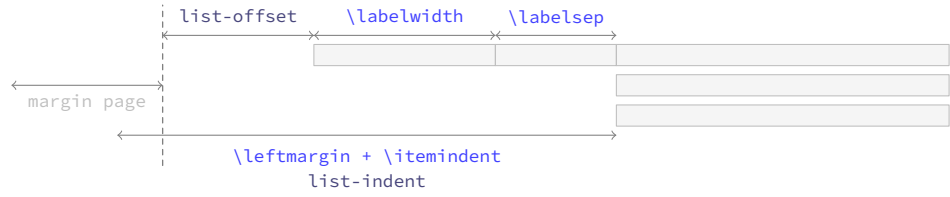


Figure 9: Representation of standard horizontal lengths in `list` environment.

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.

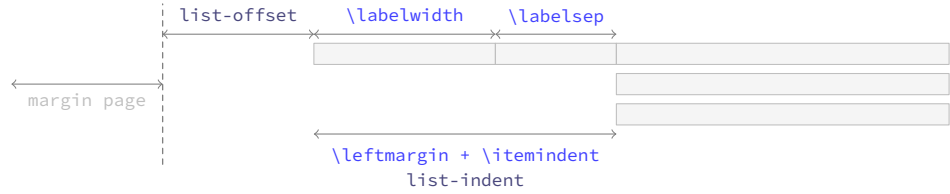


Figure 10: Representation of horizontal lengths concept in list in `enumext`.

Where the default values will look like in the figure 11.

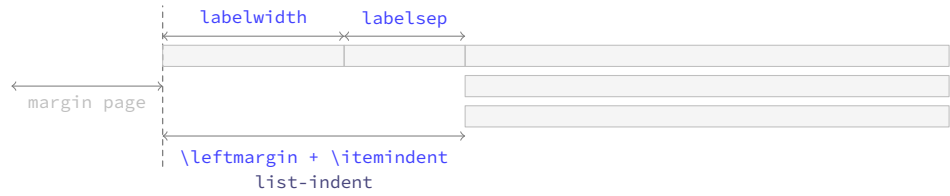


Figure 11: Default horizontal lengths in `enumext`.

```

\__enumext_calc_hspace:NNNNNNN
\__enumext_calc_hspace:ccccc

```

The function `\__enumext_calc_hspace:NNNNNNN` takes seven arguments to be able to determine horizontal spaces for all list environment:

```

#1: \l__enumext_labelwidth_X_dim      #2: \l__enumext_labelsep_X_dim
#3: \l__enumext_listoffset_X_dim     #4: \l__enumext_leftmargin_tmp_X_dim
#5: \l__enumext_leftmargin_X_dim      #6: \l__enumext_itemindent_X_dim
#7: \l__enumext_leftmargin_tmp_X_bool

```

And returns the “adjusted” values of `\leftmargin` and `\itemindent`.

This function is passed to `\__enumext_list_arg_two_X:` which is used in the definition of the `enumext` and `keyans` environments (§13.38).

```

3521 \cs_new_protected:Npn \__enumext_calc_hspace:NNNNNNN #1 #2 #3 #4 #5 #6 #7
3522 {
3523   \dim_compare:nNt { #1 } < { \c_zero_dim }
3524   {
3525     \msg_warning:nnnV { enumext } { width-non-positive } { labelwidth } { #1 }
3526     \dim_set:Nn #1 { \dim_abs:n { #1 } }
3527   }
3528   \dim_compare:nNt { #2 } < { \c_zero_dim }
3529   {
3530     \msg_warning:nnnV { enumext } { width-negative } { labelsep } { #2 }
3531     \dim_set:Nn #2 { \dim_abs:n { #2 } }
3532   }

```

If no value has been passed to the `labelwidth` and `labelsep` keys we set the default values for `\l__enumext_leftmargin_tmp_X_dim`.

```

3533   \bool_if:nF #7 { \dim_set:Nn #4 { #1 + #2 } }

```

We now analyze the cases and set the values for `\leftmargin` and `\itemindent`.

```

3534   \dim_compare:nNtF { #4 } < { \c_zero_dim }
3535   {
3536     \dim_set:Nn #6 { #1 + #2 - #4 }
3537     \dim_set:Nn #5 { #1 + #2 + #3 - #6 }
3538   }
3539   {
3540     \dim_compare:nNt { #4 } = { #1 + #2 }

```

```

3541     { \dim_set:Nn #6 { \c_zero_dim } }
3542 \dim_compare:nNnT { #4 } < { #1 + #2 }
3543     { \dim_set:Nn #6 { #1 + #2 - #4 } }
3544 \dim_compare:nNnT { #4 } > { #1 + #2 }
3545     {
3546         \dim_set:Nn #6 { -#1 - #2 + #4 }
3547         \dim_set:Nn #6 { #6*-1 }
3548     }
3549 \dim_set:Nn #5 { #1 + #2 + #3 - #6 }
3550 }
3551 }
3552 \cs_generate_variant:Nn \__enumext_calc_hspace:NNNNNNN { cccccc }

```

(End of definition for `\__enumext_calc_hspace:NNNNNNN`.)

### 13.38.2 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.

```

3553 \cs_set_protected:Npn \__enumext_tmp:n #1
3554 {
3555     \cs_new_protected:cpn { __enumext_list_arg_two_#1: }
3556     {
3557         \__enumext_calc_hspace:ccccc
3558         { \__enumext_labelwidth_#1_dim } { \__enumext_labelsep_#1_dim }
3559         { \__enumext_listoffset_#1_dim } { \__enumext_leftmargin_tmp_#1_dim }
3560         { \__enumext_leftmargin_#1_dim } { \__enumext_itemindent_#1_dim }
3561         { \__enumext_leftmargin_tmp_#1_bool }
3562         \clist_map_inline:nn
3563         { labelsep, labelwidth, itemindent, leftmargin, rightmargin, listparindent }
3564         { \dim_set_eq:cc {###1} { \__enumext_###1_#1_dim } }
3565         \clist_map_inline:nn { topsep, parsep, partopsep, itemsep }
3566         { \skip_set_eq:cc {###1} { \__enumext_###1_#1_skip } }
3567         \usecounter { enumX#1 }
3568         \setcounter { enumX#1 } { \int_eval:n { \int_use:c { \__enumext_start_#1_int } - 1 } }
3569         \bool_if_eq:nnTF {#1} { v }
3570         {
3571             \__enumext_keyans_redefine_item:
3572             \__enumext_keyans_make_label:
3573             \__enumext_keyans_ref:
3574             \__enumext_keyans_fake_item_indent:
3575             \bool_if:cT { \__enumext_show_length_#1_bool }
3576             {
3577                 \msg_term:nnnn { enumext } { list-lengths-not-nested } { v } { keyans }
3578             }
3579         }
3580         {
3581             \__enumext_redefine_item:
3582             \__enumext_make_label:
3583             \__enumext_standar_ref:
3584             \__enumext_fake_item_indent:
3585             \bool_if:cT { \__enumext_show_length_#1_bool }
3586             {
3587                 \msg_term:nnne { enumext } { list-lengths } {#1}
3588                 { \int_use:N \__enumext_level_int }
3589             }
3590         }
3591     }
3592 }
3593 \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 `\opt`. 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 `\listparindent` and `parsep` to set the value of `\parskip` locally.

```

3594 \cs_set_protected:Npn \__enumext_tmp:n #1
3595 {
3596     \cs_new_protected:cpn { __enumext_list_arg_two_#1: }
3597     {
3598         \bool_set_true:c { \__enumext_leftmargin_tmp_#1_bool }

```

```

3599 \dim_zero:c { \__enumext_leftmargin_tmp_#1_dim }
3600 \__enumext_calc_hspace:ccccc
3601 { \__enumext_labelwidth_#1_dim } { \__enumext_labelsep_#1_dim }
3602 { \__enumext_listoffset_#1_dim } { \__enumext_leftmargin_tmp_#1_dim }
3603 { \__enumext_leftmargin_#1_dim } { \__enumext_itemindent_#1_dim }
3604 { \__enumext_leftmargin_tmp_#1_bool }
3605 \clist_map_inline:nn
3606 { labelsep, labelwidth, itemindent, leftmargin, rightmargin, listparindent }
3607 { \dim_set_eq:cc {####1} { \__enumext_####1_#1_dim } }
3608 \clist_map_inline:nn { topsep, parsep, partopsep, itemsep }
3609 { \skip_set_eq:cc {####1} { \__enumext_####1_#1_skip } }
3610 \skip_set_eq:Nc \parsep { \__enumext_itemsep_#1_skip }
3611 \skip_zero:N \partopsep
3612 \usecounter { enumX#1 }
3613 \setcounter { enumX#1 } { \int_eval:n { \int_use:c { \__enumext_start_#1_int } - 1 } }
3614 \__enumext_starred_ref:
3615 \str_if_eq:nnTF {#1} { vii }
3616 {
3617     \__enumext_fake_item_indent_vii:
3618     \bool_if:cT { \__enumext_show_length_vii_bool }
3619     { \msg_term:nnnn { enumext } { list-lengths-not-nested } { vii } { enumext* } }
3620 }
3621 {
3622     \__enumext_fake_item_indent_viii:
3623     \bool_if:cT { \__enumext_show_length_#1_bool }
3624     { \msg_term:nnnn { enumext } { list-lengths-not-nested } { #1 } { keyans* } }
3625 }
3626 }
3627 }
3628 \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:.)

### 13.39 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”.

```

3629 \cs_new_protected:Nn \__enumext_safe_exec:
3630 {
3631     \__enumext_is_not_nested:
3632     \__enumext_internal_mini_page:
3633     \int_incr:N \l__enumext_level_int
3634     \int_compare:nNnT { \l__enumext_level_int } > { 4 }
3635     { \msg_fatal:nn { enumext } { list-too-deep } }
3636     \bool_set_true:N \l__enumext_standar_bool
3637     \bool_set_false:N \l__enumext_starred_bool
3638     \__enumext_is_on_first_level:
3639 }

```

(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.

```

3640 \cs_new_protected:Npn \__enumext_parse_keys:n #1
3641 {
3642     \tl_if_novalue:nF {#1}
3643     {
3644         \str_clear:N \l__enumext_series_str
3645         \int_compare:nNnTF { \l__enumext_level_int } = { 1 }
3646         {
3647             \keys_set:nn { enumext / level-1 } {#1}
3648             \__enumext_parse_series:n {#1}
3649             \__enumext_nested_base_line_fix:

```

```

3650     }
3651     {
3652         \exp_args:Ne \keys_set:nn
3653         { enumext / level-\int_use:N \l__enumext_level_int } {#1}
3654     }
3655     \__enumext_store_active_keys:n {#1}
3656 }
3657 }

```

(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\*.

```

3658 \cs_new_protected:Nn \__enumext_start_store_level:
3659 {
3660     \bool_lazy_all:nT
3661     {
3662         { \bool_if_p:N \l__enumext_store_active_bool }
3663         { \bool_not_p:n { \l__enumext_keyans_env_bool } }
3664         { \bool_if_p:N \g__enumext_standar_bool }
3665     }
3666     {
3667         \int_compare:nNnT { \l__enumext_level_int } > { 1 }
3668         {
3669             \bool_set_true:c { l__enumext_store_upper_level_ \__enumext_level: _bool }
3670             \__enumext_store_level_open:
3671         }
3672     }

```

If enumext are nested in enumext\* add \\_\_enumext\_store\_level\_open: to preserve the “*storing structure*”.

```

3673     \bool_lazy_all:nT
3674     {
3675         { \bool_if_p:N \l__enumext_store_active_bool }
3676         { \bool_not_p:n { \l__enumext_keyans_env_bool } }
3677         { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
3678     }
3679     {
3680         \int_compare:nNnT { \l__enumext_level_int } > { 0 }
3681         {
3682             \bool_set_true:c { l__enumext_store_upper_level_ \__enumext_level: _bool }
3683             \__enumext_store_level_open:
3684         }
3685     }
3686 }

```

(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\*.

```

3687 \cs_new_protected:Nn \__enumext_stop_store_level:
3688 {
3689     \bool_if:cT { l__enumext_store_upper_level_ \__enumext_level: _bool }
3690     {
3691         \__enumext_store_level_close:
3692     }
3693 }

```

(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.

```

3694 \cs_new_protected:Nn \__enumext_multicols_start:
3695 {
3696     \int_compare:nNnT
3697     { \int_use:c { l__enumext_columns_ \__enumext_level: _int } } > { 1 }
3698     {
3699         \dim_compare:nNnT
3700         { \dim_use:c { l__enumext_columns_sep_ \__enumext_level: _dim } } = { \c_zero_dim }
3701         {
3702             \dim_set:cn { l__enumext_columns_sep_ \__enumext_level: _dim }

```

```

3703         {
3704             ( \dim_use:c { \__enumext_labelwidth_ \__enumext_level: _dim }
3705               + \dim_use:c { \__enumext_labelsep_ \__enumext_level: _dim }
3706             ) / \int_use:c { \__enumext_columns_ \__enumext_level: _int }
3707             - \dim_use:c { \__enumext_listoffset_ \__enumext_level: _dim }
3708         }
3709     }
3710     \dim_set_eq:Nc \columnsep { \__enumext_columns_sep_ \__enumext_level: _dim }
3711     \int_compare:nNnT { \__enumext_level_int } > { 1 }
3712     {
3713         \dim_zero:N \columnseprule
3714     }

```

We will calculate the *vertical spacing* settings for the `multicols` environment using the function `\__enumext_multi_addvspace:`, apply our “*vertical adjust spacing*”, then start the `multicols` environment.

```

3715     \bool_if:cF { \__enumext_minipage_active_ \__enumext_level: _bool }
3716     {
3717         \skip_zero:N \multicolsep
3718         \__enumext_multi_addvspace:
3719     }
3720     \raggedcolumns
3721     \begin{multicols}{ \int_use:c { \__enumext_columns_ \__enumext_level: _int } }
3722 }
3723 }

```

(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:`.

```

3724 \cs_new_protected:Nn \__enumext_multicols_stop:
3725 {
3726     \int_compare:nNnTF
3727     { \int_use:c { \__enumext_columns_ \__enumext_level: _int } } > { 1 }
3728     {
3729         \__enumext_stop_list:
3730         \__enumext_stop_store_level:
3731         \end{multicols}
3732         \__enumext_unskip_unkern:
3733         \__enumext_unskip_unkern:
3734         \par\addvspace{ \skip_use:c { \__enumext_multicols_below_ \__enumext_level: _skip } }
3735     }
3736     {
3737         \__enumext_stop_list:
3738         \__enumext_stop_store_level:
3739     }
3740 }

```

(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.

```

3741 \cs_new_protected:Nn \__enumext_before_list:
3742 {
3743     \__enumext_vspace_above:
3744     \__enumext_before_args_exec:
3745     \__enumext_check_ans_active:

```

When the `mini-env` key is active it will set the value of the `\__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 `\__enumext_minipage_hsep_X_dim` set by the `mini-sep` key, the value of `\__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.

```

3746     \dim_compare:nNnT
3747     { \dim_use:c { \__enumext_minipage_right_ \__enumext_level: _dim } } > { \c_zero_dim }
3748     {
3749         \dim_set:cn { \__enumext_minipage_left_ \__enumext_level: _dim }
3750         {
3751             \linewidth
3752             - \dim_use:c { \__enumext_minipage_right_ \__enumext_level: _dim }

```

```

3753         - \dim_use:c { l__enumext_minipage_hsep_ \__enumext_level: _dim }
3754     }

```

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.

```

3755     \bool_set_true:c { l__enumext_minipage_active_ \__enumext_level: _bool }
3756     \int_gincr:N \g__enumext_minipage_stat_int
3757     \__enumext_minipage_add_space:
3758     \noindent
3759     \__enumext_mini_page{ \dim_use:c { l__enumext_minipage_left_ \__enumext_level: _dim } }
3760 }
3761 \__enumext_multicols_start:
3762 }

```

(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.

```

3763 \cs_new_protected:Nn \__enumext_second_part:
3764 {
3765     \bool_if:cTF { l__enumext_minipage_active_ \__enumext_level: _bool }
3766     {
3767         \int_compare:nNnT { \g__enumext_minipage_stat_int } = { 1 }
3768         {
3769             \msg_warning:nn { enumext } { missing-miniright }
3770             \miniright
3771         }
3772         \int_gzero:N \g__enumext_minipage_stat_int
3773         \__enumext_unskip_unkern: % remove topsep + [partopsep]
3774         \end__enumext_mini_page
3775     }
3776     {
3777         \__enumext_multicols_stop:
3778     }

```

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.

```

3779     \__enumext_after_stop_list:
3780     \__enumext_check_ans_key_hook:
3781     \__enumext_vspace_below:
3782     \bool_set_false:N \l__enumext_standar_bool
3783     \__enumext_resume_save_counter:
3784 }

```

(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.

```

3785 \cs_new_protected:Nn \__enumext_set_item_width:
3786 {
3787     \dim_set:Nn \itemwidth { \linewidth }
3788     \dim_compare:nT
3789     {
3790         \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim } != \c_zero_dim
3791     }
3792     {
3793         \dim_sub:Nn \itemwidth
3794         {
3795             \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim }
3796         }
3797     }
3798 }

```



(End of definition for `\__enumext_set_item_width:`.)

**enumext** Now create the `enumext` environment based on `list` environment by levels.

```

3799 \NewDocumentEnvironment{enumext}{0}{ }
3800 {
3801   \__enumext_safe_exec:
3802   \__enumext_parse_keys:n {#1}
3803   \__enumext_before_list:
3804   \__enumext_start_store_level:
3805   \__enumext_start_list:nn
3806   { \tl_use:c { \__enumext_label_ \__enumext_level: _tl } }
3807   {
3808     \use:c { __enumext_list_arg_two_ \__enumext_level: : }
3809     \__enumext_before_keys_exec:
3810   }
3811   \__enumext_set_item_width:
3812   \__enumext_after_args_exec:
3813 }
3814 {
3815   \__enumext_second_part:
3816 }

```

(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`.

```

3817 \__enumext_after_env:nn {enumext}
3818 {
3819   \__enumext_execute_after_env:
3820 }

```

### 13.40 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”.

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.

```

3821 \cs_new_protected:Nn \__enumext_keyans_safe_exec:
3822 {
3823   \bool_if:NF \l__enumext_store_active_bool
3824   {
3825     \msg_error:nnnn { enumext } { wrong-place } { keyans } { save-ans }
3826   }
3827   \int_incr:N \l__enumext_keyans_level_int
3828   \bool_set_true:N \l__enumext_keyans_env_bool
3829   \__enumext_keyans_name_and_start:
3830   % Set false for interfering with enumext nested in keyans (yes, its possible and crayze)
3831   \bool_set_false:N \l__enumext_store_active_bool
3832   \int_compare:nNnT { \l__enumext_keyans_level_int } > { 1 }
3833   {
3834     \msg_error:nn { enumext } { keyans-nested }
3835   }
3836   \int_compare:nNnT { \l__enumext_level_int } > { 1 }
3837   {
3838     \msg_error:nn { enumext } { keyans-wrong-level }
3839   }
3840 }

```

(End of definition for `\__enumext_keyans_safe_exec:`.)

`\__enumext_keyans_parse_keys:n` Parse [`key = val`] for `keyans` environment.

```

3841 \cs_new_protected:Npn \__enumext_keyans_parse_keys:n #1
3842 {
3843   \keys_set:nn { enumext / keyans } {#1}
3844 }

```

(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:
3845 \cs_new_protected:Nn \__enumext_before_list_v:
3846 {
3847   \__enumext_vspace_above_v:
3848   \__enumext_before_args_exec_v:
3849   \dim_compare:nNnT { \l__enumext_minipage_right_v_dim } > { \c_zero_dim }
3850   {
3851     \dim_set:Nn \l__enumext_minipage_left_v_dim
3852     {
3853       \linewidth - \l__enumext_minipage_right_v_dim - \l__enumext_minipage_hsep_v_dim
3854     }
3855     \bool_set_true:N \l__enumext_minipage_active_v_bool
3856     \int_gincr:N \g__enumext_minipage_stat_int
3857     \__enumext_keyans_minipage_add_space:
3858     \__enumext_mini_page{ \l__enumext_minipage_left_v_dim }
3859   }
3860   \__enumext_keyans_multicols_start:
3861 }
3862 \cs_new_protected:Nn \__enumext_keyans_multicols_start:
3863 {
3864   \int_compare:nNnT { \l__enumext_columns_v_int } > { 1 }
3865   {
3866     \dim_compare:nNnT { \l__enumext_columns_sep_v_dim } = { \c_zero_dim }
3867     {
3868       \dim_set:Nn \l__enumext_columns_sep_v_dim
3869       {
3870         (
3871           \l__enumext_labelwidth_v_dim + \l__enumext_labelsep_v_dim
3872         ) / \l__enumext_columns_v_int
3873         - \l__enumext_listoffset_v_dim
3874       }
3875     }
3876     \dim_set_eq:NN \columnsep \l__enumext_columns_sep_v_dim
3877     \dim_zero:N \columnseprule % no rule here
3878     \bool_if:NF \l__enumext_minipage_active_v_bool
3879     {
3880       \skip_zero:N \multicolsep
3881       \__enumext_keyans_multi_addvspace:
3882     }
3883     \raggedcolumns
3884     \begin{multicols}{\l__enumext_columns_v_int}
3885   }
3886 }
3887 \cs_new_protected:Nn \__enumext_keyans_multicols_stop:
3888 {
3889   \int_compare:nNnTF { \l__enumext_columns_v_int } > { 1 }
3890   {
3891     \__enumext_stop_list:
3892     \end{multicols}
3893     \__enumext_unskip_unkern:
3894     \__enumext_unskip_unkern:
3895     \par\addvspace{ \l__enumext_multicols_below_v_skip }
3896   }
3897   {
3898     \__enumext_stop_list:
3899   }
3900 }
3901 \cs_new_protected:Nn \__enumext_second_part_v:
3902 {
3903   \bool_if:NTF \l__enumext_minipage_active_v_bool
3904   {
3905     \int_compare:nNnT { \g__enumext_minipage_stat_int } = { 1 }
3906     {
3907       \msg_warning:nn { enumext } { missing-miniright }
3908       \miniright
3909     }
3910     \int_gzero:N \g__enumext_minipage_stat_int
3911     \__enumext_unskip_unkern: % remove \topsep + [\partopsep]
3912     \end__enumext_mini_page
3913     \par\addvspace{ \l__enumext_minipage_after_skip }
3914   }

```

```

3915     {
3916         \__enumext_keyans_multicols_stop:
3917     }
3918     \bool_set_false:N \__enumext_keyans_env_bool
3919     \__enumext_after_stop_list_v:
3920     \__enumext_vspace_below_v:
3921 }

```

(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.

```

3922 \cs_new_protected:Nn \__enumext_keyans_set_item_width:
3923 {
3924     \dim_set:Nn \itemwidth { \linewidth }
3925     \dim_compare:nT
3926     {
3927         \__enumext_listoffset_v_dim != \c_zero_dim
3928     }
3929     {
3930         \dim_sub:Nn \itemwidth { \__enumext_listoffset_v_dim }
3931     }
3932 }

```

(End of definition for \\_\_enumext\_keyans\_set\_item\_width:.)

keyans

Now we define the environment keyans also based on lists.

```

3933 \NewDocumentEnvironment{keyans}{0}{ }
3934 {
3935     \__enumext_keyans_safe_exec:
3936     \__enumext_keyans_parse_keys:n {#1}
3937     \__enumext_before_list_v:
3938     \__enumext_start_list:nn
3939     { \tl_use:N \__enumext_label_v_tl }
3940     {
3941         \__enumext_list_arg_two_v:
3942         \__enumext_before_keys_exec_v:
3943     }
3944     \__enumext_keyans_set_item_width:
3945     \__enumext_after_args_exec_v:
3946 }
3947 {
3948     \__enumext_check_starred_cmd:n { item }
3949     \__enumext_second_part_v:
3950 }

```

(End of definition for keyans. This function is documented on page 15.)

### 13.41 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`[17] and `ltsockets`[19]. 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](#).

#### 13.41.1 Socket for tagging support in 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

We will first define the necessary sockets and their behavior for `enumext*` and `keyans*`.

```

3951 \socket_new:nn {tagsupport/\__enumext/starred}{1 }
3952 \socket_new_plug:nnn {tagsupport/\__enumext/starred} {start-list-tags}
3953 {
3954     \tag_resume:n {#1}
3955     \tag_mc_end_push:
3956     \tag_struct_begin:n {tag=LI}
3957     \tag_struct_begin:n {tag=Lbl}
3958     \tag_mc_begin:n {tag=Lbl}
3959 }
3960 \socket_new_plug:nnn {tagsupport/\__enumext/starred} {stop-start-tags}

```

```

3961 {
3962     \tag_mc_end:
3963     \tag_struct_end:n {tag=Lbl}
3964     \tag_struct_begin:n {tag=LBody}
3965     \tag_struct_begin:n {tag=text-unit}
3966     \tag_struct_begin:n {tag=text}
3967 }
3968 \socket_new_plug:nnn {tagsupport/__enumext/starred} {stop-list-tags}
3969 {
3970     \tag_struct_end:n {tag=text}
3971     \tag_struct_end:n {tag=text-unit}
3972     \tag_struct_end:n {tag=LBody}
3973     \tag_struct_end:n {tag=LI}
3974     \tag_mc_begin_pop:n {}
3975     \tag_suspend:n {#1}
3976 }

```

And now we'll wrap them so that they're only active when `\DocumentMetadata` is present.

```

3977 \cs_new_protected_nopar:Npn \__enumext_start_list_tag:n #1
3978 {
3979     \IfDocumentMetadataTF
3980     {
3981         \socket_assign_plug:nn {tagsupport/__enumext/starred} {start-list-tags}
3982         \socket_use:nn {tagsupport/__enumext/starred} {#1}
3983     } {}
3984 }
3985 \cs_new_protected_nopar:Nn \__enumext_stop_start_list_tag:
3986 {
3987     \IfDocumentMetadataTF
3988     {
3989         \socket_assign_plug:nn {tagsupport/__enumext/starred} {stop-start-tags}
3990         \socket_use:nn {tagsupport/__enumext/starred} { }
3991     } {}
3992 }
3993 \cs_new_protected_nopar:Npn \__enumext_stop_list_tag:n #1
3994 {
3995     \IfDocumentMetadataTF
3996     {
3997         \socket_assign_plug:nn {tagsupport/__enumext/starred} {stop-list-tags}
3998         \socket_use:nn {tagsupport/__enumext/starred} {#1}
3999     } {}
4000 }

```

(End of definition for *start-list-tags* and others.)

### 13.41.2 Socket for tagging support in keyanspic

`start-list-tags` 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:
4001 \socket_new:nn {tagsupport/__enumext/keyanspic}{ 0 }
4002 \socket_new_plug:nnn {tagsupport/__enumext/keyanspic} {start-list-tags}
4003 {
4004     \tag_resume:n {keyanspic}
4005     \tag_mc_end_push:
4006     \tag_struct_begin:n {tag=LI}
4007     \tag_struct_begin:n {tag=Lbl}
4008     \tag_mc_begin:n {tag=Lbl}
4009 }
4010 \socket_new_plug:nnn {tagsupport/__enumext/keyanspic} {stop-start-tags}
4011 {
4012     \tag_mc_end:
4013     \tag_struct_end:n {tag=Lbl}
4014     \tag_struct_begin:n {tag=LBody}
4015     \tag_struct_begin:n {tag=text-unit}
4016     \tag_struct_begin:n {tag=text}
4017     \tag_mc_begin:n {tag=text}
4018 }
4019 \socket_new_plug:nnn {tagsupport/__enumext/keyanspic} {stop-list-tags}
4020 {
4021     \tag_mc_end:
4022     \tag_struct_end:n {tag=text}
4023     \tag_struct_end:n {tag=text-unit}
4024     \tag_struct_end:n {tag=LBody}
4025     \tag_struct_end:n {tag=LI}

```

```

4026 \tag_mc_begin_pop:n {}
4027 \tag_suspend:n {keyanspic}
4028 }

```

And now we'll wrap them so that they're only active when `\DocumentMetadata` is present.

```

4029 \cs_new_protected_nopar:Nn \__enumext_anspic_start_list_tag:
4030 {
4031   \IfDocumentMetadataTF
4032   {
4033     \socket_assign_plug:nn {tagsupport/__enumext/keyanspic} {start-list-tags}
4034     \socket_use:n {tagsupport/__enumext/keyanspic}
4035   } {}
4036 }
4037 \cs_new_protected_nopar:Nn \__enumext_anspic_stop_start_list_tag:
4038 {
4039   \IfDocumentMetadataTF
4040   {
4041     \socket_assign_plug:nn {tagsupport/__enumext/keyanspic} {stop-start-tags}
4042     \socket_use:n {tagsupport/__enumext/keyanspic}
4043   } {}
4044 }
4045 \cs_new_protected_nopar:Nn \__enumext_anspic_stop_list_tag:
4046 {
4047   \IfDocumentMetadataTF
4048   {
4049     \socket_assign_plug:nn {tagsupport/__enumext/keyanspic} {stop-list-tags}
4050     \socket_use:n {tagsupport/__enumext/keyanspic}
4051   } {}
4052 }

```

(End of definition for `start-list-tags` and others.)

### 13.42 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.

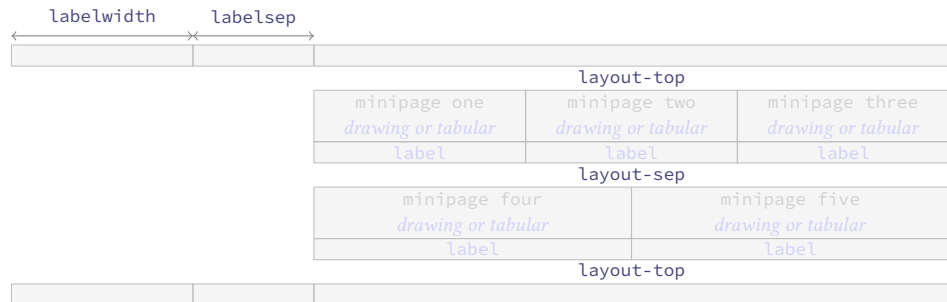


Figure 12: Representation of the `keyanspic` spacing in `enumext`.

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?](#).

#### 13.42.1 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`.

```

4053 \keys_define:nn { enumext / keyanspic }
4054 {
4055   label-pos .choice:,
4056   label-pos / above .code:n =
4057     \bool_set_true:N \l__enumext_anspic_label_above_bool
4058     \str_set:Nn \l__enumext_anspic_mini_pos_str { t },
4059   label-pos / below .code:n =

```

```

4060         \bool_set_false:N \l__enumext_anspic_label_above_bool
4061         \str_set:Nn \l__enumext_anspic_mini_pos_str { b },
4062     label-pos / unknown .code:n =
4063         \msg_error:nnee { enumext } { unknown-choice }
4064         { label-pos } { above,~ below } { \exp_not:n {#1} },
4065     label-pos .initial:n = below,
4066     label-pos .value_required:n = true,
4067     label-sep .skip_set:N = \l__enumext_anspic_label_sep_skip,
4068     label-sep .value_required:n = true,
4069     layout-sty .tl_set:N = \l__enumext_anspic_layout_style_tl,
4070     layout-sty .value_required:n = true,
4071     layout-sep .code:n = \keys_set:nn { enumext / keyans } { parsep = #1 },
4072     layout-sep .value_required:n = true,
4073     layout-top .code:n = \keys_set:nn { enumext / keyans } { topsep = #1 },
4074     layout-top .value_required:n = true,
4075     mark-ans .code:n = \keys_set:nn { enumext / keyans } { mark-ans = #1 },
4076     mark-ans .value_required:n = true,
4077     mark-pos .code:n = \keys_set:nn { enumext / keyans } { mark-pos = #1 },
4078     mark-pos .value_required:n = true,
4079     mark-sep .code:n = \keys_set:nn { enumext / keyans } { mark-sep = #1 },
4080     mark-sep .value_required:n = true,
4081     save-sep .code:n = \keys_set:nn { enumext / keyans } { save-sep = #1 },
4082     save-sep .value_required:n = true,
4083     wrap-opt .code:n = \keys_set:nn { enumext / keyans } { wrap-opt = #1 },
4084     wrap-opt .value_required:n = true,
4085     wrap-ans* .code:n = \keys_set:nn { enumext / keyans } { wrap-ans* = #1 },
4086     wrap-ans* .value_required:n = true,
4087     show-ans .code:n = \keys_set:nn { enumext / keyans } { show-ans = #1 },
4088     show-ans .value_required:n = true,
4089     show-pos .code:n = \keys_set:nn { enumext / keyans } { show-pos = #1 },
4090     show-pos .value_required:n = true,
4091     unknown .code:n = {
4092         \tl_set:Nn \l__enumext_envir_name_tl { keyanspic }
4093         \__enumext_keyans_unknown_keys:n {#1}
4094     },
4095 }

```

(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.

```

4096 \cs_new_protected:Nn \__enumext_keyans_pic_safe_exec:
4097 {
4098     \int_incr:N \l__enumext_keyans_pic_level_int
4099     \int_compare:nNtT { \l__enumext_keyans_pic_level_int } > { 1 }
4100     {
4101         \msg_error:nn { enumext } { keyanspic-nested }
4102     }
4103     \__enumext_keyans_name_and_start:
4104 }

```

Parse [`<key = val>`] for `keyanspic` environment.

```

4105 \cs_new_protected:Npn \__enumext_keyans_pic_parse_keys:n #1
4106 {
4107     \tl_if_novalue:nF {#1}
4108     {
4109         \keys_set:nn { enumext / keyanspic } {#1}
4110     }
4111 }

```

The function `\__enumext_keyans_pic_skip_abs:N` will return a positive value `\parsep` from `keyans` environment.

```

4112 \cs_new_protected:Npn \__enumext_keyans_pic_skip_abs:N #1
4113 {
4114     \dim_compare:nNtT { #1 } < { \c_zero_dim }
4115     {
4116         \skip_set:Nn #1 { -#1 }
4117     }
4118 }

```

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.

```

4119 \cs_new_protected:Npn \__enumext_keyans_pic_arg_two:
4120 {
4121   \bool_set_false:N \l__enumext_leftmargin_tmp_v_bool
4122   \__enumext_list_arg_two_v:
4123   \__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*.

```

4124   \bool_if:NF \l__enumext_anspic_label_above_bool
4125   {
4126     \stepcounter { enumXv }
4127     \hbox_set:Nn \l__enumext_anspic_label_box { \l__enumext_label_v_tl }
4128     \dim_set:Nn \l__enumext_anspic_label_htdp_dim
4129     {
4130       \box_ht_plus_dp:N \l__enumext_anspic_label_box
4131     }
4132     \skip_add:Nn \parsep
4133     {
4134       \l__enumext_anspic_label_htdp_dim
4135       + \box_dp:N \strutbox
4136       + \l__enumext_anspic_label_sep_skip
4137     }
4138   }

```

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.

```

4139   \dim_add:Nn \leftmargin { -\l__enumext_labelwidth_v_dim - \l__enumext_labelsep_v_dim }
4140   \ignorespaces
4141   \skip_add:Nn \topsep { 0.5\box_dp:N \strutbox }
4142   \dim_zero:N \listparindent
4143   \skip_zero:N \partopsep
4144   \skip_zero:N \itemsep
4145 }

```

(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.

```

4146 \NewDocumentEnvironment{keyanspic}{ o }
4147 {
4148   \__enumext_keyans_pic_safe_exec:
4149   \__enumext_keyans_pic_parse_keys:n {#1}
4150   \begin{list} { } { \__enumext_keyans_pic_arg_two: }
4151   \IfDocumentMetadataTF
4152   {
4153     \tag_suspend:n {list}
4154   }{}
4155   \item[] \scan_stop:
4156   \RenewDocumentCommand \item {}
4157   {
4158     \msg_error:nn { enumext } { keyanspic-item-cmd }
4159   }
4160   \IfDocumentMetadataTF
4161   {
4162     \tag_resume:n {keyanspic}
4163     \tag_tool:n {para/tagging=false}
4164     \tag_suspend:n {keyanspic}
4165   } { }
4166 }

```

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.

```

4167 {
4168   \IfDocumentMetadataTF

```



```

4169     {
4170       \tag_resume:n {keyanspic}
4171       \tag_mc_end_push:
4172       \tag_struct_begin:n {tag=L,attribute=enumerate}
4173     } { }
4174     \__enumext_anspic_exec:
4175     \IfDocumentMetadataTF
4176     {
4177       \tag_suspend:n {keyanspic}
4178     } { }
4179     \end{list}
4180     \IfDocumentMetadataTF
4181     {
4182       \tag_struct_end:n {tag=L}
4183       \tag_mc_begin_pop:n {}
4184       \tag_struct_end:n {tag=L}
4185       \tag_mc_begin_pop:n {}
4186     } { }

```

Finally we check if `\anspic*` has been used, set the counter `enumXvi` to zero and apply our “adjusted” vertical space bottom.

```

4187     \__enumext_check_starred_cmd:n { anspic }
4188     \setcounter { enumXvi } { 0 }
4189     \bool_if:NTF \__enumext_anspic_label_above_bool
4190     {
4191       \par\addvspace{ 0.5\box_dp:N \strutbox }
4192     }
4193     {
4194       \par
4195       \addvspace
4196       {
4197         \dim_eval:n
4198         {
4199           \__enumext_anspic_label_htdp_dim + \box_ht_plus_dp:N \strutbox
4200           + \__enumext_anspic_label_sep_skip + \__enumext_topsep_v_skip
4201         }
4202       }
4203     }
4204   }

```

(End of definition for `keyanspic`. This function is documented on page 16.)

### 13.42.2 The command `\anspic`

The `\anspic` command take three arguments, the *starred versions* `\anspic*[(content)]` store the current `<label>` next to the *optional argument* `[(content)]` in the *sequence* and *prop list* defined by `save-ans` key. The third *mandatory argument* `{(drawing or tabular)}` 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 `\__enumext_anspic_args_seq` which is processed by the `keyanspic` environment.

```

4205 \NewDocumentCommand \anspic { s o +m }
4206 {
4207   \bool_if:NF \__enumext_store_active_bool
4208   {
4209     \msg_error:nnnn { enumext } { wrong-place } { keyanspic } { save-ans }
4210   }
4211   \int_compare:nNt { \__enumext_level_int } > { 1 }
4212   {
4213     \msg_error:nn { enumext } { keyanspic-wrong-level }
4214   }
4215   \int_compare:nNt { \__enumext_keyans_level_int } = { 1 }
4216   {
4217     \msg_error:nnnn { enumext } { command-wrong-place } { anspic } { keyans }
4218   }
4219   \seq_put_right:Nn \__enumext_anspic_args_seq
4220   {

```

```

4221     \__enumext_anspic_args:nnn { #1 } { #2 } { #3 }
4222   }
4223 }

```

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”.

```

4224 \cs_new_protected:Npn \__enumext_anspic_body_dim:n #1
4225 {
4226   \bool_if:NF \l__enumext_anspic_label_above_bool
4227   {
4228     \IfDocumentMetadataTF
4229     {
4230       \tag_suspend:n {keyanspic}
4231     } { }
4232     \vbox_set:Nn \l__enumext_anspic_body_box { #1 }
4233     \dim_set:Nn \l__enumext_anspic_body_htdp_dim
4234     {
4235       \box_ht_plus_dp:N \l__enumext_anspic_body_box
4236     }
4237     \IfDocumentMetadataTF
4238     {
4239       \tag_resume:n {keyanspic}
4240     } { }
4241   }
4242 }

```

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.

```

4243 \cs_new_protected:Npn \__enumext_anspic_label:nn #1 #2
4244 {
4245   \makebox[ \l__enumext_anspic_mini_width_dim ][ c ]
4246   {
4247     \bool_if:NTF { #1 }
4248     {
4249       \bool_set_true:N \l__enumext_item_wrap_key_bool
4250       \bool_set_true:N \l__enumext_wrap_label_v_bool
4251       \__enumext_keyans_save_item_opt:n { #2 }
4252       \__enumext_keyans_addto_prop:n { #2 }
4253       \__enumext_keyans_store_ref:
4254       \__enumext_keyans_addto_seq:n { #2 }
4255       \int_gincr:N \g__enumext_check_starred_cmd_int
4256       \__enumext_keyans_show_ans:
4257       \__enumext_keyans_show_pos:
4258       \makebox[ \l__enumext_labelwidth_v_dim ][ c ]
4259       {
4260         \tl_use:N \l__enumext_label_font_style_v_tl
4261         \__enumext_keyans_wrapper_label:n { \l__enumext_label_vi_tl }
4262       }
4263       \skip_horizontal:n { \l__enumext_labelsep_v_dim }
4264       \__enumext_keyans_show_item_opt:
4265     }
4266     {
4267       \bool_set_false:N \l__enumext_item_wrap_key_bool
4268       \tl_use:N \l__enumext_label_font_style_v_tl
4269       \__enumext_wrapper_label_v:n { \l__enumext_label_vi_tl }
4270     }
4271   }
4272 }

```

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.

```

4273 \cs_new_protected:Npn \__enumext_anspic_label_pos:nnn #1 #2 #3
4274 {
4275   \stepcounter { enumXvi }
4276   \__enumext_anspic_body_dim:n { #3 }
4277   \bool_if:NTF \l__enumext_anspic_label_above_bool
4278   {
4279     \__enumext_anspic_label:nn { #1 } { #2 }
4280   }
4281   {
4282     \raisebox

```

```

4283     {
4284         -\dim_eval:n
4285         {
4286             \l__enumext_anspic_label_htdp_dim
4287             + \l__enumext_anspic_body_htdp_dim
4288             + \box_dp:N \strutbox
4289             + \l__enumext_anspic_label_sep_skip
4290         }
4291     }
4292     [ opt ] [ opt ]
4293     {
4294         \l__enumext_anspic_label:nn { #1 } { #2 }
4295     }
4296 }
4297 }
4298 %

```

The `\l__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 `\l__enumext_anspic_print:n` function in the second part of the definition of the `keyanspic` environment.

```

4299 \cs_new_protected:Nn \l__enumext_anspic_args:nnn
4300 {
4301     \l__enumext_anspic_start_list_tag:
4302     \l__enumext_anspic_label_pos:nnn { #1 } { #2 } { #3 }
4303     \l__enumext_anspic_stop_start_list_tag:
4304     \bool_if:NTF \l__enumext_anspic_label_above_bool
4305     {
4306         \\[\l__enumext_anspic_label_sep_skip] #3
4307     }
4308     {
4309         \\ #3
4310     }
4311     \l__enumext_anspic_stop_list_tag:
4312 }

```

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 `\l__enumext_anspic_print:n` and passed to the function `\l__enumext_anspic_row:n`.

```

4313 \cs_new_protected:Nn \l__enumext_anspic_print:n
4314 {
4315     \clist_map_function:nN { #1 } \l__enumext_anspic_row:n
4316 }
4317 \cs_generate_variant:Nn \l__enumext_anspic_print:n { e, V }

```

The function `\l__enumext_anspic_row:n` will set the *widths* for the `minipage` environments and place *all arguments* passed to `\anspic` saved in the `\l__enumext_anspic_args_seq` sequence inside them.

```

4318 \cs_new_protected:Nn \l__enumext_anspic_row:n
4319 {
4320     \dim_set:Nn \l__enumext_anspic_mini_width_dim { \linewidth / #1 }
4321     \int_set:Nn \l__enumext_anspic_above_int { \l__enumext_anspic_below_int }
4322     \int_set:Nn \l__enumext_anspic_below_int { \l__enumext_anspic_above_int + #1 }
4323     \int_step_inline:nnn
4324     { \l__enumext_anspic_above_int + 1 }
4325     { \l__enumext_anspic_below_int }
4326     {
4327         \IfDocumentMetadataTF
4328         {
4329             \tag_suspend:n {minipage}
4330         } { }
4331         \begin{minipage}[ \l__enumext_anspic_mini_pos_str ]{ \l__enumext_anspic_mini_width_dim }
4332             \centering
4333             \seq_item:Nn \l__enumext_anspic_args_seq { ##1 }
4334         \end{minipage}
4335         \IfDocumentMetadataTF
4336         {
4337             \tag_resume:n {minipage}
4338         } { }
4339     }
4340     \par
4341 }

```

The `\l__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*.

```

4342 \cs_new_protected:Nn \__enumext_anspic_exec:
4343 {
4344   \tl_if_empty:NTF \l__enumext_anspic_layout_style_tl
4345   {
4346     \__enumext_anspic_print:e { \seq_count:N \l__enumext_anspic_args_seq }
4347   }
4348   {
4349     \__enumext_anspic_print:V \l__enumext_anspic_layout_style_tl
4350   }
4351 }

```

(End of definition for `\anspic` and others. This function is documented on page 17.)

### 13.43 The horizontal environments

Generating *horizontal list environments* is NOT as simple as standard  $\text{\LaTeX}$  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  $\text{\LaTeX}$  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.

#### 13.43.1 Functions for item box width

We set the default value for the *width of the box* containing the  $\langle content \rangle$  of the items for `enumext*` environment.

```

\__enumext_starred_columns_set_vii:
\__enumext_starred_columns_set_viii:

```

```

4352 \cs_new_protected:Nn \__enumext_starred_columns_set_vii:
4353 {
4354   \dim_compare:nNnT { \l__enumext_columns_sep_vii_dim } = { \c_zero_dim }
4355   {
4356     \dim_set:Nn \l__enumext_columns_sep_vii_dim
4357     {
4358       ( \l__enumext_labelwidth_vii_dim + \l__enumext_labelsep_vii_dim )
4359       / \l__enumext_columns_vii_int
4360     }
4361   }
4362   \int_set:Nn \l__enumext_tmpa_vii_int { \l__enumext_columns_vii_int - 1 }
4363   \dim_set:Nn \l__enumext_item_width_vii_dim
4364   {
4365     ( \linewidth - \l__enumext_columns_sep_vii_dim * \l__enumext_tmpa_vii_int )
4366     / \l__enumext_columns_vii_int
4367     - \l__enumext_labelwidth_vii_dim
4368     - \l__enumext_labelsep_vii_dim
4369   }

```

When the key `rightmargin` is active we must adjust the values.

```

4370   \dim_compare:nNnT { \l__enumext_rightmargin_vii_dim } > { \c_zero_dim }
4371   {
4372     \dim_sub:Nn \l__enumext_item_width_vii_dim
4373     {
4374       ( \l__enumext_rightmargin_vii_dim * \l__enumext_tmpa_vii_int )
4375       / \l__enumext_columns_vii_int
4376     }
4377     \dim_add:Nn \l__enumext_columns_sep_vii_dim
4378     {
4379       \l__enumext_rightmargin_vii_dim
4380     }
4381   }
4382 }

```

Same implementation for the `keyans*` environment.

```

4383 \cs_new_protected:Nn \__enumext_starred_columns_set_viii:
4384 {
4385   \dim_compare:nNnT { \__enumext_columns_sep_viii_dim } = { \c_zero_dim }
4386   {
4387     \dim_set:Nn \__enumext_columns_sep_viii_dim
4388     {
4389       ( \__enumext_labelwidth_viii_dim + \__enumext_labelsep_viii_dim )
4390       / \__enumext_columns_viii_int
4391     }
4392   }
4393   \int_set:Nn \__enumext_tmpa_viii_int { \__enumext_columns_viii_int - 1 }
4394   \dim_set:Nn \__enumext_item_width_viii_dim
4395   {
4396     ( \linewidth - \__enumext_columns_sep_viii_dim * \__enumext_tmpa_viii_int )
4397     / \__enumext_columns_viii_int
4398     - \__enumext_labelwidth_viii_dim
4399     - \__enumext_labelsep_viii_dim
4400   }
4401   \dim_compare:nNnT { \__enumext_rightmargin_viii_dim } > { \c_zero_dim }
4402   {
4403     \dim_sub:Nn \__enumext_item_width_viii_dim
4404     {
4405       ( \__enumext_rightmargin_viii_dim * \__enumext_tmpa_viii_int )
4406       / \__enumext_columns_viii_int
4407     }
4408     \dim_add:Nn \__enumext_columns_sep_viii_dim
4409     {
4410       \__enumext_rightmargin_viii_dim
4411     }
4412   }
4413 }

```

(End of definition for `\__enumext_starred_columns_set_vii:` and `\__enumext_starred_columns_set_viii:`)

### 13.43.2 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.

```

4414 \cs_new_protected:Npn \__enumext_starred_joined_item_vii:n #1
4415 {
4416   \int_set:Nn \__enumext_joined_item_vii_int {#1}
4417   \int_compare:nNnT { \__enumext_joined_item_vii_int } > { \__enumext_columns_vii_int }
4418   {
4419     \msg_warning:nnee { enumext } { item-joined }
4420     { \int_use:N \__enumext_joined_item_vii_int }
4421     { \int_use:N \__enumext_columns_vii_int }
4422     \int_set:Nn \__enumext_joined_item_vii_int
4423     {
4424       \__enumext_columns_vii_int - \__enumext_item_column_pos_vii_int + 1
4425     }
4426   }
4427   \int_compare:nNnT
4428   { \__enumext_joined_item_vii_int }
4429   >
4430   { \__enumext_columns_vii_int - \__enumext_item_column_pos_vii_int + 1 }
4431   {
4432     \msg_warning:nnee { enumext } { item-joined-columns }
4433     { \int_use:N \__enumext_joined_item_vii_int }
4434     {
4435       \int_eval:n
4436       { \__enumext_columns_vii_int - \__enumext_item_column_pos_vii_int + 1 }
4437     }
4438     \int_set:Nn \__enumext_joined_item_vii_int
4439     {
4440       \__enumext_columns_vii_int - \__enumext_item_column_pos_vii_int + 1
4441     }
4442   }
4443   \int_compare:nNnTF { \__enumext_joined_item_vii_int } > { 1 }
4444   {
4445     \int_set_eq:NN \__enumext_joined_item_aux_vii_int \__enumext_joined_item_vii_int

```

```

4446     \int_decr:N \l__enumext_joined_item_aux_vii_int
4447     \int_add:Nn \l__enumext_item_column_pos_vii_int { \l__enumext_joined_item_aux_vii_int }
4448     \int_gadd:Nn \g__enumext_item_count_all_vii_int { \l__enumext_joined_item_aux_vii_int }
4449     \dim_set:Nn \l__enumext_joined_width_vii_dim
4450     {
4451         \l__enumext_item_width_vii_dim * \l__enumext_joined_item_vii_int
4452         + ( \l__enumext_labelwidth_vii_dim + \l__enumext_labelsep_vii_dim
4453             + \l__enumext_columns_sep_vii_dim
4454             )*\l__enumext_joined_item_aux_vii_int
4455     }
4456     \dim_set_eq:NN \itemwidth \l__enumext_joined_width_vii_dim
4457 }
4458 {
4459     \dim_set_eq:NN \l__enumext_joined_width_vii_dim \l__enumext_item_width_vii_dim
4460     \dim_set_eq:NN \itemwidth \l__enumext_item_width_vii_dim
4461 }
4462 }

```

Same implementation for the `keyans*` environment.

```

4463 \cs_new_protected:Npn \__enumext_starred_joined_item_viii:n #1
4464 {
4465     \int_set:Nn \l__enumext_joined_item_viii_int {#1}
4466     \int_compare:nNnT { \l__enumext_joined_item_viii_int } > { \l__enumext_columns_viii_int }
4467     {
4468         \msg_warning:nnee { enumext } { item-joined }
4469         { \int_use:N \l__enumext_joined_item_viii_int }
4470         { \int_use:N \l__enumext_columns_viii_int }
4471         \int_set:Nn \l__enumext_joined_item_viii_int
4472         {
4473             \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1
4474         }
4475     }
4476     \int_compare:nNnT
4477     { \l__enumext_joined_item_viii_int }
4478     >
4479     { \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1 }
4480     {
4481         \msg_warning:nnee { enumext } { item-joined-columns }
4482         { \int_use:N \l__enumext_joined_item_viii_int }
4483         {
4484             \int_eval:n
4485             { \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1 }
4486         }
4487         \int_set:Nn \l__enumext_joined_item_viii_int
4488         {
4489             \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1
4490         }
4491     }
4492     \int_compare:nNnTF { \l__enumext_joined_item_viii_int } > { 1 }
4493     {
4494         \int_set_eq:NN \l__enumext_joined_item_aux_viii_int \l__enumext_joined_item_viii_int
4495         \int_decr:N \l__enumext_joined_item_aux_viii_int
4496         \int_add:Nn \l__enumext_item_column_pos_viii_int { \l__enumext_joined_item_aux_viii_int }
4497         \int_gadd:Nn \g__enumext_item_count_all_viii_int { \l__enumext_joined_item_aux_viii_int }
4498         \dim_set:Nn \l__enumext_joined_width_viii_dim
4499         {
4500             \l__enumext_item_width_viii_dim * \l__enumext_joined_item_viii_int
4501             + ( \l__enumext_labelwidth_viii_dim + \l__enumext_labelsep_viii_dim
4502                 + \l__enumext_columns_sep_viii_dim
4503                 )*\l__enumext_joined_item_aux_viii_int
4504         }
4505         \dim_set_eq:NN \itemwidth \l__enumext_joined_width_viii_dim
4506     }
4507     {
4508         \dim_set_eq:NN \l__enumext_joined_width_viii_dim \l__enumext_item_width_viii_dim
4509         \dim_set_eq:NN \itemwidth \l__enumext_item_width_viii_dim
4510     }
4511 }

```

(End of definition for `\__enumext_starred_joined_item_vii:n` and `\__enumext_starred_joined_item_viii:n`)

### 13.43.3 Functions for mini-env, mini-right and mini-right\* keys

`\__enumext_start_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 `\__enumext_minipage_right_vii_dim` in the variable `\g__enumext_minipage_right_vii_dim`.

```

4512 \cs_new_protected:Nn \__enumext_start_mini_vii:
4513 {
4514   \dim_compare:nNnT { \__enumext_minipage_right_vii_dim } > { \c_zero_dim }
4515   {
4516     \dim_set:Nn \l__enumext_minipage_left_vii_dim
4517     {
4518       \linewidth
4519       - \__enumext_minipage_right_vii_dim
4520       - \__enumext_minipage_hsep_vii_dim
4521     }
4522     \bool_set_true:N \l__enumext_minipage_active_vii_bool
4523     \dim_gset_eq:NN
4524       \g__enumext_minipage_right_vii_dim
4525       \l__enumext_minipage_right_vii_dim
4526     \__enumext_mini_addvspace_vii:
4527     \nointerlineskip\noindent
4528     \__enumext_mini_page{ \l__enumext_minipage_left_vii_dim }
4529   }
4530 }
```

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:nn` 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 (§13.44).

```

4531 \cs_new_protected:Nn \__enumext_stop_mini_vii:
4532 {
4533   \bool_if:NTF \l__enumext_minipage_active_vii_bool
4534   {
4535     \__enumext_stop_list:
4536     \__enumext_stop_store_level_vii:
4537     \IfDocumentMetadataTF { \tag_resume:n {enumext*} } { }
4538     \end__enumext_mini_page
4539     \hfill
4540     \bool_gset_true:N \g__enumext_minipage_active_vii_bool
4541   }
4542   {
4543     \__enumext_stop_list:
4544     \__enumext_stop_store_level_vii:
4545   }
4546 }
```

(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.

```

4547 \__enumext_after_env:nn {enumext*}
4548 {
4549   \bool_if:NT \g__enumext_minipage_active_vii_bool
4550   {
4551     \__enumext_minipage:w [ t ] { \g__enumext_minipage_right_vii_dim }
4552     \legacy_if_gset_false:n { @minipage }
4553     \skip_vertical:N \c_zero_skip
4554     \par\addvspace { \g__enumext_minipage_right_skip }
4555     \bool_if:NF \g__enumext_minipage_center_vii_bool
4556     {
4557       \tl_put_left:Nn \g__enumext_miniright_code_vii_tl
4558       {
4559         \centering
4560       }
4561     }
4562     \vbox_set_top:Nn \l__enumext_miniright_code_vii_box
```



```

4563         {
4564             \tl_use:N \g__enumext_miniright_code_vii_tl
4565         }
4566         \box_use_drop:N \l__enumext_miniright_code_vii_box
4567         \skip_vertical:N \c_zero_skip
4568         \__enumext_endminipage:
4569         \par\addvspace{ \g__enumext_minipage_after_skip }
4570     }
4571     \bool_gset_false:N \g__enumext_minipage_active_vii_bool
4572     \bool_gset_true:N \g__enumext_minipage_center_vii_bool
4573     \tl_gclear:N \g__enumext_miniright_code_vii_tl
4574     \dim_gzero:N \g__enumext_minipage_right_vii_dim
4575     \bool_gset_false:N \g__enumext_starred_bool
4576 }

```

```

\__enumext_start_mini_viii:
\__enumext_stop_mini_viii:

```

The implementation of the `mini-env`, `mini-right` and `mini-right*` keys is identical to the one used in the `enumext*` environment.

```

4577 \cs_new_protected:Nn \__enumext_start_mini_viii:
4578 {
4579     \dim_compare:nNt { \l__enumext_minipage_right_viii_dim } > { \c_zero_dim }
4580     {
4581         \dim_set:Nn \l__enumext_minipage_left_viii_dim
4582         {
4583             \linewidth
4584             - \l__enumext_minipage_right_viii_dim
4585             - \l__enumext_minipage_hsep_viii_dim
4586         }
4587         \bool_set_true:N \l__enumext_minipage_active_viii_bool
4588         \dim_gset_eq:NN
4589             \g__enumext_minipage_right_viii_dim
4590             \l__enumext_minipage_right_viii_dim
4591         \__enumext_mini_addvspace_viii:
4592         \nointerlineskip\noindent
4593         \__enumext_mini_page{ \l__enumext_minipage_left_viii_dim }
4594     }
4595 }
4596 \cs_new_protected:Nn \__enumext_stop_mini_viii:
4597 {
4598     \bool_if:NTF \l__enumext_minipage_active_viii_bool
4599     {
4600         \__enumext_stop_list:
4601         \IfDocumentMetadataTF { \tag_resume:n {keyans*} } { } { }
4602         \end__enumext_mini_page
4603         \hfill
4604         \bool_gset_true:N \g__enumext_minipage_active_viii_bool
4605     }
4606     {
4607         \__enumext_stop_list:
4608     }
4609 }
4610 \__enumext_after_env:nn {keyans*}
4611 {
4612     \bool_if:NT \g__enumext_minipage_active_viii_bool
4613     {
4614         \__enumext_mini_page{ \g__enumext_minipage_right_viii_dim }
4615         \par\addvspace { \g__enumext_minipage_right_skip }
4616         \bool_if:NF \g__enumext_minipage_center_viii_bool
4617         {
4618             \tl_put_left:Nn \g__enumext_miniright_code_viii_tl
4619             {
4620                 \centering
4621             }
4622         }
4623         \vbox_set_top:Nn \l__enumext_miniright_code_viii_box
4624         {
4625             \tl_use:N \g__enumext_miniright_code_viii_tl
4626         }
4627         \box_use_drop:N \l__enumext_miniright_code_viii_box
4628         \end__enumext_mini_page
4629         \par\addvspace{ \g__enumext_minipage_after_skip }
4630     }

```

```

4631 \bool_gset_false:N \g__enumext_minipage_active_viii_bool
4632 \bool_gset_true:N \g__enumext_minipage_center_viii_bool
4633 \tl_gclear:N \g__enumext_miniright_code_viii_tl
4634 \dim_gzero:N \g__enumext_minipage_right_viii_dim
4635 }

```

(End of definition for \\_\_enumext\_start\_mini\_viii: and \\_\_enumext\_stop\_mini\_viii:.)

### 13.44 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.

```

4636 \NewDocumentEnvironment{enumext*}{o}{
4637 {
4638 \__enumext_safe_exec_vii:
4639 \__enumext_parse_keys_vii:n {#1}
4640 \__enumext_before_list_vii:
4641 \__enumext_start_store_level_vii:
4642 \__enumext_start_list:nn { }
4643 {
4644 \__enumext_list_arg_two_vii:
4645 \__enumext_before_keys_exec_vii:
4646 }
4647 \IfDocumentMetadataTF { \tag_suspend:n {enumext*} } { }
4648 \__enumext_starred_columns_set_vii:
4649 \item[] \scan_stop:
4650 \cs_set_eq:NN \__enumext_stop_item_tmp_vii: \__enumext_first_item_tmp_vii:
4651 \cs_set_eq:NN \item \__enumext_start_item_tmp_vii:
4652 \ignorespaces
4653 }
4654 {
4655 \IfDocumentMetadataTF { \tag_struct_end:n {tag=text-unit} } { }
4656 \__enumext_stop_item_tmp_vii:
4657 \__enumext_remove_extra_parsep_vii:
4658 \__enumext_after_list_vii:
4659 }

```

(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.

```

4660 \cs_new_protected:Nn \__enumext_safe_exec_vii:
4661 {
4662 \__enumext_is_not_nested:
4663 \__enumext_internal_mini_page:
4664 \int_incr:N \l__enumext_level_h_int
4665 \int_compare:nNt { \l__enumext_level_h_int } > { 1 }
4666 {
4667 \msg_error:nn { enumext } { nested }
4668 }
4669 \int_compare:nNt { \l__enumext_keyans_level_h_int } = { 1 }
4670 {
4671 \msg_error:nnn { enumext } { nested-horizontal } { keyans*}
4672 }
4673 \bool_set_true:N \l__enumext_starred_bool
4674 \bool_set_false:N \l__enumext_standar_bool
4675 \__enumext_is_on_first_level:
4676 }

```

(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.

```

4677 \cs_new_protected:Npn \__enumext_parse_keys_vii:n #1
4678 {
4679     \tl_if_novalue:nF {#1}
4680     {
4681         \str_clear:N \l__enumext_series_str
4682         \keys_set:nn { enumext / enumext* } {#1}
4683         \__enumext_parse_series:n {#1}
4684         \__enumext_store_active_keys_vii:n {#1}
4685     }
4686 }

```

(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*`.

```

4687 \cs_new_protected:Nn \__enumext_before_list_vii:
4688 {
4689     \__enumext_vspace_above_vii:
4690     \__enumext_check_ans_active:
4691     \__enumext_before_args_exec_vii:
4692     \__enumext_start_mini_vii:
4693 }

```

(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: (§13.43.3) 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.

```

4694 \cs_new_protected:Nn \__enumext_after_list_vii:
4695 {
4696     \__enumext_stop_mini_vii:
4697     \__enumext_after_stop_list_vii:
4698     \__enumext_check_ans_key_hook:
4699     \__enumext_vspace_below_vii:
4700     \bool_set_false:N \l__enumext_starred_bool
4701     \__enumext_resume_save_counter:
4702 }

```

(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`.

```

4703 \cs_new_protected:Nn \__enumext_start_store_level_vii:
4704 {
4705     \bool_if:NT \l__enumext_store_active_bool
4706     {
4707         \int_compare:nNnT { \l__enumext_level_int } > { 0 }
4708         {
4709             \__enumext_store_level_open_vii:
4710         }
4711     }
4712 }
4713 \cs_new_protected:Nn \__enumext_stop_store_level_vii:
4714 {
4715     \bool_if:NT \l__enumext_store_active_bool
4716     {
4717         \int_compare:nNnT { \l__enumext_level_int } > { 0 }
4718         {
4719             \__enumext_store_level_close_vii:

```

```

4720     }
4721   }
4722 }

```

(End of definition for `\__enumext_start_store_level_vii:` and `\__enumext_stop_store_level_vii:`.)

### 13.44.1 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.

```

4723 \cs_new_protected_nopar:Nn \__enumext_first_item_tmp_vii:
4724 {
4725   \skip_horizontal:n
4726   {
4727     -\__enumext_labelwidth_vii_dim - \__enumext_labelsep_vii_dim
4728   }
4729   \ignorespaces
4730 }

```

(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
```

First we will call the function `\__enumext_stop_item_tmp_vii:` that we will redefine later, we will increment the value of `\__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`.

```

4731 \cs_new_protected_nopar:Nn \__enumext_start_item_tmp_vii:
4732 {
4733   \__enumext_stop_item_tmp_vii:
4734   \int_incr:N \__enumext_item_column_pos_vii_int
4735   \int_gincr:N \g__enumext_item_count_all_vii_int
4736   \__enumext_item_peek_args_vii:
4737 }

```

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).

```

4738 \cs_new_protected:Nn \__enumext_item_peek_args_vii:
4739 {
4740   \peek_meaning:NTF (
4741     { \__enumext_joined_item_vii:w }
4742     { \__enumext_joined_item_vii:w (1) }
4743   }

```

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`.

```

4744 \cs_new_protected:Npn \__enumext_joined_item_vii:w (#1)
4745 {
4746   \__enumext_starred_joined_item_vii:n {#1}
4747   \peek_meaning_remove:NTF *
4748     { \__enumext_starred_item_vii:w }
4749     { \__enumext_standar_item_vii:w }
4750 }

```

The function `\__enumext_standar_item_vii:w` will first look for the argument “[”, if present it will set the state of the variable `\__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 `\__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 [ \__enumext_label_vii_tl ]`.

```

4751 \cs_new_protected:Npn \__enumext_standar_item_vii:w
4752 {
4753   \bool_set_false:N \__enumext_item_starred_vii_bool
4754   \peek_meaning:NTF [
4755     {
4756       \bool_set_eq:NN \__enumext_wrap_label_vii_bool \l__enumext_wrap_label_opt_vii_bool
4757       \__enumext_start_item_vii:w
4758     }

```

```

4759     {
4760         \bool_set_true:N \l__enumext_wrap_label_vii_bool
4761         \legacy_if_set_true:n { @noitemarg }
4762         \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ] \ignorespaces
4763     }
4764 }

```

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*[\langle symbol \rangle]` and `\item*[\langle symbol \rangle][\langle offset \rangle]`.

```

4765 \cs_new_protected:Npn \__enumext_starred_item_vii:w
4766 {
4767     \bool_set_true:N \l__enumext_item_starred_vii_bool
4768     \bool_set_true:N \l__enumext_wrap_label_vii_bool
4769     \peek_meaning:NTF [
4770         { \__enumext_starred_item_vii_aux_i:w }
4771         { \__enumext_starred_item_vii_aux_ii:w }
4772     }
4773 \cs_new_protected:Npn \__enumext_starred_item_vii_aux_i:w [#1]
4774 {
4775     \tl_gset:Nn \g__enumext_item_symbol_aux_vii_tl {#1}
4776     \__enumext_starred_item_vii_aux_ii:w
4777 }
4778 \cs_new_protected:Npn \__enumext_starred_item_vii_aux_ii:w
4779 {
4780     \peek_meaning:NTF [
4781         { \__enumext_starred_item_vii_aux_iii:w }
4782         {
4783             \dim_set_eq:NN \l__enumext_item_symbol_sep_vii_dim \l__enumext_labelsep_vii_dim
4784             \legacy_if_set_true:n { @noitemarg }
4785             \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ] \ignorespaces
4786         }
4787     }
4788 \cs_new_protected:Npn \__enumext_starred_item_vii_aux_iii:w [#1]
4789 {
4790     \dim_set:Nn \l__enumext_item_symbol_sep_vii_dim {#1}
4791     \legacy_if_set_true:n { @noitemarg }
4792     \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ] \ignorespaces
4793 }

```

(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*[\langle symbol \rangle][\langle offset \rangle]` 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 `pdflatex` and not if you are running `lua1latex`

```

4794 \cs_new_protected_nopar:Npn \__enumext_fake_make_label_vii:n #1
4795 {
4796     \legacy_if:nT { @noitemarg }
4797     {
4798         \legacy_if_set_false:n { @noitemarg }
4799         \legacy_if:nT { @nmbrrlist }
4800         {
4801             \IfDocumentMetadataTF
4802             {
4803                 \bool_if:NT \l__enumext_hyperref_bool
4804                 {
4805                     \legacy_if_set_true:n { @hyper@item }
4806                 }
4807             } { }
4808             \refstepcounter{enumXvii}
4809             \bool_if:NT \l__enumext_check_answers_bool
4810             {
4811                 \int_gincr:N \g__enumext_item_number_int

```

```

4812         \bool_set_true:N \l__enumext_item_number_bool
4813     }
4814 }
4815 }
4816 \bool_if:NT \l__enumext_item_starred_vii_bool
4817 {
4818     \tl_if_blank:VT \g__enumext_item_symbol_aux_vii_tl
4819     {
4820         \tl_gset_eq:NN
4821         \g__enumext_item_symbol_aux_vii_tl \l__enumext_item_symbol_vii_tl
4822     }
4823     \mode_leave_vertical:
4824     \skip_horizontal:n { -\l__enumext_item_symbol_sep_vii_dim }
4825     \hbox_overlap_left:n { \g__enumext_item_symbol_aux_vii_tl }
4826     \skip_horizontal:N \l__enumext_item_symbol_sep_vii_dim
4827     \tl_gclear:N \g__enumext_item_symbol_aux_vii_tl
4828 }
4829 \makebox[ \l__enumext_labelwidth_vii_dim ][ \l__enumext_align_label_vii_str ]
4830 {
4831     \tl_use:N \l__enumext_label_font_style_vii_tl
4832     \bool_if:NTF \l__enumext_wrap_label_vii_bool
4833     {
4834         \__enumext_wrapper_label_vii:n {#1}
4835     }
4836     { #1 }
4837 }
4838 \skip_horizontal:N \l__enumext_labelsep_vii_dim \ignorespaces
4839 }

```

(End of definition for \\_\_enumext\_fake\_make\_label\_vii:n.)

### 13.44.2 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.

```

4840 \cs_new_protected_nopar:Npn \__enumext_start_item_vii:w [#1]
4841 {
4842     \cs_set_eq:NN \__enumext_stop_item_tmp_vii: \__enumext_stop_item_vii:
4843     \hbox_set_to_wd:Nnw \l__enumext_item_text_vii_box
4844     {
4845         \l__enumext_joined_width_vii_dim
4846         + \l__enumext_labelwidth_vii_dim
4847         + \l__enumext_labelsep_vii_dim
4848     }

```

Redefine the \footnote command.

```

4849     \__enumext_renew_footnote_starred:

```

Now we insert our sockets for tagging PDF support and run \item.

```

4850     \__enumext_start_list_tag:n {enumext*}
4851     \__enumext_fake_make_label_vii:n {#1}
4852     \__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.

```

4853     \__enumext_minipage:w [ t ]{ \l__enumext_joined_width_vii_dim }
4854     \dim_set_eq:NN \parindent \l__enumext_listparindent_vii_dim
4855     \skip_set_eq:NN \parskip \l__enumext_parsep_vii_skip
4856     \__enumext_unskip_unkern:
4857     \__enumext_unskip_unkern:
4858     \skip_horizontal:n { -\l__enumext_listparindent_vii_dim } \ignorespaces
4859     \tl_use:N \l__enumext_fake_item_indent_vii_tl
4860     \tl_use:N \l__enumext_after_list_args_vii_tl
4861 }

```

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*.

```

4862 \cs_new_protected_nopar:Nn \__enumext_stop_item_vii:
4863 {
4864     \__enumext_endminipage:
4865     \__enumext_stop_list_tag:n {enumext*}
4866     \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*.

```

4867     \int_set:Nn \hbadness { 10000 }
4868     \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`.

```

4869     \int_compare:nNnTF
4870     { \l__enumext_item_column_pos_vii_int } = { \l__enumext_columns_vii_int }
4871     {
4872         \par\noindent
4873         \int_zero:N \l__enumext_item_column_pos_vii_int
4874     }
4875     {
4876         \skip_horizontal:N \l__enumext_columns_sep_vii_dim
4877     }
4878 }

```

(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*).

```

4879 \cs_new_protected:Nn \__enumext_remove_extra_parsep_vii:
4880 {
4881     \int_compare:nNnT
4882     {
4883         \int_mod:nn
4884         { \g__enumext_item_count_all_vii_int } { \l__enumext_columns_vii_int }
4885     }
4886     =
4887     { 0 }
4888     {
4889         \para_end:
4890         \skip_vertical:n { -\l__enumext_itemsep_vii_skip }
4891         \skip_vertical:N \c_zero_skip
4892         \int_gzero:N \g__enumext_item_count_all_vii_int
4893     }
4894 }

```

(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`.

```

4895 \__enumext_after_env:nn {enumext*}
4896 {
4897     \__enumext_execute_after_env:
4898 }

```

### 13.45 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.

```

4899 \NewDocumentEnvironment{keyans*}{ o }
4900 {
4901     \__enumext_safe_exec_viii:
4902     \__enumext_parse_keys_viii:n {#1}
4903     \__enumext_before_list_viii:
4904     \__enumext_start_list:nn { }
4905     {
4906         \__enumext_list_arg_two_viii:
4907         \__enumext_before_keys_exec_viii:
4908     }

```



```

4909     \IfDocumentMetadataTF { \tag_suspend:n {keyans*} } { }
4910     \__enumext_starred_columns_set_viii:
4911     \item[] \scan_stop:
4912     \cs_set_eq:NN \__enumext_stop_item_tmp_viii: \__enumext_first_item_tmp_viii:
4913     \cs_set_eq:NN \item \__enumext_start_item_tmp_viii:
4914     \ignorespaces
4915   }
4916   {
4917     \IfDocumentMetadataTF { \tag_struct_end:n {tag=text-unit} } { }
4918     \__enumext_stop_item_tmp_viii:
4919     \__enumext_remove_extra_parsep_viii:
4920     \__enumext_check_starred_cmd:n { item }
4921     \__enumext_after_list_viii:
4922   }

```

(End of definition for `keyans*`. This function is documented on page 15.)

`\__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 `\__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 `\__enumext_starred_bool` to true, finally we will check if we are within the appropriate level within the `enumext` environment.

```

4923 \cs_new_protected:Nn \__enumext_safe_exec_viii:
4924 {
4925   \bool_if:NF \__enumext_store_active_bool
4926   {
4927     \msg_error:nnnn { enumext } { wrong-place } { keyans* } { save-ans }
4928   }
4929   \int_incr:N \__enumext_keyans_level_h_int
4930   \int_compare:nNnT { \__enumext_keyans_level_h_int } > { 1 }
4931   {
4932     \msg_error:nn { enumext } { nested }
4933   }
4934   \__enumext_keyans_name_and_start:
4935   \bool_if:NT \__enumext_starred_bool
4936   {
4937     \msg_error:nnn { enumext } { nested-horizontal } { enumext* }
4938   }
4939   \bool_set_true:N \__enumext_starred_bool
4940   % Set false for interfering with enumext nested in keyans* (yes, its possible and crayze)
4941   \bool_set_false:N \__enumext_store_active_bool
4942   \int_compare:nNnT { \__enumext_level_int } > { 1 }
4943   {
4944     \msg_error:nn { enumext } { keyans-wrong-level }
4945   }
4946 }

```

(End of definition for `\__enumext_safe_exec_viii:`.)

`\__enumext_parse_keys_viii:n` Parse [`<key = val>`] for `keyans*`.

```

4947 \cs_new_protected:Npn \__enumext_parse_keys_viii:n #1
4948 {
4949   \tl_if_novalue:nF {#1}
4950   {
4951     \keys_set:nn { enumext / keyans* } {#1}
4952   }
4953 }

```

(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`.

```

4954 \cs_new_protected:Nn \__enumext_before_list_viii:
4955 {
4956   \__enumext_vspace_above_viii:
4957   \__enumext_before_args_exec_viii:
4958   \__enumext_start_mini_viii:
4959 }

```

(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.

```

4960 \cs_new_protected:Nn \__enumext_after_list_viii:
4961 {
4962     \__enumext_stop_mini_viii:
4963     \__enumext_after_stop_list_viii:
4964     \__enumext_vspace_below_viii:
4965 }

```

(End of definition for `\__enumext_after_list_viii:`)

### 13.45.1 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.

```

4966 \cs_new_protected_nopar:Nn \__enumext_first_item_tmp_viii:
4967 {
4968     \skip_horizontal:n
4969     {
4970         -\__enumext_labelwidth_viii_dim - \__enumext_labelsep_viii_dim
4971     }
4972     \ignorespaces
4973 }

```

(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  
`\__enumext_item_peek_args_viii:` increment the value of `\l__enumext_item_column_pos_viii_int` that will count the item’s by rows and  
`\__enumext_joined_item_viii:w` the value of `\g__enumext_item_count_all_viii_int` that will count the total of item’s in the environment.  
`\__enumext_standar_item_viii:w` After that we will call the function `\__enumext_item_peek_args_viii:` that will handle the arguments passed to `\item`.

```

4974 \cs_new_protected_nopar:Nn \__enumext_start_item_tmp_viii:
4975 {
4976     \__enumext_stop_item_tmp_viii:
4977     \int_incr:N \l__enumext_item_column_pos_viii_int
4978     \int_gincr:N \g__enumext_item_count_all_viii_int
4979     \__enumext_item_peek_args_viii:
4980 }

```

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).

```

4981 \cs_new_protected:Nn \__enumext_item_peek_args_viii:
4982 {
4983     \peek_meaning:NTF (
4984         { \__enumext_joined_item_viii:w }
4985         { \__enumext_joined_item_viii:w (1) }
4986     }

```

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`.

```

4987 \cs_new_protected:Npn \__enumext_joined_item_viii:w (#1)
4988 {
4989     \__enumext_starred_joined_item_viii:n {#1}
4990     \peek_meaning_remove:NTF *
4991     { \__enumext_starred_item_viii:w }
4992     { \__enumext_standar_item_viii:w }
4993 }

```

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 ]`.

```

4994 \cs_new_protected:Npn \__enumext_standar_item_viii:w
4995 {
4996   \bool_set_false:N \l__enumext_item_starred_viii_bool
4997   \bool_set_false:N \l__enumext_item_wrap_key_bool
4998   \peek_meaning:NTF [
4999     {
5000       \bool_set_eq:NN \l__enumext_wrap_label_viii_bool \l__enumext_wrap_label_opt_viii_bool
5001       \__enumext_start_item_viii:w
5002     }
5003     {
5004       \bool_set_true:N \l__enumext_wrap_label_viii_bool
5005       \legacy_if_set_true:n { @noitemarg }
5006       \__enumext_start_item_viii:w [ \l__enumext_label_viii_tl ] \ignorespaces
5007     }
5008   }

```

(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*[⟨content⟩]`.

```

5009 \cs_new_protected:Npn \__enumext_starred_item_viii:w
5010 {
5011   \bool_set_true:N \l__enumext_item_starred_viii_bool
5012   \bool_set_true:N \l__enumext_item_wrap_key_bool
5013   \bool_set_true:N \l__enumext_wrap_label_viii_bool
5014   \peek_meaning:NTF [
5015     { \__enumext_starred_item_viii_aux_i:w }
5016     { \__enumext_starred_item_viii_aux_ii:w }
5017   }

```

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`.

```

5018 \cs_new_protected:Npn \__enumext_starred_item_viii_aux_i:w [#1]
5019 {
5020   \tl_clear:N \l__enumext_store_current_label_tl
5021   \tl_if_no_value:nF { #1 }
5022   {
5023     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_viii_tl
5024     {
5025       \tl_put_right:NV \l__enumext_store_current_label_tl \l__enumext_store_keyans_item_opt_sep_viii_tl
5026       \tl_put_right:Nn \l__enumext_store_current_label_tl { #1 }
5027     }
5028     \tl_set:Nn \l__enumext_store_current_opt_arg_tl { #1 }
5029   }
5030   \__enumext_starred_item_viii_aux_ii:w
5031 }
5032 \cs_new_protected:Npn \__enumext_starred_item_viii_aux_ii:w
5033 {
5034   \legacy_if_set_true:n { @noitemarg }
5035   \__enumext_start_item_viii:w [ \l__enumext_label_viii_tl ] \ignorespaces
5036 }

```

The function `\__enumext_keyans_starred_item_star:` will be in charge of storing the current `⟨label⟩` for `\item*` followed by the `[⟨content⟩]` for `\item*[⟨content⟩]` 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.

```

5037 \cs_new_protected:Nn \__enumext_keyans_starred_item_star:
5038 {
5039   \tl_put_left:Ne \l__enumext_store_current_label_tl { \l__enumext_label_viii_tl }
5040   \__enumext_store_addto_prop:V \l__enumext_store_current_label_tl
5041   \__enumext_keyans_store_ref:
5042   \tl_put_left:Nn \l__enumext_store_current_label_tl { \item }

```

```

5043 \__enumext_keyans_addto_seq_link:
5044 \int_gincr:N \__enumext_check_starred_cmd_int
5045 \dim_compare:nNt { \__enumext_mark_sym_sep_viii_dim } = { \c_zero_dim }
5046 {
5047   \dim_set:nN \__enumext_mark_sym_sep_viii_dim { \__enumext_labelsep_viii_dim }
5048 }
5049 \bool_if:NT \__enumext_show_answer_bool
5050 {
5051   \tl_set_eq:NN \__enumext_mark_answer_sym_tl \__enumext_mark_answer_sym_viii_tl
5052   \str_set_eq:NN \__enumext_mark_position_str \__enumext_mark_position_viii_str
5053   \__enumext_print_keyans_box:NN
5054   \__enumext_labelwidth_viii_dim \__enumext_mark_sym_sep_viii_dim
5055 }
5056 \bool_if:NT \__enumext_show_position_bool
5057 {
5058   \tl_set:Ne \__enumext_mark_answer_sym_tl
5059   {
5060     \group_begin:
5061     \exp_not:N \normalfont
5062     \exp_not:N \footnotesize [ \int_eval:n
5063     {
5064       \prop_count:c { g__enumext_ \__enumext_store_name_tl _prop }
5065     }
5066     ]
5067     \group_end:
5068   }
5069   \str_set_eq:NN \__enumext_mark_position_str \__enumext_mark_position_viii_str
5070   \__enumext_print_keyans_box:NN
5071   \__enumext_labelwidth_viii_dim \__enumext_mark_sym_sep_viii_dim
5072 }
5073 }

```

(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.

```

5074 \cs_new_protected:Npn \__enumext_keyans_wrapper_label_viii:n #1
5075 {
5076   \bool_lazy_all:nT
5077   {
5078     { \bool_if_p:N \__enumext_wrap_label_viii_bool }
5079     { \bool_if_p:N \__enumext_show_answer_bool }
5080     { \bool_if_p:N \__enumext_item_wrap_key_bool }
5081     { \cs_if_exist_p:N \__enumext_keyans_wrapper_item_viii:n }
5082   }
5083   {
5084     \cs_set_eq:NN
5085     \__enumext_wrapper_label_viii:n \__enumext_keyans_wrapper_item_viii:n
5086   }
5087   \bool_if:NTF \__enumext_wrap_label_viii_bool
5088   {
5089     \__enumext_wrapper_label_viii:n {#1}
5090   }
5091   { #1 }
5092 }
5093 \cs_new_protected_nopar:Npn \__enumext_fake_make_label_viii:n #1
5094 {
5095   \legacy_if:nT { @noitemarg }
5096   {
5097     \legacy_if_set_false:n { @noitemarg }
5098     \legacy_if:nT { @nmbrrlist }
5099     {
5100       \refstepcounter{enumXviii}
5101     }
5102   }
5103   \bool_if:NT \__enumext_item_starred_viii_bool
5104   {
5105     \__enumext_keyans_starred_item_star:
5106   }
5107   \makebox[ \__enumext_labelwidth_viii_dim ][ \__enumext_align_label_viii_str ]
5108   {
5109     \tl_use:N \__enumext_label_font_style_viii_tl

```

```

5110     \__enumext_keyans_wrapper_label_viii:n {#1}
5111   }
5112   \skip_horizontal:N \__enumext_labelsep_viii_dim \ignorespaces
5113 }

```

(End of definition for \\_\_enumext\_keyans\_wrapper\_label\_viii:n and \\_\_enumext\_fake\_make\_label\_viii:n)

### 13.45.2 Real definition of \item in keyans\*

The implementation at this is very similar to that of the `enumext*` environment.

```

\__enumext_start_item_viii:w
\__enumext_stop_item_viii:
5114 \cs_new_protected_nopar:Npn \__enumext_start_item_viii:w [#1]
5115 {
5116   \cs_set_eq:NN \__enumext_stop_item_tmp_viii: \__enumext_stop_item_viii:
5117   \hbox_set_to_wd:Nnw \l__enumext_item_text_viii_box
5118   {
5119     \l__enumext_joined_width_viii_dim
5120     + \l__enumext_labelwidth_viii_dim
5121     + \l__enumext_labelsep_viii_dim
5122   }
5123   \__enumext_renew_footnote_starred:
5124   \__enumext_start_list_tag:n {keyans*}
5125   \__enumext_fake_make_label_viii:n {#1}
5126   \__enumext_stop_start_list_tag:
5127   \__enumext_minipage:w [ t ]{ \l__enumext_joined_width_viii_dim }
5128   \dim_set_eq:NN \parindent \l__enumext_listparindent_viii_dim
5129   \skip_set_eq:NN \parskip \l__enumext_parsep_viii_skip
5130   \__enumext_unskip_unkern:
5131   \__enumext_unskip_unkern:
5132   \skip_horizontal:n { -\l__enumext_listparindent_viii_dim } \ignorespaces
5133   \tl_use:N \l__enumext_fake_item_indent_viii_tl
5134   \bool_if:NT \l__enumext_item_starred_viii_bool
5135   {
5136     \__enumext_keyans_show_item_opt_viii:
5137   }
5138   \tl_use:N \l__enumext_after_list_args_viii_tl
5139 }
5140 \cs_new_protected_nopar:Nn \__enumext_stop_item_viii:
5141 {
5142   \__enumext_endminipage:
5143   \__enumext_stop_list_tag:n {keyans*}
5144   \hbox_set_end:
5145   \int_set:Nn \hbadness { 10000 }
5146   \box_use_drop:N \l__enumext_item_text_viii_box
5147   \int_compare:nNnTF
5148   { \l__enumext_item_column_pos_viii_int } = { \l__enumext_columns_viii_int }
5149   {
5150     \par\noindent
5151     \int_zero:N \l__enumext_item_column_pos_viii_int
5152   }
5153   {
5154     \skip_horizontal:N \l__enumext_columns_sep_viii_dim
5155   }
5156 }

```

(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.

```

5157 \cs_new_protected:Nn \__enumext_remove_extra_parsep_viii:
5158 {
5159   \int_compare:nNnT
5160   {
5161     \int_mod:nn
5162     { \g__enumext_item_count_all_viii_int }
5163     { \l__enumext_columns_viii_int }
5164   }
5165   =
5166   { 0 }
5167   {
5168     \para_end:
5169     \skip_vertical:n { -\l__enumext_itemsep_viii_skip }
5170     \skip_vertical:N \c_zero_skip
5171     \int_gzero:N \g__enumext_item_count_all_viii_int

```

```

5172     }
5173 }

```

(End of definition for `\__enumext_remove_extra_parsep_viii:`.)

### 13.46 The command `\getkeyans`

`\getkeyans` 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.

```

5174 \NewDocumentCommand \getkeyans { m }
5175 {
5176   \exp_args:Ne \__enumext_getkeyans_aux:n
5177   { \tl_to_str:e { \text_expand:n {#1} } }
5178 }

```

The internal function `\__enumext_getkeyans_aux:n` is in charge of *splitting* the *mandatory argument* using “.”. If “.” is omitted it will return an error.

```

5179 \cs_new_protected:Npn \__enumext_getkeyans_aux:n #1
5180 {
5181   \str_if_in:nnTF {#1} { : }
5182   {
5183     \use:e
5184     {
5185       \cs_set:Npn \exp_not:N \__enumext_tmp:w ##1 \c_colon_str ##2 \scan_stop:
5186       { {##1} {##2} }
5187     }
5188     \exp_after:wN \__enumext_getkeyans:nn \__enumext_tmp:w #1 \scan_stop:
5189   }
5190   { \msg_error:nnn { enumext } { missing-colon } {#1} }
5191 }

```

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*.

```

5192 \cs_new_protected:Npn \__enumext_getkeyans:nn #1 #2
5193 {
5194   \prop_if_exist:cTF { g__enumext_#1_prop }
5195   {
5196     \prop_item:cn { g__enumext_#1_prop } {#2}
5197   }
5198   {
5199     \msg_error:nnn { enumext } { undefined-storage-anskey } {#1}
5200   }
5201 }

```

(End of definition for `\getkeyans`, `\__enumext_getkeyans_aux:n`, and `\__enumext_getkeyans:nn`. This function is documented on page 18.)

### 13.47 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  $\langle \textit{filtered keys} \rangle$  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  $\langle \textit{keys} \rangle$  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⟩]`.

```

5202 \keys_define:nn { enumext / print }
5203 {
5204   print* .code:n      = \keys_precompile:neN { enumext / enumext* }
5205                   { \__enumext_filter_save_key:n {#1} }
5206                   \l__enumext_print_keyans_starred_tl, % starred cmd
5207   print* .initial:n   = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
5208                   rightmargin=0pt, listparindent=0pt, nosepl, label=\arabic*.,
5209                   columns=2, first=\small, font=\small },
5210   print-1 .code:n     = \keys_precompile:neN { enumext / level-1 }
5211                   { \__enumext_filter_save_key:n {#1} }
5212                   \l__enumext_print_keyans_i_tl,
5213   print-1 .initial:n  = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,

```

```

5214         rightmargin=0pt, listparindent=0pt, nosep, label=\arabic*.,
5215         columns=2, first=\small, font=\small },
5216     print-2 .code:n      = \keys_precompile:neN { enumext / level-2 }
5217       { \__enumext_filter_save_key:n {#1} }
5218       \l__enumext_print_keyans_ii_tl,
5219     print-2 .initial:n   = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
5220       rightmargin=0pt, listparindent=0pt, nosep, label=(\alph*),
5221       first=\small, font=\small },
5222     print-3 .code:n      = \keys_precompile:neN { enumext / level-3 }
5223       { \__enumext_filter_save_key:n {#1} }
5224       \l__enumext_print_keyans_iii_tl,
5225     print-3 .initial:n   = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
5226       rightmargin=0pt, listparindent=0pt, nosep, label=\roman*.,
5227       first=\small, font=\small },
5228     print-4 .code:n      = \keys_precompile:neN { enumext / level-4 }
5229       { \__enumext_filter_save_key:n {#1} }
5230       \l__enumext_print_keyans_iv_tl,
5231     print-4 .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-* .code:n      = \keys_precompile:neN { enumext / enumext* }
5235       { \__enumext_filter_save_key:n {#1} }
5236       \l__enumext_print_keyans_vii_tl, % starred nested
5237     print-* .initial:n   = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
5238       rightmargin=0pt, listparindent=0pt, nosep, label=\arabic*.,
5239       first=\small, font=\small },
5240   }

```

- 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`.

```

5241 \NewDocumentCommand \printkeyans { s O{} m }
5242 {
5243   \group_begin:
5244     \tl_use:N \l__enumext_print_keyans_i_tl
5245     \tl_use:N \l__enumext_print_keyans_ii_tl
5246     \tl_use:N \l__enumext_print_keyans_iii_tl
5247     \tl_use:N \l__enumext_print_keyans_iv_tl
5248     \tl_use:N \l__enumext_print_keyans_vii_tl
5249     \__enumext_printkeyans:nnn { #1 } { #2 } { #3 }
5250   \group_end:
5251 }

```

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.

```

5252 \cs_new_protected:Npn \__enumext_printkeyans:nnn #1 #2 #3
5253 {
5254   \seq_if_exist:cTF { g__enumext_#3_seq }
5255   {
5256     \seq_if_empty:cF { g__enumext_#3_seq }
5257     {

```

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.

```

5258     \bool_if:nTF {#1}
5259     {
5260       \seq_if_in:cnTF { g__enumext_#3_seq } { \end{enumext*} }
5261       {
5262         \msg_error:nnnn { enumext } { print-starred } {#3} { enumext* }
5263       }
5264       {
5265         \tl_use:N \l__enumext_print_keyans_starred_tl
5266         \bool_set_true:N \l__enumext_base_line_fix_bool

```



```

5267         \bool_set_true:N \__enumext_print_keyans_star_bool
5268         \begin{enumext*}[#2]
5269         \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
5270         \end{enumext*}
5271         \bool_set_false:N \__enumext_base_line_fix_bool
5272         \bool_set_false:N \__enumext_print_keyans_star_bool
5273     }
5274 }

```

Otherwise it will open the environment `enumext` passing the *optional argument* to the “first level” then map the *sequence*.

```

5275     {
5276         \begin{enumext}[#2]
5277         \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
5278         \end{enumext}
5279     }
5280 }
5281 }
5282 {
5283     \msg_error:nnn { enumext } { undefined-storage-anskey } {#3}
5284 }
5285 }

```

(End of definition for `\printkeyans` and `\__enumext_printkeyans:nnn`. This function is documented on page 19.)

### 13.48 The command `\setenumext`

The command `\setenumext` will be in charge of managing the *⟨keys⟩* 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 *⟨keys⟩* that complicate us.

The function `\__enumext_filter_first_level:n` will be in charge of filtering the *⟨keys⟩* passed to the environment `enumext*` and “first level” of the environment `enumext`.

```

\__enumext_filter_first_level:n
\__enumext_filter_first_level_key:n
\__enumext_filter_first_level_pair:nn
5286 \cs_new:Npn \__enumext_filter_first_level:n #1
5287 {
5288     \use:e
5289     {
5290         \keyval_parse:NNn
5291         \__enumext_filter_first_level_key:n
5292         \__enumext_filter_first_level_pair:nn {#1}
5293     }
5294 }

```

The function `\__enumext_filter_first_level_key:n` will be responsible for filtering the *⟨keys⟩* that are passed “without value” by excluding the keys `resume` and `resume*`.

```

5295 \cs_new:Npn \__enumext_filter_first_level_key:n #1
5296 {
5297     \str_case:nnF {#1}
5298     {
5299         { resume } {}
5300         { resume* } {}
5301     }
5302     { , { \exp_not:n {#1} } }
5303 }

```

The function `\__enumext_filter_first_level_pair:nn` will be responsible for filtering the *⟨keys⟩* that are passed “with value” by excluding the `series`, `resume` and `save-ans` keys.

```

5304 \cs_new:Npn \__enumext_filter_first_level_pair:nn #1#2
5305 {
5306     \str_case:nnF {#1}
5307     {
5308         { series } {}
5309         { resume } {}
5310         { save-ans } {}
5311     }
5312     { , { \exp_not:n {#1} } } = { \exp_not:n {#2} } }
5313 }

```

(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 *⟨keys⟩* to access from `\setenumext`.

```

5314 \keys_define:nn { enumext / meta-families }

```

```

5315 {
5316     enumext-1 .code:n =
5317         {
5318             \keys_set:ne { enumext / level-1 }
5319             {
5320                 \__enumext_filter_first_level:n {#1}
5321             }
5322         } ,
5323     enumext-2 .code:n = { \keys_set:nn { enumext / level-2 } {#1} } ,
5324     enumext-3 .code:n = { \keys_set:nn { enumext / level-3 } {#1} } ,
5325     enumext-4 .code:n = { \keys_set:nn { enumext / level-4 } {#1} } ,
5326     keyans .code:n = { \keys_set:nn { enumext / keyans } {#1} } ,
5327     enumext* .code:n =
5328         {
5329             \keys_set:ne { enumext / enumext* }
5330             {
5331                 \__enumext_filter_first_level:n {#1}
5332             }
5333         } ,
5334     keyans* .code:n = { \keys_set:nn { enumext / keyans* } {#1} } ,
5335     print* .code:n = { \keys_set:nn { enumext / print } { print* = {#1} } } ,
5336     print-1 .code:n = { \keys_set:nn { enumext / print } { print-1 = {#1} } } ,
5337     print-2 .code:n = { \keys_set:nn { enumext / print } { print-2 = {#1} } } ,
5338     print-3 .code:n = { \keys_set:nn { enumext / print } { print-3 = {#1} } } ,
5339     print-4 .code:n = { \keys_set:nn { enumext / print } { print-4 = {#1} } } ,
5340     print-* .code:n = { \keys_set:nn { enumext / print } { print-* = {#1} } } ,
5341     unknown .code:n = { \msg_error:nn { enumext } { unknown-key-family } } ,
5342 }

```

We store them in the constant sequence `\c__enumext_all_families_seq` separated by commas.

```

5343 \seq_const_from_clist:Nn \c__enumext_all_families_seq
5344 {
5345     enumext-1, enumext-2, enumext-3, enumext-4, keyans, enumext*,
5346     keyans*, print-1, print-2, print-3, print-4, print-*, print*,
5347 }

```

`\setenumext` Now we define the user command `\setenumext`.

```

\__enumext_set_parse:n 5348 \NewDocumentCommand \setenumext { 0{enumext,1} +m }
\__enumext_set_error:nn 5349 {
5350     \seq_clear:N \l__enumext_setkey_tmpa_seq
5351     \seq_set_from_clist:Nn \l__enumext_setkey_tmpb_seq {#1}
5352     \int_set:Nn \l__enumext_setkey_tmpa_int
5353     {
5354         \seq_count:N \l__enumext_setkey_tmpb_seq
5355     }
5356     \int_compare:nNnTF { \l__enumext_setkey_tmpa_int } > { 1 }
5357     {
5358         \seq_pop_left:NN \l__enumext_setkey_tmpb_seq \l__enumext_setkey_tmpa_tl
5359         \seq_map_function:NN \l__enumext_setkey_tmpb_seq \__enumext_set_parse:n
5360         \seq_set_map_e:NNn \l__enumext_setkey_tmpa_seq \l__enumext_setkey_tmpa_seq
5361         {
5362             \tl_use:N \l__enumext_setkey_tmpa_tl - ##1
5363         }
5364     }
5365     {
5366         \seq_put_right:Ne \l__enumext_setkey_tmpa_seq { \tl_trim_spaces:n {#1} }
5367     }
5368     \seq_if_empty:NNTF \l__enumext_setkey_tmpa_seq
5369     { \seq_map_inline:Nn \c__enumext_all_families_seq }
5370     { \seq_map_inline:Nn \l__enumext_setkey_tmpa_seq }
5371     {
5372         \keys_set:nn { enumext / meta-families } { ##1 = {#2} }
5373     }
5374 }

```

Internal functions used by the `\setenumext` command.

```

5375 \cs_new_protected:Npn \__enumext_set_parse:n #1
5376 {
5377     \tl_set:Ne \l__enumext_setkey_tmpb_tl { \tl_trim_spaces:n {#1} }
5378     \clist_map_inline:nn { 0, 1, 2, 3, 4, * } % <- max level
5379     { \tl_remove_all:Nn \l__enumext_setkey_tmpb_tl {##1} }
5380     \tl_if_empty:NNTF \l__enumext_setkey_tmpb_tl

```

```

5381     {
5382         \seq_put_right:Nn \l__enumext_setkey_tmpa_seq
5383         { \tl_trim_spaces:n {#1} }
5384     }
5385     { \__enumext_set_error:nn {#1} { } }
5386 }
5387 \cs_new_protected:Npn \__enumext_set_error:nn #1 #2
5388 { \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.)

### 13.49 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

```

```

5389 \prop_const_from_keyval:Nn \c__enumext_meta_paths_prop
5390 {
5391     {enumext,1} = level-1,
5392     {enumext,2} = level-2,
5393     {enumext,3} = level-3,
5394     {enumext,4} = level-4,
5395     {enumext*} = enumext*
5396 }

```

Now we create the user command taking care that unknown cannot be passed as an argument.

```

5397 \NewDocumentCommand \setenumextmeta { s O{enumext,1} m +m }
5398 {
5399     \str_if_eq:eeTF { \tl_trim_spaces:n {#3} } { unknown }
5400     { \msg_error:nn { enumext } { prohibited-unknown } }
5401     {
5402         \bool_if:nTF {#1}
5403         {
5404             \int_step_inline:nn { 4 }
5405             { \__enumext_add_meta_key:nnn { enumext, ##1 } {#3} {#4} }
5406             \__enumext_add_meta_key:nnn { enumext* } {#3} {#4}
5407         }
5408         { \__enumext_add_meta_key:nnn {#2} {#3} {#4} }
5409     }
5410 }

```

The internal functions `\__enumext_add_meta_key:nnn` and `\__enumext_def_meta_key:nnn` will check the *optional argument* and create the “meta-key”.

```

5411 \cs_new_protected:Npn \__enumext_add_meta_key:nnn #1
5412 {
5413     \tl_set:Nn \l__enumext_meta_path_tl {#1}
5414     \tl_replace_all:Nnn \l__enumext_meta_path_tl {~} {}
5415     \prop_get:NVNTF
5416     \c__enumext_meta_paths_prop \l__enumext_meta_path_tl \l__enumext_meta_path_tl
5417     { \__enumext_def_meta_key:Vnn \l__enumext_meta_path_tl }
5418     {
5419         \msg_error:nnn { enumext } { unknown-set } {#1}
5420         \use_none:nn
5421     }
5422 }
5423 \cs_new_protected:Npn \__enumext_def_meta_key:nnn #1#2#3
5424 {
5425     \bool_lazy_or:nnTF
5426     { \keys_if_exist_p:nn { enumext / #1 } {#2} }
5427     { \keys_if_exist_p:nn { enumext / enumext* } {#2} }
5428     { \msg_error:nnn { enumext } { already-defined } {#2} }
5429     {
5430         \keys_define:nn { enumext / #1 }
5431         {
5432             #2 .meta:n = {#3},
5433             #2 .value_forbidden:n = true
5434         }
5435     }
5436 }
5437 \cs_generate_variant:Nn \__enumext_def_meta_key:nnn { V }

```

(End of definition for `\setenumextmeta` and others. This function is documented on page 6.)

### 13.50 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](#).

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.

```
\foreachkeyans
\__enumext_parse_foreach_keys:nn
\__enumext_parse_foreach_keys:n
\__enumext_foreach_keyans:nn
\__enumext_foreach_add_body:n

5438 \keys_define:nn { enumext / foreach }
5439 {
5440     before .tl_set:N = \l__enumext_foreach_before_tl,
5441     before .value_required:n = true,
5442     after .tl_set:N = \l__enumext_foreach_after_tl,
5443     after .value_required:n = true,
5444     start .int_set:N = \l__enumext_foreach_start_int,
5445     start .value_required:n = true,
5446     stop .int_set:N = \l__enumext_foreach_stop_int,
5447     stop .value_required:n = true,
5448     step .int_set:N = \l__enumext_foreach_step_int,
5449     step .value_required:n = true,
5450     wrapper .cs_set_protected:Np = \__enumext_foreach_wrapper:n #1,
5451     wrapper .value_required:n = true,
5452     sep .tl_set:N = \l__enumext_foreach_sep_tl,
5453     sep .value_required:n = true,
5454     unknown .code:n = { \__enumext_parse_foreach_keys:n {#1} }
5455 }
5456 \keys_precompile:nnN { enumext / foreach }
5457 {
5458     before={},after={},start=1,step=1,stop=0,wrapper=#1,sep={; }
5459 }
5460 \l__enumext_foreach_default_keys_tl
```

Functions for handling unknown *keys*.

```
5461 \cs_new_protected:Npn \__enumext_parse_foreach_keys:nn #1#2
5462 {
5463     \tl_if_blank:nTF {#2}
5464     {
5465         \msg_error:nnn { enumext } { for-key-unknown } {#1}
5466     }
5467     {
5468         \msg_error:nnnn { enumext } { for-key-value-unknown } {#1} {#2}
5469     }
5470 }
5471 \cs_new_protected:Npn \__enumext_parse_foreach_keys:n #1
5472 {
5473     \exp_args:NV \__enumext_parse_foreach_keys:nn \l_keys_key_str {#1}
5474 }
```

We create the command.

```
5475 \NewDocumentCommand \foreachkeyans { +0{ } m }
5476 {
5477     \__enumext_foreach_keyans:nn {#1} {#2}
5478 }
```

Finally the internal functions `\__enumext_foreach_keyans:nn` and `\__enumext_foreach_add_body:n` will loop through the prop list and print the contents.

```
5479 \cs_new_protected:Npn \__enumext_foreach_keyans:nn #1 #2
5480 {
5481     \tl_use:N \l__enumext_foreach_default_keys_tl
5482     \keys_set:nn { enumext / foreach } {#1}
5483     \tl_set:Nn \l__enumext_foreach_name_prop_tl {#2}
5484     \prop_if_exist:cF { g__enumext_#2_prop }
5485     {
5486         \msg_error:nnn { enumext } { undefined-storage-anskey } {#2}
5487     }
5488     \int_compare:nNt { \l__enumext_foreach_stop_int } = { 0 }
5489     {
5490         \int_set:Nn \l__enumext_foreach_stop_int
5491         { \prop_count:c { g__enumext_#2_prop } }
5492     }
5493     \seq_clear:N \l__enumext_foreach_print_seq
```

```

5494 \int_step_function:nnnN
5495 { \l__enumext_foreach_start_int }
5496 { \l__enumext_foreach_step_int }
5497 { \l__enumext_foreach_stop_int }
5498 \__enumext_foreach_add_body:n
5499 \seq_use:NV \l__enumext_foreach_print_seq \l__enumext_foreach_sep_tl
5500 }
5501 \cs_new_protected:Npn \__enumext_foreach_add_body:n #1
5502 {
5503   \seq_put_right:Ne \l__enumext_foreach_print_seq
5504   {
5505     \exp_not:V \l__enumext_foreach_before_tl
5506     \__enumext_foreach_wrapper:n
5507     {
5508       \prop_item:cn { g__enumext_ \l__enumext_foreach_name_prop_tl _prop }{#1}
5509     }
5510     \exp_not:V \l__enumext_foreach_after_tl
5511   }
5512 }

```

(End of definition for `\foreachkeyans` and others. This function is documented on page 18.)

### 13.51 Messages

Message used by package-load for `multicol` and `hyperref` packages.

```

5513 \msg_new:nnn { enumext } { package-load }
5514 {
5515   The~'#1'~package~is~already~loaded.
5516 }
5517 \msg_new:nnn { enumext } { package-not-load }
5518 {
5519   The~'#1'~package~will~be~loaded~as~a~dependency.
5520 }
5521 \msg_new:nnn { enumext } { package-load-foot }
5522 {
5523   The~'#1'~package~is~loaded~with~the~option~'#2'.
5524 }

```

Message used in the creation of counters by `enumext` package.

```

5525 \msg_new:nnn { enumext } { counters }
5526 {
5527   The~counter~'#1'~is~already~defined~by~some~\\
5528   package~or~macro,~it~cannot~be~continued.
5529 }

```

Message used by `align` and `mark-pos` keys.

```

5530 \msg_new:nnn { enumext } { unknown-choice }
5531 {
5532   The~value~'#3'~for~'#1'~key~is~invalid~use~('#2').
5533 }

```

Message used by reserved `anskey*` environment by `enumext` package.

```

5534 \msg_new:nnnn { enumext } { anskey-env-error }
5535 {
5536   The~environment~'#1'~is~reserved~by ~\\
5537   'enumext'~package,~It~is~already~defined.
5538 }
5539 {
5540   The~environment~'#1'~is~defined~internally ~
5541   for~the~'save-ans'~key~with~save-ans~key~active.~See~documentation.\\
5542 }
5543 \msg_new:nnn { enumext } { anskey-env-nested }
5544 {
5545   The~#1~'#2'~can't~be~nested~\msg_line_context:.
5546 }

```

Message used in the creation of *prop list* by `enumext` package.

```

5547 \msg_new:nnn { enumext } { store-prop }
5548 {
5549   *~Package~enumext:~Creating ~
5550   \c_backslash_str g__enumext_#1_prop~\msg_line_context:.
5551 }
5552 \msg_new:nnn { enumext } { store-seq }

```

```

5553 {
5554     *~Package~enumext:~Creating ~
5555     \c_backslash_str g__enumext_#1_seq~\msg_line_context:.
5556 }
5557 \msg_new:nnn { enumext } { store-int }
5558 {
5559     *~Package~enumext:~Creating ~
5560     \c_backslash_str g__enumext_resume_#1_int~\msg_line_context:.
5561 }
5562 \msg_new:nnn { enumext } { prop-seq-int-hook }
5563 {
5564     *~Package~enumext:~Elements~in ~
5565     \c_backslash_str g__enumext_#1_prop=~#2.\\
5566     *~Package~enumext:~Elements~in ~
5567     \c_backslash_str g__enumext_#1_seq=~#3.\\
5568     *~Package~enumext:~Value~off ~
5569     \c_backslash_str g__enumext_resume_#1_int=~#4.
5570 }
5571 \msg_new:nnn { enumext } { item-answer-hook }
5572 {
5573     *~Package~enumext:~Value~off ~
5574     \c_backslash_str g__enumext_item_number_int=~#1.\\
5575     *~Package~enumext:~Value~off ~
5576     \c_backslash_str g__enumext_item_anskey_int=~#2.\\
5577     *~Package~enumext:~Difference~item_number_int~~~item_anskey_int=~#3.
5578 }

```

Message used by [*(key = val)*] system and `\setenumext` command.

```

5579 \msg_new:nnn { enumext } { invalid-key }
5580 {
5581     The~key~'#1'~is~not~know~the~level~#2.
5582 }
5583 \msg_new:nnn { enumext } { unknown-key-family }
5584 {
5585     Unknown~key~family~`\l_keys_key_str'~for~enumext.
5586 }

```

Messages used in length calculation.

```

5587 \msg_new:nnn { enumext } { width-negative }
5588 {
5589     Ignoring~negative~value~'#1=#2'~\msg_line_context:.\\
5590     The~key~'#1'~ accepts~values ~>=~0pt.
5591 }
5592 \msg_new:nnn { enumext } { width-zero }
5593 {
5594     Invalid~'#1=#2'~\msg_line_context:.\\
5595     The~key~'#1'~ accepts~values ~>~0pt.
5596 }

```

Messages used by `show-length` key in `enumext`.

```

5597 \msg_new:nnn { enumext } { list-lengths }
5598 {
5599     ****~Lengths~used~by~'enumext'~level~'#2'~\msg_line_context:~\c_space_tl ****\\
5600     \__enumext_show_length:nnn { dim } { labelsep } {#1}
5601     \__enumext_show_length:nnn { dim } { labelwidth } {#1}
5602     \__enumext_show_length:nnn { dim } { itemindent } {#1}
5603     \__enumext_show_length:nnn { dim } { leftmargin } {#1}
5604     \__enumext_show_length:nnn { dim } { rightmargin } {#1}
5605     \__enumext_show_length:nnn { dim } { listparindent } {#1}
5606     \__enumext_show_length:nnn { skip } { topsep } {#1}
5607     \__enumext_show_length:nnn { skip } { parsep } {#1}
5608     \__enumext_show_length:nnn { skip } { partopsep } {#1}
5609     \__enumext_show_length:nnn { skip } { itemsep } {#1}
5610     ****~
5611 }

```

Messages used by `show-length` key in `enumext*`, `keyans*` and `keyans`.

```

5612 \msg_new:nnn { enumext } { list-lengths-not-nested }
5613 {
5614     ****~Lengths~used~by~'#2'~environment~\msg_line_context:~\c_space_tl ****\\
5615     \__enumext_show_length:nnn { dim } { labelsep } {#1}
5616     \__enumext_show_length:nnn { dim } { labelwidth } {#1}
5617     \__enumext_show_length:nnn { dim } { itemindent } {#1}

```

```

5618     \__enumext_show_length:nnn { dim } { leftmargin } {#1}
5619     \__enumext_show_length:nnn { dim } { rightmargin } {#1}
5620     \__enumext_show_length:nnn { dim } { listparindent } {#1}
5621     \__enumext_show_length:nnn { skip } { topsep } {#1}
5622     \__enumext_show_length:nnn { skip } { parsep } {#1}
5623     \__enumext_show_length:nnn { skip } { partopsep } {#1}
5624     \__enumext_show_length:nnn { skip } { itemsep } {#1}
5625     *****
5626 }

```

Messages used by `ref` key.

```

5627 \msg_new:nnn { enumext } { key-ref-empty }
5628 {
5629     Key~'ref'~need~a~value~in~'#1'~ \msg_line_context:.
5630 }

```

Messages used by `save-ans` key.

```

5631 \msg_new:nnn { enumext } { save-ans-empty }
5632 {
5633     Key~'save-ans'~need~a~value~in~'#1'~ \msg_line_context:.
5634 }
5635 \msg_new:nnn { enumext } { save-ans-log }
5636 {
5637     *~Package~enumext:~Start~#1\c_space_tl with~save-ans=#2~\msg_line_context:.
5638 }
5639 \msg_new:nnn { enumext } { save-ans-log-hook }
5640 {
5641     *~Package~enumext:~Stop~#1\c_space_tl with~save-ans=#2~\msg_line_context:.
5642 }
5643 \msg_new:nnn { enumext } { save-ans-hook }
5644 {
5645     Stop~storing~for~'save-ans=#1'~\msg_line_context:.
5646 }

```

Messages used by the internal system to check answer used by `check-ans` key.

```

5647 \msg_new:nnn { enumext } { need-save-ans }
5648 {
5649     Key~'#1'~ works~only~with~the~'save-ans'~key~in~'#2'~ \msg_line_context:.
5650 }
5651 \msg_new:nnn { enumext } { items-same-answer }
5652 {
5653     *****\
5654     *~Package~enumext:~Checking~answers~in~'#1' ~
5655     for~\c_left_brace_str #2 \c_right_brace_str\
5656     *~started~#3~and~close~\msg_line_context: : ~
5657     'OK',~all~items~with~answer.\
5658     *****
5659 }
5660 \msg_new:nnn { enumext } { item-greater-answer }
5661 {
5662     Checking~answers~in~'#1'~for~\c_left_brace_str #2 \c_right_brace_str\
5663     started~#3~and~close~\msg_line_context: : ~'NOT~OK'\
5664     Items~>~Answers.
5665 }
5666 \msg_new:nnn { enumext } { item-less-answer }
5667 {
5668     Checking~answers~in~'#1'~for~\c_left_brace_str #2 \c_right_brace_str\
5669     started~#3~and~close~\msg_line_context: : ~'NOT~OK'\
5670     Items~<~Answers.
5671 }

```

Messages used by the internal system to check for “starred” `\item*` and `\anspic*` commands.

```

5672 \msg_new:nnn { enumext } { missing-starred }
5673 {
5674     Missing~'\c_backslash_str #1'~#2.
5675 }
5676 \msg_new:nnn { enumext } { many-starred }
5677 {
5678     Many~'\c_backslash_str #1'~#2.
5679 }

```

Messages used by `\printkeyans*` command.

```

5680 \msg_new:nnn { enumext } { print-starred }

```



```

5681 {
5682     \c_backslash_str printkeyans*:~ The~sequence~'#1'~already~contains ~
5683     #2~environment~ \msg_line_context:.
5684 }

```

Message for the nesting depth of the environment `enumext`.

```

5685 \msg_new:nnn { enumext } { list-too-deep }
5686 {
5687     Too~deep~nesting ~for~'enumext'~\msg_line_context:~ \\
5688     The~maximum ~level ~of ~nesting ~is~4.
5689 }

```

Messages used by `\anskey`, `anskey*` and `\anspic` commands.

```

5690 \msg_new:nnn { enumext } { anskey-unnumber-item }
5691 {
5692     Can't~store~with~a~unnumbered~\c_backslash_str item~\msg_line_context:.
5693 }
5694 \msg_new:nnn { enumext } { anskey-already-stored }
5695 {
5696     Content~already~stored~for~this~\c_backslash_str item~\msg_line_context:.
5697 }
5698 \msg_new:nnn { enumext } { anskey-empty-arg }
5699 {
5700     Can't~store~empty~content~\msg_line_context:.
5701 }
5702 \msg_new:nnn { enumext } { anskey-wrong-place }
5703 {
5704     Wrong~place~for~command~'\c_backslash_str #1'~\msg_line_context:~ \\
5705     '\c_backslash_str #1'~works~in~the~environment~'#2'.
5706 }
5707 \msg_new:nnn { enumext } { anskey-nested }
5708 {
5709     The~command~\c_backslash_str anskey~ can't~be~nested~\msg_line_context:.
5710 }
5711 \msg_new:nnn { enumext } { anskey-math-mode }
5712 {
5713     #1~can't~work~in~math~mode~\msg_line_context:.
5714 }
5715 \msg_new:nnn { enumext } { anskey-env-wrong }
5716 {
5717     The~environment~anskey*~cannot~use~in~'#1'~\msg_line_context:.
5718 }
5719 \msg_new:nnn { enumext } { ansPIC-wrong-place }
5720 {
5721     Wrong~place~for~command~'\c_backslash_str #1'~\msg_line_context:~ \\
5722     '\c_backslash_str #1'~works~in~the~environment~'#2'.
5723 }
5724 \msg_new:nnn { enumext } { command-wrong-place }
5725 {
5726     Wrong~place~for~command~'\c_backslash_str #1'~\msg_line_context:~ \\
5727     '\c_backslash_str #1'~works~outside~the~environment~'#2'.
5728 }
5729 \msg_new:nnnn { enumext } { anskey-env-key-unknown }
5730 {
5731     The~key~'#1'~is~unknown~by~environment~
5732     'anskey*~and~is~being~ignored.
5733 }
5734 {
5735     The~environment~'anskey*~does~not~have~a~key~called ~'#1'.\\
5736     Check~that~you~have~spelled~the~key~name~correctly.
5737 }
5738 \msg_new:nnnn { enumext } { anskey-env-key-value-unknown }
5739 {
5740     The~key~'#1=#2'~is~unknown~by~environment ~
5741     'anskey*~and~is~being~ignored.
5742 }
5743 {
5744     The~environment~'anskey*~does~not~have~a~key~called ~'#1'.\\
5745     Check~that~you~have~spelled~the~key~name~correctly.
5746 }
5747 \msg_new:nnnn { enumext } { anskey-cmd-key-unknown }
5748 { The~key~'#1'~is~unknown~by~'\c_backslash_str anskey'~and~is~being~ignored.}

```

```

5749 {
5750     The~command ~'\c_backslash_str anskey'~does~not~have~a~key~called ~'#1'.\\
5751     Check~that~you~have~spelled~the~key~name~correctly.
5752 }
5753 \msg_new:nnnn { enumext } { anskey-cmd-key-value-unknown }
5754 { The~key~'#1=#2'~is~unknown~by~'\c_backslash_str anskey'~and~is~being~ignored. }
5755 {
5756     The~command~'\c_backslash_str anskey'~does~not~have~a~key~called ~'#1'.\\
5757     Check~that~you~have~spelled~the~key~name~correctly.
5758 }
5759 \msg_new:nnn { enumext } { overwrite-file }
5760 {
5761     Overwriting~file~'#1'.
5762 }
5763 \msg_new:nnn { enumext } { writing-file }
5764 {
5765     Writing~file~'#1'.
5766 }
5767 \msg_new:nnn { enumext } { not-writing }
5768 {
5769     File~'#1'~already~exists.~Not~writing.
5770 }

```

Messages used by [keyans](#), [keyans\\*](#) and [keyanspic](#) environment.

```

5771 \msg_new:nnn { enumext } { keyans-nested }
5772 {
5773     The~environment~'keyans'~can't~be ~nested ~\msg_line_context:.
5774 }
5775 \msg_new:nnn { enumext } { keyans-wrong-level }
5776 {
5777     Wrong~level~position~for~'keyans'~\msg_line_context:.~ \\
5778     The~environment~'keyans'~can~only~be~in~the~first~level.
5779 }
5780 \msg_new:nnn { enumext } { wrong-place }
5781 {
5782     Wrong~place~for~'#1'~environment ~\msg_line_context:.~ \\
5783     '#1'~is~only~found~with~'#2'~ in ~ 'enumext.
5784 }
5785 \msg_new:nnn { enumext } { keyanspic-nested }
5786 {
5787     The~environment~'keyanspic'~can't~be ~nested~ \msg_line_context:.~.
5788 }
5789 \msg_new:nnn { enumext } { keyanspic-wrong-level }
5790 {
5791     Wrong~level~position~for~'keyanspic'~\msg_line_context:.~ \\
5792     The~environment~'keyans'~can~only~be~in~the~first~level.
5793 }
5794 \msg_new:nnn { enumext } { keyanspic-item-cmd }
5795 {
5796     Can't~use ~\c_backslash_str item~in~keyanspic~\msg_line_context:.
5797 }
5798 \msg_new:nnnn { enumext } { keyans-unknown-key }
5799 {
5800     The~key~'#1'~is~unknown~by~environment~
5801     '\l__enumext_envir_name_tl'~and~is~being~ignored.
5802 }
5803 {
5804     The~environment~'\l__enumext_envir_name_tl'~does~not
5805     ~have~a~key~called ~'#1'.\\
5806     Check~that~you~have~spelled~the~key~name~correctly.
5807 }
5808 \msg_new:nnnn { enumext } { keyans-unknown-key-value }
5809 {
5810     The~key~'#1=#2'~is~unknown~by~environment ~
5811     '\l__enumext_envir_name_tl'~and~is~being~ignored.
5812 }
5813 {
5814     The~environment~'\l__enumext_envir_name_tl'~does~not
5815     ~have~a~key~called ~'#1'.\\
5816     Check~that~you~have~spelled~the~key~name~correctly.
5817 }

```

Message used by unknown *⟨keys⟩* in `enumext*`. environment.

```
5818 \msg_new:nnnn { enumext } { starred-unknown-key }
5819 {
5820   The~key~'#1'~is~unknown~by~environment~
5821   '\l__enumext_envir_name_tl'~and~is~being~ignored.
5822 }
5823 {
5824   The~environment~'\l__enumext_envir_name_tl'~does~not
5825   ~have~a~key~called ~'#1'.\\
5826   Check~that~you~have~spelled~the~key~name~correctly.
5827 }
5828 \msg_new:nnnn { enumext } { starred-unknown-key-value }
5829 {
5830   The~key~'#1=#2'~is~unknown~by~environment ~
5831   '\l__enumext_envir_name_tl'~and~is~being~ignored.
5832 }
5833 {
5834   The~environment~'\l__enumext_envir_name_tl'~does~not
5835   ~have~a~key~called ~'#1'.\\
5836   Check~that~you~have~spelled~the~key~name~correctly.
5837 }
```

Message used by unknown *⟨keys⟩* in `enumext` environment.

```
5838 \msg_new:nnnn { enumext } { standar-unknown-key }
5839 {
5840   The~key~'#1'~is~unknown~by~environment~'\l__enumext_envir_name_tl' \c_space_tl
5841   ~on~level~\int_use:N \l__enumext_level_int \c_space_tl and~is~being~ignored.
5842 }
5843 {
5844   The~environment~'\l__enumext_envir_name_tl'~does~not
5845   ~have~a~key~called ~'#1'~on~level~\int_use:N \l__enumext_level_int.\\
5846   Check~that~you~have~spelled~the~key~name~correctly.
5847 }
5848 \msg_new:nnnn { enumext } { standar-unknown-key-value }
5849 {
5850   The~key~'#1=#2'~is~unknown~by~environment~'\l__enumext_envir_name_tl' \c_space_tl
5851   ~on~level~\int_use:N \l__enumext_level_int \c_space_tl and~is~being~ignored.
5852 }
5853 {
5854   The~environment~'\l__enumext_envir_name_tl'~does~not
5855   ~have~a~key~called ~'#1'~on~level~\int_use:N \l__enumext_level_int.\\
5856   Check~that~you~have~spelled~the~key~name~correctly.
5857 }
```

Message used by unknown *⟨keys⟩* in `\foreachkeyans`.

```
5858 \msg_new:nnnn { enumext } { for-key-unknown }
5859 { The~key~'#1'~is~unknown~by~'\c_backslash_str foreachkeyans'~and~is~being~ignored.}
5860 {
5861   The~command~'\c_backslash_str foreachkeyans'~does~not~have~a~key~called~'#1'.\\
5862   Check~that~you~have~spelled~the~key~name~correctly.
5863 }
5864 \msg_new:nnnn { enumext } { for-key-value-unknown }
5865 { The~key~'#1=#2'~is~unknown~by~'\c_backslash_str foreachkeyans'~and~is~being~ignored. }
5866 {
5867   The~command~'\c_backslash_str foreachkeyans'~does~not~have~a~key~called~'#1'.\\
5868   Check~that~you~have~spelled~the~key~name~correctly.
5869 }
```

Messages used by `\getkeyans` command.

```
5870 \msg_new:nnn { enumext } { undefined-storage-anskey }
5871 {
5872   Storage~named~'#1'~is~not~defined~\msg_line_context:.
5873 }
```

Messages used by `\miniright` command.

```
5874 \msg_new:nnn { enumext } { missing-miniright }
5875 {
5876   Missing~'\c_backslash_str miniright'~in~\msg_line_context:.\\
5877   The~key~'mini-env'~need~'\c_backslash_str miniright'.
5878 }
5879 \msg_new:nnn { enumext } { wrong-miniright-place }
5880 {
5881   Wrong~place~for~'\c_backslash_str miniright'~\msg_line_context:.~ \\
```

```

5882     Works~in~'enumext'~and~'keyans'~with~key~'mini-env'.
5883   }
5884   \msg_new:nnn { enumext } { wrong-miniright-use }
5885   {
5886     Wrong~use~for~'\c_backslash_str miniright'~\msg_line_context:~ \
5887     '\c_backslash_str miniright'~need~a~key~'mini-env'.
5888   }
5889   \msg_new:nnn { enumext } { wrong-miniright-starred }
5890   {
5891     Can't~use~ ~\c_backslash_str miniright~in~starred~environments~\msg_line_context:.
5892   }
5893   \msg_new:nnn { enumext } { many-miniright-used }
5894   {
5895     Can't~use~ ~\c_backslash_str miniright~more~than~once~ \msg_line_context:.
5896   }

```

Messages used by `\setenumextmeta` command.

```

5897   \msg_new:nnn { enumext } { unknown-set }
5898   {
5899     Argument~[#1]~is~unknown~by~ \c_backslash_str setenumextmeta~\msg_line_context:.
5900   }
5901   \msg_new:nnn { enumext } { already-defined }
5902   {
5903     The~key~'#1'~is~already~defined~\msg_line_context:.
5904   }
5905   \msg_new:nnn { enumext } { prohibited-unknown }
5906   {
5907     The~name~'unknown'~can't~be~chosen~ for~a~meta~key~\msg_line_context:.
5908   }

```

Messages used by `enumext*` and `keyans*` environments.

```

5909   \msg_new:nnn { enumext } { nested }
5910   {
5911     The~environment~\l__enumext_envir_name_tl \c_space_tl can't~be~nested~\msg_line_context:.
5912   }
5913   \msg_new:nnn { enumext } { nested-horizontal }
5914   {
5915     The~environment~\l__enumext_envir_name_tl \c_space_tl can't~be~nested~in~'#1'~ \msg_line_context:.
5916   }
5917   \msg_new:nnn { enumext } { item-joined }
5918   {
5919     Items~joined~(#1)~>~#2 ~columns~ ~\msg_line_context:.
5920   }
5921   \msg_new:nnn { enumext } { item-joined-columns }
5922   {
5923     Not~space~to~join~items~(#1)~>~#2 ~\msg_line_context:.
5924   }

```

## 13.52 Finish package

Finish package implementation.

```

5925   \file_input_stop:
5926   </package>

```

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