

# enumext

ENUMERATE EXERCISE SHEETS

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

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

## Abstract

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

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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 `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 multicols`, vertical alignment

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†E-mail: [pablgonz@educarchile.cl](mailto:pablgonz@educarchile.cl).

License and Requirements

Permission is granted to copy, distribute and/or modify this software under the terms of the LaTeX Project Public License (lpp), version 1.3 or later (<https://www.latex-project.org/lppl.txt>). The software has the status “maintained”.

The enumext package loads and requires multicol[3] and contents[4] packages, need to have a modern T<sub>E</sub>X distribution such as T<sub>E</sub>X Live or MiK<sub>T</sub>E<sub>X</sub>. 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 2024-11-01.

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
- (a)  $\alpha > \delta$

(b) L<sup>A</sup>T<sub>E</sub>X2e is cool?

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
- \*  $(x - 1)^2$

\*  $3(x + y + z)$

(a)  $\alpha > \delta$

(b) L<sup>A</sup>T<sub>E</sub>X2e is cool?
- \* Yes

\* Yes, dnf

\* doesn’t exist for now :(

\* xsim

\* very good

\* exsheets

\* obsolete

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

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

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

1.  $(x - 1)^2$

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

3. (a) False

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
- A) value

B) correct

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) value

D) value

E) I, II, and III

D) value

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

5. Question with image on right side:
- A) value

B) value

C) value

D) correct

E) value
- A) value

B) value

C) value

D) correct

E) value
- A) value

B) value

C) value

D) correct

E) value
- A) value

B) value

C) value

D) correct

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.

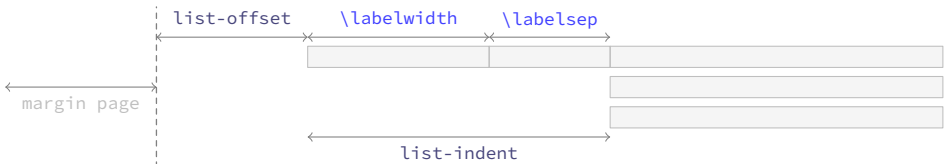


Figure 2: Representation of horizontal lengths concept in `enumext`.

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.

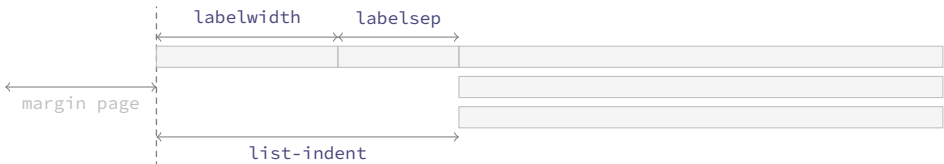


Figure 3: Default horizontal lengths `list-offset=0pt`, `list-indent=\labelwidth+\labelsep` in `enumext`.

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  $\LaTeX$  `\label` and `\ref` commands work as usual. It also provides an “internal reference” system for the “stored content” by means of the key `save-ref` (§6.1.1) when the key `save-ans` (§6.1) is active.

1.3.6 Support for \footnote

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

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

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

```
\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  $\TeX$ , `\item` and `\item[⟨custom⟩]` commands work in the usual way. The environment can be nested with at most “four levels” and the options can be configured globally using `\setenumext` command and locally using `[⟨key = val⟩]` in the environment.

Example with `columns=2`

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

2.2 The environment enumext\*

The `enumext*` is a *horizontal list environment* similar to the `shortenumberate` or `tasks` environments provided by the `shortlst`[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 if it has not been established. The default value for the first level of the environments `enumext` and `enumext*` are `\arabic*`, for second level are `(\alph*)`, 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 label \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 `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 `\alph*`, ‘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`, `\alph`, `\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 hash* ‘`{\#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[\langle custom \rangle]`.

`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: `0pt`

Sets the *horizontal translation* of the entire environment level from the left edge of the box defined by the `labelwidth` key. Internally sets the values of `\leftmargin` and `\itemindent` for the current level.

`list-indent = {  $\langle rigid length \rangle$  }` default: `labelwidth + labelsep`

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

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

`itemindent = {  $\langle rigid length \rangle$  }` default: `0pt`

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

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

`rightmargin = {  $\langle rigid length \rangle$  }` default: `0pt`

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

`listparindent = {  $\langle rigid length \rangle$  }` default: `0pt`

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

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

## 5.3 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 L<sup>A</sup>T<sub>E</sub>X 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={\<store name>}]
  \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*  $\{\langle\text{store name}\rangle\}$  would be `nosep`, `columns=2`, but using the key `save-key={columns=3}` will overwrite and the “stored key” in the *sequence*  $\{\langle\text{store name}\rangle\}$  are only `columns=3` ignoring all the others.

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

Sets the *text symbol* that will separate the current  $\langle\text{label}\rangle$  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*  $\{\langle\text{store name}\rangle\}$  set by `save-ans` key. The  $\{\langle\text{text symbol}\rangle\}$  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`  $\langle\text{value forbidden}\rangle$  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*  $\{\langle\text{store name}\rangle\}$  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` =  $\{\langle\text{true} \mid \text{false}\rangle\}$  default: *false*

Activates the “internal label and ref” mechanism for referencing “stored content” in *prop list*  $\{\langle\text{store name}\rangle\}$  set by `save-ans` key. To reference the location of the “stored content” within the environment you must use `\ref{\langle\text{store name} : \text{position}\rangle}`, where  $\langle\text{position}\rangle$  corresponds to the position occupied by the “stored content” in the *prop list*  $\{\langle\text{store name}\rangle\}$  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` =  $\{\langle\text{symbol}\rangle\}$  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 display

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

Sets the *symbol* to be displayed in the left margin for `\anskey`, `anskey*`, `\item*` and `\anspic*` in the place where they are executed 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` =  $\{\langle\text{left} \mid \text{right}\rangle\}$  default: *left*

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

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

Sets the *horizontal space* between the box containing the “symbol” defined by `mark-ans` key and the current  $\langle\text{label}\rangle$  for `\item*` and `\anspic*` in the `keyans`, `keyans*` and `keyanspic` environments, the *argument* passed to the `\anskey` and the *body* in `anskey*` environment.

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

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

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

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

`show-ans` = {`<true | false>`} default: `false`  
 Displays the *argument* passed to the `\anskey`, the *body* for `anskey*` environment, the `<label>` for `\item*` and `\anspic*` at the place where it is executed. If the *optional argument* is present in `\item*` or `\anspic*` it will be shown using `wrap-opt` key.

### 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 `{<content>}` passed to `\anskey` when “storing” in the *sequence* `{<store name>}` has the form `\item <content>`, the following `<keys>` allow modifying the way in which it is “stored” in the *sequence*.

`break-col` `<value forbidden>` default: `not used`  
 Stores `{<content>}` in the *sequence* `{<store name>}` of the form `\columnbreak \item <content>`.

`item-join` = {`<columns>`} default: `not set`  
 Set the *number of columns* to be used for `\item(<columns>)` and stores `{<content>}` in the *sequence* `{<store name>}` of the form `\item(<columns>) <content>`.

`item-star` `<value forbidden>` default: `not used`  
 Stores `{<content>}` in the *sequence* `{<store name>}` of the form `\item* <content>`.

`item-sym*` = {`<symbol>`} default: `not set`  
 Sets the *symbol* for `\item*` when using the key `item-star` and stores `{<content>}` in the *sequence* `{<store name>}` of the form `\item* [<symbol>] <content>`. The *symbol* can be in text or math mode, for example `item-sym*={\ast}` stores `\item*[\ast] <content>`.

`item-pos*` = {`<rigid length>`} default: `not set`  
 Sets the *offset* for `\item*` when using the keys `item-star` and `item-sym*` and stores `{<content>}` in the *sequence* `{<store name>}` of the form `\item* [<symbol>] [<offset>] <content>`.

### Example

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



★ 1. Text containing our instructions or questions.

\*

2. Text containing our instructions or questions.

(a) Question.

\*

3. Text containing our instructions or questions.

\*

4. Text containing our instructions or questions.

\*

### 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* `\{store name\}` set by `save-ans` key. If `save-ref` key are active and the `hyperref`[8] package is detected `\hyperlink` and `\hypertarget` will be used, otherwise the usual “label and ref” system provided by L<sup>A</sup>T<sub>E</sub>X will be used. By design the environment cannot be nested but full supports “verbatim material” in the body 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 `scontents` package, for the correct operation `\begin{anskey*}` and `\end{anskey*}` must be in different lines, 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, the package `scontents` will return an “error” message if this happens. In a similar way comments “%” or “any character” after `\end{anskey*}` on the same line the package `scontents` 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 keys inherited from package `scontents`. The environment is available for all levels of the `enumext` environment and the `enumext*` environment, but it is disabled for the `keyans`, `keyans*` and `keyanspic` environments.

`write-env = \{ \langle file.ext \rangle \}`

default: *not used*

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

`overwrite = \{ \langle true | false \rangle \}`

default: *false*

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

`force-eol = \{ \langle true | false \rangle \}`

default: *false*

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

- For security reasons the keys `store-env`, `print-env` and `write-out` they have been left disabled. It is recommended that you review the `scontents`[4] documentation to understand how the keys described here work.

#### Example

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

  \item Text containing our instructions or questions.

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

  \item Text containing our instructions or questions.
    \begin{anskey*}
      \langle third answer \rangle
    \end{anskey*}

  \item Text containing our instructions or questions.
    \begin{anskey*}
      \langle fourth answer \rangle
    \end{anskey*}
\end{enumext}
```

★ 5. Text containing our instructions or questions.

[5] First answer with verbatim

6. Text containing our instructions or questions.

(a) Question.

[6] second answer

7. Text containing our instructions or questions.

[7] third answer

8. Text containing our instructions or questions.

[8] fourth answer

## 6.4 The environments `keyans` and `keyans*`

---

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

---

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

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

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

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

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

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

---

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

---

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

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

### Example

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


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

  \item Text containing a question and image.

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

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

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

  
Some text

6.5 The environment keyanspic

keyanspic

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

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

When the `keyanspic` environment is used *without keys* the `\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.

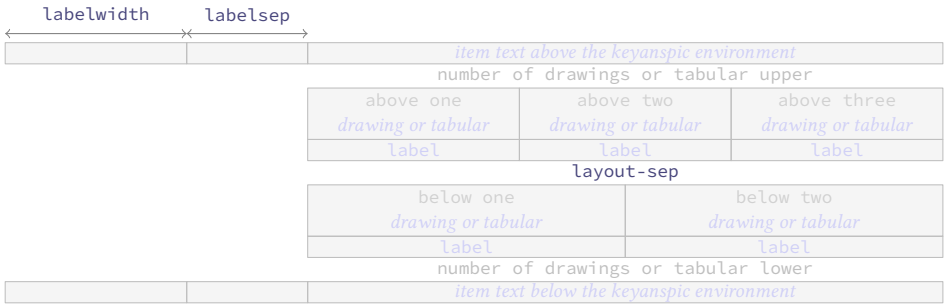


Figure 6: Representation of the `keyanspic` environment with `layout-sty={\{3, 2\}}` in `enumext`.

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

6.5.1 Keys for keyanspic

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

default: below

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

label-sep = {\langle rubber length | rigid length \rangle}

default: internal adjustment

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

layout-sty = {\langle n° upper , n° lower \rangle}

default: not set

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

layout-sep = {\langle rubber length | rigid length \rangle}

default: adjusted parsep from keyans

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

layout-top = {\langle rubber length | rigid length \rangle}

default: adjusted topsep from keyans

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

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

6.5.2 The command \anspic

\anspic

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

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

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

Example

```
\begin{enumext}[save-ans=test,show-ans,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

A)

B

B)

A

C)

A

D)

A

\* E) [note]

2. Question with images and labels above.

A)

A

B)

B

C)

A

D)

A

\* E) [note]

A

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

A

A)

B

B)

A

C)

A

D)

A

\* E) [note]

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

## 6.6 Printing stored content

### 6.6.1 The command `\getkeyans`

---

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

---

The command `\getkeyans` prints the “stored content” in *prop list* `{<store name>}` defined by `save-ans` key in the `<position>` returned by the `show-pos` key. The “stored content” can only be accessed *after* it is stored, if `{<store name>}` does not exist the command will return an error.

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

### 6.6.2 The command `\foreachkeyans`

---

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

---

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

#### Options for command

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

Establishes the *separation* between “each” `{<content>}` stored in *prop list* `{<store name>}`. For example, you can use `sep={\[\text{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 <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  $\langle keys \rangle$  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  $\langle keys \rangle$  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  $\langle keys \rangle$  for the environment `enumext` “saved” in the *sequence*  $\{⟨store name⟩\}$  we will use `\setenumext[⟨print , level⟩]{⟨keys⟩}` and if we need to set the  $\langle keys \rangle$  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 \LaTeXe\ 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) ~~LaTeXe~~ 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:

```
$ pdftdetach -saveall enumext.pdf
```


and then you can use the excellent `arara`<sup>1</sup> tool to compile them.

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

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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.
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

 $1 \text{ \AA} = 1 \times 10^3 \text{ fm}$ .
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:  $1 \text{ \AA} = 1 \times 10^{-10} \text{ m}$ ) 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 \(cross mark\)](#) .

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:  $1 \text{ \AA} = 1 \times 10^{-10} \text{ m}$ ) 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

 $1 \text{ \AA} = 1 \times 10^3 \text{ fm}$ .
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:  $1 \text{ \AA} = 1 \times 10^{-10} \text{ m}$ ) 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 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

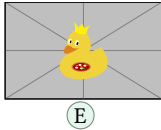
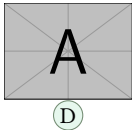
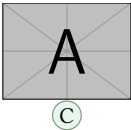
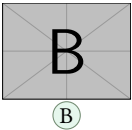
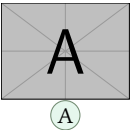
 value

D

 value

E

 value
4. Question with image and label below:



5. Question with image on right side:

- (A) value
- (B) value
- (C) value
- (D) correct
- (E) value



Test keys

1. B,  $x = 5$

2. D

3. C, some note
- ✖ 4. E, A duck


✖ 5. D, other note


✖
- ✖


✖

✖

Example 4

A “simple worksheet” using ducks :) 


 Factor  $x^2 - 2x + 1$

 Factor  $3x + 3y + 3z$

The following questions need to be cuaqtified :)

 True False

- (a)  $\alpha > \delta$
- (b) ~~ET~~Xze is cool?

 Related to Linux

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

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

1.  $(x - 1)^2$

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

3. (a) False

(b) Very True!

4. (a) Yes
- ✖ (b) Yes, dnf

✖ (c) i. doesn't exist for now :(

✖ ii. very good

✖ iii. obsolete

✖
- ✖

✖

✖

✖

Example 5

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

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













## 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`, `scontents`, `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** 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 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

**v1.0 2024-11-08** – First public release.

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## 13 Implementation

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

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

### 13.1 General conventions

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

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

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

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

### 13.2 Initial set up

Start the DocStrip guards.

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

Identify the internal prefix (L<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}[2024-11-01]
```

Now declare the `enumext` package.

```
4 \ProvidesExplPackage {enumext} {2024-11-08} {1.0} {Enumerate exercise sheets}
```

Finally check if the `multicol` and `scontents` packages 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  \IfPackageLoadedTF { scontents }
16  {
17    \msg_info:nnn { enumext } { package-load } { scontents }
18  }
19  {
20    \msg_info:nnn { enumext } { package-not-load } { scontents }
21    \RequirePackage{scontents}
22  }
23 }
```

### 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.

```
\__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
```

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

```
24 \int_new:N \__enumext_level_int
25 \int_new:N \__enumext_level_h_int
26 \int_new:N \__enumext_anskey_level_int
27 \int_new:N \__enumext_keyans_level_int
28 \int_new:N \__enumext_keyans_level_h_int
29 \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_anskey_env_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).

```

30 \bool_new:N \l__enumext_starred_bool
31 \bool_new:N \g__enumext_starred_bool
32 \bool_new:N \l__enumext_starred_first_bool
33 \bool_new:N \l__enumext_standar_bool
34 \bool_new:N \g__enumext_standar_bool
35 \bool_new:N \l__enumext_standar_first_bool
36 \bool_new:N \l__enumext_anskey_env_bool
37 \bool_new:N \l__enumext_keyans_env_bool
38 \tl_new:N \g__enumext_start_line_tl
39 \tl_new:N \g__enumext_envir_name_tl
40 \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).

```

41 \cs_set_protected:Npn \__enumext_tmp:n #1
42 {
43   \tl_new:c { l__enumext_counter_#1_tl }
44 }
45 \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).

```

46 \tl_const:Nn \c__enumext_counter_style_tl
47 { { { arabic } { roman } { Roman } { alph } { Alph } } }
48 \tl_new:N \l__enumext_ref_key_arg_tl
49 \tl_new:N \l__enumext_ref_the_count_tl
50 \cs_set_protected:Npn \__enumext_tmp:n #1
51 {
52   \tl_new:c { l__enumext_renew_the_count_#1_tl }
53   \tl_new:c { l__enumext_the_counter_#1_tl }
54   \tl_set:ce { l__enumext_the_counter_#1_tl } { \exp_not:c { theenumX#1 } }
55 }
56 \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).

```

57 \int_new:N \g__enumext_resume_int
58 \int_new:N \g__enumext_resume_vii_int
59 \tl_new:N \l__enumext_resume_name_tl
60 \bool_new:N \l__enumext_resume_active_bool
61 \tl_new:N \g__enumext_standar_series_tl
62 \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.

```

63 \dim_new:N \l__enumext_current_widest_dim
64 \tl_new:N \g__enumext_counter_styles_tl
65 \tl_new:N \g__enumext_widest_label_tl
66 \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:NNNNNNNNNN` (§13.38.1).

```
67 \cs_set_protected:Npn \__enumext_tmp:n #1
68 {
69   \bool_new:c { \l__enumext_leftmargin_tmp_#1_bool }
70   \dim_new:c { \l__enumext_leftmargin_tmp_#1_dim }
71   \dim_new:c { \l__enumext_leftmargin_#1_dim }
72   \dim_new:c { \l__enumext_itemindent_#1_dim }
73 }
74 \clist_map_inline:nn { i, ii, iii, iv, v, vi, vii, viii } { \__enumext_tmp:n {#1} }
```

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

```
\l__enumext_multicols_above_X_skip
\l__enumext_multicols_below_X_skip
\g__enumext_multicols_right_X_skip
\l__enumext_align_label_pos_X_str
```

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

```
75 \cs_set_protected:Npn \__enumext_tmp:n #1
76 {
77   \skip_new:c { \l__enumext_multicols_above_#1_skip }
78   \skip_new:c { \l__enumext_multicols_below_#1_skip }
79   \skip_new:c { \g__enumext_multicols_right_#1_skip }
80   \str_new:c { \l__enumext_align_label_pos_#1_str }
81 }
82 \clist_map_inline:nn { i, ii, iii, iv, v } { \__enumext_tmp:n {#1} }
```

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

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

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

```
83 \int_new:N \g__enumext_minipage_stat_int
84 \skip_new:N \l__enumext_minipage_temp_skip
85 \skip_new:N \l__enumext_minipage_left_skip
86 \skip_new:N \l__enumext_minipage_right_skip
87 \skip_new:N \l__enumext_minipage_after_skip
88 \skip_new:N \g__enumext_minipage_right_skip
89 \skip_new:N \g__enumext_minipage_after_skip
90 \cs_set_protected:Npn \__enumext_tmp:n #1
91 {
92   \dim_new:c { \l__enumext_minipage_left_#1_dim }
93   \bool_new:c { \l__enumext_minipage_active_#1_bool }
94 }
95 \clist_map_inline:nn { i, ii, iii, iv, v, vii, viii } { \__enumext_tmp:n {#1} }
```

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

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

The bool vars `\l__enumext_wrap_label_X_bool` and `\l__enumext_wrap_label_opt_X_bool` are used by `wrap-label` and `wrap-label*` keys (§13.13), the integer `\l__enumext_start_X_int` are used by the `start` and `start*` keys (§13.15), the token list `\l__enumext_fake_item_indent_X_tl` is used by `itemindent` key (§13.18.1), the variables `\l__enumext_label_fill_left_X_tl` and `\l__enumext_label_fill_right_X_tl` are used by the `align` key (§13.13). The boolean vars `\l__enumext_vspace_a_star_X_bool`, `\l__enumext_vspace_b_star_X_bool` are used by `above`, `above*`, `below` and `below*` keys (§13.20).

```
96 \cs_set_protected:Npn \__enumext_tmp:n #1
97 {
98   \bool_new:c { \l__enumext_wrap_label_#1_bool }
99   \bool_new:c { \l__enumext_wrap_label_opt_#1_bool }
100   \int_new:c { \l__enumext_start_#1_int }
101   \tl_new:c { \l__enumext_fake_item_indent_#1_tl }
102   \tl_new:c { \l__enumext_label_fill_left_#1_tl }
103   \tl_new:c { \l__enumext_label_fill_right_#1_tl }
104   \bool_new:c { \l__enumext_vspace_a_star_#1_bool }
105   \bool_new:c { \l__enumext_vspace_b_star_#1_bool }
106 }
107 \clist_map_inline:nn { i, ii, iii, iv, v, vii, viii } { \__enumext_tmp:n {#1} }
```

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

```

\l__enumext_store_active_bool
\l__enumext_store_name_tl
\g__enumext_store_name_tl
\l__enumext_store_anskey_arg_tl
\l__enumext_store_anskey_env_tl
\l__enumext_store_anskey_opt_tl
\l__enumext_store_current_label_tl
\l__enumext_store_current_opt_arg_tl
\l__enumext_store_current_label_tmp_tl

```

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

The variable `\l__enumext_store_anskey_arg_tl` save the *argument* of `\anskey` (§13.30) and the variables `\l__enumext_store_anskey_env_tl` and `\l__enumext_store_anskey_opt_tl` save the  $\langle body\rangle$  and the  $\langle keys\rangle$  of the environment `anskey*` (§13.31).

The variables `\l__enumext_store_current_label_tl` and `\l__enumext_store_current_opt_arg_tl` save the *current label* and *optional argument* of `\item*` (§13.37) 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.

```

108 \bool_new:N \l__enumext_store_active_bool
109 \tl_new:N \l__enumext_store_name_tl
110 \tl_new:N \g__enumext_store_name_tl
111 \tl_new:N \l__enumext_store_anskey_arg_tl
112 \tl_new:N \l__enumext_store_anskey_env_tl
113 \tl_new:N \l__enumext_store_anskey_opt_tl
114 \tl_new:N \l__enumext_store_current_label_tl
115 \tl_new:N \l__enumext_store_current_opt_arg_tl
116 \tl_new:N \l__enumext_store_current_label_tmp_tl

```

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

```

\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).

```

117 \tl_new:N \l__enumext_setkey_tmpa_tl
118 \tl_new:N \l__enumext_setkey_tmpb_tl
119 \int_new:N \l__enumext_setkey_tmpa_int
120 \seq_new:N \l__enumext_setkey_tmpa_seq
121 \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
\g__enumext_foreach_default_keys_tl

```

Internal variables used by the `\printkeyans` command (§13.47) and `\foreachkeyans` command (§13.50).

```

122 \tl_new:N \l__enumext_meta_path_tl
123 \seq_new:N \l__enumext_foreach_print_seq
124 \tl_new:N \l__enumext_foreach_name_prop_tl
125 \tl_new:N \g__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_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 (§13.27.2) and “*storing structure*”.

```

126 \tl_new:N \l__enumext_print_keyans_starred_tl
127 \bool_new:N \l__enumext_print_keyans_star_bool
128 \str_new:N \l__enumext_mark_position_str
129 \dim_new:N \l__enumext_mark_sep_tmpa_dim
130 \dim_new:N \l__enumext_mark_sep_tmpb_dim
131 \int_new:N \l__enumext_show_pos_tmp_int
132 \tl_new:N \g__enumext_item_symbol_aux_tl
133 \cs_set_protected:Npn \__enumext_tmp:n #1
134 {
135   \tl_new:c { \l__enumext_print_keyans_#1_tl }
136   \tl_new:c { \l__enumext_store_save_key_#1_tl }
137   \bool_new:c { \l__enumext_store_save_key_#1_bool }
138   \bool_new:c { \l__enumext_store_upper_level_#1_bool }
139 }
140 \clist_map_inline:nn { i, ii, iii, iv, vii } { \__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

```

Internal variables used by `keyanspic` environment and `\anspic` command (§13.42.1).

```

141 \seq_new:N \l__enumext_anspic_args_seq
142 \dim_new:N \l__enumext_anspic_mini_width_dim
143 \int_new:N \l__enumext_anspic_above_int
144 \int_new:N \l__enumext_anspic_below_int
145 \bool_new:N \l__enumext_anspic_label_above_bool
146 \str_new:N \l__enumext_anspic_mini_pos_str

```

```

147 \box_new:N \l__enumext_anspic_label_box
148 \box_new:N \l__enumext_anspic_body_box
149 \dim_new:N \l__enumext_anspic_label_htdp_dim
150 \dim_new:N \l__enumext_anspic_body_htdp_dim

```

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

Internal variables used by “*internal check answer*” mechanism (§13.26.3) used by the `check-ans`, `no-store`, `wrap-key` keys and check for starred commands `\item*` in `keyans` and `keyans*` environments and `\anspic*` in `keyanspic` environment.

```

151 \bool_new:N \l__enumext_check_answers_bool
152 \bool_new:N \g__enumext_check_ans_key_bool
153 \tl_new:N \l__enumext_check_start_line_env_tl
154 \bool_new:N \l__enumext_item_wrap_key_bool
155 \int_new:N \g__enumext_check_starred_cmd_int
156 \int_new:N \g__enumext_item_anskey_int
157 \int_new:N \g__enumext_item_number_int
158 \bool_new:N \l__enumext_item_number_bool
159 \int_new:N \g__enumext_item_answer_diff_int

```

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

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

```

160 \bool_new:N \l__enumext_hyperref_bool
161 \bool_new:N \l__enumext_footnotes_key_bool

```

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

Internal variables used by `save-ref` key (§13.27). The variables `\l__enumext_label_copy_X_tl` correspond to temporary copies of the  $\langle labels \rangle$  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.

```

162 \tl_new:N \l__enumext_newlabel_arg_one_tl
163 \tl_new:N \l__enumext_newlabel_arg_two_tl
164 \tl_new:N \l__enumext_write_aux_file_tl
165 \cs_set_protected:Npn \__enumext_tmp:n #1
166 {
167   \tl_new:c { l__enumext_label_copy_#1_tl }
168 }
169 \clist_map_inline:nn { i, ii, iii, iv, v, vi, vii, viii } { \__enumext_tmp:n {#1} }

```

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

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

```

170 \int_new:N \g__enumext_footnote_standar_int
171 \int_new:N \g__enumext_footnote_starred_int
172 \seq_new:N \g__enumext_footnote_standar_arg_seq
173 \seq_new:N \g__enumext_footnote_starred_arg_seq
174 \seq_new:N \g__enumext_footnote_standar_int_seq
175 \seq_new:N \g__enumext_footnote_starred_int_seq

```

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

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

```

176 \cs_set_protected:Npn \__enumext_tmp:n #1
177 {
178   \bool_new:c { l__enumext_item_starred_#1_bool }
179   \int_new:c { l__enumext_item_column_pos_#1_int }
180   \int_new:c { g__enumext_item_count_all_#1_int }
181   \int_new:c { l__enumext_joined_item_#1_int }
182   \int_new:c { l__enumext_joined_item_aux_#1_int }
183   \int_new:c { l__enumext_tmpa_#1_int }
184   \dim_new:c { l__enumext_tmpa_#1_dim }
185   \box_new:c { l__enumext_item_text_#1_box }
186   \dim_new:c { l__enumext_joined_width_#1_dim }
187   \dim_new:c { l__enumext_item_width_#1_dim }
188   \tl_new:c { g__enumext_item_symbol_aux_#1_tl }

```

```

189 \str_new:c { \__enumext_align_label_#1_str }
190 \bool_new:c { g__enumext_minipage_active_#1_bool }
191 \box_new:c { \__enumext_miniright_code_#1_box }
192 \bool_new:c { g__enumext_minipage_center_#1_bool }
193 \dim_new:c { g__enumext_minipage_right_#1_dim }
194 \skip_new:c { g__enumext_minipage_right_#1_skip }
195 }
196 \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`.

```

197 \clist_const:Nn \c__enumext_all_envs_clist
198 {
199   {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv},
200   {keyans}{v}, {enumext*}{vii}, {keyans*}{viii}
201 }

```

(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).

```

202 \cs_generate_variant:Nn \keys_precompile:nnN { neN }
203 \cs_generate_variant:Nn \seq_use:Nn { NV }

```

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

`\__enumext_at_begin_document:n`

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

```

204 \cs_new_protected:Npn \__enumext_at_begin_document:n #1
205 {
206   \hook_gput_code:nnn {begindocument} {enumext} { #1 }
207 }

```

(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.

```

208 \cs_new_protected:Npn \__enumext_after_env:nn #1 #2
209 {
210   \hook_gput_code:nnn {env/#1/after} {enumext} {#2}
211 }
212 \cs_new_protected:Npn \__enumext_before_env:nn #1 #2
213 {
214   \hook_gput_code:nnn {env/#1/before} {enumext} {#2}
215 }

```

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

`\__enumext_level:`

Function for check current level in `enumext`.

```

216 \cs_new:Nn \__enumext_level:
217 {
218   \int_to_roman:n { \__enumext_level_int }
219 }

```

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

`\__enumext_if_is_int:nT`  
`\__enumext_if_is_int:nF`  
`\__enumext_if_is_int:nTF`

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

```

220 \prg_new_protected_conditional:Npnn \__enumext_if_is_int:n #1 { T, F, TF }
221 {
222   \regex_match:nnTF { ^[\+|-]?[\d]+$ } {#1} % $
223   { \prg_return_true: }
224   { \prg_return_false: }
225 }

```

(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.

```

226 \cs_new_protected:Nn \__enumext_regex_counter_style:
227 {
228   \tl_map_inline:Nn \c__enumext_counter_style_tl
229   {
230     \regex_replace_once:nnN { \c{##1}\* }
231     { \c{##1}\cB{\u{\__enumext_ref_the_count_tl}\cE} } \l__enumext_ref_key_arg_tl
232   }
233 }

```

(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.

```

234 \cs_new:Npn \__enumext_show_length:nnn #1 #2 #3
235 {
236   * ~ #2
237   \prg_replicate:nn { 14 - \str_count:n {#2} } { ~ }
238   = ~ \use:c { #1_use:c } { \__enumext_#2_#3_#1 } \\
239 }

```

(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.

```

240 \cs_new_protected:Nn \__enumext_unskip_unkern:
241 {
242   \int_case:nnT { \lastnodetype }
243   {
244     { 11 }{ \unskip }
245     { 12 }{ \unkern }
246   }
247 }

```

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

### 13.5.1 Utilities for environments and levels

`\__enumext_is_not_nested:``\__enumext_is_on_first_level:`

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`.

```

248 \cs_new_protected:Nn \__enumext_is_not_nested:
249 {
250   \str_case:en { \@currentenv }
251   {
252     {enumext}
253     {
254       \tl_set:Nn \l__enumext_envir_name_tl { enumext }
255       \bool_lazy_and:nnT
256       { \bool_not_p:n { \g__enumext_standar_bool } }
257       { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
258       {
259         \bool_gset_true:N \g__enumext_standar_bool
260       }
261     }
262     {enumext*}
263     {
264       \tl_set:Nn \l__enumext_envir_name_tl { enumext* }
265       \bool_lazy_and:nnT
266       { \bool_not_p:n { \g__enumext_starred_bool } }
267       { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
268       {
269         \bool_gset_true:N \g__enumext_starred_bool
270       }
271     }
272   }
273 }

```



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) and `\l__enumext_anskey_env_bool` (§13.31) 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.

```

274 \cs_new_protected:Nn \__enumext_is_on_first_level:
275 {
276   \bool_lazy_all:nT
277   {
278     { \bool_if_p:N \g__enumext_standar_bool }
279     { \int_compare_p:nNn { \l__enumext_level_int } = { 1 } }
280     { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
281   }
282   {
283     \bool_set_true:N \l__enumext_standar_first_bool
284     \bool_set_true:N \l__enumext_anskey_env_bool
285     \tl_gset:Nn \g__enumext_envir_name_tl { enumext }
286     \tl_gset:Ne \g__enumext_start_line_tl
287     {
288       on ~ line ~ \exp_not:V \inputlineno
289     }
290   }
291   \bool_lazy_all:nT
292   {
293     { \bool_if_p:N \g__enumext_starred_bool }
294     { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
295     { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
296   }
297   {
298     \bool_set_true:N \l__enumext_starred_first_bool
299     \bool_set_true:N \l__enumext_anskey_env_bool
300     \tl_gset:Nn \g__enumext_envir_name_tl { enumext* }
301     \tl_gset:Ne \g__enumext_start_line_tl
302     {
303       on ~ line ~ \exp_not:V \inputlineno
304     }
305   }
306 }

```

(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.

```

307 \cs_new_protected:Nn \__enumext_keyans_name_and_start:
308 {
309   \str_case:en { \@currenvir }
310   {
311     {keyans}
312     {
313       \tl_set:Nn \l__enumext_envir_name_tl { keyans }
314       \tl_set:Ne \l__enumext_check_start_line_env_tl
315       {
316         in ~ 'keyans' ~ start ~ on ~ line ~ \exp_not:V \inputlineno
317       }
318     }
319     {keyans*}
320     {
321       \tl_set:Nn \l__enumext_envir_name_tl { keyans* }
322       \tl_set:Ne \l__enumext_check_start_line_env_tl
323       {
324         in ~ 'keyans*' ~ start ~ on ~ line ~ \exp_not:V \inputlineno
325       }
326     }
327     {keyanspic}
328     {
329       \tl_set:Nn \l__enumext_envir_name_tl { keyanspic }
330       \tl_set:Ne \l__enumext_check_start_line_env_tl
331       {

```

```

332         in ~ 'keyanspic' ~ start ~ on ~ line ~ \exp_not:V \inputlineno
333     }
334 }
335 }
336 }

```

(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.

```

337 \cs_new_protected:Nn \__enumext_reset_global_vars:
338 {
339     \__enumext_reset_global_int:
340     \__enumext_reset_global_bool:
341     \__enumext_reset_global_tl:
342 }
343 \cs_new_protected:Nn \__enumext_reset_global_int:
344 {
345     \int_gzero:N \g__enumext_item_number_int
346     \int_gzero:N \g__enumext_item_anskey_int
347     \int_gzero:N \g__enumext_item_answer_diff_int
348 }
349 \cs_new_protected:Nn \__enumext_reset_global_bool:
350 {
351     \bool_gset_false:N \g__enumext_check_ans_key_bool
352     \bool_gset_false:N \g__enumext_standar_bool
353     \bool_gset_false:N \g__enumext_starred_bool
354 }
355 \cs_new_protected:Nn \__enumext_reset_global_tl:
356 {
357     \tl_gclear:N \g__enumext_store_name_tl
358     \tl_gclear:N \g__enumext_start_line_tl
359     \tl_gclear:N \g__enumext_envir_name_tl
360 }

```

(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.

```

361 \cs_new_protected:Nn \__enumext_log_global_vars:
362 {
363     \msg_log:nneeee { enumext } { prop-seq-int-hook }
364     { \g__enumext_store_name_tl }
365     { \prop_count:c { g__enumext_ \g__enumext_store_name_tl _prop } }
366     { \seq_count:c { g__enumext_ \g__enumext_store_name_tl _seq } }
367     { \int_use:c { g__enumext_resume_ \g__enumext_store_name_tl _int } }
368 }

```

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.

```

369 \cs_new_protected:Nn \__enumext_log_answer_vars:
370 {
371     \msg_log:nneee { enumext } { item-answer-hook }
372     { \int_use:N \g__enumext_item_number_int }
373     { \int_use:N \g__enumext_item_anskey_int }
374     { \int_eval:n { \g__enumext_item_number_int - \g__enumext_item_anskey_int } }
375 }

```

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

## 13.6 Copying list and minipage environments

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

```

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

```

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

```

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

```

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

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

```

376 \__enumext_at_begin_document:n
377 {
378   \cs_new_eq:NN \__enumext_start_list:nn \list
379   \cs_new_eq:NN \__enumext_stop_list: \endlist
380   \NewCommandCopy \__enumext_item_std:w \item
381 }

```

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

```

382 \__enumext_at_begin_document:n
383 {
384   \cs_new_eq:NN \__enumext_minipage:w \minipage
385   \cs_new_eq:NN \__enumext_endminipage: \endminipage
386 }

```

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

### 13.7 Compatibility with hyperref and footnotehyper

```

\__enumext_after_hyperref:
\__enumext_hypertarget:nn
\__enumext_phantomsection:

```

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

```

387 \hook_gput_code:nnn { begindocument } { enumext } { \__enumext_after_hyperref: }
388 \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”.

```

389 \cs_new_protected:Nn \__enumext_after_hyperref:
390 {
391   \IfPackageLoadedTF { hyperref }
392   {
393     \msg_info:nnn { enumext } { package-load } { hyperref }
394     \bool_set_true:N \l__enumext_hyperref_bool
395     \IfHyperBoolean{hyperfootnotes}
396     {
397       \bool_set_true:N \l__enumext_footnotes_key_bool
398     }
399     { }
400   }
401   { }

```

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`.

```

402 \bool_if:NT \l__enumext_footnotes_key_bool
403 {
404   \IfPackageLoadedTF { footnotehyper }
405   {
406     \msg_info:nnn { enumext } { package-load } { footnotehyper }
407   }
408   {
409     \bool_set_false:N \l__enumext_footnotes_key_bool
410   }
411 }

```

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.

```

412 \bool_if:NTF \l__enumext_hyperref_bool
413 {

```

```

414         \cs_new_eq:NN \__enumext_hypertarget:nn \hypertarget
415         \cs_new_eq:NN \__enumext_phantomsection: \phantomsection
416     }
417     {
418         \cs_new_eq:NN \__enumext_hypertarget:nn \use_none:nn
419         \cs_new_eq:NN \__enumext_phantomsection: \prg_do_nothing:
420     }
421 }

```

(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.

```

422 \cs_new_protected:Npn \__enumext_newlabel:nn #1 #2
423 {
424     \protected@write \@auxout { }
425     {
426         \token_to_str:N \newlabel {#1}
427         {
428             {#2}
429             \bool_if:NT \l__enumext_hyperref_bool
430             { { \thepage } {#2} {#1} }
431             { }
432         }
433     }
434     \__enumext_hypertarget:nn {#1} { }
435     \__enumext_phantomsection:
436 }

```

(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.

```

437 \cs_new_protected:Nn \__enumext_footnotetext:nn
438 {
439     \footnotetext[#1]{#2}
440 }
441 \cs_new_protected:Nn \__enumext_renew_footnote:
442 {
443     \RenewDocumentCommand \footnote { o +m }
444     {
445         \tl_if_novalue:nTF {##1}
446         {
447             \stepcounter{footnote}
448             \int_gset_eq:Nc \g__enumext_footnote_standar_int { c@footnote }
449         }
450         {
451             \int_gset:Nn \g__enumext_footnote_standar_int { ##1 }
452         }
453         \footnotemark [ \g__enumext_footnote_standar_int ]
454         \seq_gput_right:Nn \g__enumext_footnote_standar_arg_seq { ##2 }
455         \seq_gput_right:NV
456         \g__enumext_footnote_standar_int_seq \g__enumext_footnote_standar_int
457     }
458 }
459 \cs_new_protected:Nn \__enumext_print_footnote:
460 {
461     \seq_if_empty:NF \g__enumext_footnote_standar_int_seq
462     {
463         \seq_map_pairwise_function:NNN

```

```

464         \g__enumext_footnote_standar_int_seq
465         \g__enumext_footnote_standar_arg_seq
466         \__enumext_footnotetext:nn
467     }
468     \seq_gclear:N \g__enumext_footnote_standar_arg_seq
469     \seq_gclear:N \g__enumext_footnote_standar_int_seq
470 }

```

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.

```

471 \cs_new_protected:Nn \__enumext_renew_footnote_mini:
472 {
473     \RenewDocumentCommand \footnote { o +m }
474     {
475         \tl_if_novalue:nTF {##1}
476         {
477             \stepcounter{footnote}
478             \int_gset_eq:Nc \g__enumext_footnote_starred_int { c@footnote }
479         }
480         {
481             \int_gset:Nn \g__enumext_footnote_starred_int { ##1 }
482         }
483         \footnotemark [ \g__enumext_footnote_starred_int ]
484         \seq_gput_right:Nn \g__enumext_footnote_starred_arg_seq { ##2 }
485         \seq_gput_right:NV
486             \g__enumext_footnote_starred_int_seq \g__enumext_footnote_starred_int
487     }
488 }
489 \cs_new_protected:Nn \__enumext_print_footnote_mini:
490 {
491     \seq_if_empty:NF \g__enumext_footnote_starred_int_seq
492     {
493         \seq_map_pairwise_function:NNN
494             \g__enumext_footnote_starred_int_seq
495             \g__enumext_footnote_starred_arg_seq
496             \__enumext_footnotetext:nn
497     }
498     \seq_gclear:N \g__enumext_footnote_starred_arg_seq
499     \seq_gclear:N \g__enumext_footnote_starred_int_seq
500 }

```

(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.

```

501 \cs_new_protected:Nn \__enumext_renew_footnote_standar:
502 {
503     \bool_if:NT \g__enumext_standar_bool
504     {
505         \IfDocumentMetadataTF
506         {
507             \__enumext_renew_footnote:
508         }
509         {
510             \bool_if:NF \l__enumext_footnotes_key_bool
511             {
512                 \__enumext_renew_footnote:
513             }
514         }
515     }
516 }
517 \cs_new_protected:Nn \__enumext_print_footnote_standar:
518 {
519     \bool_if:NT \g__enumext_standar_bool
520     {
521         \IfDocumentMetadataTF
522         {
523             \__enumext_print_footnote:
524         }
525         {

```

```

526         \bool_if:NF \l__enumext_footnotes_key_bool
527         {
528             \__enumext_print_footnote:
529         }
530     }
531 }
532 }

```

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.

```

533 \cs_new_protected:Nn \__enumext_renew_footnote_starred:
534 {
535     \IfDocumentMetadataTF
536     {
537         \__enumext_renew_footnote_mini:
538     }
539     {
540         \bool_if:NF \l__enumext_footnotes_key_bool
541         {
542             \__enumext_renew_footnote_mini:
543         }
544     }
545 }
546 \cs_new_protected:Nn \__enumext_print_footnote_starred:
547 {
548     \IfDocumentMetadataTF
549     {
550         \__enumext_print_footnote_mini:
551     }
552     {
553         \bool_if:NF \l__enumext_footnotes_key_bool
554         {
555             \__enumext_print_footnote_mini:
556         }
557     }
558 }

```

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

```

559 \__enumext_after_env:n { enumext* }
560 {
561     \__enumext_print_footnote_starred:
562 }
563 \__enumext_after_env:n { keyans* }
564 {
565     \__enumext_print_footnote_starred:
566 }

```

(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)

```

567 \cs_new_protected:Nn \__enumext_internal_mini_page:
568 {
569     \int_compare:nNt { \l__enumext_level_int } = { 0 }
570     {
571         \DeclareDocumentEnvironment{__enumext_mini_page}{ m }
572         {
573             \__enumext_renew_footnote_standar:
574             \__enumext_minipage:w [ t ] { ##1 }
575             \legacy_if_gset_false:n { @minipage }
576             \skip_vertical:N \c_zero_skip
577         }
578     }
579 }

```



```

578         {
579             \skip_vertical:N \c_zero_skip
580             \__enumext_endminipage:
581             \__enumext_print_footnote_standar:
582         }
583     }
584 }

```

(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.

```

585 \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.

```

586 \cs_new_protected:Npn \__enumext_define_counters:Nn #1 #2
587 {
588     \cs_if_exist:cTF { c@ #2 }
589     { \msg_fatal:nnn { enumext } { counters } { #2 } }
590     {
591         \tl_set:Nn #1 { #2 }
592         \newcounter { #2 }
593     }
594 }

```

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.

```

595 \__enumext_define_counters:Nn \__enumext_counter_i_tl { enumXi }
596 \__enumext_define_counters:Nn \__enumext_counter_ii_tl { enumXii }
597 \__enumext_define_counters:Nn \__enumext_counter_iii_tl { enumXiii }
598 \__enumext_define_counters:Nn \__enumext_counter_iv_tl { enumXiv }
599 \__enumext_define_counters:Nn \__enumext_counter_v_tl { enumXv }
600 \__enumext_define_counters:Nn \__enumext_counter_vi_tl { enumXvi }
601 \__enumext_define_counters:Nn \__enumext_counter_vii_tl { enumXvii }
602 \__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.

```

603 \cs_new_protected:Npn \__enumext_register_counter_style:Nn #1 #2
604 {
605     \tl_const:cn { c__enumext_widest_ \cs_to_str:N #1 _tl } {#2}
606     \tl_gput_right:Nn \g__enumext_counter_styles_tl {#1}
607 }
608 \__enumext_register_counter_style:Nn \arabic { 0 }
609 \__enumext_register_counter_style:Nn \Alph { M }
610 \__enumext_register_counter_style:Nn \alph { m }
611 \__enumext_register_counter_style:Nn \Roman { VIII }
612 \__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.

```

613 \cs_new_protected:Npn \__enumext_label_width_by_box:Nn #1 #2
614 {
615   \hbox_set:Nn \l__enumext_label_width_by_box {#2}
616   \dim_set:Nn #1 { \box_wd:N \l__enumext_label_width_by_box }
617 }
618 \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.

```

619 \cs_new_protected:Npn \__enumext_label_style:Nnn #1 #2 #3
620 {
621   \tl_clear_new:N #1
622   \tl_put_right:Ne #1 { \tl_trim_spaces:n {#3} }
623   \tl_gset_eq:NN \g__enumext_widest_label_tl #1
624   \tl_map_inline:Nn \g__enumext_counter_styles_tl
625   {
626     \tl_replace_all:Nne #1 { ##1* } { \exp_not:N ##1 {#2} }
627     \tl_greplace_all:Nne \g__enumext_widest_label_tl { ##1* }
628     { \tl_use:c { c__enumext_widest_ \cs_to_str:N ##1 _tl } }
629   }
630   \__enumext_label_width_by_box:Nn \l__enumext_current_widest_dim
631   { \tl_use:N \g__enumext_widest_label_tl }
632   \tl_set_eq:cN { the #2 } #1
633 }
634 \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.

```

635 \cs_set_protected:Npn \__enumext_tmp:n #1
636 {
637   \keys_define:nn { enumext / #1 }
638   {
639     mode-box .bool_set:N = \l__enumext_mode_box_bool,
640     mode-box .initial:n = false,
641     mode-box .value_forbidden:n = true,
642   }
643 }
644 \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.

```

645 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
646 {
647   \keys_define:nn { enumext / #1 }
648   {
649     font .tl_set:c = { \l__enumext_label_font_style_#2_tl },
650     font .value_required:n = true,
651     labelsep .dim_set:c = { \l__enumext_labelsep_#2_dim },
652     labelsep .initial:n = {0.3333em},
653     labelsep .value_required:n = true,
654     labelwidth .dim_set:c = { \l__enumext_labelwidth_#2_dim },
655     labelwidth .value_required:n = true,
656     wrap-label .cs_set_protected:cp = { __enumext_wrapper_label_#2:n } ##1,
657     wrap-label .initial:n = {##1},
658     wrap-label .value_required:n = true,

```

```

659     wrap-label* .code:n = {
660         \bool_set_true:c { l__enumext_wrap_label_opt_#2_bool }
661         \keys_set:nn { enumext / #1 } { wrap-label = {##1} }
662     },
663     wrap-label* .value_required:n = true,
664 }
665 }
666 \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`.

```

667 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
668 {
669     \keys_define:nn { enumext / #1 }
670     {
671         align .choice:,
672         align / left .code:n =
673             {
674                 \tl_clear:c { l__enumext_label_fill_left_#2_tl }
675                 \tl_set:cn { l__enumext_label_fill_right_#2_tl } { \hfill }
676                 \str_set:cn { l__enumext_align_label_pos_#2_str } { l }
677             },
678         align / right .code:n =
679             {
680                 \tl_set:cn { l__enumext_label_fill_left_#2_tl } { \hfill }
681                 \tl_clear:c { l__enumext_label_fill_right_#2_tl }
682                 \str_set:cn { l__enumext_align_label_pos_#2_str } { r }
683             },
684         align / center .code:n =
685             {
686                 \tl_set:cn { l__enumext_label_fill_left_#2_tl } { \hfill }
687                 \tl_set:cn { l__enumext_label_fill_right_#2_tl } { \hfill }
688                 \str_set:cn { l__enumext_align_label_pos_#2_str } { c }
689             },
690         align / unknown .code:n =
691             \msg_error:nneee { enumext } { unknown-choice }
692             { align } { left, ~ right, ~ center } { \exp_not:n {##1} },
693         align .initial:n = left,
694         align .value_required:n = true,
695     }
696 }
697 \clist_map_inline:nn
698 {
699     {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {keyans}{v}
700 }
701 { \__enumext_tmp:nn #1 }
702 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
703 {
704     \keys_define:nn { enumext / #1 }
705     {
706         align .choice:,
707         align / left .code:n = \str_set:cn { l__enumext_align_label_#2_str } { l },
708         align / right .code:n = \str_set:cn { l__enumext_align_label_#2_str } { r },
709         align / center .code:n = \str_set:cn { l__enumext_align_label_#2_str } { c },
710         align / unknown .code:n =
711             \msg_error:nneee { enumext } { unknown-choice }
712             { align } { left, ~ right, ~ center } { \exp_not:n {##1} },
713         align .initial:n = left,
714         align .value_required:n = true,
715     }
716 }
717 \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

label Here we set the default *⟨labels⟩* of the *four levels* of `enumext` environment, along with the default value for  
 ref `labelwidth` key if it has not been established and `ref` key.

```

\l__enumext_label_i_tl 718 \cs_set_protected:Npn \__enumext_tmp:nnn #1 #2 #3
\l__enumext_label_ii_tl 719 {
\l__enumext_label_iii_tl 720   \keys_define:nn { enumext / #1 }
\l__enumext_label_iv_tl 721   {
722     label .code:n = {
723       \__enumext_label_style:cnv { l__enumext_label_#2_tl }
724       { l__enumext_counter_#2_tl } {##1}
725       \dim_compare:nNnT
726       { \dim_use:c { l__enumext_labelwidth_#2_dim } }
727       =
728       { \c_zero_dim }
729       {
730         \dim_set_eq:cN { l__enumext_labelwidth_#2_dim }
731         \l__enumext_current_widest_dim
732       }
733     },
734     label .initial:n = #3,
735     label .value_required:n = true,
736     ref .code:n = \__enumext_standar_ref:n {##1},
737     ref .value_required:n = true,
738   }
739 }
740 \__enumext_tmp:nnn { level-1 } { i } { \arabic*. }
741 \__enumext_tmp:nnn { level-2 } { ii } { (\alph*) }
742 \__enumext_tmp:nnn { level-3 } { iii } { \roman*. }
743 \__enumext_tmp:nnn { level-4 } { iv } { \Alph*. }
```

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

\\_\_enumext\_standar\_ref:n The \\_\_enumext\_standar\_ref:n first we will pass the key argument to \\_\_enumext\_ref\_key\_arg\_tl  
 \\_\_enumext\_standar\_ref: and we will analyze its state, if it is not *empty* we will make a copy of the current counter in \\_\_enumext\_ref\_the\_count\_tl and we will execute the function \\_\_enumext\_regex\_counter\_style: which will return the modified \\_\_enumext\_ref\_key\_arg\_tl and we make the value of \\_\_enumext\_ref\_the\_count\_tl the same as that \\_\_enumext\_the\_counter\_X\_tl which contains \theenumX and finally we set \\_\_enumext\_renew\_the\_count\_X\_tl with the renewed command.

```

744 \cs_new_protected:Npn \__enumext_standar_ref:n #1
745 {
746   \tl_set:Nn \__enumext_ref_key_arg_tl {#1}
747   \tl_if_empty:NTF \__enumext_ref_key_arg_tl
748   {
749     \msg_error:nnn { enumext } { key-ref-empty } { enumext }
750   }
751   {
752     \tl_set_eq:Nc
753     \__enumext_ref_the_count_tl { l__enumext_counter_ \__enumext_level: _tl }
754     \__enumext_regex_counter_style:
755     \tl_set_eq:Nc
756     \__enumext_ref_the_count_tl { l__enumext_the_counter_ \__enumext_level: _tl }
757     \tl_put_right:ce { l__enumext_renew_the_count_ \__enumext_level: _tl }
758     {
759       \exp_not:N \renewcommand { \exp_not:V \__enumext_ref_the_count_tl } { \exp_not:V \l__
760     }
761   }
762 }
```

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

```

763 \cs_new_protected:Nn \__enumext_standar_ref:
764 {
765   \tl_if_empty:cF { l__enumext_renew_the_count_ \__enumext_level: _tl }
766   {
767     \tl_use:c { l__enumext_renew_the_count_ \__enumext_level: _tl }
768   }
769 }
```

(End of definition for \\_\_enumext\_standar\_ref:n and \\_\_enumext\_standar\_ref:.)

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

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

```

label
ref
\l__enumext_label_vii_tl 770 \cs_set_protected:Npn \l__enumext_tmp:nnn #1 #2 #3
\l__enumext_label_viii_tl 771 {
772   \keys_define:nn { enumext / #1 }
773   {
774     label .code:n = {
775       \__enumext_label_style:cvn { \l__enumext_label_#2_tl }
776       { \l__enumext_counter_#2_tl } {##1}
777       \dim_compare:nNnT
778       { \dim_use:c { \l__enumext_labelwidth_#2_dim } }
779       =
780       { \c_zero_dim }
781       {
782         \dim_set_eq:cN { \l__enumext_labelwidth_#2_dim }
783         \l__enumext_current_widest_dim
784       }
785     },
786     label .initial:n = #3,
787     label .value_required:n = true,
788     ref .code:n = \__enumext_starred_ref:n {##1},
789     ref .value_required:n = true,
790   }
791 }
792 \__enumext_tmp:nnn { enumext* } { vii } { \arabic*.}
793 \__enumext_tmp:nnn { keyans* } { viii } { \Alph*.}

```

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

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

```

\__enumext_starred_ref:n 794 \cs_new_protected:Npn \__enumext_starred_ref:n #1
\__enumext_starred_ref:n 795 {
796   \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
797   \int_compare:nNnT { \l__enumext_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 } { enumext* }
802     }
803     {
804       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_counter_vii_tl
805       \__enumext_regex_counter_style:
806       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_vii_tl
807       \tl_put_right:Ne \l__enumext_renew_the_count_vii_tl
808       {
809         \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V
810       }
811     }
812   }
813   \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
814   {
815     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
816     {
817       \msg_error:nnn { enumext } { key-ref-empty } { keyans* }
818     }
819     {
820       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_counter_viii_tl
821       \__enumext_regex_counter_style:
822       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_viii_tl
823       \tl_put_right:Ne \l__enumext_renew_the_count_viii_tl
824       {
825         \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V
826       }
827     }
828   }
829 }

```

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.

```

830 \cs_new_protected:Nn \__enumext_starred_ref:

```

```

831 {
832   \int_compare:nNt { \l__enumext_level_h_int } = { 1 }
833   {
834     \tl_if_empty:NF \l__enumext_renew_the_count_vii_tl
835     {
836       \tl_use:N \l__enumext_renew_the_count_vii_tl
837     }
838   }
839   \int_compare:nNt { \l__enumext_keyans_level_h_int } = { 1 }
840   {
841     \tl_if_empty:NF \l__enumext_renew_the_count_viii_tl
842     {
843       \tl_use:N \l__enumext_renew_the_count_viii_tl
844     }
845   }
846 }

```

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

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

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

```

\__enumext_label_v_tl
\__enumext_label_vi_tl
847 \keys_define:nn { enumext / keyans }
848 {
849   label .code:n = {
850     \__enumext_label_style:cnv { \__enumext_label_v_tl }
851     { \__enumext_counter_v_tl } {#1}
852     \__enumext_label_style:cnv { \__enumext_label_vi_tl }
853     { \__enumext_counter_vi_tl } {#1}
854     \dim_compare:nNt
855     { \__enumext_labelwidth_v_dim } = { \c_zero_dim }
856     {
857       \dim_set_eq:NN \__enumext_labelwidth_v_dim \__enumext_current_wide
858     }
859   },
860   label .initial:n = \Alph*,
861   label .value_required:n = true,
862   ref .code:n = \__enumext_keyans_ref:n {#1},
863   ref .value_required:n = true,
864 }

```

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

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

```

\__enumext_keyans_ref:n
\__enumext_keyans_ref:
865 \cs_new_protected:Npn \__enumext_keyans_ref:n #1
866 {
867   \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
868   \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
869   {
870     \msg_error:nnn { enumext } { key-ref-empty } { keyans }
871   }
872   {
873     \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_counter_v_tl
874     \__enumext_regex_counter_style:
875     \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_v_tl
876     \tl_put_right:Ne \l__enumext_renew_the_count_v_tl
877     {
878       \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V \l__
879     }
880   }
881 }

```

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

```

882 \cs_new_protected:Nn \__enumext_keyans_ref:
883 {
884   \tl_if_empty:NF \l__enumext_renew_the_count_v_tl
885   {
886     \tl_use:N \l__enumext_renew_the_count_v_tl
887   }
888 }

```



(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.

```
889 \cs_new_protected:Npn \__enumext_start_from:NNn #1 #2 #3
890 {
891   \__enumext_if_is_int:nTF { #3 }
892   {
893     \int_set:Nn #2 {#3}
894   }
895   {
896     \regex_match:nVT { \c{Alph} | \c{alph} } {#1}
897     { \int_set:Nn #2 { \int_from_alph:n {#3} } }
898     \regex_match:nVT { \c{Roman} | \c{roman} } {#1}
899     { \int_set:Nn #2 { \int_from_roman:n {#3} } }
900   }
901 }
902 \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.

```
903 \cs_new_protected:Npn \__enumext_widest_from:nNNn #1 #2 #3 #4
904 {
905   \__enumext_if_is_int:nTF {#4}
906   {
907     \setcounter{enumX#1} { #4 }
908   }
909   {
910     \regex_match:nVT { \c{Alph} | \c{alph} } {#2}
911     { \setcounter{enumX#1} { \int_from_alph:n {#4} } }
912     \regex_match:nVT { \c{Roman} | \c{roman} } {#2}
913     { \setcounter{enumX#1} { \int_from_roman:n {#4} } }
914   }
915   \__enumext_label_width_by_box:cv
916   { \__enumext_labelwidth_#1_dim } { \__enumext_label_#1_tl }
917 }
918 \cs_generate_variant:Nn \__enumext_widest_from:nNNn { nccn }
```

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

```
start
start*
widest
```

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

```
919 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
920 {
921   \keys_define:nn { enumext / #1 }
922   {
923     start* .code:n = {
924       \__enumext_start_from:ccn
925       { \__enumext_label_#2_tl }
926       { \__enumext_start_#2_int } {##1}
927     },
928     start* .value_required:n = true,
929     start .code:n = {
930       \__enumext_start_from:cce
```

```

931             { l__enumext_label_#2_tl }
932             { l__enumext_start_#2_int } { \int_eval:n {##1} }
933         },
934         start .initial:n = 1,
935         start .value_required:n = true,
936         widest .code:n = {
937             \__enumext_widest_from:nccn {#2}
938             { l__enumext_label_#2_tl }
939             { l__enumext_labelwidth_#2_dim } {##1}
940         },
941         widest .value_required:n = true,
942     }
943 }
944 \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.

```

topsep  \cs_set_protected:Npn \__enumext_tmp:nnnnnn #1 #2 #3 #4 #5 #6
partopsep {
parsep   \keys_define:nn { enumext / #1 }
noitemsep {
nosep    {
945         topsep .skip_set:c = { l__enumext_topsep_#2_skip },
946         topsep .initial:n = {#3},
947         topsep .value_required:n = true,
948         partopsep .skip_set:c = { l__enumext_partopsep_#2_skip },
949         partopsep .initial:n = {#4},
950         partopsep .value_required:n = true,
951         parsep .skip_set:c = { l__enumext_parsep_#2_skip },
952         parsep .initial:n = {#5},
953         parsep .value_required:n = true,
954         itemsep .skip_set:c = { l__enumext_itemsep_#2_skip },
955         itemsep .initial:n = {#6},
956         itemsep .value_required:n = true,
957         noitemsep .meta:n = { itemsep = 0pt, parsep = 0pt },
958         noitemsep .value_forbidden:n = true,
959         nosep .meta:n = {
960             itemsep = 0pt, parsep= 0pt,
961             topsep = 0pt, partopsep = 0pt,
962         },
963         nosep .value_forbidden:n = true,
964     }
965 }
966 }
967 }
968 }
969 }

```

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

```

970 \__enumext_tmp:nnnnnn { level-1 } { i } { 8.0pt plus 2.0pt minus 4.0pt }
971 { 2.0pt plus 1.0pt minus 1.0pt } { 4.0pt plus 2.0pt minus 1.0pt }
972 { 4.0pt plus 2.0pt minus 1.0pt }
973 \__enumext_tmp:nnnnnn { level-2 } { ii } { 4.0pt plus 2.0pt minus 1.0pt }
974 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
975 { 2.0pt plus 1.0pt minus 1.0pt }
976 \__enumext_tmp:nnnnnn { level-3 } { iii } { 2.0pt plus 1.0pt minus 1.0pt }
977 { 1.0pt minus 1.0pt } { 0pt } { 2.0pt plus 1.0pt minus 1.0pt }
978 \__enumext_tmp:nnnnnn { level-4 } { iv } { 2.0pt plus 1.0pt minus 1.0pt }
979 { 1.0pt minus 1.0pt } { 0pt } { 2.0pt plus 1.0pt minus 1.0pt }
980 \__enumext_tmp:nnnnnn { keyans } { v } { 4.0pt plus 2.0pt minus 1.0pt }
981 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
982 { 2.0pt plus 1.0pt minus 1.0pt }
983 \__enumext_tmp:nnnnnn { enumext* } { vii } { 8.0pt plus 2.0pt minus 4.0pt }
984 { 2.0pt plus 1.0pt minus 1.0pt } { 4.0pt plus 2.0pt minus 1.0pt }
985 { 4.0pt plus 2.0pt minus 1.0pt }
986 \__enumext_tmp:nnnnnn { keyans* } { viii } { 4.0pt plus 2.0pt minus 1.0pt }
987 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
988 { 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.

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

```

base-fix
\__enumext_nested_base_line_fix:
989 \keys_define:nn { enumext / level-1 }
990 {
991   base-fix .bool_set:N = \l__enumext_base_line_fix_bool,
992   base-fix .initial:n = false,
993   base-fix .value_forbidden:n = true,
994 }
```

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 `\l__enumext_print_keyans_star_bool` set by the `\printkeyans` command is false and the variable `\l__enumext_base_line_fix_bool` is true.

```

995 \cs_new_protected:Nn \__enumext_nested_base_line_fix:
996 {
997   \bool_lazy_all:nT
998   {
999     { \bool_if_p:N \l__enumext_starred_first_bool }
1000     { \bool_if_p:N \l__enumext_base_line_fix_bool }
1001     { \bool_not_p:n { \l__enumext_print_keyans_star_bool } }
1002   }
1003   {
1004     \mode_leave_vertical:
1005     \vspace { -\dim_eval:n { \baselineskip + \parsep } }
1006   }

```

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

```

1007   \bool_lazy_and:nnT
1008   { \bool_if_p:N \l__enumext_starred_first_bool }
1009   { \bool_if_p:N \l__enumext_print_keyans_star_bool }
1010   {
1011     \mode_leave_vertical:
1012     \skip_vertical:n { -\baselineskip }
1013     \skip_vertical:N \c_zero_skip
1014   }

```

Finally we set the values of the keys `topsep`, `above` and `above*` for the “first level” of `enumext` environment equal to `0pt` and set the variable `\l__enumext_base_line_fix_bool` to false.

```

1015   \keys_set:nn { enumext / level-1 }
1016   {
1017     topsep = 0pt, above = 0pt, above* = 0pt,
1018   }
1019   \bool_set_false:N \l__enumext_base_line_fix_bool
1020 }
```

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

### 13.18 Setting keys for horizontal spaces

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

```

1021 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1022 {
1023   \keys_define:nn { enumext / #1 }
1024   {
1025     itemindent .dim_set:c = { \l__enumext_fake_item_indent_#2_dim },
1026     itemindent .value_required:n = true,
1027     rightmargin .dim_set:c = { \l__enumext_rightmargin_#2_dim },
1028     rightmargin .value_required:n = true,
1029     listparindent .dim_set:c = { \l__enumext_listparindent_#2_dim },

```

```

1030     listparindent .value_required:n = true,
1031     list-offset   .dim_set:c = { l__enumext_listoffset_#2_dim },
1032     list-offset   .value_required:n = true,
1033     list-indent   .code:n      =
1034                     \bool_set_true:c { l__enumext_leftmargin_tmp_#2_bool }
1035                     \dim_set:cn { l__enumext_leftmargin_tmp_#2_dim } {##1},
1036     list-indent   .value_required:n = true,
1037   }
1038 }
1039 \clist_map_inline:nn
1040 {
1041   {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {keyans}{v}
1042 }
1043 { \__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.

```

1044 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1045 {
1046   \keys_define:nn { enumext / #1 }
1047   {
1048     itemindent .dim_set:c = { l__enumext_fake_item_indent_#2_dim },
1049     itemindent .value_required:n = true,
1050     rightmargin .dim_set:c = { l__enumext_rightmargin_#2_dim },
1051     rightmargin .value_required:n = true,
1052     listparindent .dim_set:c = { l__enumext_listparindent_#2_dim },
1053     listparindent .value_required:n = true,
1054     list-offset .dim_set:c = { l__enumext_listoffset_#2_dim },
1055     list-offset .value_required:n = true,
1056     list-indent .meta:n      = { list-offset = ##1 },
1057     list-indent .value_required:n = true,
1058   }
1059 }
1060 \clist_map_inline:nn
1061 {
1062   {enumext*}{vii}, {keyans*}{viii}
1063 }
1064 { \__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.

```

1065 \cs_set_protected:Nn \__enumext_fake_item_indent:
1066 {
1067   \dim_compare:nNnT
1068   { \dim_use:c { l__enumext_fake_item_indent_ \__enumext_level: _dim } }
1069   >
1070   { \c_zero_dim }
1071   {
1072     \tl_set:ce { l__enumext_fake_item_indent_ \__enumext_level: _tl }
1073     {
1074       \exp_not:N \mode_leave_vertical:
1075       \exp_not:n { \skip_horizontal:n }
1076       { \dim_use:c { l__enumext_fake_item_indent_ \__enumext_level: _dim } }
1077       \exp_not:N \ignorespaces
1078     }
1079   }
1080 }
1081 \cs_set_protected:Nn \__enumext_keyans_fake_item_indent:
1082 {
1083   \dim_compare:nNnT
1084   { \l__enumext_fake_item_indent_v_dim } > { \c_zero_dim }
1085   {
1086     \tl_set:Ne \l__enumext_fake_item_indent_v_tl
1087     {
1088       \exp_not:N \mode_leave_vertical:
1089       \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_v_dim

```

```

1090         \exp_not:N \ignorespaces
1091     }
1092 }
1093 }
1094 \cs_set_protected:Nn \__enumext_fake_item_indent_vii:
1095 {
1096     \dim_compare:nNnT
1097     { \l__enumext_fake_item_indent_vii_dim } > { \c_zero_dim }
1098     {
1099         \tl_set:Nc \l__enumext_fake_item_indent_vii_tl
1100         {
1101             \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_vii_dim
1102             \exp_not:N \ignorespaces
1103         }
1104     }
1105 }
1106 \cs_set_protected:Nn \__enumext_fake_item_indent_viii:
1107 {
1108     \dim_compare:nNnT
1109     { \l__enumext_fake_item_indent_viii_dim } > { \c_zero_dim }
1110     {
1111         \tl_set:Nc \l__enumext_fake_item_indent_viii_tl
1112         {
1113             \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_viii_dim
1114             \exp_not:N \ignorespaces
1115         }
1116     }
1117 }

```

(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.

```

1118 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1119 {
1120     \keys_define:nn { enumext / #1 }
1121     {
1122         show-length .bool_set:c = { \l__enumext_show_length_#2_bool },
1123         show-length .initial:n = false,
1124     }
1125 }
1126 \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.

```

1127 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1128 {
1129     \keys_define:nn { enumext / #1 }
1130     {
1131         before .tl_set:c = { \l__enumext_before_no_starred_key_#2_tl },
1132         before .value_required:n = true,
1133         before* .tl_set:c = { \l__enumext_before_starred_key_#2_tl },
1134         before* .value_required:n = true,
1135         after .tl_set:c = { \l__enumext_after_stop_list_#2_tl },
1136         after .value_required:n = true,
1137         first .tl_set:c = { \l__enumext_after_list_args_#2_tl },
1138         first .value_required:n = true,
1139     }
1140 }
1141 \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⟩}`.

```
1142 \cs_new_protected:Nn \__enumext_before_args_exec:
1143 {
1144   \tl_use:c { l__enumext_before_starred_key_ \__enumext_level: _tl }
1145 }
```

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⟩}`

```
1146 \cs_new_protected:Nn \__enumext_before_keys_exec:
1147 {
1148   \tl_use:c { l__enumext_before_no_starred_key_ \__enumext_level: _tl }
1149 }
```

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

```
1150 \cs_new_protected:Nn \__enumext_after_stop_list:
1151 {
1152   \tl_use:c { l__enumext_after_stop_list_ \__enumext_level: _tl }
1153 }
```

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.`

```
1154 \cs_new_protected:Nn \__enumext_after_args_exec:
1155 {
1156   \tl_use:c { l__enumext_after_list_args_ \__enumext_level: _tl }
1157 }
```

(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:

1158 \cs_new_protected:Nn \__enumext_before_args_exec_v:
1159 {
1160   \tl_use:N \l__enumext_before_starred_key_v_tl
1161 }
1162 \cs_new_protected:Nn \__enumext_before_keys_exec_v:
1163 {
1164   \tl_use:N \l__enumext_before_no_starred_key_v_tl
1165 }
1166 \cs_new_protected:Nn \__enumext_after_stop_list_v:
1167 {
1168   \tl_use:N \l__enumext_after_stop_list_v_tl
1169 }
1170 \cs_new_protected:Nn \__enumext_after_args_exec_v:
1171 {
1172   \tl_use:N \l__enumext_after_list_args_v_tl
1173 }
```

(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:

1174 \cs_new_protected:Nn \__enumext_before_args_exec_vii:
1175 {
1176   \tl_use:N \l__enumext_before_starred_key_vii_tl
1177 }
1178 \cs_new_protected:Nn \__enumext_before_args_exec_viii:
1179 {
1180   \tl_use:N \l__enumext_before_starred_key_viii_tl
1181 }
1182 \cs_new_protected:Nn \__enumext_before_keys_exec_vii:
1183 {
1184   \tl_use:N \l__enumext_before_no_starred_key_vii_tl
1185 }
1186 \cs_new_protected:Nn \__enumext_before_keys_exec_viii:
1187 {
```



```

1188     \tl_use:N \l__enumext_before_no_starred_key_viii_tl
1189   }
1190   \cs_new_protected:Nn \__enumext_after_stop_list_vii:
1191   {
1192     \tl_use:N \l__enumext_after_stop_list_vii_tl
1193   }
1194   \cs_new_protected:Nn \__enumext_after_stop_list_viii:
1195   {
1196     \tl_use:N \l__enumext_after_stop_list_viii_tl
1197   }
1198   \cs_new_protected:Nn \__enumext_after_args_exec_vii:
1199   {
1200     \tl_use:N \l__enumext_after_list_args_vii_tl
1201   }
1202   \cs_new_protected:Nn \__enumext_after_args_exec_viii:
1203   {
1204     \tl_use:N \l__enumext_after_list_args_viii_tl
1205   }

```

(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.

```

1206   \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1207   {
1208     \keys_define:nn { enumext / #1 }
1209     {
1210       mini-env .dim_set:c = { l__enumext_minipage_right_#2_dim },
1211       mini-env .value_required:n = true,
1212       mini-sep .dim_set:c = { l__enumext_minipage_hsep_#2_dim },
1213       mini-sep .initial:n = 0.3333em,
1214       mini-sep .value_required:n = true,
1215       columns-sep .dim_set:c = { l__enumext_columns_sep_#2_dim },
1216       columns-sep .value_required:n = true,
1217       columns .int_set:c = { l__enumext_columns_#2_int },
1218       columns .initial:n = 1,
1219       columns .value_required:n = true,
1220     }
1221   }
1222   \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.

```

1223   \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1224   {
1225     \keys_define:nn { enumext / #1 }
1226     {
1227       mini-right .tl_gset:c = { g__enumext_miniright_code_#2_tl },
1228       mini-right .value_required:n = true,
1229       mini-right* .code:n = {
1230         \bool_gset_true:c { g__enumext_minipage_center_#2_bool }
1231         \keys_set:nn { enumext / #1 } { mini-right = {##1} }
1232       },
1233       mini-right* .value_required:n = true,
1234     }
1235   }
1236   \clist_map_inline:nn { {enumext*}{vii}, {keyans*}{viii} } { \__enumext_tmp:nn #1 }

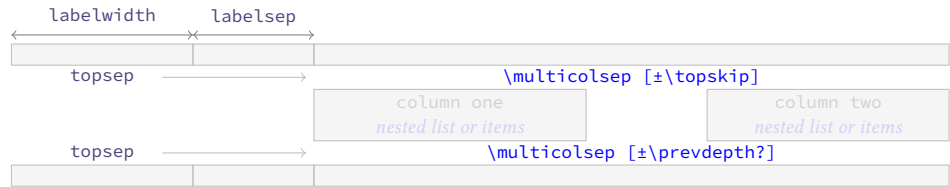
```

(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 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  $\text{\TeX}$  is in *horizontal mode*, then we will make the settings for the *vertical mode* in which `\partopsep` comes into play.

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

```

1237 \cs_new_protected:Nn \__enumext_multi_set_vskip:
1238 {
1239   \skip_set:cn { \l__enumext_multicols_above_ \__enumext_level: _skip }
1240   {
1241     \skip_use:c { \l__enumext_topsep_ \__enumext_level: _skip }
1242   }
1243   \skip_set:cn { \l__enumext_multicols_below_ \__enumext_level: _skip }
1244   {
1245     \skip_use:c { \l__enumext_topsep_ \__enumext_level: _skip }
1246   }
1247   \__enumext_add_pre_parsep:
1248 }

```

(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*.

```

1249 \cs_new_protected:Nn \__enumext_add_pre_parsep:
1250 {
1251   \int_case:nn { \l__enumext_level_int }
1252   {
1253     { 2 }{
1254       \skip_if_eq:nnF { \l__enumext_parsep_i_skip } { \c_zero_skip }
1255       {
1256         \skip_add:Nn \l__enumext_multicols_above_ii_skip
1257         {
1258           \l__enumext_parsep_i_skip
1259         }
1260       }
1261     }
1262     { 3 }{
1263       \skip_if_eq:nnF { \l__enumext_parsep_ii_skip } { \c_zero_skip }
1264       {
1265         \skip_add:Nn \l__enumext_multicols_above_iii_skip
1266         {
1267           \l__enumext_parsep_ii_skip
1268         }
1269       }
1270     }
1271     { 4 }{
1272       \skip_if_eq:nnF { \l__enumext_parsep_iii_skip } { \c_zero_skip }
1273       {
1274         \skip_add:Nn \l__enumext_multicols_above_iv_skip
1275         {
1276           \l__enumext_parsep_iii_skip
1277         }
1278       }
1279     }
1280   }

```

```

1278         }
1279     }
1280 }
1281 }

```

(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 T<sub>E</sub>X is in *horizontal mode* or *vertical mode*.

```

1282 \cs_new_protected:Nn \__enumext_multi_addvspace:
1283 {
1284     \__enumext_multi_set_vskip:
1285     \mode_if_vertical:T
1286     {
1287         \skip_add:cn { l__enumext_multicols_above_ \__enumext_level: _skip }
1288         {
1289             \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
1290         }
1291         \skip_add:cn { l__enumext_multicols_below_ \__enumext_level: _skip }
1292         {
1293             \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
1294         }
1295     }
1296     \par\nopagebreak
1297     \addvspace{ \skip_use:c { l__enumext_multicols_above_ \__enumext_level: _skip } }
1298 }

```

(End of definition for `\__enumext_multi_addvspace:`)

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

`\__enumext_keyans_multi_set_vskip:`

`\__enumext_keyans_multi_addvspace:`

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

```

1299 \cs_new_protected:Nn \__enumext_keyans_multi_set_vskip:
1300 {
1301     \skip_set:Nn \l__enumext_multicols_above_v_skip
1302     {
1303         \l__enumext_topsep_v_skip
1304     }
1305     \skip_set:Nn \l__enumext_multicols_below_v_skip
1306     {
1307         \l__enumext_topsep_v_skip
1308     }
1309 }
1310 \cs_new_protected:Nn \__enumext_keyans_multi_addvspace:
1311 {
1312     \__enumext_keyans_multi_set_vskip:
1313     \mode_if_vertical:T
1314     {
1315         \skip_add:Nn \l__enumext_multicols_above_v_skip
1316         {
1317             \skip_use:N \l__enumext_partopsep_v_skip
1318         }
1319         \skip_add:Nn \l__enumext_multicols_below_v_skip
1320         {
1321             \skip_use:N \l__enumext_partopsep_v_skip
1322         }
1323     }
1324     \par\nopagebreak
1325     \addvspace{ \l__enumext_multicols_above_v_skip }
1326 }

```

(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

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

First we will set the value of `\l__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 `\l__enumext_minipage_after_skip`.

```

1327 \cs_new_protected:Nn \__enumext_minipage_set_skip:
1328 {
1329   \skip_set:Nn \l__enumext_minipage_right_skip
1330   {
1331     \skip_use:c { \l__enumext_topsep_ \__enumext_level: _skip }
1332   }
1333   \mode_if_vertical:T
1334   {
1335     \skip_add:Nn \l__enumext_minipage_right_skip
1336     {
1337       \skip_use:c { \l__enumext_partopsep_ \__enumext_level: _skip }
1338     }
1339   }
1340   \skip_set_eq:NN \l__enumext_minipage_after_skip \l__enumext_minipage_right_skip

```

We will adjust the values `\l__enumext_multicols_above_X_skip` and `\l__enumext_multicols_below_X_skip` and call the function `\__enumext_pre_itemsep_skip:`.

```

1341   \skip_set_eq:cN
1342   { \l__enumext_multicols_above_ \__enumext_level: _skip } \l__enumext_minipage_right_skip
1343   \skip_set_eq:cN
1344   { \l__enumext_multicols_below_ \__enumext_level: _skip } \l__enumext_minipage_right_skip
1345   \__enumext_pre_itemsep_skip:

```

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

```

1346   \int_compare:nNnT
1347   { \int_use:c { \l__enumext_columns_ \__enumext_level: _int } } > { 1 }
1348   {
1349     \skip_zero:N \topskip
1350     \skip_set_eq:Nc \multicolsep { \l__enumext_multicols_above_ \__enumext_level: _skip }
1351   }
1352 }

```

The function `\__enumext_minipage_add_space:` will apply the spaces on the “left side” using `\addvspace` “above” the `__enumext_mini_page` environment, taking into account whether  $\text{\TeX}$  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*.

```

1353 \cs_new_protected:Nn \__enumext_minipage_add_space:
1354 {
1355   \__enumext_minipage_set_skip:
1356   \__enumext_unskip_unkern:
1357   \mode_if_vertical:TF
1358   {
1359     \nopagebreak\nointerlineskip

```

```

1360     }
1361     {
1362         \par\nopagebreak\nointerlineskip
1363         \skip_zero:c { \l__enumext_partopsep_ \l__enumext_level: \_skip }
1364     }
1365     \int_compare:nNnTF
1366     { \int_use:c { \l__enumext_columns_ \l__enumext_level: \_int } } > { 1 }
1367     {
1368         \addvspace{ 0.445\box_ht:N \strutbox }
1369     }
1370     {
1371         \addvspace{ 0.250\box_ht:N \strutbox }
1372     }
1373 }

```

(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.

```

1374 \cs_new_protected:Nn \l__enumext_pre_itemsep_skip:
1375 {
1376     \int_case:nn { \l__enumext_level_int }
1377     {
1378         { 2 }{
1379             \skip_if_eq:nnTF
1380             { \l__enumext_itemsep_i_skip } { \l__enumext_minipage_after_skip }
1381             {
1382                 \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1383                 \skip_set:Nn \l__enumext_multicols_below_ii_skip { 0.350\box_ht:N \strutbox }
1384             }
1385             {
1386                 \dim_compare:nNnT
1387                 { \l__enumext_itemsep_i_skip } < { \l__enumext_minipage_after_skip }
1388                 {
1389                     \skip_sub:Nn
1390                     \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1391                     \skip_sub:Nn
1392                     \l__enumext_multicols_below_ii_skip { \l__enumext_itemsep_i_skip }
1393                     \skip_add:Nn
1394                     \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1395                     \skip_add:Nn
1396                     \l__enumext_multicols_below_ii_skip { 0.350\box_ht:N \strutbox }
1397                 }
1398                 \dim_compare:nNnT
1399                 { \l__enumext_itemsep_i_skip } > { \l__enumext_minipage_after_skip }
1400                 {
1401                     \skip_set:Nn \l__enumext_minipage_temp_skip
1402                     {
1403                         \l__enumext_itemsep_i_skip - \l__enumext_minipage_after_skip
1404                     }
1405                     \skip_sub:Nn
1406                     \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1407                     \skip_sub:Nn
1408                     \l__enumext_multicols_below_ii_skip { \l__enumext_itemsep_i_skip }
1409                     \skip_add:Nn
1410                     \l__enumext_minipage_after_skip
1411                     { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1412                     \skip_add:Nn
1413                     \l__enumext_multicols_below_ii_skip
1414                     { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1415                 }
1416             }
1417         }
1418         { 3 }{
1419             \skip_if_eq:nnTF
1420             { \l__enumext_itemsep_ii_skip } { \c_zero_skip }
1421             {
1422                 \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1423                 \skip_set:Nn \l__enumext_multicols_below_iii_skip { 0.350\box_ht:N \strutbox }
1424             }

```

```

1425 {
1426   \dim_compare:nNnT
1427   { \l__enumext_itemsep_ii_skip } < { \l__enumext_minipage_after_skip }
1428   {
1429     \skip_sub:Nn
1430     \l__enumext_minipage_after_skip { \l__enumext_itemsep_ii_skip }
1431     \skip_sub:Nn
1432     \l__enumext_multicols_below_iii_skip { \l__enumext_itemsep_ii_skip }
1433     \skip_add:Nn
1434     \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1435     \skip_add:Nn
1436     \l__enumext_multicols_below_iii_skip { 0.350\box_ht:N \strutbox }
1437   }
1438   \dim_compare:nNnT
1439   { \l__enumext_itemsep_ii_skip } > { \l__enumext_minipage_after_skip }
1440   {
1441     \skip_set:Nn \l__enumext_minipage_temp_skip
1442     {
1443       \l__enumext_itemsep_ii_skip - \l__enumext_minipage_after_skip
1444     }
1445     \skip_sub:Nn
1446     \l__enumext_minipage_after_skip { \l__enumext_itemsep_ii_skip }
1447     \skip_sub:Nn
1448     \l__enumext_multicols_below_iii_skip { \l__enumext_itemsep_ii_skip }
1449     \skip_add:Nn
1450     \l__enumext_minipage_after_skip
1451     { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1452     \skip_add:Nn
1453     \l__enumext_multicols_below_iii_skip
1454     { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1455   }
1456 }
1457 }
1458 { 4 }{
1459   \skip_if_eq:nnTF { \l__enumext_itemsep_iii_skip } { \c_zero_skip }
1460   {
1461     \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1462     \skip_set:Nn \l__enumext_multicols_below_iv_skip { 0.350\box_ht:N \strutbox }
1463   }
1464   {
1465     \dim_compare:nNnT
1466     { \l__enumext_itemsep_iii_skip } < { \l__enumext_minipage_after_skip }
1467     {
1468       \skip_sub:Nn
1469       \l__enumext_minipage_after_skip { \l__enumext_itemsep_iii_skip }
1470       \skip_sub:Nn
1471       \l__enumext_multicols_below_iv_skip { \l__enumext_itemsep_iii_skip }
1472       \skip_add:Nn
1473       \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1474       \skip_add:Nn
1475       \l__enumext_multicols_below_iv_skip { 0.350\box_ht:N \strutbox }
1476     }
1477     \dim_compare:nNnT
1478     { \l__enumext_itemsep_iii_skip } > { \l__enumext_minipage_after_skip }
1479     {
1480       \skip_set:Nn \l__enumext_minipage_temp_skip
1481       {
1482         \l__enumext_itemsep_iii_skip - \l__enumext_minipage_after_skip
1483       }
1484       \skip_sub:Nn
1485       \l__enumext_minipage_after_skip { \l__enumext_itemsep_iii_skip }
1486       \skip_sub:Nn
1487       \l__enumext_multicols_below_iv_skip { \l__enumext_itemsep_iii_skip }
1488       \skip_add:Nn
1489       \l__enumext_minipage_after_skip
1490       { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1491       \skip_add:Nn
1492       \l__enumext_multicols_below_iv_skip
1493       { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1494     }
1495   }

```



```

1496         }
1497     }
1498 }

```

(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](#).

```

\__enumext_keyans_minipage_set_skip:
\__enumext_keyans_minipage_add_space:
\__enumext_keyans_pre_itemsep_skip:

```

```

1499 \cs_new_protected:Nn \__enumext_keyans_minipage_set_skip:
1500 {
1501     \skip_zero:N \l__enumext_minipage_after_skip
1502     \skip_zero:N \l__enumext_minipage_left_skip
1503     \skip_zero:N \l__enumext_minipage_right_skip
1504     \skip_set:Nn \l__enumext_minipage_right_skip
1505     {
1506         \l__enumext_topsep_v_skip
1507     }
1508     \mode_if_vertical:T
1509     {
1510         \skip_add:Nn \l__enumext_minipage_right_skip
1511         {
1512             \l__enumext_partopsep_v_skip
1513         }
1514     }
1515     \skip_set_eq:NN \l__enumext_minipage_after_skip \l__enumext_minipage_right_skip
1516     \skip_set_eq:NN \l__enumext_multicols_above_v_skip \l__enumext_minipage_right_skip
1517     \skip_set_eq:NN \l__enumext_multicols_below_v_skip \l__enumext_minipage_right_skip
1518     \__enumext_keyans_pre_itemsep_skip:
1519     \int_compare:nNnT { \l__enumext_columns_v_int } > { 1 }
1520     {
1521         \skip_zero:N \topskip
1522         \skip_set_eq:NN \multicolsep \l__enumext_minipage_right_skip
1523     }
1524 }
1525 \cs_new_protected:Nn \__enumext_keyans_minipage_add_space:
1526 {
1527     \__enumext_keyans_minipage_set_skip:
1528     \__enumext_unskip_unkern:
1529     \mode_if_vertical:TF
1530     {
1531         \nopagebreak\nointerlineskip
1532     }
1533     {
1534         \par\nopagebreak\nointerlineskip
1535         \skip_zero:N \l__enumext_partopsep_v_skip
1536     }
1537     \int_compare:nNnTF { \l__enumext_columns_v_int } > { 1 }
1538     {
1539         \addvspace{ 0.445\box_ht:N \strutbox }
1540     }
1541     {
1542         \addvspace{ 0.250\box_ht:N \strutbox }
1543     }
1544 }
1545 \cs_new_protected:Nn \__enumext_keyans_pre_itemsep_skip:
1546 {
1547     \skip_if_eq:nnTF
1548     { \l__enumext_itemsep_i_skip } { \l__enumext_minipage_after_skip }
1549     {
1550         \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1551         \skip_set:Nn \l__enumext_multicols_below_v_skip { 0.350\box_ht:N \strutbox }
1552     }
1553     {
1554         \dim_compare:nNnT
1555         { \l__enumext_itemsep_i_skip } < { \l__enumext_minipage_after_skip }
1556         {
1557             \skip_sub:Nn \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1558             \skip_sub:Nn \l__enumext_multicols_below_v_skip { \l__enumext_itemsep_i_skip }
1559             \skip_add:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }

```

```

1560         \skip_add:Nn \l__enumext_multicols_below_v_skip { 0.350\box_ht:N \strutbox }
1561     }
1562 \dim_compare:nNnT
1563 { \l__enumext_itemsep_i_skip } > { \l__enumext_minipage_after_skip }
1564 {
1565     \skip_set:Nn \l__enumext_minipage_temp_skip
1566     {
1567         \l__enumext_itemsep_i_skip - \l__enumext_minipage_after_skip
1568     }
1569     \skip_sub:Nn \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1570     \skip_sub:Nn \l__enumext_multicols_below_v_skip { \l__enumext_itemsep_i_skip }
1571     \skip_add:Nn \l__enumext_minipage_after_skip
1572     { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1573     \skip_add:Nn \l__enumext_multicols_below_v_skip
1574     { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1575 }
1576 }
1577 }

```

(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*`.

```

1578 \cs_new_protected:Nn \__enumext_mini_set_vskip_vii:
1579 {
1580     \skip_zero_new:N \l__enumext_minipage_left_skip
1581     \skip_gzero_new:N \g__enumext_minipage_right_skip
1582     \skip_gzero_new:N \g__enumext_minipage_after_skip
1583     \skip_if_eq:nnTF { \l__enumext_topsep_vii_skip } { \c_zero_skip }
1584     {
1585         \skip_set:Nn \l__enumext_minipage_left_skip { 0.5\box_dp:N \strutbox }
1586         \skip_gset:Nn \g__enumext_minipage_right_skip { 0.325\box_dp:N \strutbox }
1587     }
1588     {
1589         \skip_set:Nn \l__enumext_minipage_left_skip { 0.5875\box_dp:N \strutbox }
1590         \skip_gset:Nn \g__enumext_minipage_right_skip
1591         {
1592             \l__enumext_topsep_vii_skip
1593         }
1594         \skip_gset:Nn \g__enumext_minipage_after_skip
1595         {
1596             0.325\box_dp:N \strutbox + \l__enumext_topsep_vii_skip
1597         }
1598     }
1599 }
1600 \cs_new_protected:Nn \__enumext_mini_set_vskip_viii:
1601 {
1602     \skip_zero_new:N \l__enumext_minipage_after_skip
1603     \skip_zero_new:N \l__enumext_minipage_left_skip
1604     \skip_zero_new:N \l__enumext_minipage_right_skip
1605     \skip_if_eq:nnTF { \l__enumext_topsep_viii_skip } { \c_zero_skip }
1606     {
1607         \skip_set:Nn \l__enumext_minipage_left_skip
1608         {
1609             0.5\box_dp:N \strutbox
1610         }
1611         \skip_set:Nn \l__enumext_minipage_right_skip
1612         {
1613             \l__enumext_partopsep_viii_skip
1614         }
1615         \skip_set:Nn \l__enumext_minipage_after_skip
1616         {
1617             1.6\box_dp:N \strutbox
1618         }
1619     }
1620     {
1621         \skip_set:Nn \l__enumext_minipage_left_skip
1622         {

```

```

1623         0.5875\box_dp:N \strutbox
1624     }
1625     \skip_set:Nn \l__enumext_minipage_right_skip
1626     {
1627         \l__enumext_topsep_viii_skip
1628     }
1629     \skip_set:Nn \l__enumext_minipage_after_skip
1630     {
1631         0.325\box_dp:N \strutbox + \l__enumext_topsep_viii_skip
1632     }
1633 }
1634 }

```

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

`\__enumext_mini_addvspace_vii:`  
`\__enumext_mini_addvspace_viii:`

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

Here we will NOT take into account whether  $\TeX$  is in  $\langle horizontal\ mode \rangle$  or  $\langle vertical\ mode \rangle$ , since `\partopsep` is equal to `0pt` in both environments.

```

1635 \cs_new_protected:Nn \__enumext_mini_addvspace_vii:
1636 {
1637     \__enumext_mini_set_vskip_vii:
1638     \par\nopagebreak
1639     \addvspace { \l__enumext_minipage_left_skip }
1640 }
1641 \cs_new_protected:Nn \__enumext_mini_addvspace_viii:
1642 {
1643     \__enumext_mini_set_vskip_viii:
1644     \par\nopagebreak
1645     \addvspace { \l__enumext_minipage_left_skip }
1646 }

```

(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  $\TeX$  justification is maintained in the `\__enumext_mini_page` on the “right side”.

`\miniright`

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

```

1647 \NewDocumentCommand \miniright { s }
1648 {
1649     \int_compare:nNt { \l__enumext_keyans_pic_level_int } = { 1 }
1650     {
1651         \msg_error:nnn { enumext } { wrong-miniright-place }
1652     }
1653     % outside
1654     \bool_lazy_and:nnT
1655     { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
1656     { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
1657     {
1658         \msg_error:nnn { enumext } { wrong-miniright-place }
1659     }
1660     % starred env
1661     \bool_lazy_and:nnT
1662     { \bool_if_p:N \g__enumext_starred_bool }
1663     { \bool_not_p:n { \l__enumext_standar_bool } }
1664     {
1665         \msg_error:nnn { enumext } { wrong-miniright-starred }
1666     }
1667     % exec
1668     \int_compare:nNtF { \l__enumext_keyans_level_int } = { 1 }
1669     {
1670         \__enumext_keyans_mini_right_cmd:n {#1}
1671     }

```

```

1672     { \__enumext_mini_right_cmd:n {#1} }
1673 }

```

(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.

```

1674 \cs_new_protected:Npn \__enumext_mini_right_cmd:n #1
1675 {
1676   \dim_compare:nNnTF
1677   { \dim_use:c { \l__enumext_minipage_right_ \__enumext_level: _dim } } > { \c_zero_dim }
1678   {
1679     \__enumext_multicols_stop:
1680     \int_compare:nNnT
1681     { \int_use:c { \l__enumext_columns_ \__enumext_level: _int } } = { 1 }
1682     {
1683       \par\addvspace{ \l__enumext_minipage_after_skip }
1684     }
1685     \end__enumext_mini_page
1686     \hfill
1687     \__enumext_mini_page{ \dim_use:c { \l__enumext_minipage_right_ \__enumext_level: _dim } }
1688     \par\nointerlineskip
1689     \addvspace { \l__enumext_minipage_right_skip }
1690     \bool_if:nF {#1}
1691     {
1692       \centering
1693     }
1694     \int_gzero:N \g__enumext_minipage_stat_int
1695   }
1696   { \msg_error:nnn { enumext } { wrong-miniright-use } }
1697   % paranoia
1698   \RenewDocumentCommand \miniright { s }
1699   {
1700     \msg_error:nn { enumext } { many-miniright-used }
1701   }
1702 }

```

(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.

```

1703 \cs_new_protected:Npn \__enumext_keyans_mini_right_cmd:n #1
1704 {
1705   \dim_compare:nNnTF { \l__enumext_minipage_right_v_dim } > { \c_zero_dim }
1706   {
1707     \__enumext_keyans_multicols_stop:
1708     \int_compare:nNnT { \l__enumext_columns_v_int } = { 1 }
1709     {
1710       \par\addvspace{ \l__enumext_minipage_after_skip }
1711     }
1712     \end__enumext_mini_page
1713     \hfill
1714     \__enumext_mini_page{ \l__enumext_minipage_right_v_dim }
1715     \par\nointerlineskip
1716     \addvspace { \l__enumext_minipage_right_skip }
1717     \bool_if:nF {#1}
1718     {
1719       \centering
1720     }
1721     \int_gzero:N \g__enumext_minipage_stat_int
1722   }
1723   { \msg_error:nnn { enumext } { wrong-miniright-use } }
1724   % paranoia
1725   \RenewDocumentCommand \miniright { s }
1726   {
1727     \msg_error:nn { enumext } { many-miniright-used }

```

```

1728     }
1729 }

```

(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* 1730 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
below 1731 {
below* 1732 \keys_define:nn { enumext / #1 }
1733 {
1734     above .skip_set:c = { \__enumext_vspace_above_#2_skip },
1735     above .value_required:n = true,
1736     above* .code:n = \bool_set_true:c { \__enumext_vspace_a_star_#2_bool }
1737             \keys_set:nn { enumext / #1 } { above = {##1} },
1738     above* .value_required:n = true,
1739     below .skip_set:c = { \__enumext_vspace_below_#2_skip },
1740     below .value_required:n = true,
1741     below* .code:n = \bool_set_true:c { \__enumext_vspace_b_star_#2_bool }
1742             \keys_set:nn { enumext / #1 } { below = {##1} },
1743     below* .value_required:n = true,
1744 }
1745 }
1746 \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.

```

1747 \cs_new_protected:Nn \__enumext_vspace_above:
1748 {
1749     \skip_if_eq:nnF
1750     { \skip_use:c { \__enumext_vspace_above_ \__enumext_level: _skip } } { \c_zero_skip }
1751     {
1752         \bool_if:cTF { \__enumext_vspace_a_star_ \__enumext_level: _bool }
1753         {
1754             \vspace*{ \skip_use:c { \__enumext_vspace_above_ \__enumext_level: _skip } }
1755         }
1756         {
1757             \vspace { \skip_use:c { \__enumext_vspace_above_ \__enumext_level: _skip } }
1758         }
1759     }
1760 }

```

(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.

```

1761 \cs_new_protected:Nn \__enumext_vspace_below:
1762 {
1763     \skip_if_eq:nnF
1764     { \skip_use:c { \__enumext_vspace_below_ \__enumext_level: _skip } } { \c_zero_skip }
1765     {
1766         \bool_if:cTF { \__enumext_vspace_b_star_ \__enumext_level: _bool }
1767         {
1768             \vspace*{ \skip_use:c { \__enumext_vspace_below_ \__enumext_level: _skip } }
1769         }
1770         {
1771             \vspace { \skip_use:c { \__enumext_vspace_below_ \__enumext_level: _skip } }
1772         }
1773     }
1774 }

```

(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.

```

1775 \cs_new_protected:Nn \__enumext_vspace_above_v:
1776 {
1777   \skip_if_eq:nnF { \l__enumext_vspace_above_v_skip } { \c_zero_skip }
1778   {
1779     \bool_if:NTF \l__enumext_vspace_a_star_v_bool
1780     {
1781       \vspace*{ \l__enumext_vspace_above_v_skip }
1782     }
1783     { \vspace { \l__enumext_vspace_above_v_skip } }
1784   }
1785 }
```

(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.

```

1786 \cs_new_protected:Nn \__enumext_vspace_below_v:
1787 {
1788   \skip_if_eq:nnF { \l__enumext_vspace_below_v_skip } { \c_zero_skip }
1789   {
1790     \bool_if:NTF \l__enumext_vspace_b_star_v_bool
1791     {
1792       \vspace*{ \l__enumext_vspace_below_v_skip }
1793     }
1794     { \vspace { \l__enumext_vspace_below_v_skip } }
1795   }
1796 }
```

(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:`

```

1797 \cs_new_protected:Nn \__enumext_vspace_above_vii:
1798 {
1799   \skip_if_eq:nnF { \l__enumext_vspace_above_vii_skip } { \c_zero_skip }
1800   {
1801     \bool_if:NTF \l__enumext_vspace_a_star_vii_bool
1802     {
1803       \vspace*{ \l__enumext_vspace_above_vii_skip }
1804     }
1805     { \vspace { \l__enumext_vspace_above_vii_skip } }
1806   }
1807 }
1808 \cs_new_protected:Nn \__enumext_vspace_above_viii:
1809 {
1810   \skip_if_eq:nnF { \l__enumext_vspace_above_viii_skip } { \c_zero_skip }
1811   {
1812     \bool_if:NTF \l__enumext_vspace_a_star_viii_bool
1813     {
1814       \vspace*{ \l__enumext_vspace_above_viii_skip }
1815     }
1816     { \vspace { \l__enumext_vspace_above_viii_skip } }
1817   }
1818 }
```

(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:`

```

1819 \cs_new_protected:Nn \__enumext_vspace_below_vii:
1820 {
1821   \skip_if_eq:nnF { \l__enumext_vspace_below_vii_skip } { \c_zero_skip }
1822   {
1823     \bool_if:NTF \l__enumext_vspace_b_star_vii_bool
1824     {
1825       \vspace*{ \l__enumext_vspace_below_vii_skip }

```



```

1826         }
1827         { \vspace { \l__enumext_vspace_below_vii_skip } }
1828     }
1829 }
1830 \cs_new_protected:Nn \__enumext_vspace_below_viii:
1831 {
1832     \skip_if_eq:nnF { \l__enumext_vspace_below_viii_skip } { \c_zero_skip }
1833     {
1834         \bool_if:NTF \l__enumext_vspace_b_star_viii_bool
1835         {
1836             \vspace*{ \l__enumext_vspace_below_viii_skip }
1837         }
1838         { \vspace { \l__enumext_vspace_below_viii_skip } }
1839     }
1840 }

```

(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*
1841 \cs_set_protected:Npn \__enumext_tmp:n #1
1842 {
1843     \keys_define:nn { enumext / #1 }
1844     {
1845         series .str_set:N = \l__enumext_series_str,
1846         series .value_required:n = true,
1847         resume .code:n = \__enumext_resume_series:n {##1},
1848         resume* .code:n = \__enumext_resume_starred:,
1849         resume* .value_forbidden:n = true,
1850     }
1851 }
1852 \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.

```

1853 \cs_new:Npn \__enumext_filter_series:n #1
1854 {
1855     \use:e
1856     {
1857         \keyval_parse:NNn
1858         \__enumext_filter_series_key:n
1859         \__enumext_filter_series_pair:nn {#1}
1860     }
1861 }

```

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.

```

1862 \cs_new:Npn \__enumext_filter_series_key:n #1
1863 {
1864     \str_case:nnF {#1}
1865     {
1866         { resume } {} { resume* } {} { base-fix } {}
1867     }
1868     { , { \exp_not:n {#1} } }
1869 }

```

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.

```

1870 \cs_new:Npn \__enumext_filter_series_pair:nn #1#2
1871 {
1872     \str_case:nnF {#1}
1873     {
1874         { series } {} { resume } {} { start } {}

```

```

1875         { start* } {} { save-ans } {} { save-key } {}
1876     }
1877     { , { \exp_not:n {#1} } = { \exp_not:n {#2} } }
1878 }

```

(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).

```

1879 \cs_new_protected:Npn \__enumext_parse_series:n #1
1880 {
1881     \str_if_empty:NTF \l__enumext_series_str
1882     {
1883         \bool_if:NF \l__enumext_resume_active_bool
1884         {
1885             \__enumext_resume_last:n {#1}
1886         }
1887     }
1888     {
1889         \tl_gclear_new:c { g__enumext_series_ \l__enumext_series_str _tl }
1890         \tl_gset:ce { g__enumext_series_ \l__enumext_series_str _tl }
1891             { \__enumext_filter_series:n {#1} }
1892         \int_if_exist:cF { g__enumext_series_ \l__enumext_series_str _int }
1893         {
1894             \int_new:c { g__enumext_series_ \l__enumext_series_str _int }
1895         }
1896     }
1897 }

```

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.

```

1898 \cs_new_protected:Npn \__enumext_resume_last:n #1
1899 {
1900     \bool_if:NT \l__enumext_standar_first_bool
1901     {
1902         \tl_gclear:N \g__enumext_standar_series_tl
1903         \tl_gset:Ne \g__enumext_standar_series_tl { \__enumext_filter_series:n {#1} }
1904     }
1905     \bool_if:NT \l__enumext_starred_first_bool
1906     {
1907         \tl_gclear:N \g__enumext_starred_series_tl
1908         \tl_gset:Ne \g__enumext_starred_series_tl { \__enumext_filter_series:n {#1} }
1909     }
1910 }

```

(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).

```

1911 \cs_new_protected:Nn \__enumext_resume_save_counter:
1912 {

```

```

1913 \bool_if:NT \g__enumext_standar_bool
1914 {
1915     \tl_if_empty:NF \l__enumext_series_str
1916     {
1917         \int_gset_eq:cN
1918         { g__enumext_series_ \l__enumext_series_str_int } \value{enumXi}
1919     }
1920     \tl_if_empty:NTF \l__enumext_resume_name_tl
1921     {
1922         \str_if_empty:NT \l__enumext_series_str
1923         {
1924             \int_gset_eq:NN \g__enumext_resume_int \value{enumXi}
1925         }
1926     }
1927     {
1928         \int_if_exist:cT { g__enumext_series_ \l__enumext_resume_name_tl_int }
1929         {
1930             \int_gset_eq:cN
1931             { g__enumext_series_ \l__enumext_resume_name_tl_int } \value{enumXi}
1932         }
1933     }
1934     \int_if_exist:cT { g__enumext_resume_ \l__enumext_store_name_tl_int }
1935     {
1936         \int_gset_eq:cN
1937         { g__enumext_resume_ \l__enumext_store_name_tl_int } \value{enumXi}
1938     }
1939 }
1940 \bool_if:NT \g__enumext_starred_bool
1941 {
1942     \tl_if_empty:NF \l__enumext_series_str
1943     {
1944         \int_gset_eq:cN
1945         { g__enumext_series_ \l__enumext_series_str_int } \value{enumXvii}
1946     }
1947     \tl_if_empty:NTF \l__enumext_resume_name_tl
1948     {
1949         \str_if_empty:NT \l__enumext_series_str
1950         {
1951             \int_gset_eq:NN \g__enumext_resume_vii_int \value{enumXvii}
1952         }
1953     }
1954     {
1955         \int_if_exist:cT { g__enumext_series_ \l__enumext_resume_name_tl_int }
1956         {
1957             \int_gset_eq:cN
1958             { g__enumext_series_ \l__enumext_resume_name_tl_int } \value{enumXvii}
1959         }
1960     }
1961     \int_if_exist:cT { g__enumext_resume_ \l__enumext_store_name_tl_int }
1962     {
1963         \int_gset_eq:cN
1964         { g__enumext_resume_ \l__enumext_store_name_tl_int } \value{enumXvii}
1965     }
1966 }
1967 }

```

(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.

```

1968 \cs_new_protected:Npn \__enumext_resume_series:n #1
1969 {
1970     \tl_if_empty:NTF {#1}
1971     {
1972         \__enumext_resume_counter:n { }

```

```

1973     }
1974     {
1975         \tl_if_exist:cTF { g__enumext_series_ \tl_to_str:n {#1} _tl }
1976         {
1977             \__enumext_resume_counter:n {#1}
1978             \bool_if:NT \g__enumext_standar_bool
1979             {
1980                 \keys_set:nv { enumext / level-1 }
1981                 { g__enumext_series_ \tl_to_str:n {#1} _tl }
1982             }
1983             \bool_if:NT \g__enumext_starred_bool
1984             {
1985                 \keys_set:nv { enumext / enumext* }
1986                 { g__enumext_series_ \tl_to_str:n {#1} _tl }
1987             }
1988         }
1989     }
1990     \bool_if:NT \g__enumext_standar_bool
1991     {
1992         \msg_error:nnn { enumext } { unknown-series } {#1}
1993     }
1994     \bool_if:NT \g__enumext_starred_bool
1995     {
1996         \msg_error:nnn { enumext } { unknown-series } {#1}
1997     }
1998 }
1999 }
2000 }

```

(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  $\{\langle series\ name \rangle\}$ . 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={\langle series\ name \rangle}` 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`.

```

2001 \cs_new_protected:Npn \__enumext_resume_counter:n #1
2002 {
2003     \bool_set_true:N \l__enumext_resume_active_bool
2004     \tl_set:Nn \l__enumext_resume_name_tl {#1}
2005     \tl_if_empty:NTF \l__enumext_resume_name_tl
2006     {
2007         \__enumext_resume_counter:
2008     }
2009     {
2010         \__enumext_resume_counter_series:
2011     }
2012     \__enumext_resume_counter_save_ans:
2013 }

```

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.

```

2014 \cs_new_protected:Nn \__enumext_resume_counter:
2015 {
2016     \bool_if:NT \g__enumext_standar_bool
2017     {
2018         \int_gincr:N \g__enumext_resume_int
2019         \int_set_eq:NN \l__enumext_start_i_int \g__enumext_resume_int
2020     }
2021     \bool_if:NT \g__enumext_starred_bool
2022     {
2023         \int_gincr:N \g__enumext_resume_vii_int
2024         \int_set_eq:NN \l__enumext_start_vii_int \g__enumext_resume_vii_int
2025     }
2026 }

```

The function \\_\_enumext\_resume\_counter\_series: will be executed when the `resume={\langle series\ name \rangle}` 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.

```

2027 \cs_new_protected:Nn \__enumext_resume_counter_series:
2028 {
2029   \bool_if:NT \g__enumext_standar_bool
2030   {
2031     \int_set:Nn \l__enumext_start_i_int
2032     {
2033       \int_use:c { g__enumext_series_ \l__enumext_resume_name_tl _int } + 1
2034     }
2035   }
2036   \bool_if:NT \g__enumext_starred_bool
2037   {
2038     \int_set:Nn \l__enumext_start_vii_int
2039     {
2040       \int_use:c { g__enumext_series_ \l__enumext_resume_name_tl _int } + 1
2041     }
2042   }
2043 }

```

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.

```

2044 \cs_new_protected:Nn \__enumext_resume_counter_save_ans:
2045 {
2046   \bool_lazy_and:nnT
2047   { \bool_if_p:N \l__enumext_standar_first_bool }
2048   { \bool_if_p:N \l__enumext_store_active_bool }
2049   {
2050     \int_set:Nn \l__enumext_start_i_int
2051     {
2052       \int_use:c { g__enumext_resume_ \l__enumext_store_name_tl _int } + 1
2053     }
2054   }
2055   \bool_lazy_and:nnT
2056   { \bool_if_p:N \l__enumext_starred_first_bool }
2057   { \bool_if_p:N \l__enumext_store_active_bool }
2058   {
2059     \int_set:Nn \l__enumext_start_vii_int
2060     {
2061       \int_use:c { g__enumext_resume_ \l__enumext_store_name_tl _int } + 1
2062     }
2063   }
2064 }

```

(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.

```

2065 \cs_new_protected:Nn \__enumext_resume_starred:
2066 {
2067   \bool_if:NT \g__enumext_standar_bool
2068   {
2069     \tl_if_empty:NF \g__enumext_standar_series_tl
2070     {
2071       \__enumext_resume_counter:n { }
2072       \keys_set:nV { enumext / level-1 } \g__enumext_standar_series_tl
2073     }
2074   }
2075   \bool_if:NT \g__enumext_starred_bool
2076   {
2077     \tl_if_empty:NF \g__enumext_starred_series_tl
2078     {
2079       \__enumext_resume_counter:n { }
2080       \keys_set:nV { enumext / enumext* } \g__enumext_starred_series_tl
2081     }
2082   }
2083 }

```

(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*`.

```
2084 \cs_set_protected:Npn \__enumext_tmp:n #1
2085 {
2086   \keys_define:nn { enumext / #1 }
2087   {
2088     save-ans .code:n = \__enumext_storing_set:n {##1},
2089     save-ans .value_required:n = true,
2090   }
2091 }
2092 \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:`  
`\__enumext_stop_save_ans_msg:`

The functions `\__enumext_start_save_ans_msg:` and `\__enumext_stop_save_ans_msg:` will display in the terminal and .log file the environment in which the `save-ans` key was executed along with the line at the beginning and end of it. The function `\__enumext_start_save_ans_msg:` will be passed to `\__enumext_storing_set:n` and the function `\__enumext_stop_save_ans_msg:` will be passed to the function `\__enumext_execute_after_env:`.

```
2093 \cs_new_protected:Nn \__enumext_start_save_ans_msg:
2094 {
2095   \msg_term:nnVV { enumext } { save-ans-log }
2096   \g__enumext_envir_name_tl \l__enumext_store_name_tl
2097 }
2098 \cs_new_protected:Nn \__enumext_stop_save_ans_msg:
2099 {
2100   \msg_term:nnVV { enumext } { save-ans-log-hook }
2101   \g__enumext_envir_name_tl \g__enumext_store_name_tl
2102 }
```

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

`\__enumext_storing_set:n`  
`\__enumext_storing_exec:`

The function `\__enumext_storing_set:n` first pass the value of the `save-ans` key to the variable `\l__enumext_store_name_tl` which will contain the `{⟨store name⟩}` of the *sequence* and *prop list* we will use. If `\l__enumext_store_name_tl` is *empty* we return an error message, otherwise will return the appropriate message `\__enumext_start_save_ans_msg:` and proceed to execute the function `\__enumext_storing_exec:` for `enumext` and `enumext*` environments.

```
2103 \cs_new_protected:Npn \__enumext_storing_set:n #1
2104 {
2105   \tl_set:Nx \l__enumext_store_name_tl {#1}
2106   \tl_if_empty:NTF \l__enumext_store_name_tl
2107   {
2108     \bool_lazy_or:nnT
2109     { \l__enumext_standar_first_bool } { \l__enumext_starred_first_bool }
2110     {
2111       \msg_error:nnV { enumext } { save-ans-empty } \g__enumext_envir_name_tl
2112     }
2113   }
2114   {
2115     \bool_lazy_or:nnT
2116     { \l__enumext_standar_first_bool } { \l__enumext_starred_first_bool }
2117     {
2118       \__enumext_start_save_ans_msg:
2119       \__enumext_storing_exec:
2120     }
2121   }
2122 }
```

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` and execute the function `\__enumext_anskey_env_make:V` creating the environment `anskey*` (§13.31).

```
2123 \cs_new_protected:Nn \__enumext_storing_exec:
```

```

2124 {
2125     \bool_set_true:N \l__enumext_store_active_bool
2126     \bool_set_true:N \l__enumext_check_answers_bool
2127     \tl_gset:NV \g__enumext_store_name_tl \l__enumext_store_name_tl
2128     \__enumext_anskey_env_make:V \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*`.

```

2129     \prop_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _prop }
2130     {
2131         \msg_log:nnV { enumext } { store-prop } \l__enumext_store_name_tl
2132         \prop_new:c { g__enumext_ \l__enumext_store_name_tl _prop }
2133     }
2134     \seq_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _seq }
2135     {
2136         \msg_log:nnV { enumext } { store-seq } \l__enumext_store_name_tl
2137         \seq_new:c { g__enumext_ \l__enumext_store_name_tl _seq }
2138     }
2139     \int_if_exist:cF { g__enumext_resume_ \l__enumext_store_name_tl _int }
2140     {
2141         \msg_log:nnV { enumext } { store-int } \l__enumext_store_name_tl
2142         \int_new:c { g__enumext_resume_ \l__enumext_store_name_tl _int }
2143     }
2144 }

```

(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
2145 \cs_set_protected:Npn \__enumext_tmp:n #1
2146 {
2147     \keys_define:nn { enumext / #1 }
2148     {
2149         check-ans .bool_set:N = \l__enumext_check_ans_key_bool,
2150         check-ans .initial:n = false,
2151         check-ans .value_required:n = true,
2152         no-store .code:n = {
2153             \bool_set_false:N \l__enumext_check_answers_bool

```



```

2154         \bool_set_false:N \l__enumext_check_ans_key_bool
2155     },
2156     no-store .value_forbidden:n = true,
2157 }
2158 }
2159 \clist_map_inline:nn
2160 {
2161     level-1, level-2, level-3, level-4, enumext*
2162 }
2163 { \l__enumext_tmp:n {#1} }

```

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

### 13.26.5 Set-up check answer mechanism

`\l__enumext_check_ans_active:` The function `\l__enumext_check_ans_active:` will first check the state of the variable `\l__enumext_store_name_tl`, that is, the *save-ans* key is active, if so it will check the state of the variable `\l__enumext_check_answers_bool` handled by the key *no-store* and will execute the function `\l__enumext_check_ans_level:` only if “*true*”, i.e. the key *no-store* is not active.

```

2164 \cs_new_protected:Nn \l__enumext_check_ans_active:
2165 {
2166     \tl_if_empty:NF \l__enumext_store_name_tl
2167     {
2168         \bool_if:NT \l__enumext_check_answers_bool
2169         {
2170             \l__enumext_check_ans_level:
2171         }
2172     }
2173 }

```

The function `\l__enumext_check_ans_level:` will decrement by “*one*” the value of the variable `\g__enumext_item_number_int` which keeps track of the executions of `\item` and `\item*` for each level of nesting of the environment *enumext*, taking into account whether it is nested within *enumext\** or the opposite and set `\l__enumext_item_number_bool` to “*false*”.

```

2174 \cs_new_protected:Nn \l__enumext_check_ans_level:
2175 {
2176     \int_case:nn { \l__enumext_level_int }
2177     {
2178         { 1 }{
2179             \bool_lazy_all:nT
2180             {
2181                 { \bool_if_p:N \g__enumext_starred_bool }
2182                 { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
2183             }
2184             {
2185                 \int_gdecr:N \g__enumext_item_number_int
2186                 \bool_set_false:N \l__enumext_item_number_bool
2187             }
2188         }
2189         { 2 }{
2190             \int_gdecr:N \g__enumext_item_number_int
2191             \bool_set_false:N \l__enumext_item_number_bool
2192         }
2193         { 3 }{
2194             \int_gdecr:N \g__enumext_item_number_int
2195             \bool_set_false:N \l__enumext_item_number_bool
2196         }
2197         { 4 }{
2198             \int_gdecr:N \g__enumext_item_number_int
2199             \bool_set_false:N \l__enumext_item_number_bool
2200         }
2201     }

```

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.

```

2202     \int_case:nn { \l__enumext_level_h_int }
2203     {
2204         { 1 }{
2205             \bool_lazy_all:nT
2206             {
2207                 { \bool_if_p:N \g__enumext_standar_bool }
2208                 { \int_compare_p:nNn { \l__enumext_level_int } = { 1 } }

```

```

2209         }
2210         {
2211             \int_gdecr:N \g__enumext_item_number_int
2212             \bool_set_false:N \l__enumext_item_number_bool
2213         }
2214     }
2215 }
2216 }

```

(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.

```

2217 \cs_new_protected:Nn \__enumext_check_ans_key_hook:
2218 {
2219     \bool_lazy_and:nnT
2220     { \bool_if_p:N \l__enumext_check_ans_key_bool }
2221     { \bool_if_p:N \g__enumext_standar_bool }
2222     {
2223         \bool_gset_true:N \g__enumext_check_ans_key_bool
2224     }
2225     \bool_lazy_and:nnT
2226     { \bool_if_p:N \l__enumext_check_ans_key_bool }
2227     { \bool_if_p:N \g__enumext_starred_bool }
2228     {
2229         \bool_gset_true:N \g__enumext_check_ans_key_bool
2230     }
2231 }

```

(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:`.

```

2232 \cs_new_protected:Nn \__enumext_item_answer_diff:
2233 {
2234     \int_gset:Nn \g__enumext_item_answer_diff_int
2235     {
2236         \int_sign:n { \g__enumext_item_number_int - \g__enumext_item_anskey_int }
2237     }
2238 }

```

(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:`.

```

2239 \cs_new_protected:Nn \__enumext_check_ans_show:
2240 {
2241     \int_case:nn { \g__enumext_item_answer_diff_int }
2242     {
2243         { -1 } { \__enumext_check_ans_msg_less: }
2244         { 0 } { \__enumext_check_ans_msg_same_ok: }
2245         { 1 } { \__enumext_check_ans_msg_greater: }
2246     }
2247 }
2248 \cs_new_protected:Nn \__enumext_check_ans_msg_less:
2249 {
2250     \msg_warning:nneee { enumext } { item-less-answer } { \g__enumext_store_name_tl }
2251     { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2252 }
2253 \cs_new_protected:Nn \__enumext_check_ans_msg_same_ok:
2254 {
2255     \msg_term:nneee { enumext } { items-same-answer } { \g__enumext_store_name_tl }
2256     { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2257 }
2258 \cs_new_protected:Nn \__enumext_check_ans_msg_greater:

```

```

2259 {
2260     \msg_warning:nneee { enumext } { item-greater-answer } { \g__enumext_store_name_tl }
2261     { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2262 }

```

(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:`.

```

2263 \cs_new_protected:Nn \__enumext_check_ans_log:
2264 {
2265     \int_case:nn { \g__enumext_item_answer_diff_int }
2266     {
2267         { -1 } { \__enumext_check_ans_log_msg_less: }
2268         { 0 } { \__enumext_check_ans_log_msg_same_ok: }
2269         { 1 } { \__enumext_check_ans_log_msg_greater: }
2270     }
2271 }
2272 \cs_new_protected:Nn \__enumext_check_ans_log_msg_less:
2273 {
2274     \msg_log:nneee { enumext } { item-less-answer } { \g__enumext_store_name_tl }
2275     { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2276 }
2277 \cs_new_protected:Nn \__enumext_check_ans_log_msg_same_ok:
2278 {
2279     \msg_log:nneee { enumext } { items-same-answer } { \g__enumext_store_name_tl }
2280     { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2281 }
2282 \cs_new_protected:Nn \__enumext_check_ans_log_msg_greater:
2283 {
2284     \msg_log:nneee { enumext } { item-greater-answer } { \g__enumext_store_name_tl }
2285     { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2286 }

```

(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.

```

2287 \cs_new_protected:Npn \__enumext_check_starred_cmd:n #1
2288 {
2289     \int_compare:nNt
2290     { \g__enumext_check_starred_cmd_int } = { 0 }
2291     {
2292         \msg_warning:nnnV
2293         { enumext } { missing-starred } { #1 } \l__enumext_check_start_line_env_tl
2294     }
2295     \int_compare:nNt
2296     { \g__enumext_check_starred_cmd_int } > { 1 }
2297     {
2298         \msg_warning:nnnV
2299         { enumext } { many-starred } { #1 } \l__enumext_check_start_line_env_tl
2300     }
2301     \int_gzero:N \g__enumext_check_starred_cmd_int
2302     \tl_clear:N \l__enumext_check_start_line_env_tl
2303 }

```

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

## 13.27 Keys and functions associated with storage

`wrap-ans` `wrap-opt` `wrap-key` `save-sep` `mark-ans` `mark-pos` `mark-sep` `show-ans` `show-pos` `mark-ref` and `save-ref` related to the “storage system” and internal mechanism of “label and ref” only at the *first level* of `enumext` and `enumext*`.

```

2304 \cs_set_protected:Npn \__enumext_tmp:n #1
2305 {
2306     \keys_define:nn { enumext / #1 }
2307     {

```

```

2308 wrap-ans .cs_set_protected:Np = \__enumext_anskey_wrapper:n ##1,
2309 wrap-ans .initial:n =
2310 {
2311     \fbox{\parbox[t]{\dimeval{\itemwidth -2\fboxsep -2\fboxrule}}{##1}}
2312 },
2313 wrap-ans .value_required:n = true,
2314 wrap-opt .cs_set_protected:Np = \__enumext_keyans_wrapper_opt:n ##1,
2315 wrap-opt .initial:n = [{##1}],
2316 wrap-opt .value_required:n = true,
2317 wrap-key .cs_set_protected:Np = \__enumext_keyans_wrapper_item:n ##1,
2318 wrap-key .value_required:n = true,
2319 save-sep .tl_set:N = \__enumext_store_keyans_item_opt_sep_tl,
2320 save-sep .initial:n = {, ~ },
2321 save-sep .value_required:n = true,
2322 mark-ans .tl_set:N = \__enumext_mark_answer_sym_tl,
2323 mark-ans .initial:n = \textasteriskcentered,
2324 mark-ans .value_required:n = true,
2325 mark-pos .choice:,
2326 mark-pos / left .code:n = \str_set:Nn \__enumext_mark_position_str { l },
2327 mark-pos / right .code:n = \str_set:Nn \__enumext_mark_position_str { r },
2328 mark-pos / unknown .code:n =
2329     \msg_error:nnee { enumext } { unknown-choice }
2330     { mark-pos } { left, ~ right } { \exp_not:n {##1} },
2331 mark-pos .initial:n = right,
2332 mark-pos .value_required:n = true,
2333 mark-sep .dim_set:N = \__enumext_mark_sym_sep_dim,
2334 mark-sep .value_required:n = true,
2335 show-ans .bool_set:N = \__enumext_show_answer_bool,
2336 show-ans .initial:n = false,
2337 show-ans .value_required:n = true,
2338 show-pos .bool_set:N = \__enumext_show_position_bool,
2339 show-pos .initial:n = false,
2340 show-pos .value_required:n = true,
2341 mark-ref .tl_set:N = \__enumext_mark_ref_sym_tl,
2342 mark-ref .initial:n = \textreferencemark,
2343 mark-ref .value_required:n = true,
2344 save-ref .bool_set:N = \__enumext_store_ref_key_bool,
2345 save-ref .initial:n = false,
2346 save-ref .value_required:n = true,
2347 }
2348 }
2349 \clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }

```

(End of definition for wrap-ans and others.)

For the **keyans** and **keyans\*** environments we will only add the keys mark-ans, mark-pos, mark-sep, save-sep, wrap-opt, wrap-key, show-ans and show-pos.

```

2350 \cs_set_protected:Npn \__enumext_tmp:n #1
2351 {
2352     \keys_define:nn { enumext / #1 }
2353     {
2354         mark-ans .tl_set:N = \__enumext_mark_answer_sym_tl,
2355         mark-ans .initial:n = \textasteriskcentered,
2356         mark-ans .value_required:n = true,
2357         mark-pos / left .code:n = \str_set:Nn \__enumext_mark_position_str { l },
2358         mark-pos / right .code:n = \str_set:Nn \__enumext_mark_position_str { r },
2359         mark-pos / unknown .code:n =
2360             \msg_error:nnee { enumext } { unknown-choice }
2361             { mark-pos } { left, ~ right } { \exp_not:n {##1} },
2362         mark-pos .initial:n = right,
2363         mark-pos .value_required:n = true,
2364         mark-pos .value_required:n = true,
2365         mark-sep .dim_set:N = \__enumext_mark_sym_sep_dim,
2366         mark-sep .value_required:n = true,
2367         save-sep .tl_set:N = \__enumext_store_keyans_item_opt_sep_tl,
2368         save-sep .value_required:n = true,
2369         wrap-opt .cs_set_protected:Np = \__enumext_keyans_wrapper_opt:n ##1,
2370         wrap-opt .value_required:n = true,
2371         wrap-key .cs_set_protected:Np = \__enumext_keyans_wrapper_item:n ##1,
2372         wrap-key .value_required:n = true,
2373         show-ans .bool_set:N = \__enumext_show_answer_bool,

```

```

2374     show-ans .initial:n = false,
2375     show-ans .value_required:n = true,
2376     show-pos .bool_set:N = \__enumext_show_position_bool,
2377     show-pos .initial:n = false,
2378     show-pos .value_required:n = true,
2379   }
2380 }
2381 \clist_map_inline:nn { keyans, keyans* } { \__enumext_tmp:n {#1} }

```

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

### 13.27.1 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*.

```

2382 \cs_new_protected:Npn \__enumext_store_active_keys:n #1
2383 {
2384   \bool_if:cF { \__enumext_store_save_key_ \__enumext_level: _bool }
2385   {
2386     \tl_clear:c { \__enumext_save_key_ \__enumext_level: _tl }
2387     \tl_set:ce
2388       { \__enumext_store_save_key_ \__enumext_level: _tl }
2389       { \__enumext_filter_save_key:n {#1} }
2390   }
2391 }
2392 \cs_new_protected:Npn \__enumext_store_active_keys_vii:n #1
2393 {
2394   \bool_if:NF \__enumext_store_save_key_vii_bool
2395   {
2396     \tl_clear:N \__enumext_store_save_key_vii_tl
2397     \tl_set:Nc \__enumext_store_save_key_vii_tl { \__enumext_filter_save_key:n {#1} }
2398   }
2399 }

```

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

### 13.27.2 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 `\__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.

```

2400 \cs_set_protected:Npn \__enumext_tmp:n #1
2401 {
2402   \keys_define:nn { enumext / enumext* }
2403   {
2404     save-key .code:n = \__enumext_parse_save_key_vii:n {##1},
2405     save-key .value_required:n = true,
2406   }
2407   \keys_define:nn { enumext / #1 }
2408   {
2409     save-key .code:n = \__enumext_parse_save_key:n {##1},
2410     save-key .value_required:n = true,
2411   }
2412 }
2413 \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*`.

```

2414 \cs_new_protected:Npn __enumext_parse_save_key:n #1
2415 {
2416   \bool_set_true:c { l__enumext_store_save_key_ __enumext_level: _bool }
2417   \tl_clear:c { l__enumext_save_key_ __enumext_level: _tl }
2418   \tl_set:ce
2419     { l__enumext_store_save_key_ __enumext_level: _tl }
2420     { __enumext_filter_save_key:n {#1} }
2421 }
2422 \cs_new_protected:Npn __enumext_parse_save_key_vii:n #1
2423 {
2424   \bool_set_true:N l__enumext_store_save_key_vii_bool
2425   \tl_clear:N l__enumext_store_save_key_vii_tl
2426   \tl_set:Ne l__enumext_store_save_key_vii_tl { __enumext_filter_save_key:n {#1} }
2427 }

```

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

### 13.27.3 Internal functions to store optional arguments

```

__enumext_filter_save_key:n
  __enumext_filter_save_key_key:n
  __enumext_filter_save_key_pair:nn

```

The function `__enumext_filter_save_key:n` will be in charge of “*filtering keys*” we want to *stored in sequence* where `{#1}` represents the *optional argument* passed to the environment.

```

2428 \cs_new:Npn __enumext_filter_save_key:n #1
2429 {
2430   \use:e
2431   {
2432     \keyval_parse:NNn
2433       __enumext_filter_save_key_key:n
2434       __enumext_filter_save_key_pair:nn {#1}
2435   }
2436 }

```

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.

```

2437 \cs_new:Npn __enumext_filter_save_key_key:n #1
2438 {
2439   \str_case:nnF {#1}
2440   {
2441     { resume } {} { resume* } {} { no-store } {} { base-fix } {}
2442   }
2443   { , { \exp_not:n {#1} } }
2444 }

```

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`, `wrap-ans`, `mark-ans`, `wrap-opt`, `wrap-key`, `save-sep`, `mark-sep`, `mark-ref`, `save-sep`, `mini-env`, `mini-sep`, `mini-right` and `mini-right*` keys.

```

2445 \cs_new:Npn __enumext_filter_save_key_pair:nn #1#2
2446 {
2447   \str_case:nnF {#1}
2448   {
2449     { series } {} { resume } {} { save-ans } {} { save-ref } {}
2450     { save-key } {} { check-ans } {} { show-ans } {} { show-pos } {}
2451     { wrap-ans } {} { mark-ans } {} { wrap-opt } {} { wrap-key } {}
2452     { save-sep } {} { mark-sep } {} { mark-ref } {} { mini-env } {}
2453     { mini-sep } {} { mini-right } {} { mini-right* } {}
2454   }
2455   { , { \exp_not:n {#1} } } = { \exp_not:n {#2} } }
2456 }

```

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

### 13.27.4 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 `{<content>}` in *prop list* defined by `save-ans` key. The “*stored content*” is retrieved by means of the `\getkeyans` command.

The form in which the `{<content>}` is “*stored*” in the *prop list* is `{<position>}{<content>}`. This function is used by `\anskey` in `enumext` and `enumext*` environments, `\item*` in `keyans` and `keyans*` environments and `\anspic*` in `keyanspic` environment.

```

2457 \cs_new_protected:Npn __enumext_store_addto_prop:n #1
2458 {

```

```

2459     \prop_gput_if_not_in:cen { g__enumext_ \l__enumext_store_name_tl _prop }
2460     {
2461         \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } + 1 }
2462     }
2463     { #1 }
2464 }
2465 \cs_generate_variant:Nn \__enumext_store_addto_prop:n { V }

```

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

### 13.27.5 Function for storing content in sequence

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.

```

2466 \cs_new_protected:Npn \__enumext_store_addto_seq:n #1
2467 {
2468     \seq_gput_right:cn { g__enumext_ \l__enumext_store_name_tl _seq } { #1 }
2469 }
2470 \cs_generate_variant:Nn \__enumext_store_addto_seq:n { v, V }

```

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

### 13.27.6 Functions for storing structure in the sequence

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.

```

2471 \cs_new_protected:Nn \__enumext_store_level_open:
2472 {
2473     \bool_if:NT \l__enumext_check_answers_bool
2474     {
2475         \tl_if_empty:cTF { l__enumext_store_save_key_ \__enumext_level: _tl }
2476         {
2477             \__enumext_store_addto_seq:n
2478             {
2479                 \item \begin{enumext}
2480             }
2481         }
2482         {
2483             \tl_put_left:cn { l__enumext_store_save_key_ \__enumext_level: _tl }
2484             {
2485                 \item \begin{enumext} [
2486             }
2487             \tl_put_right:cn { l__enumext_store_save_key_ \__enumext_level: _tl }
2488             {
2489                 ]
2490             }
2491             \__enumext_store_addto_seq:v { l__enumext_store_save_key_ \__enumext_level: _tl }
2492         }
2493     }
2494 }
2495 \cs_new_protected:Nn \__enumext_store_level_close:
2496 {
2497     \bool_if:NT \l__enumext_check_answers_bool
2498     {
2499         \__enumext_store_addto_seq:n { \end{enumext} }
2500     }
2501 }

```

(End of definition for `\__enumext_store_level_open:` and `\__enumext_store_level_close:`.)

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.

```

2502 \cs_new_protected:Nn \__enumext_store_level_open_vii:
2503 {
2504     \bool_if:NT \l__enumext_check_answers_bool
2505     {
2506         \tl_if_empty:NTF \l__enumext_store_save_key_vii_tl
2507         {
2508             \__enumext_store_addto_seq:n

```



```

2509         {
2510             \item \begin{enumext*}
2511         }
2512     }
2513     {
2514         \tl_put_left:Nn \l__enumext_store_save_key_vii_tl
2515         {
2516             \item \begin{enumext*}[
2517             ]
2518             \tl_put_right:Nn \l__enumext_store_save_key_vii_tl
2519             {
2520                 ]
2521             }
2522             \__enumext_store_addto_seq:V \l__enumext_store_save_key_vii_tl
2523         }
2524     }
2525 }
2526 \cs_new_protected:Nn \__enumext_store_level_close_vii:
2527 {
2528     \bool_if:NT \l__enumext_check_answers_bool
2529     {
2530         \__enumext_store_addto_seq:n { \end{enumext*} }
2531     }
2532 }

```

(End of definition for `\__enumext_store_level_open_vii:` and `\__enumext_store_level_close_vii:.`)

### 13.27.7 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

```

```

2533 \cs_new_protected:Nn \__enumext_print_keyans_box:NN
2534 {
2535     \mode_leave_vertical:
2536     \skip_horizontal:n { -\dim_use:N #2 }
2537     \hbox_overlap_left:n
2538     {
2539         \makebox[ \dim_use:N #1 ][ \l__enumext_mark_position_str ]
2540         {
2541             \tl_use:N \l__enumext_mark_answer_sym_tl
2542         }
2543     }
2544     \skip_horizontal:n { \dim_use:N #2 }
2545 }
2546 \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`.

```

2547 \cs_new_protected:Nn \__enumext_store_internal_ref:
2548 {
2549     \cs_set_protected:Npn \__enumext_tmp:n ##1
2550     {
2551         \tl_set_eq:cc { \l__enumext_label_copy_##1_tl } { \l__enumext_label_##1_tl }
2552         \tl_reverse:c { \l__enumext_label_copy_##1_tl }
2553         \tl_remove_once:cn { \l__enumext_label_copy_##1_tl } { . }
2554         \tl_reverse:c { \l__enumext_label_copy_##1_tl }
2555     }
2556     \clist_map_inline:nn { i, ii, iii, iv, vii } { \__enumext_tmp:n {##1} }
2557     \cs_set:Npn \__enumext_tmp:n ##1
2558     { . \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.

```

2559 \bool_lazy_all:nT
2560 {
2561   { \bool_if_p:N \g__enumext_starred_bool }
2562   { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
2563 }
2564 {
2565   \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2566   { \tl_use:N \l__enumext_label_copy_vii_tl }
2567 }
2568 \bool_lazy_all:nT
2569 {
2570   { \bool_not_p:n { \g__enumext_standar_bool } }
2571   { \bool_if_p:N \l__enumext_standar_bool }
2572   { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } }
2573 }
2574 {
2575   \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2576   {
2577     \tl_use:N \l__enumext_label_copy_vii_tl
2578     \int_step_function:nnN { 1 } { \l__enumext_level_int } \__enumext_tmp:n
2579   }
2580 }

```

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.

```

2581 \bool_lazy_all:nT
2582 {
2583   { \bool_if_p:N \g__enumext_standar_bool }
2584   { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } }
2585   { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
2586 }
2587 {
2588   \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2589   {
2590     \tl_use:N \l__enumext_label_copy_i_tl
2591     \int_step_function:nnN { 2 } { \l__enumext_level_int } \__enumext_tmp:n
2592   }
2593 }
2594 \cs_set:Npn \__enumext_tmp:n ##1
2595 { \tl_use:c { \l__enumext_label_copy_ \int_to_roman:n {##1} _tl } . }
2596 \bool_lazy_all:nT
2597 {
2598   { \bool_if_p:N \g__enumext_standar_bool }
2599   { \bool_if_p:N \l__enumext_starred_bool }
2600   { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } }
2601 }
2602 {
2603   \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2604   {
2605     \int_step_function:nnN { 1 } { \l__enumext_level_int } \__enumext_tmp:n
2606     \tl_use:N \l__enumext_label_copy_vii_tl
2607   }
2608 }

```

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

```

2609 \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
2610 {
2611   \l__enumext_store_name_tl \c_colon_str
2612   \int_eval:n { \prop_count:c { \g__enumext_ \l__enumext_store_name_tl _prop } }
2613 }

```

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.

```

2614 \tl_put_right:Ne \l__enumext_write_aux_file_tl
2615 {
2616   \__enumext_newlabel:nn
2617   { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2618   { \l__enumext_newlabel_arg_two_tl }
2619 }
2620 \l__enumext_write_aux_file_tl

```

```
2621 }
```

(End of definition for `\__enumext_store_internal_ref:`)

### 13.29 Common functions for `\anskey` and `anskey*` environment

```
\__enumext_store_anskey_code:n
```

The internal function `\__enumext_store_anskey_code: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*”  $\langle \textit{argument} \rangle$ .

```
2622 \cs_new_protected:Npn \__enumext_store_anskey_code:n #1
2623 {
2624   \int_gincr:N \g__enumext_item_anskey_int
2625   \__enumext_store_addto_prop:n {#1}
2626   \bool_if:NT \l__enumext_store_ref_key_bool
2627   {
2628     \__enumext_store_internal_ref:
2629   }
2630   \__enumext_anskey_show_wrap_left:n { #1 }
```

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

```
2631   \tl_clear:N \l__enumext_store_anskey_arg_tl
2632   \bool_lazy_and:nnT
2633   { \bool_if_p:N \l__enumext_store_columns_break_bool }
2634   { \bool_not_p:n { \l__enumext_starred_bool } }
2635   {
2636     \tl_put_left:Nn \l__enumext_store_anskey_arg_tl { \columnbreak }
2637   }
2638   \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`.

```
2639   \bool_lazy_and:nnT
2640   { \bool_not_p:n { \l__enumext_starred_bool } }
2641   { \int_compare_p:nNn { \l__enumext_store_item_join_int } > { 1 } }
2642   {
2643     \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2644     {
2645       ( \exp_not:V \l__enumext_store_item_join_int )
2646     }
2647   }
```

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  $\langle \textit{argument} \rangle$  for `\anskey` or  $\langle \textit{body} \rangle$  for `anskey*`.

```
2648   \bool_if:NTF \l__enumext_store_item_star_bool
2649   {
2650     \tl_put_right:Nn \l__enumext_store_anskey_arg_tl { * }
2651     \tl_if_empty:NF \l__enumext_store_item_symbol_tl
2652     {
2653       \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2654       {
2655         [ \exp_not:V \l__enumext_store_item_symbol_tl ]
2656       }
2657     }
2658     \dim_compare:nT
2659     {
2660       \l__enumext_store_item_symbol_sep_dim != \c_zero_dim
2661     }
2662     {
2663       \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2664       {
2665         [ \exp_not:V \l__enumext_store_item_symbol_sep_dim ]
2666       }
2667     }
2668     \tl_put_right:Nn \l__enumext_store_anskey_arg_tl {#1}
2669   }
2670   {
2671     \tl_put_right:Nn \l__enumext_store_anskey_arg_tl {#1}
2672   }
```

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*.

```

2673 \bool_lazy_and:nnT
2674 { \bool_if_p:N \l__enumext_store_ref_key_bool }
2675 { \bool_if_p:N \l__enumext_hyperref_bool }
2676 {
2677   \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2678   {
2679     \hfill \exp_not:N \hyperlink { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2680     { \exp_not:V \l__enumext_mark_ref_sym_tl }
2681   }
2682 }
2683 \__enumext_store_addto_seq:V \l__enumext_store_anskey_arg_tl
2684 }

```

(End of definition for `\__enumext_store_anskey_code: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` key.

```

2685 \cs_new_protected:Npn \__enumext_anskey_show_wrap_arg:n #1
2686 {
2687   \par
2688   \bool_if:NTF \l__enumext_starred_bool
2689   {
2690     \__enumext_print_keyans_box:NN
2691     \l__enumext_labelwidth_vii_dim \l__enumext_labelsep_vii_dim
2692   }
2693   {
2694     \__enumext_print_keyans_box:cc
2695     { \l__enumext_labelwidth_ \l__enumext_level: _dim }
2696     { \l__enumext_labelsep_ \l__enumext_level: _dim }
2697   }
2698   \__enumext_anskey_wrapper:n { #1 }
2699 }

```

(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.

```

2700 \cs_new_protected:Npn \__enumext_anskey_show_wrap_left:n #1
2701 {
2702   \bool_if:NT \l__enumext_show_answer_bool
2703   {
2704     \__enumext_anskey_show_wrap_arg:n { #1 }
2705   }
2706   \bool_if:NT \l__enumext_show_position_bool
2707   {
2708     \tl_set:Ne \l__enumext_mark_answer_sym_tl
2709     {
2710       \group_begin:
2711       \exp_not:N \normalfont
2712       \exp_not:N \footnotesize [ \int_eval:n
2713         {
2714           \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
2715         }
2716       ]
2717       \group_end:
2718     }
2719     \__enumext_anskey_show_wrap_arg:n { #1 }
2720   }
2721 }

```

(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⟩]{⟨content⟩}`.

First we'll add the keys `break-col`, `item-join`, `item-star`, `item-sym*` and `item-pos*`.

```

2722 \keys_define:nn { enumext / anskey }
2723 {
2724   break-col .bool_set:N = \l__enumext_store_columns_break_bool,
2725   break-col .default:n = true,
2726   break-col .value_forbidden:n = true,
2727   item-join .int_set:N = \l__enumext_store_item_join_int,
2728   item-join .value_required:n = true,
2729   item-star .bool_set:N = \l__enumext_store_item_star_bool,
2730   item-star .default:n = true,
2731   item-star .value_forbidden:n = true,
2732   item-sym* .tl_set:N = \l__enumext_store_item_symbol_tl,
2733   item-sym* .value_required:n = true,
2734   item-pos* .dim_set:N = \l__enumext_store_item_symbol_sep_dim,
2735   item-pos* .value_required:n = true,
2736   unknown .code:n = { \l__enumext_anskey_unknown:n {#1} },
2737 }

```

The `⟨keys⟩` are stored in `\l_keys_key_str` and the value (if any) is passed as an argument to the function `\l__enumext_anskey_unknown:n`.

```

2738 \cs_new_protected:Npn \l__enumext_anskey_unknown:n #1
2739 {
2740   \exp_args:NV \l__enumext_anskey_unknown:nn \l_keys_key_str {#1}
2741 }
2742 \cs_new_protected:Npn \l__enumext_anskey_unknown:nn #1 #2
2743 {
2744   \tl_if_blank:nTF {#2}
2745   {
2746     \msg_error:nnn { enumext } { anskey-cmd-key-unknown } {#1}
2747   }
2748   {
2749     \msg_error:nnnn { enumext } { anskey-cmd-key-value-unknown } {#1} {#2}
2750   }
2751 }

```

(End of definition for `\l__enumext_anskey_unknown:n` and `\l__enumext_anskey_unknown:nn`.)

- 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 `\l__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 `\l__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 `\l__enumext_store_anskey_code:n`.

```

2752 \NewDocumentCommand \anskey { o +m }
2753 {
2754   \l__enumext_anskey_safe_outer:
2755   \group_begin:
2756     \bool_if:NT \l__enumext_check_answers_bool
2757     {
2758       \tl_if_novalue:nF {#1}
2759       {
2760         \keys_set:nn { enumext / anskey } {#1}
2761       }
2762       \tl_if_blank:nTF {#2}
2763       {
2764         \msg_error:nn { enumext } { anskey-empty-arg }
2765       }
2766       {
2767         \l__enumext_anskey_safe_inner:
2768         \l__enumext_store_anskey_code:n {#2}
2769       }
2770     }

```

```

2771 \group_end:
2772 }

```

(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:`

```

2773 \cs_new_protected:Nn \__enumext_anskey_safe_outer:
2774 {
2775   \bool_if:NF \l__enumext_store_active_bool
2776   {
2777     \msg_error:nnnn { enumext } { anskey-wrong-place } { anskey } { enumext }
2778   }
2779   \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
2780   {
2781     \msg_error:nnnn { enumext } { command-wrong-place } { anskey } { keyans }
2782   }
2783   \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
2784   {
2785     \msg_error:nnnn { enumext } { command-wrong-place } { anskey } { keyans* }
2786   }
2787   \int_compare:nNnT { \l__enumext_keyans_pic_level_int } = { 1 }
2788   {
2789     \msg_error:nnnn { enumext } { command-wrong-place } { anskey } { keyanspic }
2790   }
2791 }

```

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.

```

2792 \cs_new_protected:Nn \__enumext_anskey_safe_inner:
2793 {
2794   \int_incr:N \l__enumext_anskey_level_int
2795   \int_compare:nNnT { \l__enumext_anskey_level_int } > { 1 }
2796   {
2797     \msg_error:nn { enumext } { anskey-nested }
2798   }
2799   \bool_if:NF \l__enumext_item_number_bool
2800   {
2801     \msg_error:nn { enumext } { anskey-unnumber-item }
2802   }
2803   \mode_if_math:T
2804   {
2805     \msg_error:nne { enumext } { anskey-math-mode } { \c_backslash_str anskey }
2806   }
2807 }

```

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

### 13.31 The environment `anskey*`

Managing *verbatim content* in an environment is quite complicated, I learned that when creating the `scontents` package, so to be able to have support at this point it is best to play a little with the internal code of `scontents` and *hooks*. Some considerations I should have here before implementing this:

- If some package, class or user has defined the environment with the same name somewhere in the document it would be a problem, you would not know what argument has been passed to `store-env`, if you are using the key `print-env` or the `write-out` key, sure, I can detect and modify it within the `enumext` and `enumext*` environments, but it would look strange not to have some keys available when running within these environments.
- A better (perhaps a bit paranoid) option is to define it within the environment in which the `save-ans` key is executed. and have it available only when that key is executed, here I would have absolute control of the *⟨keys⟩* and I make sure that `write-out` is not used, then using *hooks after* I undefine it and using *hook before* I check if it has been created by any package, class or user and I return a error, then the user will have to see how to solve the problem.

`\__enumext_undefine_anskey_env:`

The function `\__enumext_undefine_anskey_env:` will undefine the environment `anskey*` and will be passed to the function `\__enumext_execute_after_env:` (§13.32) which is executed after the environment in which the key `save-ans` is active.

```

2808 \cs_new_protected:Nn \__enumext_undefine_anskey_env:
2809 {
2810   \cs_undefine:c { anskey* }

```

```

2811 \cs_undefine:c { endanskey* }
2812 \cs_undefine:c { __scontents_anskey*_env_begin: }
2813 \cs_undefine:c { __scontents_anskey*_env_end: }
2814 }

```

Detection of the `anskey*` environment outside the `enumext` and `enumext*` environments.

```

2815 \__enumext_before_env:nn { enumext }
2816 {
2817   \bool_lazy_and:nnT
2818   { \int_compare_p:nNn { \__enumext_level_int } = { 0 } }
2819   { \int_compare_p:nNn { \__enumext_level_h_int } = { 0 } }
2820   {
2821     \cs_if_free:cF { __scontents_anskey*_env_begin: }
2822     {
2823       \msg_error:nnn { enumext } { anskey-env-error } { anskey* }
2824     }
2825   }
2826 }
2827 \__enumext_before_env:nn { enumext* }
2828 {
2829   \bool_lazy_and:nnT
2830   { \int_compare_p:nNn { \__enumext_level_int } = { 0 } }
2831   { \int_compare_p:nNn { \__enumext_level_h_int } = { 0 } }
2832   {
2833     \cs_if_free:cF { __scontents_anskey*_env_begin: }
2834     {
2835       \msg_error:nnn { enumext } { anskey-env-error } { anskey* }
2836     }
2837   }
2838 }

```

Detection of the `anskey*` environment inside the `keyans`, `keyans*` and `keyanspic` environments, if preceded by a not numbered `\item` or if it is in *math mode* returning the appropriate messages.

```

2839 \__enumext_before_env:nn { anskey* }
2840 {
2841   \int_compare:nNnT { \__enumext_keyans_level_int } = { 1 }
2842   {
2843     \msg_error:nnn { enumext } { anskey-env-wrong } { keyans }
2844   }
2845   \int_compare:nNnT { \__enumext_keyans_level_h_int } = { 1 }
2846   {
2847     \msg_error:nnn { enumext } { anskey-env-wrong } { keyans* }
2848   }
2849   \int_compare:nNnT { \__enumext_keyans_pic_level_int } = { 1 }
2850   {
2851     \msg_error:nnn { enumext } { anskey-env-wrong } { keyanspic }
2852   }
2853   \bool_if:NF \__enumext_item_number_bool
2854   {
2855     \msg_error:nn { enumext } { anskey-unnumber-item }
2856   }
2857   \mode_if_math:T
2858   {
2859     \msg_error:nnn { enumext } { anskey-math-mode } { anskey* }
2860   }
2861 }

```

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

`anskey*`

The function `\__enumext_anskey_env_make:n` creates the environment `anskey*` (*custom version of `scontents` environment*) by setting the initial keys `store-env={⟨store name⟩}` and `print-env=false`.

To maintain the *scope* of the environment and that it is only active when the key `save-ans` is active we will pass this function to the function `\__enumext_storing_exec: (§13.26.1)` and we will execute it only if the variable `\__enumext_anskey_env_bool` is true, with this we prevent it from being executed again when the environment is nested and the key `save-ans` is active, which returns an error for part of the package `scontents`.

```

2862 \cs_new_protected:Npn \__enumext_anskey_env_make:n #1
2863 {
2864   \bool_if:NT \__enumext_anskey_env_bool
2865   {
2866     \newenvsc{anskey*}[store-env=#1,print-env=false]

```



```

2867     \__enumext_anskey_env_exec:
2868   }
2869 }
2870 \cs_generate_variant:Nn \__enumext_anskey_env_make:n { V }

```

The function `\__enumext_anskey_env_define_keys:` will add the keys `break-col`, `item-join`, `item-join`, `item-star`, `item-sym*` and `item-pos*` and will leave the keys `print-env`, `store-env` and `write-out` undefined. We will apply this function using the *hook* function `\__enumext_before_env:nn`.

```

2871 \cs_new_protected:Nn \__enumext_anskey_env_define_keys:
2872 {
2873   \keys_define:nn { scontents / scontents }
2874   {
2875     break-col .bool_gset:N = \g__enumext_store_columns_break_bool,
2876     break-col .default:n   = true,
2877     break-col .value_forbidden:n = true,
2878     item-join .int_gset:N = \g__enumext_store_item_join_int,
2879     item-join .value_required:n = true,
2880     item-star .bool_gset:N = \g__enumext_store_item_star_bool,
2881     item-star .default:n   = true,
2882     item-star .value_forbidden:n = true,
2883     item-sym* .tl_gset:N   = \g__enumext_store_item_symbol_tl,
2884     item-sym* .value_required:n = true,
2885     item-pos* .dim_gset:N = \g__enumext_store_item_symbol_sep_dim,
2886     item-pos* .value_required:n = true,
2887     print-env .undefine:,
2888     store-env .undefine:,
2889     write-out .undefine:,
2890     unknown   .code:n     = { \__enumext_anskey_env_unknown:n {##1} },
2891   }
2892 }

```

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`.

```

2893 \cs_new_protected:Npn \__enumext_anskey_env_unknown:n #1
2894 {
2895   \exp_args:NV \__enumext_anskey_env_unknown:nn \l_keys_key_str {#1}
2896 }
2897 \cs_new_protected:Npn \__enumext_anskey_env_unknown:nn #1#2
2898 {
2899   \tl_if_blank:nTF {#2}
2900   {
2901     \msg_error:nnn { enumext } { anskey-env-key-unknown } {#1}
2902   }
2903   {
2904     \msg_error:nnnn { enumext } { anskey-env-key-value-unknown } {#1} {#2}
2905   }
2906 }

```

The function `\__enumext_anskey_env_reset_keys:` will leave the keys `break-col`, `item-join`, `item-join`, `item-star`, `item-sym*` and `item-pos*` undefined. We will apply this function using the *hook* function `\__enumext_after_env:nn`.

```

2907 \cs_new_protected:Nn \__enumext_anskey_env_reset_keys:
2908 {
2909   \keys_define:nn { scontents / scontents }
2910   {
2911     break-col .undefine:,
2912     item-join .undefine:,
2913     item-star .undefine:,
2914     item-sym* .undefine:,
2915     item-pos* .undefine:,
2916     write-out .code:n     = {
2917       \bool_set_false:N \l__scontents_storing_bool
2918       \bool_set_true:N  \l__scontents_writing_bool
2919       \tl_set:Nn \l__scontents_fname_out_tl {##1}
2920     },
2921     write-out .value_required:n = true,
2922     print-env .meta:nn         = { scontents } { print-env = ##1 },
2923     print-env .default:n       = true,
2924     store-env .meta:nn         = { scontents } { store-env = ##1 },
2925     unknown   .code:n         = { \__scontents_parse_environment_keys:n {##1} },
2926   }
2927 }

```

The function `\__enumext_rescan_anskey_env:n` will be responsible for bringing the *(body)* of the environment saved in the sequence `\g__scontents_name_⟨store name⟩_seq` to pass it to our *sequence* and *prop list*.

```

2928 \cs_new_protected:Npn \__enumext_rescan_anskey_env:n #1
2929 {
2930   \group_begin:
2931   \int_set:Nn \tex_newlinechar:D { ``\^^J }
2932   \__scontents_rescan_tokens:x
2933   {
2934     \endgroup % This assumes \catcode`\=0... Things might go off otherwise.
2935     #1
2936   }
2937 }

```

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

`\__enumext_anskey_env_exec:` The function `\__enumext_anskey_env_exec:` will be responsible for processing all the code necessary for the execution of the environment. The first thing will be to add our *(keys)*.

```

2938 \cs_new_protected:Nn \__enumext_anskey_env_exec:
2939 {
2940   \__enumext_before_env:nn { anskey* }
2941   {
2942     \__enumext_anskey_env_define_keys:
2943   }

```

Now we will execute our actions after the *anskey\** environment is closed. We'll fetch the contents of the *environment body* that is now saved in `\g__scontents_name_⟨store name⟩_seq` and store it in the variable `\l__enumext_store_anskey_env_tl` then we execute the rest of the functions.

```

2944   \hook_if_empty:nF {env/anskey*/after}
2945   {
2946     \hook_gremove_code:nn {env/anskey*/after} { * }
2947   }
2948   \__enumext_after_env:nn { anskey* }
2949   {
2950     \__enumext_anskey_env_save_keys:
2951     \tl_clear:N \l__enumext_store_anskey_env_tl
2952     \tl_clear:N \l__enumext_store_anskey_opt_tl
2953     \bool_if:NT \l__enumext_check_answers_bool
2954     {
2955       \tl_gset:Nx \l__enumext_store_anskey_env_tl
2956       {
2957         \seq_item:ce { g__scontents_name_ \l__enumext_store_name_tl _seq } { -1 }
2958       }
2959       \regex_match:nVTF
2960       { ^\s* \z | ^\s* \u{c__scontents_hidden_space_str} \z }
2961       \l__enumext_store_anskey_env_tl
2962       {
2963         \msg_error:nn { enumext } { anskey-empty-arg }
2964       }
2965       {
2966         \__enumext_anskey_env_store:
2967       }
2968     }
2969     \__enumext_anskey_env_clean_vars:
2970     \__enumext_anskey_env_reset_keys:
2971   }
2972 }

```

🔗 The use of `\hook_gremove_code:nn` is necessary here, otherwise the `{⟨code⟩}` passed to `\__enumext_after_env:nn{anskey*}` will be accumulated for each execution. The last function `\__enumext_anskey_env_reset_keys:` is necessary so as not to hinder any *scontents* environment running within *enumext* or *enumext\**.

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

```

\__enumext_anskey_env_save_keys:
\__enumext_anskey_env_store:
\__enumext_anskey_env_clean_vars:

```

The function `\__enumext_anskey_env_save_keys:` processing the `[⟨key = val⟩]` passed to the environment and save this in the variable `\l__enumext_store_anskey_opt_tl`. If the `break-col` key is present and the environment is running under *enumext* (not in *enumext\**) we will add the key `break-col`.

```

2973 \cs_new_protected:Nn \__enumext_anskey_env_save_keys:
2974 {
2975   \bool_lazy_and:nnT
2976   { \bool_if_p:N \g__enumext_store_columns_break_bool }

```

```

2977     { \bool_not_p:n { \l__enumext_starred_bool } }
2978     {
2979       \tl_put_left:Ne \l__enumext_store_anskey_opt_tl { ,break-col, }
2980     }

```

If the `item-join` key is present and the command is running under `enumext*` we will add to `\l__enumext_store_anskey_opt_tl`.

```

2981     \bool_lazy_and:nnT
2982     { \bool_not_p:n { \l__enumext_starred_bool } }
2983     { \int_compare_p:nNn { \g__enumext_store_item_join_int } > { 1 } }
2984     {
2985       \tl_put_left::Ne \l__enumext_store_anskey_opt_tl
2986       {
2987         ,item-join = \exp_not:V \g__enumext_store_item_join_int,
2988       }
2989     }

```

And now we will review the keys `item-star`, `item-sym*` and `item-pos*` and pass them to `\l__enumext_store_anskey_opt_tl`.

```

2990     \bool_if:NT \g__enumext_store_item_star_bool
2991     {
2992       \tl_put_left:Ne \l__enumext_store_anskey_opt_tl
2993       {
2994         ,item-star,
2995       }
2996       \tl_if_empty:NF \g__enumext_store_item_symbol_tl
2997       {
2998         \tl_put_left:Ne \l__enumext_store_anskey_opt_tl
2999         {
3000           ,item-sym* = \exp_not:V \g__enumext_store_item_symbol_tl,
3001         }
3002       }
3003       \dim_compare:nT
3004       {
3005         \g__enumext_store_item_symbol_sep_dim != \c_zero_dim
3006       }
3007       {
3008         \tl_put_left:Ne \l__enumext_store_anskey_opt_tl
3009         {
3010           ,item-pos* = \exp_not:V \g__enumext_store_item_symbol_sep_dim,
3011         }
3012       }
3013     }
3014   }

```

The function `\__enumext_anskey_env_store:` will be responsible for storing the content of the environment using the functions `\__enumext_store_anskey_code:n` and `\__enumext_rescan_anskey_env:n`.

```

3015 \cs_new_protected:Nn \__enumext_anskey_env_store:
3016 {
3017   \group_begin:
3018   \tl_if_empty:NTF \l__enumext_store_anskey_opt_tl
3019   {
3020     \exp_args:Ne
3021     \__enumext_store_anskey_code:n
3022     {
3023       \__enumext_rescan_anskey_env:n { \l__enumext_store_anskey_env_tl }
3024     }
3025   }
3026   {
3027     \keys_set_known:nV { enumext / anskey } \l__enumext_store_anskey_opt_tl
3028     \exp_args:Ne
3029     \__enumext_store_anskey_code:n
3030     {
3031       \__enumext_rescan_anskey_env:n { \l__enumext_store_anskey_env_tl }
3032     }
3033   }
3034   \group_end:
3035 }

```

The function `\__enumext_anskey_env_clean_vars:` will return the global variables used by the `⟨keys⟩` to their initial state.

```

3036 \cs_new_protected:Nn \__enumext_anskey_env_clean_vars:

```

```

3037 {
3038   \bool_gset_false:N \g__enumext_store_columns_break_bool
3039   \int_gzero:N       \g__enumext_store_item_join_int
3040   \bool_gset_false:N \g__enumext_store_item_star_bool
3041   \tl_gclear:N       \g__enumext_store_item_symbol_tl
3042   \dim_gzero:N       \g__enumext_store_item_symbol_sep_dim
3043 }

```

(End of definition for \\_\_enumext\_anskey\_env\_save\_keys:, \\_\_enumext\_anskey\_env\_store:, and \\_\_enumext\_anskey\_env\_clean\_vars:.)

### 13.32 Executing anskey\*, check-ans 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, undefine the environment `anskey*` (§13.31) through the function \\_\_enumext\_undefine\_anskey\_env: and finally we execute the function \\_\_enumext\_reset\_global\_vars: returning the used variables to their original state.

```

3044 \cs_new_protected:Nn \__enumext_execute_after_env:
3045 {
3046   \int_compare:nNt { \l__enumext_level_int } = { 0 }
3047   {
3048     \tl_if_empty:NF \g__enumext_store_name_tl
3049     {
3050       \__enumext_stop_save_ans_msg:
3051       \__enumext_item_answer_diff:
3052       \__enumext_log_global_vars:
3053       \__enumext_log_answer_vars:
3054       \bool_if:NTF \g__enumext_check_ans_key_bool
3055       {
3056         \__enumext_check_ans_show:
3057       }
3058       { \__enumext_check_ans_log: }
3059       \__enumext_undefine_anskey_env:
3060     }
3061     \__enumext_reset_global_vars:
3062   }
3063 }

```

(End of definition for \\_\_enumext\_execute\_after\_env:.)

- 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..

### 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 *⟨label⟩* for `\item*` in `keyans` environment and the current *⟨label⟩* for `\anspic*` in `keyanspic` environment followed by the *⟨contents⟩* of the *optional argument* of both commands to the \\_\_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.

```

3064 \cs_new_protected:Npn \__enumext_keyans_addto_prop:n #1
3065 {
3066   \tl_clear:N \l__enumext_store_current_label_tl
3067   \int_compare:nNtTF { \l__enumext_keyans_pic_level_int } = { 1 }
3068   {
3069     \tl_put_right:Ne \l__enumext_store_current_label_tl { \l__enumext_label_vi_tl }
3070   }
3071   {
3072     \tl_put_right:Ne \l__enumext_store_current_label_tl { \l__enumext_label_v_tl }
3073   }

```

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

```

3074   \tl_if_novalue:nF { #1 }
3075   {
3076     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_tl
3077     {
3078       \tl_put_right:Ne \l__enumext_store_current_label_tl

```

```

3079         {
3080             \l__enumext_store_keyans_item_opt_sep_tl
3081         }
3082     }
3083     \tl_put_right:Ne \l__enumext_store_current_label_tl { #1 }
3084 }
3085 \__enumext_store_addto_prop:V \l__enumext_store_current_label_tl
3086 }

```

(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 *⟨label⟩* for `\item*` and `\anspic*` with the *⟨contents⟩* of the *optional argument*. The mechanism defined here will allow to execute `\ref{⟨store name: position⟩}` and will return `1`. (A).

```

\__enumext_keyans_store_ref:
  \__enumext_keyans_store_ref_aux_i:
  \__enumext_keyans_store_ref_aux_ii:

```

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 *⟨labels⟩* and remove the dots “.” from them, we do not want to get double dots in references.

```

3087 \cs_new_protected:Nn \__enumext_keyans_store_ref:
3088 {
3089     \bool_if:NT \l__enumext_store_ref_key_bool
3090     {
3091         \cs_set_protected:Npn \__enumext_tmp:n ##1
3092         {
3093             \tl_set_eq:cc { \l__enumext_label_copy_##1_tl } { \l__enumext_label_##1_tl }
3094             \tl_reverse:c { \l__enumext_label_copy_##1_tl }
3095             \tl_remove_once:cn { \l__enumext_label_copy_##1_tl } { . }
3096             \tl_reverse:c { \l__enumext_label_copy_##1_tl }
3097         }
3098         \clist_map_inline:nn { i, v, vi, vii, viii } { \__enumext_tmp:n {##1} }
3099         \__enumext_keyans_store_ref_aux_i:
3100     }
3101 }

```

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`.

```

3102 \cs_new_protected:Nn \__enumext_keyans_store_ref_aux_i:
3103 {
3104     \bool_if:NT \g__enumext_starred_bool
3105     {
3106         \tl_set_eq:NN \l__enumext_label_copy_i_tl \l__enumext_label_copy_vii_tl
3107     }
3108     \int_compare:nNnT { \l__enumext_keyans_pic_level_int } = { 1 }
3109     {
3110         \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
3111         { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_vii_tl }
3112     }
3113     \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
3114     {
3115         \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
3116         { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_v_tl }
3117     }
3118     \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
3119     {
3120         \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
3121         { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_viii_tl }
3122     }
3123     \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
3124     {
3125         \l__enumext_store_name_tl \c_colon_str
3126         \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } }
3127     }
3128     \__enumext_keyans_store_ref_aux_ii:
3129 }

```

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.

```

3130 \cs_new_protected:Nn \__enumext_keyans_store_ref_aux_ii:

```

```

3131 {
3132   \tl_put_right:Ne \l__enumext_write_aux_file_tl
3133   {
3134     \__enumext_newlabel:nn
3135     { \exp_not:V \l__enumext_newlabel_arg_one_tl }
3136     { \l__enumext_newlabel_arg_two_tl }
3137   }
3138   \l__enumext_write_aux_file_tl
3139 }

```

(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.

```

3140 \cs_new_protected:Npn \__enumext_keyans_addto_seq:n #1
3141 {
3142   \tl_clear:N \l__enumext_store_current_label_tl
3143   \int_compare:nNnTF { \l__enumext_keyans_pic_level_int } = { 1 }
3144   {
3145     \tl_put_right:Ne \l__enumext_store_current_label_tl { \item \l__enumext_label_vi_tl }
3146   }
3147   {
3148     \tl_put_right:Ne \l__enumext_store_current_label_tl { \item \l__enumext_label_v_tl }
3149   }
3150   \tl_if_novalue:nF { #1 }
3151   {
3152     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_tl
3153     {
3154       \tl_put_right:Ne \l__enumext_store_current_label_tl
3155       {
3156         \l__enumext_store_keyans_item_opt_sep_tl
3157       }
3158     }
3159     \tl_put_right:Ne \l__enumext_store_current_label_tl { #1 }
3160   }
3161   \__enumext_keyans_addto_seq_link:
3162 }

```

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.

```

3163 \cs_new_protected:Nn \__enumext_keyans_addto_seq_link:
3164 {
3165   \bool_lazy_and:nnT
3166   { \bool_if_p:N \l__enumext_store_ref_key_bool }
3167   { \bool_if_p:N \l__enumext_hyperref_bool }
3168   {
3169     \tl_put_right:Ne \l__enumext_store_current_label_tl
3170     {
3171       \hfill \exp_not:N \hyperlink
3172       {
3173         \exp_not:V \l__enumext_newlabel_arg_one_tl
3174       }
3175       { \exp_not:V \l__enumext_mark_ref_sym_tl }
3176     }
3177   }
3178   \__enumext_store_addto_seq:V \l__enumext_store_current_label_tl
3179   \bool_if:NT \l__enumext_check_answers_bool
3180   {
3181     \int_gincr:N \g__enumext_item_anskey_int
3182   }
3183 }

```

(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:

```

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`.

```

3184 \cs_new_protected:Npn \__enumext_keyans_save_item_opt:n #1
3185 {
3186   \tl_if_novalue:nF { #1 }
3187   {
3188     \tl_set:Nx \l__enumext_store_current_opt_arg_tl { #1 }
3189   }
3190 }

```

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.

```

3191 \cs_new_protected:Nn \__enumext_keyans_show_item_opt:
3192 {
3193   \tl_if_empty:NF \l__enumext_store_current_opt_arg_tl
3194   {
3195     \bool_lazy_or:nnT
3196     { \bool_if_p:N \l__enumext_show_answer_bool }
3197     { \bool_if_p:N \l__enumext_show_position_bool }
3198     {
3199       \__enumext_keyans_wrapper_opt:n
3200       { \l__enumext_store_current_opt_arg_tl } \c_space_tl
3201     }
3202   }
3203 }

```

(End of definition for `\__enumext_keyans_save_item_opt:n` and `\__enumext_keyans_show_item_opt:.`)

```

\__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`.

```

3204 \cs_new_protected:Nn \__enumext_keyans_pos_mark_set:
3205 {
3206   \__enumext_label_width_by_box:Nn
3207   \l__enumext_mark_sep_tmpa_dim { \l__enumext_label_v_tl }
3208   \str_case:Vn \l__enumext_align_label_pos_v_str
3209   {
3210     { l }
3211     {
3212       \dim_set:Nn \l__enumext_mark_sep_tmpb_dim { \c_zero_dim }
3213     }
3214     { r }
3215     {
3216       \dim_set:Nn \l__enumext_mark_sep_tmpb_dim
3217       { \l__enumext_labelwidth_v_dim - \l__enumext_mark_sep_tmpa_dim }
3218     }
3219     { c }
3220     {
3221       \dim_set:Nn \l__enumext_mark_sep_tmpb_dim
3222       { 0.5\l__enumext_labelwidth_v_dim - 0.5\l__enumext_mark_sep_tmpa_dim }
3223     }
3224   }

```

Here we set the default value for the key `mark-sep`.

```

3225 \dim_compare:nNnT { \l__enumext_mark_sym_sep_dim } = { \c_zero_dim }
3226 {
3227   \dim_set:Nn \l__enumext_mark_sym_sep_dim { \l__enumext_labelsep_v_dim }
3228 }
3229 \dim_add:Nn \l__enumext_mark_sym_sep_dim { \l__enumext_mark_sep_tmpb_dim }
3230 }

```

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

```

3231 \cs_new_protected:Nn \__enumext_keyans_show_ans:
3232 {
3233   \bool_lazy_all:nT
3234   {
3235     { \bool_if_p:N \l__enumext_show_answer_bool }
3236     { \bool_if_p:N \l__enumext_item_wrap_key_bool }
3237   }
3238   {

```



```

3239         \__enumext_keyans_pos_mark_set:
3240         \__enumext_print_keyans_box:NN
3241         \l__enumext_labelwidth_v_dim \l__enumext_mark_sym_sep_dim
3242     }
3243 }

```

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.

```

3244 \cs_new_protected:Nn \__enumext_keyans_show_pos:
3245 {
3246     \int_compare:nNnTF { \l__enumext_keyans_level_int } = { 1 }
3247     {
3248         \int_incr:N \l__enumext_show_pos_tmp_int
3249     }
3250     {
3251         \int_zero:N \l__enumext_show_pos_tmp_int
3252     }
3253     \bool_lazy_all:nT
3254     {
3255         { \bool_if_p:N \l__enumext_show_position_bool }
3256         { \bool_if_p:N \l__enumext_item_wrap_key_bool }
3257     }
3258     {
3259         \tl_set:Nc \l__enumext_mark_answer_sym_tl
3260         {
3261             \group_begin:
3262             \exp_not:N \normalfont
3263             \exp_not:N \footnotesize [ \int_eval:n
3264             {
3265                 \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } + \l__enumext_show_pos:
3266             }
3267             ]
3268             \group_end:
3269         }
3270         \__enumext_keyans_pos_mark_set:
3271         \__enumext_print_keyans_box:NN
3272         \l__enumext_labelwidth_v_dim \l__enumext_mark_sym_sep_dim
3273     }
3274 }

```

(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*.

```

3275 \cs_new_protected:Npn \__enumext_default_item:n #1
3276 {
3277     \tl_if_no_value:nTF {#1}
3278     {
3279         \bool_if:NT \l__enumext_check_answers_bool
3280         {
3281             \int_gincr:N \g__enumext_item_number_int
3282             \bool_set_true:N \l__enumext_item_number_bool
3283         }
3284         \bool_set_true:c { l__enumext_wrap_label_ \__enumext_level: _bool }

```

```

3285     \__enumext_item_std:w \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
3286   }
3287   {
3288     \bool_set_eq:cc
3289     { l__enumext_wrap_label_ \__enumext_level: _bool }
3290     { l__enumext_wrap_label_opt_ \__enumext_level: _bool }
3291     \__enumext_item_std:w [#1] \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
3292   }
3293 }

```

(End of definition for \\_\_enumext\_default\_item:n.)

\\_\_enumext\_starred\_item\_exec:nn  
 \\_\_enumext\_starred\_item\_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`.

```

3294 \cs_new_protected:Npn \__enumext_starred_item_exec:nn #1 #2
3295 {
3296   \tl_if_novalue:nTF {#1}
3297   {
3298     \tl_gset_eq:Nc
3299     \g__enumext_item_symbol_aux_tl { l__enumext_item_symbol_ \__enumext_level: _tl }
3300   }
3301   {
3302     \tl_gset:Nn \g__enumext_item_symbol_aux_tl {#1}
3303   }
3304   \tl_if_novalue:nTF {#2}
3305   {
3306     \dim_set_eq:cc
3307     { l__enumext_item_symbol_sep_ \__enumext_level: _dim }
3308     { l__enumext_labelsep_ \__enumext_level: _dim }
3309   }
3310   {
3311     \dim_set:cn { l__enumext_item_symbol_sep_ \__enumext_level: _dim } {#2}
3312   }
3313   \bool_if:NT \l__enumext_check_answers_bool
3314   {
3315     \int_gincr:N \g__enumext_item_number_int
3316     \bool_set_true:N \l__enumext_item_number_bool
3317   }
3318   \bool_set_true:c { l__enumext_wrap_label_ \__enumext_level: _bool }
3319   \__enumext_item_std:w \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
3320 }

```

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

```

3321 \cs_new_protected:Nn \__enumext_starred_item_exec:
3322 {
3323   \tl_if_empty:cF { l__enumext_item_symbol_ \__enumext_level: _tl }
3324   {
3325     \mode_leave_vertical:
3326     \skip_horizontal:n { -\dim_use:c { l__enumext_item_symbol_sep_ \__enumext_level: _dim } }
3327     \hbox_overlap_left:n { \g__enumext_item_symbol_aux_tl }
3328     \skip_horizontal:n { \dim_use:c { l__enumext_item_symbol_sep_ \__enumext_level: _dim } }
3329   }
3330 }

```

(End of definition for \\_\_enumext\_starred\_item\_exec:nn and \\_\_enumext\_starred\_item\_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).

```

3331 \cs_new_protected:Nn \__enumext_redefine_item:

```

```

3332 {
3333   \RenewDocumentCommand \item { s o o }
3334   {
3335     \bool_if:nTF {##1}
3336     {
3337       \__enumext_starred_item_exec:nn {##2} {##3}
3338     }
3339     { \__enumext_default_item:n {##2} }
3340   }
3341 }

```

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

\\_\_enumext\_make\_label: The function \\_\_enumext\_make\_label: redefine \make\_label 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).

```

3342 \cs_new_protected:Nn \__enumext_make_label:
3343 {
3344   \IfDocumentMetadataTF
3345   {
3346     \__enumext_make_label_box:
3347   }
3348   {
3349     \bool_if:NTF \l__enumext_mode_box_bool
3350     {
3351       \__enumext_make_label_box:
3352     }
3353     {
3354       \__enumext_make_label_std:
3355     }
3356   }
3357 }

```

Standard definition when \DocumentMetadata is not active.

```

3358 \cs_new_protected:Nn \__enumext_make_label_std:
3359 {
3360   \RenewDocumentCommand \make_label { m }
3361   {
3362     \tl_use:c { l__enumext_label_fill_left_ \__enumext_level: _tl }
3363     \__enumext_starred_item_exec:
3364     \tl_use:c { l__enumext_label_font_style_ \__enumext_level: _tl }
3365     \bool_if:cTF { l__enumext_wrap_label_ \__enumext_level: _bool }
3366     {
3367       \use:c { __enumext_wrapper_label_ \__enumext_level: :n } { ##1 }
3368     }
3369     { ##1 }
3370     \tl_use:c { l__enumext_label_fill_right_ \__enumext_level: _tl }
3371     \tl_gclear:N \g__enumext_item_symbol_aux_tl
3372   }
3373 }

```

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*.

```

3374 \cs_new_protected:Nn \__enumext_make_label_box:
3375 {
3376   \RenewDocumentCommand \make_label { m }
3377   {
3378     \strut\smash
3379     {
3380       \makebox
3381       [ \dim_use:c { l__enumext_labelwidth_ \__enumext_level: _dim } ]
3382       [ \str_use:c { l__enumext_align_label_pos_ \__enumext_level: _str } ]
3383       {
3384         \__enumext_starred_item_exec:
3385         \tl_use:c { l__enumext_label_font_style_ \__enumext_level: _tl }
3386         \bool_if:cTF { l__enumext_wrap_label_ \__enumext_level: _bool }
3387         {
3388           \use:c { __enumext_wrapper_label_ \__enumext_level: :n } { ##1 }
3389         }
3390       }
3391     }
3392   }

```

```

3390             { ##1 }
3391             \tl_gclear:N \g__enumext_item_symbol_aux_tl
3392         }
3393     } % close smash
3394 }
3395 }

```

(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*
3396 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
3397 {
3398     \keys_define:nn { enumext / #1 }
3399     {
3400         item-sym* .tl_set:c = { \__enumext_item_symbol_#2_tl },
3401         item-sym* .value_required:n = true,
3402         item-sym* .initial:n = {\textborn},
3403         item-pos* .dim_set:c = { \__enumext_item_symbol_sep_#2_dim },
3404         item-pos* .value_required:n = true,
3405     }
3406 }
3407 \clist_map_inline:nn
3408 {
3409     {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {enumext*}{vii}
3410 }
3411 { \__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>` 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).

#### 13.36.1 Handling unknown keys for `keyans`, `keyans*` and `keyanspic`

`unknown` Define and set `unknown` key for `keyans`, `keyans*` and `keyanspic` environments.

```

\__enumext_keyans_unknown_keys:n
\__enumext_keyans_unknown_keys:nn
3412 \cs_set_protected:Npn \__enumext_tmp:n #1
3413 {
3414     \keys_define:nn { enumext / #1 }
3415     {
3416         unknown .code:n = {
3417             \tl_set:Nn \l__enumext_envir_name_tl {#1}
3418             \__enumext_keyans_unknown_keys:n {##1}
3419         },
3420     }
3421 }
3422 \clist_map_inline:nn { keyans, keyans*, keyanspic } { \__enumext_tmp:n {#1} }

```

Internal functions for handling `unknown` key.

```

3423 \cs_new_protected:Npn \__enumext_keyans_unknown_keys:n #1
3424 {
3425     \exp_args:NV \__enumext_keyans_unknown_keys:nn \l_keys_key_str {#1}
3426 }
3427 \cs_new_protected:Npn \__enumext_keyans_unknown_keys:nn #1#2
3428 {
3429     \tl_if_blank:nTF {#2}
3430     {
3431         \msg_error:nne { enumext } { keyans-unknown-key } {#1}
3432     }
3433     {
3434         \msg_error:nnee { enumext } { keyans-unknown-key-value } {#1} {#2}
3435     }
3436 }

```

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

### 13.36.2 Handling unknown keys for enumext\*

unknown

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

```

3437 \keys_define:nn { enumext / enumext* }
3438 {
3439   unknown .code:n = { \__enumext_starred_unknown_keys:n {#1} },
3440 }

Internal functions for handling unknown key.

3441 \cs_new_protected:Npn \__enumext_starred_unknown_keys:n #1
3442 {
3443   \exp_args:NV \__enumext_starred_unknown_keys:nn \l_keys_key_str {#1}
3444 }
3445 \cs_new_protected:Npn \__enumext_starred_unknown_keys:nn #1#2
3446 {
3447   \tl_if_blank:nTF {#2}
3448   {
3449     \msg_error:nnn { enumext } { starred-unknown-key } {#1}
3450   }
3451   {
3452     \msg_error:nnnn { enumext } { starred-unknown-key-value } {#1} {#2}
3453   }
3454 }
```

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

### 13.36.3 Handling unknown keys for enumext

unknown

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

```

3455 \cs_set_protected:Npn \__enumext_tmp:n #1
3456 {
3457   \keys_define:nn { enumext / #1 }
3458   {
3459     unknown .code:n = { \__enumext_standar_unknown_keys:n {##1} },
3460   }
3461 }
3462 \clist_map_inline:nn { level-1,level-2,level-3,level-4 } { \__enumext_tmp:n {#1} }
```

Internal functions for handling unknown key.

```

3463 \cs_new_protected:Npn \__enumext_standar_unknown_keys:n #1
3464 {
3465   \exp_args:NV \__enumext_standar_unknown_keys:nn \l_keys_key_str {#1}
3466 }
3467 \cs_new_protected:Npn \__enumext_standar_unknown_keys:nn #1#2
3468 {
3469   \tl_if_blank:nTF {#2}
3470   {
3471     \msg_error:nnn { enumext } { standar-unknown-key } {#1}
3472   }
3473   {
3474     \msg_error:nnnn { enumext } { standar-unknown-key-value } {#1} {#2}
3475   }
3476 }
```

(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.

\\_\_enumext\_keyans\_default\_item:n

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

```

3477 \cs_new_protected:Npn \__enumext_keyans_default_item:n #1
3478 {
3479   \tl_if_novalue:nTF { #1 }
3480   {
3481     \bool_set_true:N \__enumext_wrap_label_v_bool
3482     \__enumext_item_std:w \tl_use:N \__enumext_fake_item_indent_v_tl
3483   }
3484   {
3485     \bool_set_eq:NN \__enumext_wrap_label_v_bool \__enumext_wrap_label_opt_v_bool
3486     \__enumext_item_std:w {#1} \tl_use:N \__enumext_fake_item_indent_v_tl
3487   }
```

```

3487     }
3488 }

```

(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.

```

3489 \cs_new_protected:Npn \__enumext_keyans_starred_item:n #1
3490 {
3491     \__enumext_keyans_save_item_opt:n { #1 }
3492     \bool_set_true:N \l__enumext_wrap_label_v_bool
3493     \__enumext_item_std:w \tl_use:N \l__enumext_fake_item_indent_v_tl
3494     \__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.

```

3495     \__enumext_keyans_addto_prop:n { #1 }
3496     \__enumext_keyans_store_ref:
3497     \__enumext_keyans_addto_seq:n { #1 }
3498     \int_gincr:N \g__enumext_check_starred_cmd_int
3499 }

```

(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-key` 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).

```

3500 \cs_new_protected:Nn \__enumext_keyans_redefine_item:
3501 {
3502     \RenewDocumentCommand \item { s o }
3503     {
3504         \bool_if:nTF {##1}
3505         {
3506             \bool_set_true:N \l__enumext_item_wrap_key_bool % wrap-key
3507             \peek_remove_spaces:n
3508             {
3509                 \__enumext_keyans_starred_item:n {##2}
3510             }
3511         }
3512         {
3513             \bool_set_false:N \l__enumext_item_wrap_key_bool
3514             \__enumext_keyans_default_item:n {##2}
3515         }
3516     }
3517 }

```

(End of definition for `\item*` and `\__enumext_keyans_redefine_item:`. This function is documented on page 15.)

`\__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-key` 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).

```

3518 \cs_new_protected:Nn \__enumext_keyans_make_label:
3519 {
3520     \IfDocumentMetadataTF
3521     {
3522         \__enumext_keyans_make_label_box:
3523     }
3524     {
3525         \bool_if:NTF \l__enumext_mode_box_bool
3526         {
3527             \__enumext_keyans_make_label_box:
3528         }
3529         {
3530             \__enumext_keyans_make_label_std:

```

```

3531     }
3532   }
3533 }

```

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

```

3534 \cs_new_protected:Npn \__enumext_keyans_wrapper_label:n #1
3535 {
3536   \bool_lazy_all:nT
3537   {
3538     { \bool_if_p:N \l__enumext_wrap_label_v_bool }
3539     { \bool_if_p:N \l__enumext_show_answer_bool }
3540     { \bool_if_p:N \l__enumext_item_wrap_key_bool }
3541     { \cs_if_exist_p:N \__enumext_keyans_wrapper_item:n }
3542   }
3543   {
3544     \cs_set_eq:NN \__enumext_wrapper_label_v:n \__enumext_keyans_wrapper_item:n
3545   }
3546   \bool_if:NTF \l__enumext_wrap_label_v_bool
3547   {
3548     \__enumext_wrapper_label_v:n { #1 }
3549   }
3550   { #1 }
3551 }

```

Standard definition when `\DocumentMetadata` is not active.

```

3552 \cs_new_protected:Nn \__enumext_keyans_make_label_std:
3553 {
3554   \RenewDocumentCommand \makeLabel { m }
3555   {
3556     \tl_use:N \l__enumext_label_fill_left_v_tl
3557     \__enumext_keyans_show_ans:
3558     \__enumext_keyans_show_pos:
3559     \tl_use:N \l__enumext_label_font_style_v_tl
3560     \__enumext_keyans_wrapper_label:n { ##1 }
3561     \tl_use:N \l__enumext_label_fill_right_v_tl
3562   }
3563 }

```

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

```

3564 \cs_new_protected:Nn \__enumext_keyans_make_label_box:
3565 {
3566   \RenewDocumentCommand \makeLabel { m }
3567   {
3568     \strut\smash
3569     {
3570       \makebox[ \l__enumext_labelwidth_v_dim ][ \l__enumext_align_label_pos_v_str ]
3571       {
3572         \__enumext_keyans_show_ans:
3573         \__enumext_keyans_show_pos:
3574         \tl_use:N \l__enumext_label_font_style_v_tl
3575         \__enumext_keyans_wrapper_label:n { ##1 }
3576       }
3577     }
3578   }
3579 }

```

(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`.

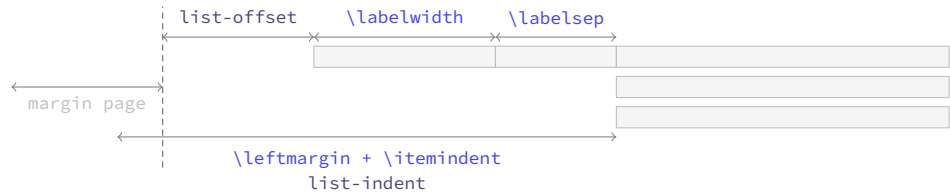
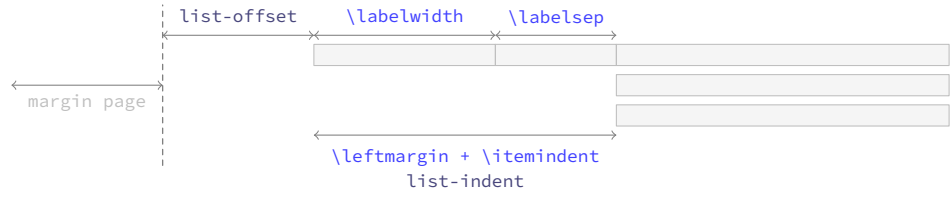
#### 13.38.1 Calculation of `\leftmargin` and `\itemindent`

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

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.

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



Figure 9: Representation of standard horizontal lengths in `list` environment.Figure 10: Representation of horizontal lengths concept in list in `enumext`.

```

\__enumext_calc_hspace:NNNNNN
\__enumext_calc_hspace:ccccccc

```

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

```

#1: \__enumext_labelwidth_X_dim      #2: \__enumext_labelsep_X_dim
#3: \__enumext_listoffset_X_dim      #4: \__enumext_leftmargin_tmp_X_dim
#5: \__enumext_leftmargin_X_dim      #6: \__enumext_itemindent_X_dim
#7: \__enumext_leftmargin_tmp_X_bool

```

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

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

```

3580 \cs_new_protected:Npn \__enumext_calc_hspace:NNNNNN #1 #2 #3 #4 #5 #6 #7
3581 {
3582   \dim_compare:nNt { #1 } < { \c_zero_dim }
3583   {
3584     \msg_warning:nnnV { enumext } { width-non-positive } { labelwidth } { #1 }
3585     \dim_set:Nn #1 { \dim_abs:n { #1 } }
3586   }
3587   \dim_compare:nNt { #2 } < { \c_zero_dim }
3588   {
3589     \msg_warning:nnnV { enumext } { width-negative } { labelsep } { #2 }
3590     \dim_set:Nn #2 { \dim_abs:n { #2 } }
3591   }

```

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

```

3592   \bool_if:nF #7 { \dim_set:Nn #4 { #1 + #2 } }

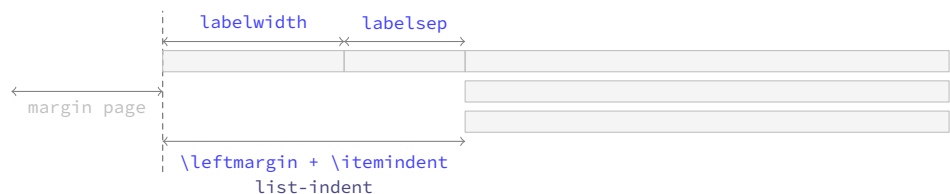
```

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

```

3593   \dim_compare:nNtF { #4 } < { \c_zero_dim }
3594   {
3595     \dim_set:Nn #6 { #1 + #2 - #4 }
3596     \dim_set:Nn #5 { #1 + #2 + #3 - #6 }
3597   }
3598   {
3599     \dim_compare:nNt { #4 } = { #1 + #2 }
3600     { \dim_set:Nn #6 { \c_zero_dim } }
3601     \dim_compare:nNt { #4 } < { #1 + #2 }
3602     { \dim_set:Nn #6 { #1 + #2 - #4 } }
3603     \dim_compare:nNt { #4 } > { #1 + #2 }
3604     {
3605       \dim_set:Nn #6 { -#1 - #2 + #4 }

```

Figure 11: Default horizontal lengths in `enumext`.

```

3606         \dim_set:Nn #6 { #6*-1}
3607     }
3608     \dim_set:Nn #5 { #1 + #2 + #3 - #6 }
3609 }
3610 }
3611 \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.

```

3612 \cs_set_protected:Npn \__enumext_tmp:n #1
3613 {
3614     \cs_new_protected:cpn { __enumext_list_arg_two_#1: }
3615     {
3616         \__enumext_calc_hspace:ccccc
3617         { \__enumext_labelwidth_#1_dim } { \__enumext_labelsep_#1_dim }
3618         { \__enumext_listoffset_#1_dim } { \__enumext_leftmargin_tmp_#1_dim }
3619         { \__enumext_leftmargin_#1_dim } { \__enumext_itemindent_#1_dim }
3620         { \__enumext_leftmargin_tmp_#1_bool }
3621         \clist_map_inline:nn
3622         { labelsep, labelwidth, itemindent, leftmargin, rightmargin, listparindent }
3623         { \dim_set_eq:cc {###1} { \__enumext_###1_#1_dim } }
3624         \clist_map_inline:nn { topsep, parsep, partopsep, itemsep }
3625         { \skip_set_eq:cc {###1} { \__enumext_###1_#1_skip } }
3626         \usecounter { enumX#1 }
3627         \setcounter { enumX#1 } { \int_eval:n { \int_use:c { \__enumext_start_#1_int } - 1 } }
3628         \str_if_eq:nnTF {#1} { v }
3629         {
3630             \__enumext_keyans_redefine_item:
3631             \__enumext_keyans_make_label:
3632             \__enumext_keyans_ref:
3633             \__enumext_keyans_fake_item_indent:
3634             \bool_if:cT { \__enumext_show_length_#1_bool }
3635             {
3636                 \msg_term:nnnn { enumext } { list-lengths-not-nested } { v } { keyans }
3637             }
3638         }
3639         {
3640             \__enumext_redefine_item:
3641             \__enumext_make_label:
3642             \__enumext_standar_ref:
3643             \__enumext_fake_item_indent:
3644             \bool_if:cT { \__enumext_show_length_#1_bool }
3645             {
3646                 \msg_term:nnne { enumext } { list-lengths } {#1}
3647                 { \int_use:N \__enumext_level_int }
3648             }
3649         }
3650     }
3651 }
3652 \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.

```

3653 \cs_set_protected:Npn \__enumext_tmp:n #1
3654 {
3655     \cs_new_protected:cpn { __enumext_list_arg_two_#1: }
3656     {
3657         \bool_set_true:c { \__enumext_leftmargin_tmp_#1_bool }
3658         \dim_zero:c { \__enumext_leftmargin_tmp_#1_dim }
3659         \__enumext_calc_hspace:ccccc
3660         { \__enumext_labelwidth_#1_dim } { \__enumext_labelsep_#1_dim }
3661         { \__enumext_listoffset_#1_dim } { \__enumext_leftmargin_tmp_#1_dim }
3662         { \__enumext_leftmargin_#1_dim } { \__enumext_itemindent_#1_dim }
3663         { \__enumext_leftmargin_tmp_#1_bool }

```

```

3664 \clist_map_inline:nn
3665 { labelsep, labelwidth, itemindent, leftmargin, rightmargin, listparindent }
3666 { \dim_set_eq:cc {####1} { l__enumext_####1_#1_dim } }
3667 \clist_map_inline:nn { topsep, parsep, partopsep, itemsep }
3668 { \skip_set_eq:cc {####1} { l__enumext_####1_#1_skip } }
3669 \skip_set_eq:Nc \parsep { l__enumext_itemsep_#1_skip }
3670 \skip_zero:N \partopsep
3671 \usecounter { enumX#1 }
3672 \setcounter { enumX#1 } { \int_eval:n { \int_use:c { l__enumext_start_#1_int } - 1 } }
3673 \__enumext_starred_ref:
3674 \str_if_eq:nnTF {#1} { vii }
3675 {
3676   \__enumext_fake_item_indent_vii:
3677   \bool_if:cT { l__enumext_show_length_vii_bool }
3678   { \msg_term:nnnn { enumext } { list-lengths-not-nested } { vii } { enumext* } }
3679 }
3680 {
3681   \__enumext_fake_item_indent_viii:
3682   \bool_if:cT { l__enumext_show_length_#1_bool }
3683   { \msg_term:nnnn { enumext } { list-lengths-not-nested } { #1 } { keyans* } }
3684 }
3685 }
3686 }
3687 \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”.

```

3688 \cs_new_protected:Nn \__enumext_safe_exec:
3689 {
3690   \__enumext_is_not_nested:
3691   \__enumext_internal_mini_page:
3692   \int_incr:N \l__enumext_level_int
3693   \int_compare:nNnT { \l__enumext_level_int } > { 4 }
3694   { \msg_fatal:nn { enumext } { list-too-deep } }
3695   \bool_set_true:N \l__enumext_standar_bool
3696   \bool_set_false:N \l__enumext_starred_bool
3697   \__enumext_is_on_first_level:
3698 }

```

(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.

```

3699 \cs_new_protected:Npn \__enumext_parse_keys:n #1
3700 {
3701   \tl_if_novalue:nF {#1}
3702   {
3703     \str_clear:N \l__enumext_series_str
3704     \int_compare:nNnTF { \l__enumext_level_int } = { 1 }
3705     {
3706       \keys_set:nn { enumext / level-1 } {#1}
3707       \__enumext_parse_series:n {#1}
3708       \__enumext_nested_base_line_fix:
3709     }
3710     {
3711       \exp_args:Ne \keys_set:nn
3712       { enumext / level-\int_use:N \l__enumext_level_int } {#1}
3713     }
3714     \__enumext_store_active_keys:n {#1}

```

```

3715     }
3716 }

```

(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*`.

```

3717 \cs_new_protected:Nn \__enumext_start_store_level:
3718 {
3719   \bool_lazy_all:nT
3720   {
3721     { \bool_if_p:N \__enumext_store_active_bool }
3722     { \bool_not_p:n { \l__enumext_keyans_env_bool } }
3723     { \bool_if_p:N \g__enumext_standar_bool }
3724   }
3725   {
3726     \int_compare:nNnT { \l__enumext_level_int } > { 1 }
3727     {
3728       \bool_set_true:c { l__enumext_store_upper_level_ \__enumext_level: _bool }
3729       \__enumext_store_level_open:
3730     }
3731   }

```

If `enumext` are nested in `enumext*` add `\__enumext_store_level_open:` to preserve the “*storing structure*”.

```

3732   \bool_lazy_all:nT
3733   {
3734     { \bool_if_p:N \l__enumext_store_active_bool }
3735     { \bool_not_p:n { \l__enumext_keyans_env_bool } }
3736     { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
3737   }
3738   {
3739     \int_compare:nNnT { \l__enumext_level_int } > { 0 }
3740     {
3741       \bool_set_true:c { l__enumext_store_upper_level_ \__enumext_level: _bool }
3742       \__enumext_store_level_open:
3743     }
3744   }
3745 }

```

(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*`.

```

3746 \cs_new_protected:Nn \__enumext_stop_store_level:
3747 {
3748   \bool_if:cT { l__enumext_store_upper_level_ \__enumext_level: _bool }
3749   {
3750     \__enumext_store_level_close:
3751   }
3752 }

```

(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.

```

3753 \cs_new_protected:Nn \__enumext_multicols_start:
3754 {
3755   \int_compare:nNnT
3756   { \int_use:c { l__enumext_columns_ \__enumext_level: _int } } > { 1 }
3757   {
3758     \dim_compare:nNnT
3759     { \dim_use:c { l__enumext_columns_sep_ \__enumext_level: _dim } } = { \c_zero_dim }
3760     {
3761       \dim_set:cn { l__enumext_columns_sep_ \__enumext_level: _dim }
3762       {
3763         ( \dim_use:c { l__enumext_labelwidth_ \__enumext_level: _dim }
3764         + \dim_use:c { l__enumext_labelsep_ \__enumext_level: _dim }
3765         ) / \int_use:c { l__enumext_columns_ \__enumext_level: _int }
3766         - \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim }
3767       }

```

```

3768     }
3769     \dim_set_eq:Nc \columnsep { \__enumext_columns_sep_ \__enumext_level: _dim }
3770     \int_compare:nNnT { \__enumext_level_int } > { 1 }
3771     {
3772         \dim_zero:N \columnseprule
3773     }

```

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.

```

3774     \bool_if:cF { \__enumext_minipage_active_ \__enumext_level: _bool }
3775     {
3776         \skip_zero:N \multicolsep
3777         \__enumext_multi_addvspace:
3778     }
3779     \raggedcolumns
3780     \begin{multicols}{ \int_use:c { \__enumext_columns_ \__enumext_level: _int } }
3781 }
3782 }

```

(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:`.

```

3783 \cs_new_protected:Nn \__enumext_multicols_stop:
3784 {
3785     \int_compare:nNnTF
3786     { \int_use:c { \__enumext_columns_ \__enumext_level: _int } } > { 1 }
3787     {
3788         \__enumext_stop_list:
3789         \__enumext_stop_store_level:
3790         \end{multicols}
3791         \__enumext_unskip_unkern:
3792         \__enumext_unskip_unkern:
3793         \par\addvspace{ \skip_use:c { \__enumext_multicols_below_ \__enumext_level: _skip } }
3794     }
3795     {
3796         \__enumext_stop_list:
3797         \__enumext_stop_store_level:
3798     }
3799 }

```

(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.

```

3800 \cs_new_protected:Nn \__enumext_before_list:
3801 {
3802     \__enumext_vspace_above:
3803     \__enumext_before_args_exec:
3804     \__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.

```

3805     \dim_compare:nNnT
3806     { \dim_use:c { \__enumext_minipage_right_ \__enumext_level: _dim } } > { \c_zero_dim }
3807     {
3808         \dim_set:cn { \__enumext_minipage_left_ \__enumext_level: _dim }
3809         {
3810             \linewidth
3811             - \dim_use:c { \__enumext_minipage_right_ \__enumext_level: _dim }
3812             - \dim_use:c { \__enumext_minipage_hsep_ \__enumext_level: _dim }
3813         }

```

The boolean variable `\__enumext_minipage_active_X_bool` will be activated and the integer variable `\g__enumext_minipage_stat_int` used by the `\mini-right` 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.

```

3814         \bool_set_true:c { l__enumext_minipage_active_ \__enumext_level: _bool }
3815         \int_gincr:N \g__enumext_minipage_stat_int
3816         \__enumext_minipage_add_space:
3817         \noindent
3818         \__enumext_mini_page{ \dim_use:c { l__enumext_minipage_left_ \__enumext_level: _dim } }
3819     }
3820     \__enumext_multicols_start:
3821 }

```

(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.

```

3822 \cs_new_protected:Nn \__enumext_second_part:
3823 {
3824     \bool_if:cTF { l__enumext_minipage_active_ \__enumext_level: _bool }
3825     {
3826         \int_compare:nNnT { \g__enumext_minipage_stat_int } = { 1 }
3827         {
3828             \msg_warning:nn { enumext } { missing-miniright }
3829             \miniright
3830         }
3831         \int_gzero:N \g__enumext_minipage_stat_int
3832         \__enumext_unskip_unkern: % remove topsep + [partopsep]
3833         \end__enumext_mini_page
3834     }
3835     {
3836         \__enumext_multicols_stop:
3837     }

```

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.

```

3838     \__enumext_after_stop_list:
3839     \__enumext_check_ans_key_hook:
3840     \__enumext_vspace_below:
3841     \bool_set_false:N \l__enumext_standar_bool
3842     \__enumext_resume_save_counter:
3843 }

```

(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.

```

3844 \cs_new_protected:Nn \__enumext_set_item_width:
3845 {
3846     \dim_set:Nn \itemwidth { \linewidth }
3847     \dim_compare:nT
3848     {
3849         \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim } != \c_zero_dim
3850     }
3851     {
3852         \dim_sub:Nn \itemwidth
3853         {
3854             \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim }
3855         }
3856     }
3857 }

```

(End of definition for `\__enumext_set_item_width:`)

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

```

3858 \NewDocumentEnvironment{enumext}{0}{ }
3859 {
3860   \__enumext_safe_exec:
3861   \__enumext_parse_keys:n {#1}
3862   \__enumext_before_list:
3863   \__enumext_start_store_level:
3864   \__enumext_start_list:nn
3865   { \tl_use:c { \__enumext_label_ \__enumext_level: _tl } }
3866   {
3867     \use:c { __enumext_list_arg_two_ \__enumext_level: : }
3868     \__enumext_before_keys_exec:
3869   }
3870   \__enumext_set_item_width:
3871   \__enumext_after_args_exec:
3872 }
3873 {
3874   \__enumext_second_part:
3875 }

```

(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`.

```

3876 \__enumext_after_env:nn {enumext}
3877 {
3878   \__enumext_execute_after_env:
3879 }

```

### 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.

```

3880 \cs_new_protected:Nn \__enumext_keyans_safe_exec:
3881 {
3882   \bool_if:NF \__enumext_store_active_bool
3883   {
3884     \msg_error:nnnn { enumext } { wrong-place } { keyans } { save-ans }
3885   }
3886   \int_incr:N \__enumext_keyans_level_int
3887   \bool_set_true:N \__enumext_keyans_env_bool
3888   \__enumext_keyans_name_and_start:
3889   % Set false for interfering with enumext nested in keyans (yes, its possible and crayze)
3890   \bool_set_false:N \__enumext_store_active_bool
3891   \int_compare:nNnT { \__enumext_keyans_level_int } > { 1 }
3892   {
3893     \msg_error:nn { enumext } { keyans-nested }
3894   }
3895   \int_compare:nNnT { \__enumext_level_int } > { 1 }
3896   {
3897     \msg_error:nn { enumext } { keyans-wrong-level }
3898   }
3899 }

```

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

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

```

3900 \cs_new_protected:Npn \__enumext_keyans_parse_keys:n #1
3901 {
3902   \keys_set:nn { enumext / keyans } {#1}
3903 }

```

(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:
3904 \cs_new_protected:Nn \__enumext_before_list_v:
3905 {
3906   \__enumext_vspace_above_v:
3907   \__enumext_before_args_exec_v:
3908   \dim_compare:nNnT { \l__enumext_minipage_right_v_dim } > { \c_zero_dim }
3909   {
3910     \dim_set:Nn \l__enumext_minipage_left_v_dim
3911     {
3912       \linewidth - \l__enumext_minipage_right_v_dim - \l__enumext_minipage_hsep_v_dim
3913     }
3914     \bool_set_true:N \l__enumext_minipage_active_v_bool
3915     \int_gincr:N \g__enumext_minipage_stat_int
3916     \__enumext_keyans_minipage_add_space:
3917     \__enumext_mini_page{ \l__enumext_minipage_left_v_dim }
3918   }
3919   \__enumext_keyans_multicols_start:
3920 }
3921 \cs_new_protected:Nn \__enumext_keyans_multicols_start:
3922 {
3923   \int_compare:nNnT { \l__enumext_columns_v_int } > { 1 }
3924   {
3925     \dim_compare:nNnT { \l__enumext_columns_sep_v_dim } = { \c_zero_dim }
3926     {
3927       \dim_set:Nn \l__enumext_columns_sep_v_dim
3928       {
3929         (
3930           \l__enumext_labelwidth_v_dim + \l__enumext_labelsep_v_dim
3931         ) / \l__enumext_columns_v_int
3932         - \l__enumext_listoffset_v_dim
3933       }
3934     }
3935     \dim_set_eq:NN \columnsep \l__enumext_columns_sep_v_dim
3936     \dim_zero:N \columnseprule % no rule here
3937     \bool_if:NF \l__enumext_minipage_active_v_bool
3938     {
3939       \skip_zero:N \multicolsep
3940       \__enumext_keyans_multi_addvspace:
3941     }
3942     \raggedcolumns
3943     \begin{multicols}{\l__enumext_columns_v_int}
3944   }
3945 }
3946 \cs_new_protected:Nn \__enumext_keyans_multicols_stop:
3947 {
3948   \int_compare:nNnTF { \l__enumext_columns_v_int } > { 1 }
3949   {
3950     \__enumext_stop_list:
3951     \end{multicols}
3952     \__enumext_unskip_unkern:
3953     \__enumext_unskip_unkern:
3954     \par\addvspace{ \l__enumext_multicols_below_v_skip }
3955   }
3956   {
3957     \__enumext_stop_list:
3958   }
3959 }
3960 \cs_new_protected:Nn \__enumext_second_part_v:
3961 {
3962   \bool_if:NTF \l__enumext_minipage_active_v_bool
3963   {
3964     \int_compare:nNnT { \g__enumext_minipage_stat_int } = { 1 }
3965     {
3966       \msg_warning:nn { enumext } { missing-miniright }
3967       \miniright
3968     }
3969     \int_gzero:N \g__enumext_minipage_stat_int
3970     \__enumext_unskip_unkern: % remove \topsep + [\partopsep]
3971     \end__enumext_mini_page
3972     \par\addvspace{ \l__enumext_minipage_after_skip }
3973   }

```

```

3974     {
3975         \__enumext_keyans_multicols_stop:
3976     }
3977     \bool_set_false:N \__enumext_keyans_env_bool
3978     \__enumext_after_stop_list_v:
3979     \__enumext_vspace_below_v:
3980 }

```

(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.

```

3981 \cs_new_protected:Nn \__enumext_keyans_set_item_width:
3982 {
3983     \dim_set:Nn \itemwidth { \linewidth }
3984     \dim_compare:nT
3985     {
3986         \__enumext_listoffset_v_dim != \c_zero_dim
3987     }
3988     {
3989         \dim_sub:Nn \itemwidth { \__enumext_listoffset_v_dim }
3990     }
3991 }

```

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

keyans

Now we define the environment keyans also based on lists.

```

3992 \NewDocumentEnvironment{keyans}{0}{ }
3993 {
3994     \__enumext_keyans_safe_exec:
3995     \__enumext_keyans_parse_keys:n {#1}
3996     \__enumext_before_list_v:
3997     \__enumext_start_list:nn
3998     { \tl_use:N \__enumext_label_v_tl }
3999     {
4000         \__enumext_list_arg_two_v:
4001         \__enumext_before_keys_exec_v:
4002     }
4003     \__enumext_keyans_set_item_width:
4004     \__enumext_after_args_exec_v:
4005 }
4006 {
4007     \__enumext_check_starred_cmd:n { item }
4008     \__enumext_second_part_v:
4009 }

```

(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*`.

```

4010 \socket_new:nn {tagsupport/\__enumext/starred}{1 }
4011 \socket_new_plug:nnn {tagsupport/\__enumext/starred} {start-list-tags}
4012 {
4013     \tag_resume:n {#1}
4014     \tag_mc_end_push:
4015     \tag_struct_begin:n {tag=LI}
4016     \tag_struct_begin:n {tag=Lbl}
4017     \tag_mc_begin:n {tag=Lbl}
4018 }
4019 \socket_new_plug:nnn {tagsupport/\__enumext/starred} {stop-start-tags}

```

```

4020 {
4021     \tag_mc_end:
4022     \tag_struct_end:n {tag=Lbl}
4023     \tag_struct_begin:n {tag=LBody}
4024     \tag_struct_begin:n {tag=text-unit}
4025     \tag_struct_begin:n {tag=text}
4026 }
4027 \socket_new_plug:nnn {tagsupport/__enumext/starred} {stop-list-tags}
4028 {
4029     \tag_struct_end:n {tag=text}
4030     \tag_struct_end:n {tag=text-unit}
4031     \tag_struct_end:n {tag=LBody}
4032     \tag_struct_end:n {tag=LI}
4033     \tag_mc_begin_pop:n {}
4034     \tag_suspend:n {#1}
4035 }

```

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

```

4036 \cs_new_protected_nopar:Npn \__enumext_start_list_tag:n #1
4037 {
4038     \IfDocumentMetadataTF
4039     {
4040         \socket_assign_plug:nn {tagsupport/__enumext/starred} {start-list-tags}
4041         \socket_use:nn {tagsupport/__enumext/starred} {#1}
4042     } {}
4043 }
4044 \cs_new_protected_nopar:Nn \__enumext_stop_start_list_tag:
4045 {
4046     \IfDocumentMetadataTF
4047     {
4048         \socket_assign_plug:nn {tagsupport/__enumext/starred} {stop-start-tags}
4049         \socket_use:nn {tagsupport/__enumext/starred} { }
4050     } {}
4051 }
4052 \cs_new_protected_nopar:Npn \__enumext_stop_list_tag:n #1
4053 {
4054     \IfDocumentMetadataTF
4055     {
4056         \socket_assign_plug:nn {tagsupport/__enumext/starred} {stop-list-tags}
4057         \socket_use:nn {tagsupport/__enumext/starred} {#1}
4058     } {}
4059 }

```

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

### 13.41.2 Socket for tagging support in keyanspic

We will first define the necessary sockets and their behavior for `keyanspic` environment.

```

start-list-tags
stop-start-tags
stop-list-tags
__enumext_anspic_start_list_tag:
__enumext_anspic_stop_start_list_tag:
__enumext_anspic_stop_list_tag:
4060 \socket_new:nn {tagsupport/__enumext/keyanspic}{ 0 }
4061 \socket_new_plug:nnn {tagsupport/__enumext/keyanspic} {start-list-tags}
4062 {
4063     \tag_resume:n {keyanspic}
4064     \tag_mc_end_push:
4065     \tag_struct_begin:n {tag=LI}
4066     \tag_struct_begin:n {tag=Lbl}
4067     \tag_mc_begin:n {tag=Lbl}
4068 }
4069 \socket_new_plug:nnn {tagsupport/__enumext/keyanspic} {stop-start-tags}
4070 {
4071     \tag_mc_end:
4072     \tag_struct_end:n {tag=Lbl}
4073     \tag_struct_begin:n {tag=LBody}
4074     \tag_struct_begin:n {tag=text-unit}
4075     \tag_struct_begin:n {tag=text}
4076     \tag_mc_begin:n {tag=text}
4077 }
4078 \socket_new_plug:nnn {tagsupport/__enumext/keyanspic} {stop-list-tags}
4079 {
4080     \tag_mc_end:
4081     \tag_struct_end:n {tag=text}
4082     \tag_struct_end:n {tag=text-unit}
4083     \tag_struct_end:n {tag=LBody}
4084     \tag_struct_end:n {tag=LI}

```

```

4085 \tag_mc_begin_pop:n {}
4086 \tag_suspend:n {keyanspic}
4087 }

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

4088 \cs_new_protected_nopar:Nn \__enumext_anspic_start_list_tag:
4089 {
4090   \IfDocumentMetadataTF
4091   {
4092     \socket_assign_plug:nn {tagsupport/__enumext/keyanspic} {start-list-tags}
4093     \socket_use:n {tagsupport/__enumext/keyanspic}
4094   } {}
4095 }
4096 \cs_new_protected_nopar:Nn \__enumext_anspic_stop_start_list_tag:
4097 {
4098   \IfDocumentMetadataTF
4099   {
4100     \socket_assign_plug:nn {tagsupport/__enumext/keyanspic} {stop-start-tags}
4101     \socket_use:n {tagsupport/__enumext/keyanspic}
4102   } {}
4103 }
4104 \cs_new_protected_nopar:Nn \__enumext_anspic_stop_list_tag:
4105 {
4106   \IfDocumentMetadataTF
4107   {
4108     \socket_assign_plug:nn {tagsupport/__enumext/keyanspic} {stop-list-tags}
4109     \socket_use:n {tagsupport/__enumext/keyanspic}
4110   } {}
4111 }

```

(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  $\langle label \rangle$  as the `keyans` environment, but it does not use `\item`. The  $\langle contents \rangle$  are passed to the environment by means of the `\anspic` command as replacement for `\item` command and placed inside `minipage` environments, with the  $\langle label \rangle$  centered “*above*” or “*below*”, adjusting *widths* and *position* according to the options passed to the environment.

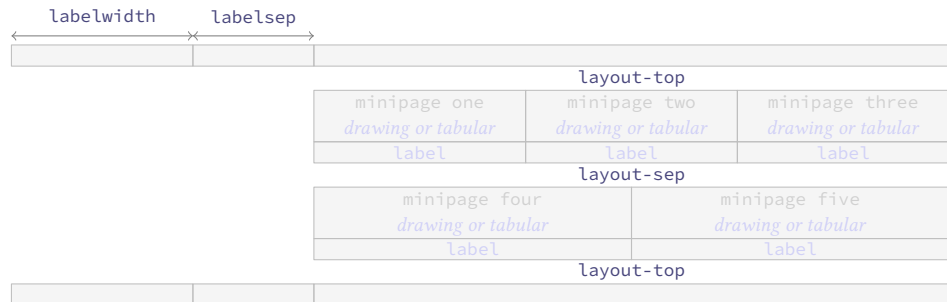


Figure 12: Representation of the `keyanspic` spacing in `enumext`.

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  $\langle label \rangle$  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  $\{ \langle n^\circ upper, n^\circ lower \rangle \}$  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`.

```

4112 \keys_define:nn { enumext / keyanspic }
4113 {
4114   label-pos .choice:,
4115   label-pos / above .code:n =
4116     \bool_set_true:N \l__enumext_anspic_label_above_bool
4117     \str_set:Nn \l__enumext_anspic_mini_pos_str { t },
4118   label-pos / below .code:n =

```

```

4119         \bool_set_false:N \l__enumext_anspic_label_above_bool
4120         \str_set:Nn \l__enumext_anspic_mini_pos_str { b },
4121     label-pos / unknown .code:n =
4122         \msg_error:nnee { enumext } { unknown-choice }
4123         { label-pos } { above,~ below } { \exp_not:n {#1} },
4124     label-pos .initial:n = below,
4125     label-pos .value_required:n = true,
4126     label-sep .skip_set:N = \l__enumext_anspic_label_sep_skip,
4127     label-sep .value_required:n = true,
4128     layout-sty .tl_set:N = \l__enumext_anspic_layout_style_tl,
4129     layout-sty .value_required:n = true,
4130     layout-sep .code:n = \keys_set:nn { enumext / keyans } { parsep = #1 },
4131     layout-sep .value_required:n = true,
4132     layout-top .code:n = \keys_set:nn { enumext / keyans } { topsep = #1 },
4133     layout-top .value_required:n = true,
4134     mark-ans .code:n = \keys_set:nn { enumext / keyans } { mark-ans = #1 },
4135     mark-ans .value_required:n = true,
4136     mark-pos .code:n = \keys_set:nn { enumext / keyans } { mark-pos = #1 },
4137     mark-pos .value_required:n = true,
4138     mark-sep .code:n = \keys_set:nn { enumext / keyans } { mark-sep = #1 },
4139     mark-sep .value_required:n = true,
4140     save-sep .code:n = \keys_set:nn { enumext / keyans } { save-sep = #1 },
4141     save-sep .value_required:n = true,
4142     wrap-opt .code:n = \keys_set:nn { enumext / keyans } { wrap-opt = #1 },
4143     wrap-opt .value_required:n = true,
4144     wrap-key .code:n = \keys_set:nn { enumext / keyans } { wrap-key = #1 },
4145     wrap-key .value_required:n = true,
4146     show-ans .code:n = \keys_set:nn { enumext / keyans } { show-ans = #1 },
4147     show-ans .value_required:n = true,
4148     show-pos .code:n = \keys_set:nn { enumext / keyans } { show-pos = #1 },
4149     show-pos .value_required:n = true,
4150     unknown .code:n = {
4151         \tl_set:Nn \l__enumext_envir_name_tl { keyanspic }
4152         \__enumext_keyans_unknown_keys:n {#1}
4153     },
4154 }

```

(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.

```

4155 \cs_new_protected:Nn \__enumext_keyans_pic_safe_exec:
4156 {
4157     \int_incr:N \l__enumext_keyans_pic_level_int
4158     \int_compare:nNtT { \l__enumext_keyans_pic_level_int } > { 1 }
4159     {
4160         \msg_error:nn { enumext } { keyanspic-nested }
4161     }
4162     \__enumext_keyans_name_and_start:
4163 }

```

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

```

4164 \cs_new_protected:Npn \__enumext_keyans_pic_parse_keys:n #1
4165 {
4166     \tl_if_novalue:nF {#1}
4167     {
4168         \keys_set:nn { enumext / keyanspic } {#1}
4169     }
4170 }

```

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

```

4171 \cs_new_protected:Npn \__enumext_keyans_pic_skip_abs:N #1
4172 {
4173     \dim_compare:nNtT { #1 } < { \c_zero_dim }
4174     {
4175         \skip_set:Nn #1 { -#1 }
4176     }
4177 }

```

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.

```

4178 \cs_new_protected:Npn \__enumext_keyans_pic_arg_two:
4179 {
4180   \bool_set_false:N \l__enumext_leftmargin_tmp_v_bool
4181   \__enumext_list_arg_two_v:
4182   \__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*.

```

4183   \bool_if:NF \l__enumext_anspic_label_above_bool
4184   {
4185     \stepcounter { enumXv }
4186     \hbox_set:Nn \l__enumext_anspic_label_box { \l__enumext_label_v_tl }
4187     \dim_set:Nn \l__enumext_anspic_label_htdp_dim
4188     {
4189       \box_ht_plus_dp:N \l__enumext_anspic_label_box
4190     }
4191     \skip_add:Nn \parsep
4192     {
4193       \l__enumext_anspic_label_htdp_dim
4194       + \box_dp:N \strutbox
4195       + \l__enumext_anspic_label_sep_skip
4196     }
4197   }

```

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.

```

4198   \dim_add:Nn \leftmargin { -\l__enumext_labelwidth_v_dim - \l__enumext_labelsep_v_dim }
4199   \ignorespaces
4200   \skip_add:Nn \topsep { 0.5\box_dp:N \strutbox }
4201   \dim_zero:N \listparindent
4202   \skip_zero:N \partopsep
4203   \skip_zero:N \itemsep
4204 }

```

(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.

```

4205 \NewDocumentEnvironment{keyanspic}{ o }
4206 {
4207   \__enumext_keyans_pic_safe_exec:
4208   \__enumext_keyans_pic_parse_keys:n {#1}
4209   \begin{list} { } { \__enumext_keyans_pic_arg_two: }
4210   \IfDocumentMetadataTF
4211   {
4212     \tag_suspend:n {list}
4213   }{}
4214   \item[] \scan_stop:
4215   \RenewDocumentCommand \item {}
4216   {
4217     \msg_error:nn { enumext } { keyanspic-item-cmd }
4218   }
4219   \IfDocumentMetadataTF
4220   {
4221     \tag_resume:n {keyanspic}
4222     \tag_tool:n {para/tagging=false}
4223     \tag_suspend:n {keyanspic}
4224   } { }
4225 }

```

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.

```

4226 {
4227   \IfDocumentMetadataTF

```

```

4228     {
4229       \tag_resume:n {keyanspic}
4230       \tag_mc_end_push:
4231       \tag_struct_begin:n {tag=L,attribute=enumerate}
4232     } { }
4233     \__enumext_anspic_exec:
4234     \IfDocumentMetadataTF
4235     {
4236       \tag_suspend:n {keyanspic}
4237     } { }
4238     \end{list}
4239     \IfDocumentMetadataTF
4240     {
4241       \tag_struct_end:n {tag=L}
4242       \tag_mc_begin_pop:n {}
4243       \tag_struct_end:n {tag=L}
4244       \tag_mc_begin_pop:n {}
4245     } { }

```

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

```

4246     \__enumext_check_starred_cmd:n { anspic }
4247     \setcounter { enumXvi } { 0 }
4248     \bool_if:NTF \__enumext_anspic_label_above_bool
4249     {
4250       \par\addvspace{ 0.5\box_dp:N \strutbox }
4251     }
4252     {
4253       \par
4254       \addvspace
4255       {
4256         \dim_eval:n
4257         {
4258           \l__enumext_anspic_label_htdp_dim + \box_ht_plus_dp:N \strutbox
4259           + \l__enumext_anspic_label_sep_skip + \l__enumext_topsep_v_skip
4260         }
4261       }
4262     }
4263   }

```

(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 `\l__enumext_anspic_args_seq` which is processed by the `keyanspic` environment.

```

4264 \NewDocumentCommand \anspic { s o +m }
4265 {
4266   \bool_if:NF \l__enumext_store_active_bool
4267   {
4268     \msg_error:nnnn { enumext } { wrong-place } { keyanspic } { save-ans }
4269   }
4270   \int_compare:nNt { \l__enumext_level_int } > { 1 }
4271   {
4272     \msg_error:nn { enumext } { keyanspic-wrong-level }
4273   }
4274   \int_compare:nNt { \l__enumext_keyans_level_int } = { 1 }
4275   {
4276     \msg_error:nnnn { enumext } { command-wrong-place } { anspic } { keyans }
4277   }
4278   \seq_put_right:Nn \l__enumext_anspic_args_seq
4279   {

```



```

4280     \__enumext_anspic_args:nnn { #1 } { #2 } { #3 }
4281   }
4282 }

```

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”.

```

4283 \cs_new_protected:Npn \__enumext_anspic_body_dim:n #1
4284 {
4285   \bool_if:NF \l__enumext_anspic_label_above_bool
4286   {
4287     \IfDocumentMetadataTF
4288     {
4289       \tag_suspend:n {keyanspic}
4290     } { }
4291     \vbox_set:Nn \l__enumext_anspic_body_box { #1 }
4292     \dim_set:Nn \l__enumext_anspic_body_htdp_dim
4293     {
4294       \box_ht_plus_dp:N \l__enumext_anspic_body_box
4295     }
4296     \IfDocumentMetadataTF
4297     {
4298       \tag_resume:n {keyanspic}
4299     } { }
4300   }
4301 }

```

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-key` and `wrap-opt` keys.

```

4302 \cs_new_protected:Npn \__enumext_anspic_label:nn #1 #2
4303 {
4304   \makebox[ \l__enumext_anspic_mini_width_dim ][ c ]
4305   {
4306     \bool_if:NTF { #1 }
4307     {
4308       \bool_set_true:N \l__enumext_item_wrap_key_bool
4309       \bool_set_true:N \l__enumext_wrap_label_v_bool
4310       \__enumext_keyans_save_item_opt:n { #2 }
4311       \__enumext_keyans_addto_prop:n { #2 }
4312       \__enumext_keyans_store_ref:
4313       \__enumext_keyans_addto_seq:n { #2 }
4314       \int_gincr:N \g__enumext_check_starred_cmd_int
4315       \__enumext_keyans_show_ans:
4316       \__enumext_keyans_show_pos:
4317       \tl_use:N \l__enumext_label_font_style_v_tl
4318       \__enumext_keyans_wrapper_label:n { \l__enumext_label_vi_tl }
4319       \c_space_tl \__enumext_keyans_show_item_opt:
4320     }
4321     {
4322       \bool_set_false:N \l__enumext_item_wrap_key_bool
4323       \tl_use:N \l__enumext_label_font_style_v_tl
4324       \__enumext_wrapper_label_v:n { \l__enumext_label_vi_tl }
4325     }
4326   }
4327 }

```

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.

```

4328 \cs_new_protected:Npn \__enumext_anspic_label_pos:nnn #1 #2 #3
4329 {
4330   \stepcounter { enumXvi }
4331   \__enumext_anspic_body_dim:n { #3 }
4332   \bool_if:NTF \l__enumext_anspic_label_above_bool
4333   {
4334     \__enumext_anspic_label:nn { #1 } { #2 }
4335   }
4336   {
4337     \raisebox
4338     {
4339       -\dim_eval:n
4340       {
4341         \l__enumext_anspic_label_htdp_dim

```

```

4342         + \l__enumext_anspic_body_htdp_dim
4343         + \box_dp:N \strutbox
4344         + \l__enumext_anspic_label_sep_skip
4345     }
4346 }
4347 [ opt ] [ opt ]
4348 {
4349     \__enumext_anspic_label:nn { #1 } { #2 }
4350 }
4351 }
4352 }
4353 %

```

The `\__enumext_anspic_args:nnn` function will be responsible for placing the code compatible with *tagged* PDF and the arguments within the `\l__enumext_anspic_args_seq` sequence which will be processed by the `\__enumext_anspic_print:n` function in the second part of the definition of the `keyanspic` environment.

```

4354 \cs_new_protected:Nn \__enumext_anspic_args:nnn
4355 {
4356     \__enumext_anspic_start_list_tag:
4357     \__enumext_anspic_label_pos:nnn { #1 } { #2 } { #3 }
4358     \__enumext_anspic_stop_start_list_tag:
4359     \bool_if:NTF \l__enumext_anspic_label_above_bool
4360     {
4361         \[\[ \l__enumext_anspic_label_sep_skip] #3
4362     }
4363     {
4364         \[ \[ #3
4365     }
4366     \__enumext_anspic_stop_list_tag:
4367 }

```

The value  $\{ \langle n^{\circ upper}, n^{\circ lower} \rangle \}$  passed to the `layout-sty` key is split by comma and is handled directly by the function `\__enumext_anspic_print:n` and passed to the function `\__enumext_anspic_row:n`.

```

4368 \cs_new_protected:Nn \__enumext_anspic_print:n
4369 {
4370     \clist_map_function:nN { #1 } \__enumext_anspic_row:n
4371 }
4372 \cs_generate_variant:Nn \__enumext_anspic_print:n { e, V }

```

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

```

4373 \cs_new_protected:Nn \__enumext_anspic_row:n
4374 {
4375     \dim_set:Nn \l__enumext_anspic_mini_width_dim { \linewidth / #1 }
4376     \int_set:Nn \l__enumext_anspic_above_int { \l__enumext_anspic_below_int }
4377     \int_set:Nn \l__enumext_anspic_below_int { \l__enumext_anspic_above_int + #1 }
4378     \int_step_inline:nnn
4379     { \l__enumext_anspic_above_int + 1 }
4380     { \l__enumext_anspic_below_int }
4381     {
4382         \IfDocumentMetadataTF
4383         {
4384             \tag_suspend:n {minipage}
4385         } { }
4386         \begin{minipage}[ \l__enumext_anspic_mini_pos_str ]{ \l__enumext_anspic_mini_width_dim }
4387             \centering
4388             \seq_item:Nn \l__enumext_anspic_args_seq { ##1 }
4389         \end{minipage}
4390         \IfDocumentMetadataTF
4391         {
4392             \tag_resume:n {minipage}
4393         } { }
4394     }
4395     \par
4396 }

```

The `\__enumext_anspic_exec:` function will execute all the code in the `\anspic` command in the second argument of the `keyanspic` environment definition. If the key `layout-sty` is not set, everything will be printed on a *single line*.

```

4397 \cs_new_protected:Nn \__enumext_anspic_exec:
4398 {
4399     \tl_if_empty:NTF \l__enumext_anspic_layout_style_tl

```

```

4400     {
4401       \__enumext_anspic_print:e { \seq_count:N \__enumext_anspic_args_seq }
4402     }
4403     {
4404       \__enumext_anspic_print:V \__enumext_anspic_layout_style_tl
4405     }
4406   }

```

(End of definition for `\anspic` and others. This function is documented on page 16.)

### 13.43 The horizontal environments

Generating *horizontal list environments* is NOT as simple as standard  $\TeX$  list environments. The fundamental part of the code is adapted from the `shortlst` package to a more modern version using `expl3`. It is not possible to redefine `\item` and `\makelabel` using `\RenewDocumentCommand` as in the vertical *non starred* versions.

To achieve the *horizontal list environments* we will capture the `\item` command and the  $\langle content \rangle$  of this in *horizontal box* using `\makebox` for the `label` and a `minipage` environment for the  $\langle content \rangle$  passed to `\item`, we will also add the *optional argument* ( $\langle number \rangle$ ) to `\item` to be able to *join columns* horizontally, in simple terms, we want `\item` to behave in the same way as in the `enumext` environment but adding an *first optional argument* ( $\langle number \rangle$ ).

A side effect is the limitation of using `\item` in this way *without* using `\RenewDocumentCommand`, which loses the original definition and affects the *standard list environments* provided by  $\TeX$  and any environment defined using base `list` environment, including: `itemize`, `enumerate`, `description`, `quote`, `quotation`, `verse`, `center`, `flushleft`, `flushright`, `verbatim`, `tabbing`, `trivlist`, `list` and all environments created with `\newtheorem`.

- One way to get around this is to use something like:

```
\AddToHook{env/enumerate/before}{recover original \item definition}
```

inside `minipage`, but in my partial tests this does not have the desired effect and the vertical and horizontal spacing is distorted. For now this will remain as a limitation and I will see if it is feasible to implement it in the future.

- For compatibility with the *tagged* PDF we close the environments according to the presence or not of the `mini-env` key.

#### 13.43.1 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:

```

```

4407 \cs_new_protected:Nn \__enumext_starred_columns_set_vii:
4408 {
4409   \dim_compare:nNnT { \__enumext_columns_sep_vii_dim } = { \c_zero_dim }
4410   {
4411     \dim_set:Nn \__enumext_columns_sep_vii_dim
4412     {
4413       ( \__enumext_labelwidth_vii_dim + \__enumext_labelsep_vii_dim )
4414       / \__enumext_columns_vii_int
4415     }
4416   }
4417   \int_set:Nn \__enumext_tmpa_vii_int { \__enumext_columns_vii_int - 1 }
4418   \dim_set:Nn \__enumext_item_width_vii_dim
4419   {
4420     ( \linewidth - \__enumext_columns_sep_vii_dim * \__enumext_tmpa_vii_int )
4421     / \__enumext_columns_vii_int
4422     - \__enumext_labelwidth_vii_dim
4423     - \__enumext_labelsep_vii_dim
4424   }

```

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

```

4425   \dim_compare:nNnT { \__enumext_rightmargin_vii_dim } > { \c_zero_dim }
4426   {
4427     \dim_sub:Nn \__enumext_item_width_vii_dim
4428     {
4429       ( \__enumext_rightmargin_vii_dim * \__enumext_tmpa_vii_int )
4430       / \__enumext_columns_vii_int
4431     }
4432     \dim_add:Nn \__enumext_columns_sep_vii_dim
4433     {
4434       \__enumext_rightmargin_vii_dim
4435     }
4436   }
4437 }

```

Same implementation for the `keyans*` environment.

```

4438 \cs_new_protected:Nn \__enumext_starred_columns_set_viii:
4439 {
4440   \dim_compare:nNnT { \__enumext_columns_sep_viii_dim } = { \c_zero_dim }
4441   {
4442     \dim_set:Nn \__enumext_columns_sep_viii_dim
4443     {
4444       ( \__enumext_labelwidth_viii_dim + \__enumext_labelsep_viii_dim )
4445       / \__enumext_columns_viii_int
4446     }
4447   }
4448   \int_set:Nn \__enumext_tmpa_viii_int { \__enumext_columns_viii_int - 1 }
4449   \dim_set:Nn \__enumext_item_width_viii_dim
4450   {
4451     ( \linewidth - \__enumext_columns_sep_viii_dim * \__enumext_tmpa_viii_int )
4452     / \__enumext_columns_viii_int
4453     - \__enumext_labelwidth_viii_dim
4454     - \__enumext_labelsep_viii_dim
4455   }
4456   \dim_compare:nNnT { \__enumext_rightmargin_viii_dim } > { \c_zero_dim }
4457   {
4458     \dim_sub:Nn \__enumext_item_width_viii_dim
4459     {
4460       ( \__enumext_rightmargin_viii_dim * \__enumext_tmpa_viii_int )
4461       / \__enumext_columns_viii_int
4462     }
4463     \dim_add:Nn \__enumext_columns_sep_viii_dim
4464     {
4465       \__enumext_rightmargin_viii_dim
4466     }
4467   }
4468 }

```

(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.

```

4469 \cs_new_protected:Npn \__enumext_starred_joined_item_vii:n #1
4470 {
4471   \int_set:Nn \__enumext_joined_item_vii_int {#1}
4472   \int_compare:nNnT { \__enumext_joined_item_vii_int } > { \__enumext_columns_vii_int }
4473   {
4474     \msg_warning:nnee { enumext } { item-joined }
4475     { \int_use:N \__enumext_joined_item_vii_int }
4476     { \int_use:N \__enumext_columns_vii_int }
4477     \int_set:Nn \__enumext_joined_item_vii_int
4478     {
4479       \__enumext_columns_vii_int - \__enumext_item_column_pos_vii_int + 1
4480     }
4481   }
4482   \int_compare:nNnT
4483   { \__enumext_joined_item_vii_int }
4484   >
4485   { \__enumext_columns_vii_int - \__enumext_item_column_pos_vii_int + 1 }
4486   {
4487     \msg_warning:nnee { enumext } { item-joined-columns }
4488     { \int_use:N \__enumext_joined_item_vii_int }
4489     {
4490       \int_eval:n
4491       { \__enumext_columns_vii_int - \__enumext_item_column_pos_vii_int + 1 }
4492     }
4493     \int_set:Nn \__enumext_joined_item_vii_int
4494     {
4495       \__enumext_columns_vii_int - \__enumext_item_column_pos_vii_int + 1
4496     }
4497   }
4498   \int_compare:nNnTF { \__enumext_joined_item_vii_int } > { 1 }
4499   {
4500     \int_set_eq:NN \__enumext_joined_item_aux_vii_int \__enumext_joined_item_vii_int

```

```

4501     \int_decr:N \l__enumext_joined_item_aux_vii_int
4502     \int_add:Nn \l__enumext_item_column_pos_vii_int { \l__enumext_joined_item_aux_vii_int }
4503     \int_gadd:Nn \g__enumext_item_count_all_vii_int { \l__enumext_joined_item_aux_vii_int }
4504     \dim_set:Nn \l__enumext_joined_width_vii_dim
4505     {
4506         \l__enumext_item_width_vii_dim * \l__enumext_joined_item_vii_int
4507         + ( \l__enumext_labelwidth_vii_dim + \l__enumext_labelsep_vii_dim
4508             + \l__enumext_columns_sep_vii_dim
4509             )*\l__enumext_joined_item_aux_vii_int
4510     }
4511     \dim_set_eq:NN \itemwidth \l__enumext_joined_width_vii_dim
4512 }
4513 {
4514     \dim_set_eq:NN \l__enumext_joined_width_vii_dim \l__enumext_item_width_vii_dim
4515     \dim_set_eq:NN \itemwidth \l__enumext_item_width_vii_dim
4516 }
4517 }

```

Same implementation for the `keyans*` environment.

```

4518 \cs_new_protected:Npn \__enumext_starred_joined_item_viii:n #1
4519 {
4520     \int_set:Nn \l__enumext_joined_item_viii_int {#1}
4521     \int_compare:nNnT { \l__enumext_joined_item_viii_int } > { \l__enumext_columns_viii_int }
4522     {
4523         \msg_warning:nnee { enumext } { item-joined }
4524         { \int_use:N \l__enumext_joined_item_viii_int }
4525         { \int_use:N \l__enumext_columns_viii_int }
4526         \int_set:Nn \l__enumext_joined_item_viii_int
4527         {
4528             \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1
4529         }
4530     }
4531     \int_compare:nNnT
4532     { \l__enumext_joined_item_viii_int }
4533     >
4534     { \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1 }
4535     {
4536         \msg_warning:nnee { enumext } { item-joined-columns }
4537         { \int_use:N \l__enumext_joined_item_viii_int }
4538         {
4539             \int_eval:n
4540             { \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1 }
4541         }
4542         \int_set:Nn \l__enumext_joined_item_viii_int
4543         {
4544             \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1
4545         }
4546     }
4547     \int_compare:nNnTF { \l__enumext_joined_item_viii_int } > { 1 }
4548     {
4549         \int_set_eq:NN \l__enumext_joined_item_aux_viii_int \l__enumext_joined_item_viii_int
4550         \int_decr:N \l__enumext_joined_item_aux_viii_int
4551         \int_add:Nn \l__enumext_item_column_pos_viii_int { \l__enumext_joined_item_aux_viii_int }
4552         \int_gadd:Nn \g__enumext_item_count_all_viii_int { \l__enumext_joined_item_aux_viii_int }
4553         \dim_set:Nn \l__enumext_joined_width_viii_dim
4554         {
4555             \l__enumext_item_width_viii_dim * \l__enumext_joined_item_viii_int
4556             + ( \l__enumext_labelwidth_viii_dim + \l__enumext_labelsep_viii_dim
4557                 + \l__enumext_columns_sep_viii_dim
4558                 )*\l__enumext_joined_item_aux_viii_int
4559         }
4560         \dim_set_eq:NN \itemwidth \l__enumext_joined_width_viii_dim
4561     }
4562     {
4563         \dim_set_eq:NN \l__enumext_joined_width_viii_dim \l__enumext_item_width_viii_dim
4564         \dim_set_eq:NN \itemwidth \l__enumext_item_width_viii_dim
4565     }
4566 }

```

(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

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`.

```

4567 \cs_new_protected:Nn \__enumext_start_mini_vii:
4568 {
4569   \dim_compare:nNnT { \__enumext_minipage_right_vii_dim } > { \c_zero_dim }
4570   {
4571     \dim_set:Nn \l__enumext_minipage_left_vii_dim
4572     {
4573       \linewidth
4574       - \__enumext_minipage_right_vii_dim
4575       - \__enumext_minipage_hsep_vii_dim
4576     }
4577     \bool_set_true:N \l__enumext_minipage_active_vii_bool
4578     \dim_gset_eq:NN
4579       \g__enumext_minipage_right_vii_dim
4580       \l__enumext_minipage_right_vii_dim
4581     \__enumext_mini_addvspace_vii:
4582     \nointerlineskip\noindent
4583     \__enumext_mini_page{ \l__enumext_minipage_left_vii_dim }
4584   }
4585 }
```

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).

```

4586 \cs_new_protected:Nn \__enumext_stop_mini_vii:
4587 {
4588   \bool_if:NTF \l__enumext_minipage_active_vii_bool
4589   {
4590     \__enumext_stop_list:
4591     \__enumext_stop_store_level_vii:
4592     \IfDocumentMetadataTF { \tag_resume:n {enumext*} } { }
4593     \end__enumext_mini_page
4594     \hfill
4595     \bool_gset_true:N \g__enumext_minipage_active_vii_bool
4596   }
4597   {
4598     \__enumext_stop_list:
4599     \__enumext_stop_store_level_vii:
4600   }
4601 }
```

(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.

```

4602 \__enumext_after_env:nn {enumext*}
4603 {
4604   \bool_if:NT \g__enumext_minipage_active_vii_bool
4605   {
4606     \__enumext_minipage:w [ t ] { \g__enumext_minipage_right_vii_dim }
4607     \legacy_if_gset_false:n { @minipage }
4608     \skip_vertical:N \c_zero_skip
4609     \par\addvspace { \g__enumext_minipage_right_skip }
4610     \bool_if:NF \g__enumext_minipage_center_vii_bool
4611     {
4612       \tl_put_left:Nn \g__enumext_miniright_code_vii_tl
4613       {
4614         \centering
4615       }
4616     }
4617     \vbox_set_top:Nn \l__enumext_miniright_code_vii_box
```

```

4618         {
4619             \tl_use:N \g__enumext_miniright_code_vii_tl
4620         }
4621         \box_use_drop:N \l__enumext_miniright_code_vii_box
4622         \skip_vertical:N \c_zero_skip
4623         \__enumext_endminipage:
4624         \par\addvspace{ \g__enumext_minipage_after_skip }
4625     }
4626     \bool_gset_false:N \g__enumext_minipage_active_vii_bool
4627     \bool_gset_true:N \g__enumext_minipage_center_vii_bool
4628     \tl_gclear:N \g__enumext_miniright_code_vii_tl
4629     \dim_gzero:N \g__enumext_minipage_right_vii_dim
4630     \bool_gset_false:N \g__enumext_starred_bool
4631 }

```

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

`\__enumext_stop_mini_viii:`

```

4632 \cs_new_protected:Nn \__enumext_start_mini_viii:
4633 {
4634     \dim_compare:nNtT { \l__enumext_minipage_right_viii_dim } > { \c_zero_dim }
4635     {
4636         \dim_set:Nn \l__enumext_minipage_left_viii_dim
4637         {
4638             \linewidth
4639             - \l__enumext_minipage_right_viii_dim
4640             - \l__enumext_minipage_hsep_viii_dim
4641         }
4642         \bool_set_true:N \l__enumext_minipage_active_viii_bool
4643         \dim_gset_eq:NN
4644             \g__enumext_minipage_right_viii_dim
4645             \l__enumext_minipage_right_viii_dim
4646         \__enumext_mini_addvspace_viii:
4647         \nointerlineskip\noindent
4648         \__enumext_mini_page{ \l__enumext_minipage_left_viii_dim }
4649     }
4650 }
4651 \cs_new_protected:Nn \__enumext_stop_mini_viii:
4652 {
4653     \bool_if:NTF \l__enumext_minipage_active_viii_bool
4654     {
4655         \__enumext_stop_list:
4656         \IfDocumentMetadataTF { \tag_resume:n {keyans*} } { }
4657         \end__enumext_mini_page
4658         \hfill
4659         \bool_gset_true:N \g__enumext_minipage_active_viii_bool
4660     }
4661     {
4662         \__enumext_stop_list:
4663     }
4664 }
4665 \__enumext_after_env:nn {keyans*}
4666 {
4667     \bool_if:NT \g__enumext_minipage_active_viii_bool
4668     {
4669         \__enumext_mini_page{ \g__enumext_minipage_right_viii_dim }
4670         \par\addvspace { \g__enumext_minipage_right_skip }
4671         \bool_if:NF \g__enumext_minipage_center_viii_bool
4672         {
4673             \tl_put_left:Nn \g__enumext_miniright_code_viii_tl
4674             {
4675                 \centering
4676             }
4677         }
4678         \vbox_set_top:Nn \l__enumext_miniright_code_viii_box
4679         {
4680             \tl_use:N \g__enumext_miniright_code_viii_tl
4681         }
4682         \box_use_drop:N \l__enumext_miniright_code_viii_box
4683         \end__enumext_mini_page
4684         \par\addvspace{ \g__enumext_minipage_after_skip }
4685     }

```



```

4686 \bool_gset_false:N \g__enumext_minipage_active_viii_bool
4687 \bool_gset_true:N \g__enumext_minipage_center_viii_bool
4688 \tl_gclear:N \g__enumext_miniright_code_viii_tl
4689 \dim_gzero:N \g__enumext_minipage_right_viii_dim
4690 }

```

(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.

```

4691 \NewDocumentEnvironment{enumext*}{o}{
4692 {
4693 \__enumext_safe_exec_vii:
4694 \__enumext_parse_keys_vii:n {#1}
4695 \__enumext_before_list_vii:
4696 \__enumext_start_store_level_vii:
4697 \__enumext_start_list:nn { }
4698 {
4699 \__enumext_list_arg_two_vii:
4700 \__enumext_before_keys_exec_vii:
4701 }
4702 \IfDocumentMetadataTF { \tag_suspend:n {enumext*} } { }
4703 \__enumext_starred_columns_set_vii:
4704 \item[] \scan_stop:
4705 \cs_set_eq:NN \__enumext_stop_item_tmp_vii: \__enumext_first_item_tmp_vii:
4706 \cs_set_eq:NN \item \__enumext_start_item_tmp_vii:
4707 \ignorespaces
4708 }
4709 {
4710 \IfDocumentMetadataTF { \tag_struct_end:n {tag=text-unit} } { }
4711 \__enumext_stop_item_tmp_vii:
4712 \__enumext_remove_extra_parsep_vii:
4713 \__enumext_after_list_vii:
4714 }
}

```

(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.

```

4715 \cs_new_protected:Nn \__enumext_safe_exec_vii:
4716 {
4717 \__enumext_is_not_nested:
4718 \__enumext_internal_mini_page:
4719 \int_incr:N \l__enumext_level_h_int
4720 \int_compare:nNt { \l__enumext_level_h_int } > { 1 }
4721 {
4722 \msg_error:nn { enumext } { nested }
4723 }
4724 \int_compare:nNt { \l__enumext_keyans_level_h_int } = { 1 }
4725 {
4726 \msg_error:nnn { enumext } { nested-horizontal } { keyans*}
4727 }
4728 \bool_set_true:N \l__enumext_starred_bool
4729 \bool_set_false:N \l__enumext_standar_bool
4730 \__enumext_is_on_first_level:
4731 }

```

(End of definition for \\_\_enumext\_safe\_exec\_vii:.)

`\__enumext_parse_keys_vii:n`

First we will clear the variable `\__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.

```

4732 \cs_new_protected:Npn \__enumext_parse_keys_vii:n #1
4733 {
4734   \tl_if_novalue:nF {#1}
4735   {
4736     \str_clear:N \__enumext_series_str
4737     \keys_set:nn { enumext / enumext* } {#1}
4738     \__enumext_parse_series:n {#1}
4739     \__enumext_store_active_keys_vii:n {#1}
4740   }
4741 }

```

(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*`.

```

4742 \cs_new_protected:Nn \__enumext_before_list_vii:
4743 {
4744   \__enumext_vspace_above_vii:
4745   \__enumext_check_ans_active:
4746   \__enumext_before_args_exec_vii:
4747   \__enumext_start_mini_vii:
4748 }

```

(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 `\__enumext_starred_bool` to false and call the `\__enumext_resume_save_counter:` function used by the `series`, `resume` and `resume*` keys.

```

4749 \cs_new_protected:Nn \__enumext_after_list_vii:
4750 {
4751   \__enumext_stop_mini_vii:
4752   \__enumext_after_stop_list_vii:
4753   \__enumext_check_ans_key_hook:
4754   \__enumext_vspace_below_vii:
4755   \bool_set_false:N \__enumext_starred_bool
4756   \__enumext_resume_save_counter:
4757 }

```

(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`.

```

4758 \cs_new_protected:Nn \__enumext_start_store_level_vii:
4759 {
4760   \bool_if:NT \__enumext_store_active_bool
4761   {
4762     \int_compare:nNt { \__enumext_level_int } > { 0 }
4763     {
4764       \__enumext_store_level_open_vii:
4765     }
4766   }
4767 }
4768 \cs_new_protected:Nn \__enumext_stop_store_level_vii:
4769 {
4770   \bool_if:NT \__enumext_store_active_bool
4771   {
4772     \int_compare:nNt { \__enumext_level_int } > { 0 }
4773     {
4774       \__enumext_store_level_close_vii:

```

```

4775     }
4776   }
4777 }

```

(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.

```

4778 \cs_new_protected_nopar:Nn \__enumext_first_item_tmp_vii:
4779 {
4780   \skip_horizontal:n
4781   {
4782     -\__enumext_labelwidth_vii_dim - \__enumext_labelsep_vii_dim
4783   }
4784   \ignorespaces
4785 }

```

(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`.

```

4786 \cs_new_protected_nopar:Nn \__enumext_start_item_tmp_vii:
4787 {
4788   \__enumext_stop_item_tmp_vii:
4789   \int_incr:N \__enumext_item_column_pos_vii_int
4790   \int_gincr:N \g__enumext_item_count_all_vii_int
4791   \__enumext_item_peek_args_vii:
4792 }

```

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).

```

4793 \cs_new_protected:Nn \__enumext_item_peek_args_vii:
4794 {
4795   \peek_meaning:NTF (
4796     { \__enumext_joined_item_vii:w }
4797     { \__enumext_joined_item_vii:w (1) }
4798   }

```

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`.

```

4799 \cs_new_protected:Npn \__enumext_joined_item_vii:w (#1)
4800 {
4801   \__enumext_starred_joined_item_vii:n {#1}
4802   \peek_meaning_remove:NTF *
4803     { \__enumext_starred_item_vii:w }
4804     { \__enumext_standar_item_vii:w }
4805 }

```

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 ]`.

```

4806 \cs_new_protected:Npn \__enumext_standar_item_vii:w
4807 {
4808   \bool_set_false:N \__enumext_item_starred_vii_bool
4809   \peek_meaning:NTF [
4810     {
4811       \bool_set_eq:NN \__enumext_wrap_label_vii_bool \l__enumext_wrap_label_opt_vii_bool
4812       \__enumext_start_item_vii:w
4813     }

```

```

4814     {
4815         \bool_set_true:N \l__enumext_wrap_label_vii_bool
4816         \legacy_if_set_true:n { @noitemarg }
4817         \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ] \ignorespaces
4818     }
4819 }

```

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]`.

```

4820 \cs_new_protected:Npn \__enumext_starred_item_vii:w
4821 {
4822     \bool_set_true:N \l__enumext_item_starred_vii_bool
4823     \bool_set_true:N \l__enumext_wrap_label_vii_bool
4824     \peek_meaning:NTF [
4825         { \__enumext_starred_item_vii_aux_i:w }
4826         { \__enumext_starred_item_vii_aux_ii:w }
4827     }
4828     \cs_new_protected:Npn \__enumext_starred_item_vii_aux_i:w [#1]
4829     {
4830         \tl_gset:Nn \g__enumext_item_symbol_aux_vii_tl {#1}
4831         \__enumext_starred_item_vii_aux_ii:w
4832     }
4833     \cs_new_protected:Npn \__enumext_starred_item_vii_aux_ii:w
4834     {
4835         \peek_meaning:NTF [
4836             { \__enumext_starred_item_vii_aux_iii:w }
4837             {
4838                 \dim_set_eq:NN \l__enumext_item_symbol_sep_vii_dim \l__enumext_labelsep_vii_dim
4839                 \legacy_if_set_true:n { @noitemarg }
4840                 \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ] \ignorespaces
4841             }
4842         }
4843     \cs_new_protected:Npn \__enumext_starred_item_vii_aux_iii:w [#1]
4844     {
4845         \dim_set:Nn \l__enumext_item_symbol_sep_vii_dim {#1}
4846         \legacy_if_set_true:n { @noitemarg }
4847         \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ] \ignorespaces
4848     }

```

(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 `lualatex`

```

4849 \cs_new_protected_nopar:Npn \__enumext_fake_make_label_vii:n #1
4850 {
4851     \legacy_if:nT { @noitemarg }
4852     {
4853         \legacy_if_set_false:n { @noitemarg }
4854         \legacy_if:nT { @nmbrlist }
4855         {
4856             \IfDocumentMetadataTF
4857             {
4858                 \bool_if:NT \l__enumext_hyperref_bool
4859                 {
4860                     \legacy_if_set_true:n { @hyper@item }
4861                 }
4862             } { }
4863             \refstepcounter{enumXvii}
4864             \bool_if:NT \l__enumext_check_answers_bool
4865             {
4866                 \int_gincr:N \g__enumext_item_number_int

```

```

4867         \bool_set_true:N \l__enumext_item_number_bool
4868     }
4869 }
4870 }
4871 \bool_if:NT \l__enumext_item_starred_vii_bool
4872 {
4873     \tl_if_blank:VT \g__enumext_item_symbol_aux_vii_tl
4874     {
4875         \tl_gset_eq:NN
4876         \g__enumext_item_symbol_aux_vii_tl \l__enumext_item_symbol_vii_tl
4877     }
4878     \mode_leave_vertical:
4879     \skip_horizontal:n { -\l__enumext_item_symbol_sep_vii_dim }
4880     \hbox_overlap_left:n { \g__enumext_item_symbol_aux_vii_tl }
4881     \skip_horizontal:N \l__enumext_item_symbol_sep_vii_dim
4882     \tl_gclear:N \g__enumext_item_symbol_aux_vii_tl
4883 }
4884 \makebox[ \l__enumext_labelwidth_vii_dim ][ \l__enumext_align_label_vii_str ]
4885 {
4886     \tl_use:N \l__enumext_label_font_style_vii_tl
4887     \bool_if:NTF \l__enumext_wrap_label_vii_bool
4888     {
4889         \__enumext_wrapper_label_vii:n {#1}
4890     }
4891     { #1 }
4892 }
4893 \skip_horizontal:N \l__enumext_labelsep_vii_dim \ignorespaces
4894 }

```

(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.

```

4895 \cs_new_protected_nopar:Npn \__enumext_start_item_vii:w [#1]
4896 {
4897     \cs_set_eq:NN \__enumext_stop_item_tmp_vii: \__enumext_stop_item_vii:
4898     \hbox_set_to_wd:Nnw \l__enumext_item_text_vii_box
4899     {
4900         \l__enumext_joined_width_vii_dim
4901         + \l__enumext_labelwidth_vii_dim
4902         + \l__enumext_labelsep_vii_dim
4903     }

```

Redefine the \footnote command.

```

4904     \__enumext_renew_footnote_starred:

```

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

```

4905     \__enumext_start_list_tag:n {enumext*}
4906     \__enumext_fake_make_label_vii:n {#1}
4907     \__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.

```

4908     \__enumext_minipage:w [ t ]{ \l__enumext_joined_width_vii_dim }
4909     \dim_set_eq:NN \parindent \l__enumext_listparindent_vii_dim
4910     \skip_set_eq:NN \parskip \l__enumext_parsep_vii_skip
4911     \__enumext_unskip_unkern:
4912     \__enumext_unskip_unkern:
4913     \skip_horizontal:n { -\l__enumext_listparindent_vii_dim } \ignorespaces
4914     \tl_use:N \l__enumext_fake_item_indent_vii_tl
4915     \tl_use:N \l__enumext_after_list_args_vii_tl
4916 }

```

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*.

```
4917 \cs_new_protected_nopar:Nn \__enumext_stop_item_vii:
4918 {
4919     \__enumext_endminipage:
4920     \__enumext_stop_list_tag:n {enumext*}
4921     \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*.

```
4922     \int_set:Nn \hbadness { 10000 }
4923     \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`.

```
4924     \int_compare:nNnTF
4925     { \l__enumext_item_column_pos_vii_int } = { \l__enumext_columns_vii_int }
4926     {
4927         \par\noindent
4928         \int_zero:N \l__enumext_item_column_pos_vii_int
4929     }
4930     {
4931         \skip_horizontal:N \l__enumext_columns_sep_vii_dim
4932     }
4933 }
```

(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)*.

```
4934 \cs_new_protected:Nn \__enumext_remove_extra_parsep_vii:
4935 {
4936     \int_compare:nNnT
4937     {
4938         \int_mod:nn
4939         { \g__enumext_item_count_all_vii_int } { \l__enumext_columns_vii_int }
4940     }
4941     =
4942     { 0 }
4943     {
4944         \para_end:
4945         \skip_vertical:n { -\l__enumext_itemsep_vii_skip }
4946         \skip_vertical:N \c_zero_skip
4947         \int_gzero:N \g__enumext_item_count_all_vii_int
4948     }
4949 }
```

(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`.

```
4950 \__enumext_after_env:nn {enumext*}
4951 {
4952     \__enumext_execute_after_env:
4953 }
```

### 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.

```
4954 \NewDocumentEnvironment{keyans*}{ o }
4955 {
4956     \__enumext_safe_exec_viii:
4957     \__enumext_parse_keys_viii:n {#1}
4958     \__enumext_before_list_viii:
4959     \__enumext_start_list:nn { }
4960     {
4961         \__enumext_list_arg_two_viii:
4962         \__enumext_before_keys_exec_viii:
4963     }
```

```

4964 \IfDocumentMetadataTF { \tag_suspend:n {keyans*} } { }
4965 \__enumext_starred_columns_set_viii:
4966 \item[] \scan_stop:
4967 \cs_set_eq:NN \__enumext_stop_item_tmp_viii: \__enumext_first_item_tmp_viii:
4968 \cs_set_eq:NN \item \__enumext_start_item_tmp_viii:
4969 \ignorespaces
4970 }
4971 {
4972 \IfDocumentMetadataTF { \tag_struct_end:n {tag=text-unit} } { }
4973 \__enumext_stop_item_tmp_viii:
4974 \__enumext_remove_extra_parsep_viii:
4975 \__enumext_check_starred_cmd:n { item }
4976 \__enumext_after_list_viii:
4977 }

```

(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.

```

4978 \cs_new_protected:Nn \__enumext_safe_exec_viii:
4979 {
4980   \bool_if:NF \__enumext_store_active_bool
4981   {
4982     \msg_error:nnnn { enumext } { wrong-place } { keyans* } { save-ans }
4983   }
4984   \int_incr:N \__enumext_keyans_level_h_int
4985   \int_compare:nNnT { \__enumext_keyans_level_h_int } > { 1 }
4986   {
4987     \msg_error:nn { enumext } { nested }
4988   }
4989   \__enumext_keyans_name_and_start:
4990   \bool_if:NT \__enumext_starred_bool
4991   {
4992     \msg_error:nnn { enumext } { nested-horizontal } { enumext* }
4993   }
4994   \bool_set_true:N \__enumext_starred_bool
4995   % Set false for interfering with enumext nested in keyans* (yes, its possible and crayze)
4996   \bool_set_false:N \__enumext_store_active_bool
4997   \int_compare:nNnT { \__enumext_level_int } > { 1 }
4998   {
4999     \msg_error:nn { enumext } { keyans-wrong-level }
5000   }
5001 }

```

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

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

```

5002 \cs_new_protected:Npn \__enumext_parse_keys_viii:n #1
5003 {
5004   \tl_if_novalue:nF {#1}
5005   {
5006     \keys_set:nn { enumext / keyans* } {#1}
5007   }
5008 }

```

(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`.

```

5009 \cs_new_protected:Nn \__enumext_before_list_viii:
5010 {
5011   \__enumext_vspace_above_viii:
5012   \__enumext_before_args_exec_viii:
5013   \__enumext_start_mini_viii:
5014 }

```



(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.

```
5015 \cs_new_protected:Nn \__enumext_after_list_viii:
5016 {
5017     \__enumext_stop_mini_viii:
5018     \__enumext_after_stop_list_viii:
5019     \__enumext_vspace_below_viii:
5020 }
```

(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.

```
5021 \cs_new_protected_nopar:Nn \__enumext_first_item_tmp_viii:
5022 {
5023     \skip_horizontal:n
5024     {
5025         -\__enumext_labelwidth_viii_dim - \__enumext_labelsep_viii_dim
5026     }
5027     \ignorespaces
5028 }
```

(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`.

```
5029 \cs_new_protected_nopar:Nn \__enumext_start_item_tmp_viii:
5030 {
5031     \__enumext_stop_item_tmp_viii:
5032     \int_incr:N \l__enumext_item_column_pos_viii_int
5033     \int_gincr:N \g__enumext_item_count_all_viii_int
5034     \__enumext_item_peek_args_viii:
5035 }
```

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).

```
5036 \cs_new_protected:Nn \__enumext_item_peek_args_viii:
5037 {
5038     \peek_meaning:NTF (
5039         { \__enumext_joined_item_viii:w }
5040         { \__enumext_joined_item_viii:w (1) }
5041     }
```

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`.

```
5042 \cs_new_protected:Npn \__enumext_joined_item_viii:w (#1)
5043 {
5044     \__enumext_starred_joined_item_viii:n {#1}
5045     \peek_meaning_remove:NTF *
5046     { \__enumext_starred_item_viii:w }
5047     { \__enumext_standar_item_viii:w }
5048 }
```

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 ]`.

```

5049 \cs_new_protected:Npn \__enumext_standar_item_viii:w
5050 {
5051   \bool_set_false:N \l__enumext_item_starred_viii_bool
5052   \bool_set_false:N \l__enumext_item_wrap_key_bool
5053   \peek_meaning:NTF [
5054     {
5055       \bool_set_eq:NN \l__enumext_wrap_label_viii_bool \l__enumext_wrap_label_opt_viii_bool
5056       \__enumext_start_item_viii:w
5057     }
5058     {
5059       \bool_set_true:N \l__enumext_wrap_label_viii_bool
5060       \legacy_if_set_true:n { @noitemarg }
5061       \__enumext_start_item_viii:w [ \l__enumext_label_viii_tl ] \ignorespaces
5062     }
5063   }

```

(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⟩]`.

```

5064 \cs_new_protected:Npn \__enumext_starred_item_viii:w
5065 {
5066   \bool_set_true:N \l__enumext_item_starred_viii_bool
5067   \bool_set_true:N \l__enumext_item_wrap_key_bool
5068   \bool_set_true:N \l__enumext_wrap_label_viii_bool
5069   \peek_meaning:NTF [
5070     { \__enumext_starred_item_viii_aux_i:w }
5071     { \__enumext_starred_item_viii_aux_ii:w }
5072   }

```

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`.

```

5073 \cs_new_protected:Npn \__enumext_starred_item_viii_aux_i:w [#1]
5074 {
5075   \tl_clear:N \l__enumext_store_current_label_tl
5076   \tl_if_no_value:nF { #1 }
5077   {
5078     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_tl
5079     {
5080       \tl_put_right:Ne \l__enumext_store_current_label_tl
5081       {
5082         \l__enumext_store_keyans_item_opt_sep_tl
5083       }
5084       \tl_put_right:Ne \l__enumext_store_current_label_tl { #1 }
5085     }
5086     \tl_set:Ne \l__enumext_store_current_opt_arg_tl { #1 }
5087   }
5088   \__enumext_starred_item_viii_aux_ii:w
5089 }
5090 \cs_new_protected:Npn \__enumext_starred_item_viii_aux_ii:w
5091 {
5092   \legacy_if_set_true:n { @noitemarg }
5093   \__enumext_start_item_viii:w [ \l__enumext_label_viii_tl ] \ignorespaces
5094 }

```

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.

```

5095 \cs_new_protected:Nn \__enumext_keyans_starred_item_star:
5096 {
5097   \tl_put_left:Ne \l__enumext_store_current_label_tl { \l__enumext_label_viii_tl }

```

```

5098 \__enumext_store_addto_prop:V \l__enumext_store_current_label_tl
5099 \__enumext_keyans_store_ref:
5100 \tl_put_left:Ne \l__enumext_store_current_label_tl { \item }
5101 \__enumext_keyans_addto_seq_link:
5102 \int_gincr:N \g__enumext_check_starred_cmd_int
5103 \dim_compare:nNnT { \l__enumext_mark_sym_sep_dim } = { \c_zero_dim }
5104 {
5105   \dim_set:Nn \l__enumext_mark_sym_sep_dim { \l__enumext_labelsep_viii_dim }
5106 }
5107 \bool_if:NT \l__enumext_show_answer_bool
5108 {
5109   \__enumext_print_keyans_box:NN
5110   \l__enumext_labelwidth_viii_dim \l__enumext_mark_sym_sep_dim
5111 }
5112 \bool_if:NT \l__enumext_show_position_bool
5113 {
5114   \tl_set:Ne \l__enumext_mark_answer_sym_tl
5115   {
5116     \group_begin:
5117     \exp_not:N \normalfont
5118     \exp_not:N \footnotesize [ \int_eval:n
5119       {
5120         \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
5121       }
5122     ]
5123     \group_end:
5124   }
5125   \__enumext_print_keyans_box:NN
5126   \l__enumext_labelwidth_viii_dim \l__enumext_mark_sym_sep_dim
5127 }
5128 }

```

(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.

```

5129 \cs_new_protected:Npn \__enumext_keyans_wrapper_label_viii:n #1
5130 {
5131   \bool_lazy_all:nT
5132   {
5133     { \bool_if_p:N \l__enumext_wrap_label_viii_bool }
5134     { \bool_if_p:N \l__enumext_show_answer_bool }
5135     { \bool_if_p:N \l__enumext_item_wrap_key_bool }
5136     { \cs_if_exist_p:N \__enumext_keyans_wrapper_item:n }
5137   }
5138   {
5139     \cs_set_eq:NN \__enumext_wrapper_label_viii:n \__enumext_keyans_wrapper_item:n
5140   }
5141   \bool_if:NTF \l__enumext_wrap_label_viii_bool
5142   {
5143     \__enumext_wrapper_label_viii:n {#1}
5144   }
5145   { #1 }
5146 }
5147 \cs_new_protected_nopar:Npn \__enumext_fake_make_label_viii:n #1
5148 {
5149   \legacy_if:nT { @noitemarg }
5150   {
5151     \legacy_if_set_false:n { @noitemarg }
5152     \legacy_if:nT { @nmbrrlist }
5153     {
5154       \refstepcounter{enumXviii}
5155     }
5156   }
5157   \bool_if:NT \l__enumext_item_starred_viii_bool
5158   {
5159     \__enumext_keyans_starred_item_star:
5160   }
5161   \makebox[ \l__enumext_labelwidth_viii_dim ][ \l__enumext_align_label_viii_str ]
5162   {
5163     \tl_use:N \l__enumext_label_font_style_viii_tl
5164     \__enumext_keyans_wrapper_label_viii:n {#1}
5165   }

```

```

5165     }
5166     \skip_horizontal:N \l__enumext_labelsep_viii_dim \ignorespaces
5167 }

```

(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:
5168 \cs_new_protected_nopar:Npn \__enumext_start_item_viii:w [#1]
5169 {
5170   \cs_set_eq:NN \__enumext_stop_item_tmp_viii: \__enumext_stop_item_viii:
5171   \hbox_set_to_wd:Nnw \l__enumext_item_text_viii_box
5172   {
5173     \l__enumext_joined_width_viii_dim
5174     + \l__enumext_labelwidth_viii_dim
5175     + \l__enumext_labelsep_viii_dim
5176   }
5177   \__enumext_renew_footnote_starred:
5178   \__enumext_start_list_tag:n {keyans*}
5179   \__enumext_fake_make_label_viii:n {#1}
5180   \__enumext_stop_start_list_tag:
5181   \__enumext_minipage:w [ t ]{ \l__enumext_joined_width_viii_dim }
5182   \dim_set_eq:NN \parindent \l__enumext_listparindent_viii_dim
5183   \skip_set_eq:NN \parskip \l__enumext_parsep_viii_skip
5184   \__enumext_unskip_unkern:
5185   \__enumext_unskip_unkern:
5186   \skip_horizontal:n { -\l__enumext_listparindent_viii_dim } \ignorespaces
5187   \tl_use:N \l__enumext_fake_item_indent_viii_tl
5188   \bool_if:NT \l__enumext_item_starred_viii_bool
5189   {
5190     \__enumext_keyans_show_item_opt:
5191   }
5192   \tl_use:N \l__enumext_after_list_args_viii_tl
5193 }
5194 \cs_new_protected_nopar:Nn \__enumext_stop_item_viii:
5195 {
5196   \__enumext_endminipage:
5197   \__enumext_stop_list_tag:n {keyans*}
5198   \hbox_set_end:
5199   \int_set:Nn \hbadness { 10000 }
5200   \box_use_drop:N \l__enumext_item_text_viii_box
5201   \int_compare:nNnTF
5202   { \l__enumext_item_column_pos_viii_int } = { \l__enumext_columns_viii_int }
5203   {
5204     \par\noindent
5205     \int_zero:N \l__enumext_item_column_pos_viii_int
5206   }
5207   {
5208     \skip_horizontal:N \l__enumext_columns_sep_viii_dim
5209   }
5210 }

```

(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.

```

5211 \cs_new_protected:Nn \__enumext_remove_extra_parsep_viii:
5212 {
5213   \int_compare:nNnT
5214   {
5215     \int_mod:nn
5216     { \g__enumext_item_count_all_viii_int }
5217     { \l__enumext_columns_viii_int }
5218   }
5219   =
5220   { 0 }
5221   {
5222     \para_end:
5223     \skip_vertical:n { -\l__enumext_itemsep_viii_skip }
5224     \skip_vertical:N \c_zero_skip
5225     \int_gzero:N \g__enumext_item_count_all_viii_int
5226   }
5227 }

```

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

### 13.46 The command `\getkeyans`

```
\getkeyans
\__enumext_getkeyans_aux:n
\__enumext_getkeyans:nn
```

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.

```
5228 \NewDocumentCommand \getkeyans { m }
5229 {
5230   \exp_args:Ne \__enumext_getkeyans_aux:n
5231   { \tl_to_str:e { \text_expand:n {#1} } }
5232 }
```

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

```
5233 \cs_new_protected:Npn \__enumext_getkeyans_aux:n #1
5234 {
5235   \str_if_in:nnTF {#1} { : }
5236   {
5237     \use:e
5238     {
5239       \cs_set:Npn \exp_not:N \__enumext_tmp:w ##1 \c_colon_str ##2 \scan_stop:
5240       { {##1} {##2} }
5241     }
5242     \exp_after:wN \__enumext_getkeyans:nn \__enumext_tmp:w #1 \scan_stop:
5243   }
5244   { \msg_error:nnn { enumext } { missing-colon } {#1} }
5245 }
```

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*.

```
5246 \cs_new_protected:Npn \__enumext_getkeyans:nn #1 #2
5247 {
5248   \prop_if_exist:cTF { g__enumext_#1_prop }
5249   {
5250     \prop_item:cn { g__enumext_#1_prop }{#2}
5251   }
5252   {
5253     \msg_error:nnn { enumext } { undefined-storage-anskey } {#1}
5254   }
5255 }
```

(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[ $\langle \textit{print}^* \rangle$ ]` 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[ $\langle \textit{print}^*, * \rangle$ ]`, the rest of the variables will be for the environment `enumext` and will be set by `\setenumext[ $\langle \textit{print}, \textit{level} \rangle$ ]`.

```
5256 \keys_define:nn { enumext / print }
5257 {
5258   print* .code:n = \keys_precompile:neN { enumext / enumext* }
5259               { \__enumext_filter_save_key:n {#1} }
5260               \l__enumext_print_keyans_starred_tl, % starred cmd
5261   print* .initial:n = { nosep, label=\arabic*., columns=2, first=\small, font=\small },
5262   print-1 .code:n = \keys_precompile:neN { enumext / level-1 }
5263               { \__enumext_filter_save_key:n {#1} }
5264               \l__enumext_print_keyans_i_tl,
5265   print-1 .initial:n = { nosep, label=\arabic*., columns=2, first=\small, font=\small },
5266   print-2 .code:n = \keys_precompile:neN { enumext / level-2 }
5267               { \__enumext_filter_save_key:n {#1} }
5268               \l__enumext_print_keyans_ii_tl,
5269   print-2 .initial:n = { nosep, label=(\alph*), first=\small, font=\small },
5270   print-3 .code:n = \keys_precompile:neN { enumext / level-3 }
```

```

5271         { \__enumext_filter_save_key:n {#1} }
5272         \l__enumext_print_keyans_iii_tl,
5273     print-3 .initial:n = { nosep, label=\roman*., first=\small, font=\small },
5274     print-4 .code:n    = \keys_precompile:neN { enumext / level-4 }
5275         { \__enumext_filter_save_key:n {#1} }
5276         \l__enumext_print_keyans_iv_tl,
5277     print-4 .initial:n = { nosep, label=\Alph*., first=\small, font=\small },
5278     print-* .code:n    = \keys_precompile:neN { enumext / enumext* }
5279         { \__enumext_filter_save_key:n {#1} }
5280         \l__enumext_print_keyans_vii_tl, % starred nested
5281     print-* .initial:n = { nosep, label=\arabic*., first=\small, font=\small },
5282 }

```

The reason for storing `\keys` 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`.

```

5283 \NewDocumentCommand \printkeyans { s O{} m }
5284 {
5285     \group_begin:
5286     \tl_use:N \l__enumext_print_keyans_i_tl
5287     \tl_use:N \l__enumext_print_keyans_ii_tl
5288     \tl_use:N \l__enumext_print_keyans_iii_tl
5289     \tl_use:N \l__enumext_print_keyans_iv_tl
5290     \tl_use:N \l__enumext_print_keyans_vii_tl
5291     \__enumext_printkeyans:nnn { #1 } { #2 } { #3 }
5292     \group_end:
5293 }

```

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.

```

5294 \cs_new_protected:Npn \__enumext_printkeyans:nnn #1 #2 #3
5295 {
5296     \seq_if_exist:cTF { g__enumext_#3_seq }
5297     {
5298         \seq_if_empty:cF { g__enumext_#3_seq }
5299         {

```

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 `\keys` 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.

```

5300         \bool_if:nTF {#1}
5301         {
5302             \seq_if_in:cnTF { g__enumext_#3_seq } { \end{enumext*} }
5303             {
5304                 \msg_error:nnnn { enumext } { print-starred } {#3} { enumext* }
5305             }
5306             {
5307                 \tl_use:N \l__enumext_print_keyans_starred_tl
5308                 \bool_set_true:N \l__enumext_base_line_fix_bool
5309                 \bool_set_true:N \l__enumext_print_keyans_star_bool
5310                 \begin{enumext*}[#2]
5311                     \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
5312                     \end{enumext*}
5313                 \bool_set_false:N \l__enumext_base_line_fix_bool
5314                 \bool_set_false:N \l__enumext_print_keyans_star_bool
5315             }
5316         }

```

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

```

5317         {
5318             \begin{enumext}[#2]
5319             \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
5320             \end{enumext}
5321         }

```

```

5322     }
5323   }
5324   {
5325     \msg_error:nnn { enumext } { undefined-storage-anskey } {#3}
5326   }
5327 }

```

(End of definition for `\printkeyans` and `\__enumext_printkeyans:nnn`. This function is documented on page 18.)

### 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`.

```

5328 \cs_new:Npn \__enumext_filter_first_level:n #1
5329 {
5330   \use:e
5331   {
5332     \keyval_parse:NNn
5333     \__enumext_filter_first_level_key:n
5334     \__enumext_filter_first_level_pair:nn {#1}
5335   }
5336 }

```

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*`.

```

5337 \cs_new:Npn \__enumext_filter_first_level_key:n #1
5338 {
5339   \str_case:nnF {#1}
5340   {
5341     { resume } {}
5342     { resume* } {}
5343   }
5344   { , { \exp_not:n {#1} } } }
5345 }

```

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.

```

5346 \cs_new:Npn \__enumext_filter_first_level_pair:nn #1#2
5347 {
5348   \str_case:nnF {#1}
5349   {
5350     { series } {}
5351     { resume } {}
5352     { save-ans } {}
5353   }
5354   { , { \exp_not:n {#1} } = { \exp_not:n {#2} } } }
5355 }

```

(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`.

```

5356 \keys_define:nn { enumext / meta-families }
5357 {
5358   enumext-1 .code:n =
5359     {
5360       \keys_set:ne { enumext / level-1 }
5361       {
5362         \__enumext_filter_first_level:n {#1}
5363       }
5364     } ,
5365   enumext-2 .code:n = { \keys_set:nn { enumext / level-2 } {#1} } ,
5366   enumext-3 .code:n = { \keys_set:nn { enumext / level-3 } {#1} } ,
5367   enumext-4 .code:n = { \keys_set:nn { enumext / level-4 } {#1} } ,
5368   keyans .code:n = { \keys_set:nn { enumext / keyans } {#1} } ,
5369   enumext* .code:n =
5370     {
5371       \keys_set:ne { enumext / enumext* }
5372       {

```



```

5373         \__enumext_filter_first_level:n {#1}
5374     }
5375     } ,
5376     keyans* .code:n = { \keys_set:nn { enumext / keyans* } {#1} } ,
5377     print* .code:n = { \keys_set:nn { enumext / print } { print* = {#1} } } ,
5378     print-1 .code:n = { \keys_set:nn { enumext / print } { print-1 = {#1} } } ,
5379     print-2 .code:n = { \keys_set:nn { enumext / print } { print-2 = {#1} } } ,
5380     print-3 .code:n = { \keys_set:nn { enumext / print } { print-3 = {#1} } } ,
5381     print-4 .code:n = { \keys_set:nn { enumext / print } { print-4 = {#1} } } ,
5382     print-* .code:n = { \keys_set:nn { enumext / print } { print-* = {#1} } } ,
5383     unknown .code:n = { \msg_error:nn { enumext } { unknown-key-family } } ,
5384 }

```

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

```

5385 \seq_const_from_clist:Nn \c__enumext_all_families_seq
5386 {
5387     enumext-1, enumext-2, enumext-3, enumext-4, keyans, enumext*,
5388     keyans*, print-1, print-2, print-3, print-4, print-*, print*,
5389 }

```

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

```

\__enumext_set_parse:n
\__enumext_set_error:nn
5390 \NewDocumentCommand \setenumext { 0{enumext,1} +m }
5391 {
5392     \seq_clear:N \l__enumext_setkey_tmpa_seq
5393     \seq_set_from_clist:Nn \l__enumext_setkey_tmpb_seq {#1}
5394     \int_set:Nn \l__enumext_setkey_tmpa_int
5395     {
5396         \seq_count:N \l__enumext_setkey_tmpb_seq
5397     }
5398     \int_compare:nNnTF { \l__enumext_setkey_tmpa_int } > { 1 }
5399     {
5400         \seq_pop_left:NN \l__enumext_setkey_tmpb_seq \l__enumext_setkey_tmpa_tl
5401         \seq_map_function:NN \l__enumext_setkey_tmpb_seq \__enumext_set_parse:n
5402         \seq_set_map_e:NNn \l__enumext_setkey_tmpa_seq \l__enumext_setkey_tmpa_seq
5403         {
5404             \tl_use:N \l__enumext_setkey_tmpa_tl - ##1
5405         }
5406     }
5407     {
5408         \seq_put_right:Ne \l__enumext_setkey_tmpa_seq { \tl_trim_spaces:n {#1} }
5409     }
5410     \seq_if_empty:NNTF \l__enumext_setkey_tmpa_seq
5411     { \seq_map_inline:Nn \c__enumext_all_families_seq }
5412     { \seq_map_inline:Nn \l__enumext_setkey_tmpa_seq }
5413     {
5414         \keys_set:nn { enumext / meta-families } { ##1 = {#2} }
5415     }
5416 }

```

Internal functions used by the `\setenumext` command.

```

5417 \cs_new_protected:Npn \__enumext_set_parse:n #1
5418 {
5419     \tl_set:Ne \l__enumext_setkey_tmpb_tl { \tl_trim_spaces:n {#1} }
5420     \clist_map_inline:nn { 0, 1, 2, 3, 4, * } % <- max level
5421     { \tl_remove_all:Nn \l__enumext_setkey_tmpb_tl {##1} }
5422     \tl_if_empty:NNTF \l__enumext_setkey_tmpb_tl
5423     {
5424         \seq_put_right:Ne \l__enumext_setkey_tmpa_seq
5425         { \tl_trim_spaces:n {#1} }
5426     }
5427     { \__enumext_set_error:nn {#1} { } }
5428 }
5429 \cs_new_protected:Npn \__enumext_set_error:nn #1 #2
5430 { \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
```

```
5431 \prop_const_from_keyval:Nn \c__enumext_meta_paths_prop
5432 {
5433   {enumext,1} = level-1,
5434   {enumext,2} = level-2,
5435   {enumext,3} = level-3,
5436   {enumext,4} = level-4,
5437   {enumext*}  = enumext*
5438 }
```

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

```
5439 \NewDocumentCommand \setenumextmeta { s O{enumext,1} m +m }
5440 {
5441   \str_if_eq:eeTF { \tl_trim_spaces:n {#3} } { unknown }
5442   { \msg_error:nn { enumext } { prohibited-unknown } }
5443   {
5444     \bool_if:nTF {#1}
5445     {
5446       \int_step_inline:nn { 4 }
5447       { \__enumext_add_meta_key:nnn { enumext, ##1 } {#3} {#4} }
5448       \__enumext_add_meta_key:nnn { enumext* } {#3} {#4}
5449     }
5450     { \__enumext_add_meta_key:nnn {#2} {#3} {#4} }
5451   }
5452 }
```

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

```
5453 \cs_new_protected:Npn \__enumext_add_meta_key:nnn #1
5454 {
5455   \tl_set:Nn \l__enumext_meta_path_tl {#1}
5456   \tl_replace_all:Nnn \l__enumext_meta_path_tl { ~ } {}
5457   \prop_get:NVNTF
5458   \c__enumext_meta_paths_prop \l__enumext_meta_path_tl \l__enumext_meta_path_tl
5459   { \__enumext_def_meta_key:Vnn \l__enumext_meta_path_tl }
5460   {
5461     \msg_error:nnn { enumext } { unknown-set } {#1}
5462     \use_none:nn
5463   }
5464 }
5465 \cs_new_protected:Npn \__enumext_def_meta_key:nnn #1#2#3
5466 {
5467   \bool_lazy_or:nnTF
5468   { \keys_if_exist_p:nn { enumext / #1 } {#2} }
5469   { \keys_if_exist_p:nn { enumext / enumext* } {#2} }
5470   { \msg_error:nnn { enumext } { already-defined } {#2} }
5471   {
5472     \keys_define:nn { enumext / #1 }
5473     {
5474       #2 .meta:n = {#3},
5475       #2 .value_forbidden:n = true
5476     }
5477   }
5478 }
5479 \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](#).

```
\foreachkeyans
```

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.

```
\__enumext_parse_foreach_keys:nn
\__enumext_parse_foreach_keys:n
\__enumext_t_foreach_keyans:nn
\__enumext_foreach_add_body:n
```

```
5480 \keys_define:nn { enumext / foreach }
5481 {
5482   before .tl_set:N = \l__enumext_foreach_before_tl,
5483   before .value_required:n = true,
5484   after .tl_set:N = \l__enumext_foreach_after_tl,
5485   after .value_required:n = true,
```

```

5486   start   .int_set:N = \l__enumext_foreach_start_int,
5487   start   .value_required:n = true,
5488   stop    .int_set:N = \l__enumext_foreach_stop_int,
5489   stop    .value_required:n = true,
5490   step    .int_set:N = \l__enumext_foreach_step_int,
5491   step    .value_required:n = true,
5492   wrapper .cs_set_protected:Np = \l__enumext_foreach_wrapper:n #1,
5493   wrapper .value_required:n = true,
5494   sep     .tl_set:N = \l__enumext_foreach_sep_tl,
5495   sep     .value_required:n = true,
5496   unknown .code:n = { \l__enumext_parse_foreach_keys:n {#1} }
5497 }
5498 \keys_precompile:nnN { enumext / foreach }
5499 {
5500   before={},after={},start=1,step=1,stop=0,wrapper=#1,sep={; }
5501 }
5502 \g__enumext_foreach_default_keys_tl

```

Functions for handling unknown  $\langle keys \rangle$ .

```

5503 \cs_new_protected:Npn \l__enumext_parse_foreach_keys:nn #1#2
5504 {
5505   \tl_if_blank:nTF {#2}
5506   {
5507     \msg_error:nnn { enumext } { for-key-unknown } {#1}
5508   }
5509   {
5510     \msg_error:nnnn { enumext } { for-key-value-unknown } {#1} {#2}
5511   }
5512 }
5513 \cs_new_protected:Npn \l__enumext_parse_foreach_keys:n #1
5514 {
5515   \exp_args:NV \l__enumext_parse_foreach_keys:nn \l_keys_key_str {#1}
5516 }

```

We create the command.

```

5517 \NewDocumentCommand \foreachkeyans { +0{ } m }
5518 {
5519   \l__enumext_foreach_keyans:nn {#1} {#2}
5520 }

```

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

```

5521 \cs_new_protected:Npn \l__enumext_foreach_keyans:nn #1 #2
5522 {
5523   \tl_use:N \g__enumext_foreach_default_keys_tl
5524   \keys_set:nn { enumext / foreach } {#1}
5525   \tl_set:Nn \l__enumext_foreach_name_prop_tl {#2}
5526   \prop_if_exist:cF { g__enumext_#2_prop }
5527   {
5528     \msg_error:nnn { enumext } { undefined-storage-anskey } {#2}
5529   }
5530   \int_compare:nNtT { \l__enumext_foreach_stop_int } = { 0 }
5531   {
5532     \int_set:Nn \l__enumext_foreach_stop_int
5533     { \prop_count:c { g__enumext_#2_prop } }
5534   }
5535   \seq_clear:N \l__enumext_foreach_print_seq
5536   \int_step_function:nnnN
5537   { \l__enumext_foreach_start_int }
5538   { \l__enumext_foreach_step_int }
5539   { \l__enumext_foreach_stop_int }
5540   \l__enumext_foreach_add_body:n
5541   \seq_use:NV \l__enumext_foreach_print_seq \l__enumext_foreach_sep_tl
5542 }
5543 \cs_new_protected:Npn \l__enumext_foreach_add_body:n #1
5544 {
5545   \seq_put_right:Ne \l__enumext_foreach_print_seq
5546   {
5547     \exp_not:V \l__enumext_foreach_before_tl
5548     \l__enumext_foreach_wrapper:n
5549     {
5550       \prop_item:cn { g__enumext_ \l__enumext_foreach_name_prop_tl _prop } {#1}

```

```

5551         }
5552         \exp_not:V \l__enumext_foreach_after_tl
5553     }
5554 }

```

(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.

```

5555 \msg_new:nnn { enumext } { package-load }
5556 {
5557     The ~ '#1' ~ package ~ is ~ already ~ loaded.
5558 }
5559 \msg_new:nnn { enumext } { package-not-load }
5560 {
5561     The ~ '#1' ~ package ~ will ~ be ~ loaded ~ as ~ a ~ dependency.
5562 }
5563 \msg_new:nnn { enumext } { package-load-foot }
5564 {
5565     The ~ '#1' ~ package ~ is ~ loaded ~ with ~ the ~ option ~ '#2'.
5566 }

```

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

```

5567 \msg_new:nnn { enumext } { counters }
5568 {
5569     The ~ counter ~ '#1' ~ is ~ already ~ defined ~ by ~ some ~ \\
5570     package ~ or ~ macro, ~ it ~ cannot ~ be ~ continued.
5571 }

```

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

```

5572 \msg_new:nnn { enumext } { unknown-choice }
5573 {
5574     The ~ value ~ '#3' ~ for ~ '#1' ~ key ~ is ~ invalid ~ use ~ ('#2').
5575 }

```

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

```

5576 \msg_new:nnnn { enumext } { anskey-env-error }
5577 {
5578     The ~ '#1' ~ environment ~is ~ reserved ~ by ~\\
5579     'enumext' ~ package, ~ It~ is~ already~ defined.
5580 }
5581 {
5582     The ~ anskey* ~ environment ~ is ~ defined ~ internally ~
5583     for ~ the ~ 'save-ans' ~ key.\\
5584 }

```

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

```

5585 \msg_new:nnn { enumext } { store-prop }
5586 {
5587     * ~ Package ~ enumext: ~ Creating ~
5588     \c_backslash_str g__enumext_#1_prop ~ \msg_line_context:.
5589 }
5590 \msg_new:nnn { enumext } { store-seq }
5591 {
5592     * ~ Package ~ enumext: ~ Creating ~
5593     \c_backslash_str g__enumext_#1_seq ~ \msg_line_context:.
5594 }
5595 \msg_new:nnn { enumext } { store-int }
5596 {
5597     * ~ Package ~ enumext: ~ Creating ~
5598     \c_backslash_str g__enumext_resume_#1_int ~ \msg_line_context:.
5599 }
5600 \msg_new:nnn { enumext } { prop-seq-int-hook }
5601 {
5602     * ~ Package ~ enumext: ~ Elements ~ in ~
5603     \c_backslash_str g__enumext_#1_prop ~ = ~ #2.\\
5604     * ~ Package ~ enumext: ~ Elements ~ in ~
5605     \c_backslash_str g__enumext_#1_seq ~ = ~ #3.\\
5606     * ~ Package ~ enumext: ~ Value ~ off ~
5607     \c_backslash_str g__enumext_resume_#1_int ~ = ~ #4.
5608 }
5609 \msg_new:nnn { enumext } { item-answer-hook }

```

```

5610 {
5611     * ~ Package ~ enumext: ~ Value ~ off ~
5612     \c_backslash_str g__enumext_item_number_int ~ = ~ #1.\\
5613     * ~ Package ~ enumext: ~ Value ~ off ~
5614     \c_backslash_str g__enumext_item_anskey_int ~ = ~ #2.\\
5615     * ~ Package ~ enumext: ~ Difference ~ item_number_int ~ - ~ item_anskey_int ~ = ~ #3.
5616 }

```

Message used by [`<key = val>`] system and `\setenumext` command.

```

5617 \msg_new:nnn { enumext } { invalid-key }
5618 {
5619     The ~ key ~ '#1' ~ is ~ not ~ know ~ the ~ level ~ #2.
5620 }
5621 \msg_new:nnn { enumext } { unknown-key-family }
5622 {
5623     Unknown~key~family~`\l_keys_key_str'~for~enumext.
5624 }

```

Messages used in length calculation.

```

5625 \msg_new:nnn { enumext } { width-negative }
5626 {
5627     Ignoring ~ negative ~ value ~ '#1=#2' ~ \msg_line_context:.\
5628     The ~ key ~ '#1'~ accepts ~ values ~ >= ~ 0pt.
5629 }
5630 \msg_new:nnn { enumext } { width-zero }
5631 {
5632     Invalid ~ '#1=#2' ~ \msg_line_context:.\
5633     The ~ key ~ '#1'~ accepts ~ values ~ > ~ 0pt.
5634 }

```

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

```

5635 \msg_new:nnn { enumext } { list-lengths }
5636 {
5637     **** ~ Lengths ~ used ~ by ~ 'enumext' ~ level ~ '#2' ~ \msg_line_context:~\c_space_tl ****\\
5638     \__enumext_show_length:nnn { dim } { labelsep } {#1}
5639     \__enumext_show_length:nnn { dim } { labelwidth } {#1}
5640     \__enumext_show_length:nnn { dim } { itemindent } {#1}
5641     \__enumext_show_length:nnn { dim } { leftmargin } {#1}
5642     \__enumext_show_length:nnn { dim } { rightmargin } {#1}
5643     \__enumext_show_length:nnn { dim } { listparindent } {#1}
5644     \__enumext_show_length:nnn { skip } { topsep } {#1}
5645     \__enumext_show_length:nnn { skip } { parsep } {#1}
5646     \__enumext_show_length:nnn { skip } { partopsep } {#1}
5647     \__enumext_show_length:nnn { skip } { itemsep } {#1}
5648     ****
5649 }

```

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

```

5650 \msg_new:nnn { enumext } { list-lengths-not-nested }
5651 {
5652     **** ~ Lengths ~ used ~ by ~ '#2' ~ environment ~ \msg_line_context:~\c_space_tl ****\\
5653     \__enumext_show_length:nnn { dim } { labelsep } {#1}
5654     \__enumext_show_length:nnn { dim } { labelwidth } {#1}
5655     \__enumext_show_length:nnn { dim } { itemindent } {#1}
5656     \__enumext_show_length:nnn { dim } { leftmargin } {#1}
5657     \__enumext_show_length:nnn { dim } { rightmargin } {#1}
5658     \__enumext_show_length:nnn { dim } { listparindent } {#1}
5659     \__enumext_show_length:nnn { skip } { topsep } {#1}
5660     \__enumext_show_length:nnn { skip } { parsep } {#1}
5661     \__enumext_show_length:nnn { skip } { partopsep } {#1}
5662     \__enumext_show_length:nnn { skip } { itemsep } {#1}
5663     ****
5664 }

```

Messages used by `ref` key.

```

5665 \msg_new:nnn { enumext } { key-ref-empty }
5666 {
5667     Key ~ 'ref' ~ need ~ a ~ value ~ in ~ '#1'~ \msg_line_context:.
5668 }

```

Messages used by `save-ans` key.

```

5669 \msg_new:nnn { enumext } { save-ans-empty }
5670 {
5671     Key ~ 'save-ans' ~ need ~ a ~ value ~ in ~ '#1'~ \msg_line_context:.

```

```

5672     }
5673     \msg_new:nnn { enumext } { save-ans-log }
5674     {
5675         * ~ Package ~ enumext: ~ Start ~ #1\c_space_tl with ~ save-ans=#2 ~ \msg_line_context:.
5676     }
5677     \msg_new:nnn { enumext } { save-ans-log-hook }
5678     {
5679         * ~ Package ~ enumext: ~ Stop ~ #1\c_space_tl with ~ save-ans=#2 ~ \msg_line_context:.
5680     }
5681     \msg_new:nnn { enumext } { save-ans-hook }
5682     {
5683         Stop ~ storing ~ for ~ 'save-ans=#1' ~ \msg_line_context:.
5684     }

```

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

```

5685     \msg_new:nnn { enumext } { need-save-ans }
5686     {
5687         Key ~ '#1'~ works ~ only ~ with ~ the ~ 'save-ans' ~ key ~ in ~ '#2'~ \msg_line_context:.
5688     }
5689     \msg_new:nnn { enumext } { items-same-answer }
5690     {
5691         *****\
5692         * ~ Package ~ enumext: ~ Checking ~ answers ~ in ~ '#1' ~
5693         for ~ \c_left_brace_str #2 \c_right_brace_str\
5694         * ~ started ~ #3 ~ and ~ close ~ \msg_line_context: : ~
5695         'OK', ~ all ~ items ~ with ~ answer.\
5696         *****
5697     }
5698     \msg_new:nnn { enumext } { item-greater-answer }
5699     {
5700         Checking ~ answers ~ in ~ '#1' ~ for ~ \c_left_brace_str #2 \c_right_brace_str\
5701         started ~ #3 ~ and ~ close ~ \msg_line_context: : ~'NOT ~ OK'\
5702         Items ~ > ~ Answers.
5703     }
5704     \msg_new:nnn { enumext } { item-less-answer }
5705     {
5706         Checking ~ answers ~ in ~ '#1' ~ for ~ \c_left_brace_str #2 \c_right_brace_str\
5707         started ~ #3 ~ and ~ close ~ \msg_line_context: : ~'NOT ~ OK'\
5708         Items ~ < ~ Answers.
5709     }

```

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

```

5710     \msg_new:nnn { enumext } { missing-starred }
5711     {
5712         Missing ~ '\c_backslash_str #1*' ~ #2.
5713     }
5714     \msg_new:nnn { enumext } { many-starred }
5715     {
5716         Many ~ '\c_backslash_str #1*' ~ #2.
5717     }

```

Messages used by `\printkeyans*` command.

```

5718     \msg_new:nnn { enumext } { print-starred }
5719     {
5720         \c_backslash_str printkeyans*:~ The ~ sequence ~ '#1' ~ already ~ contains ~
5721         #2 ~ environment ~ \msg_line_context:.
5722     }

```

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

```

5723     \msg_new:nnn { enumext } { list-too-deep }
5724     {
5725         Too ~ deep ~ nesting ~ for ~ 'enumext' ~ \msg_line_context:~ \
5726         The ~ maximum ~ level ~ of ~ nesting ~ is ~ 4.
5727     }

```

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

```

5728     \msg_new:nnn { enumext } { anskey-unnumber-item }
5729     {
5730         Can't ~ store ~ with ~ a ~ unnumbered ~ \c_backslash_str item ~ \msg_line_context:.
5731     }
5732     \msg_new:nnn { enumext } { anskey-already-stored }
5733     {
5734         Content ~ already ~ stored ~ for ~ this ~ \c_backslash_str item ~ \msg_line_context:.

```

```

5735     }
5736 \msg_new:nnn { enumext } { anskey-empty-arg }
5737 {
5738     Can't ~ store ~ empty ~ content ~ \msg_line_context:.
5739 }
5740 \msg_new:nnn { enumext } { anskey-wrong-place }
5741 {
5742     Wrong ~ place ~ for ~ command ~ '\c_backslash_str #1' ~ \msg_line_context:~ \\
5743     '\c_backslash_str #1' ~ works ~ in ~ the ~ environment ~ '#2'.
5744 }
5745 \msg_new:nnn { enumext } { anskey-nested }
5746 {
5747     The ~ command ~ \c_backslash_str anskey~ can't ~ be ~ nested ~ \msg_line_context:.
5748 }
5749 \msg_new:nnn { enumext } { anskey-math-mode }
5750 {
5751     #1 ~ can't ~ work ~ in ~ math ~ mode ~ \msg_line_context:.
5752 }
5753 \msg_new:nnn { enumext } { anskey-env-wrong }
5754 {
5755     The ~ environment ~ anskey* ~ cannot ~ use ~ in ~ '#1' ~ \msg_line_context:.
5756 }
5757 \msg_new:nnn { enumext } { anspic-wrong-place }
5758 {
5759     Wrong ~ place ~ for ~ command ~ '\c_backslash_str #1' ~ \msg_line_context:~ \\
5760     '\c_backslash_str #1' ~ works ~ in ~ the ~ environment ~ '#2'.
5761 }
5762 \msg_new:nnn { enumext } { command-wrong-place }
5763 {
5764     Wrong ~ place ~ for ~ command ~ '\c_backslash_str #1' ~ \msg_line_context:~ \\
5765     '\c_backslash_str #1' ~ works ~ outside ~ the ~ environment ~ '#2'.
5766 }
5767 \msg_new:nnnn { enumext } { anskey-env-key-unknown }
5768 {
5769     The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment~
5770     'anskey*' ~ and ~ is ~ being ~ ignored.
5771 }
5772 {
5773     The ~ environment ~ 'anskey*' ~ does ~ not ~ have ~ a ~ key ~ called ~'#1'.\\
5774     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5775 }
5776 \msg_new:nnnn { enumext } { anskey-env-key-value-unknown }
5777 {
5778     The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~
5779     'anskey*' ~ and ~ is ~ being ~ ignored.
5780 }
5781 {
5782     The ~ environment ~ 'anskey*' ~ does ~ not ~ have ~ a ~ key ~ called ~'#1'.\\
5783     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5784 }
5785 \msg_new:nnnn { enumext } { anskey-cmd-key-unknown }
5786 { The ~ key ~ '#1'~ is ~ unknown ~ by ~ '\c_backslash_str anskey' ~ and ~ is ~ being ~ ignored.}
5787 {
5788     The ~ command ~'\c_backslash_str anskey' ~ does ~ not ~ have ~ a ~ key ~ called ~'#1'.\\
5789     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5790 }
5791 \msg_new:nnnn { enumext } { anskey-cmd-key-value-unknown }
5792 { The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ '\c_backslash_str anskey' ~ and ~ is ~ being ~ ignored.}
5793 {
5794     The ~ command ~ '\c_backslash_str anskey' ~ does ~ not ~ have ~ a ~ key ~ called ~'#1'.\\
5795     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5796 }

```

Messages used by **keyans**, **keyans\*** and **keyanspic** environment.

```

5797 \msg_new:nnn { enumext } { keyans-nested }
5798 {
5799     The ~ environment ~ 'keyans' ~ can't ~ be ~ nested ~ \msg_line_context:.
5800 }
5801 \msg_new:nnn { enumext } { keyans-wrong-level }
5802 {
5803     Wrong ~ level ~ position ~ for ~ 'keyans' ~ \msg_line_context:~ \\
5804     The ~ environment ~ 'keyans' ~ can ~ only ~ be ~ in ~ the ~ first ~ level.

```



```

5805     }
5806     \msg_new:nnn { enumext } { wrong-place }
5807     {
5808         Wrong ~ place ~ for ~ '#1' ~ environment ~\msg_line_context:~ \\
5809         '#1' ~ is ~ only ~ found ~ with ~ '#2' ~ in ~ 'enumext.
5810     }
5811     \msg_new:nnn { enumext } { keyanspic-nested }
5812     {
5813         The ~ environment ~ 'keyanspic' ~ can't ~ be ~ nested~ \msg_line_context:~.
5814     }
5815     \msg_new:nnn { enumext } { keyanspic-wrong-level }
5816     {
5817         Wrong ~ level ~ position ~ for ~ 'keyanspic' ~ \msg_line_context:~ \\
5818         The ~ environment ~ 'keyans' ~ can ~ only ~ be ~ in ~ the ~ first ~ level.
5819     }
5820     \msg_new:nnn { enumext } { keyanspic-item-cmd }
5821     {
5822         Can't ~ use ~ \c_backslash_str item ~ in ~ keyanspic ~ \msg_line_context:.
5823     }
5824     \msg_new:nnnn { enumext } { keyans-unknown-key }
5825     {
5826         The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment~
5827         '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
5828     }
5829     {
5830         The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5831         ~ have ~ a ~ key ~ called ~ '#1'.\\
5832         Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5833     }
5834     \msg_new:nnnn { enumext } { keyans-unknown-key-value }
5835     {
5836         The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~
5837         '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
5838     }
5839     {
5840         The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5841         ~ have ~ a ~ key ~ called ~ '#1'.\\
5842         Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5843     }

```

Message used by unknown  $\langle keys \rangle$  in `enumext*`. environment.

```

5844     \msg_new:nnnn { enumext } { starred-unknown-key }
5845     {
5846         The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment~
5847         '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
5848     }
5849     {
5850         The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5851         ~ have ~ a ~ key ~ called ~ '#1'.\\
5852         Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5853     }
5854     \msg_new:nnnn { enumext } { starred-unknown-key-value }
5855     {
5856         The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~
5857         '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
5858     }
5859     {
5860         The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5861         ~ have ~ a ~ key ~ called ~ '#1'.\\
5862         Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5863     }

```

Message used by unknown  $\langle keys \rangle$  in `enumext` environment.

```

5864     \msg_new:nnnn { enumext } { standar-unknown-key }
5865     {
5866         The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment ~ '\l__enumext_envir_name_tl' \c_space_tl
5867         ~ on ~ level ~ \int_use:N \l__enumext_level_int \c_space_tl and ~ is ~ being ~ ignored.
5868     }
5869     {
5870         The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5871         ~ have ~ a ~ key ~ called ~ '#1' ~ on ~ level ~ \int_use:N \l__enumext_level_int.\\
5872         Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.

```

```

5873     }
5874     \msg_new:nnnn { enumext } { standar-unknown-key-value }
5875     {
5876       The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~ '\l__enumext_envir_name_tl' \c_space_
5877       ~ on ~ level ~ \int_use:N \l__enumext_level_int \c_space_tl and ~ is ~ being ~ ignored.
5878     }
5879     {
5880       The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5881       ~ have ~ a ~ key ~ called ~ '#1' ~ on ~ level ~ \int_use:N \l__enumext_level_int.\\
5882       Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5883     }

```

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

```

5884     \msg_new:nnnn { enumext } { for-key-unknown }
5885     { The~key~'#1'~is~unknown~by~'\c_backslash_str foreachkeyans'~and~is~being~ignored.}
5886     {
5887       The~command~'\c_backslash_str foreachkeyans'~does~not~have~a~key~called~'#1'.\\
5888       Check~that~you~have~spelled~the~key~name~correctly.
5889     }
5890     \msg_new:nnnn { enumext } { for-key-value-unknown }
5891     { The~key~'#1=#2'~is~unknown~by~'\c_backslash_str foreachkeyans'~and~is~being~ignored. }
5892     {
5893       The~command~'\c_backslash_str foreachkeyans'~does~not~have~a~key~called~'#1'.\\
5894       Check~that~you~have~spelled~the~key~name~correctly.
5895     }

```

Messages used by `\getkeyans` command.

```

5896     \msg_new:nnn { enumext } { undefined-storage-anskey }
5897     {
5898       Storage ~ named ~ '#1' ~ is ~ not ~ defined ~ \msg_line_context:.
5899     }

```

Messages used by `\miniright` command.

```

5900     \msg_new:nnn { enumext } { missing-miniright }
5901     {
5902       Missing ~ '\c_backslash_str miniright' ~ in ~ \msg_line_context:.\\
5903       The ~ key ~ 'mini-env' ~ need ~ '\c_backslash_str miniright'.
5904     }
5905     \msg_new:nnn { enumext } { wrong-miniright-place }
5906     {
5907       Wrong ~ place ~ for ~ '\c_backslash_str miniright' ~ \msg_line_context:~ \\
5908       Works ~ in ~ 'enumext' ~ and ~ 'keyans' ~ with ~ key ~ 'mini-env'.
5909     }
5910     \msg_new:nnn { enumext } { wrong-miniright-use }
5911     {
5912       Wrong ~ use ~ for ~ '\c_backslash_str miniright' ~ \msg_line_context:~ \\
5913       '\c_backslash_str miniright' ~ need ~ a ~ key ~ 'mini-env'.
5914     }
5915     \msg_new:nnn { enumext } { wrong-miniright-starred }
5916     {
5917       Can't ~ use ~ \c_backslash_str miniright ~ in ~ starred ~ environments ~ \msg_line_context:.
5918     }
5919     \msg_new:nnn { enumext } { many-miniright-used }
5920     {
5921       Can't ~ use ~ \c_backslash_str miniright ~ more ~ than ~ once ~ \msg_line_context:.
5922     }

```

Messages used by `\setenumextmeta` command.

```

5923     \msg_new:nnn { enumext } { unknown-set }
5924     {
5925       Argument ~ [#1] ~ is ~ unknown ~ by ~ \c_backslash_str setenumextmeta ~ \msg_line_context:.
5926     }
5927     \msg_new:nnn { enumext } { already-defined }
5928     {
5929       The ~ key ~ '#1' ~ is ~ already ~ defined ~ \msg_line_context:.
5930     }
5931     \msg_new:nnn { enumext } { prohibited-unknown }
5932     {
5933       The ~ name ~ 'unknown' ~ can't ~ be ~ chosen~ for ~ a ~ meta ~ key ~ \msg_line_context:.
5934     }

```

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

```

5935     \msg_new:nnn { enumext } { nested }

```

```

5936 {
5937     The ~ environment ~ \l__enumext_envir_name_tl \c_space_tl can't ~ be ~ nested ~ \msg_line_con
5938 }
5939 \msg_new:nnn { enumext } { nested-horizontal }
5940 {
5941     The ~ environment ~ \l__enumext_envir_name_tl \c_space_tl can't ~ be ~ nested ~ in ~ '#1' ~ '
5942 }
5943 \msg_new:nnn { enumext } { item-joined }
5944 {
5945     Items ~ joined ~ (#1) ~ > ~ #2 ~ columns ~\msg_line_context:.
5946 }
5947 \msg_new:nnn { enumext } { item-joined-columns }
5948 {
5949     Not ~ space ~ to ~ join ~ items ~ (#1) ~ > ~ #2 ~\msg_line_context:.
5950 }

```

## 13.52 Finish package

Finish package implementation.

```

5951 \file_input_stop:
5952 \</package>

```

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wrap-label .....	<a href="#">645</a>
wrap-label* .....	<a href="#">645</a>
wrap-opt .....	<a href="#">2304</a> , <a href="#">2350</a> , <a href="#">4112</a>

$$\mathbf{Z}$$
\z ..... 2960