

# 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 for creating “*simple exercise sheets*” along with “*multiple choice questions*”, storing the `<answers>` to these in memory using `multicol` and `scontents` packages and the `l3seq` and `l3prop` modules.

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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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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/lpp1.txt>). The software has the status “maintained”.  
The enumext package loads and requires multicol[3] and contents[4] packages, need to have a modern TeX distribution such as TeX Live or MiKTeX. It has been tested with the standard classes provided by LaTeX: book, report, article and letter on 10pt, 11pt and 12pt.

1 Introduction

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

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

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

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

3. True False

(a)  $\alpha > \delta$

(b) LaTeXze is cool?

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

(b) Usually uses the package manager?

(c) Rate the following package and class

i. xsim-exam

ii. xsim

iii. exsheets

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

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

\* 

$(x - 1)^2$

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

\* 

$3(x + y + z)$

3. True False

(a)  $\alpha > \delta$

\* 

False

(b) LaTeXze is cool?

\* 

Very True!

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

\* 

Yes

(b) Usually uses the package manager?

\* 

Yes, dnf

(c) Rate the following package and class

i. xsim-exam

\* 

doesn’t exist for now :(

ii. xsim

\* 

very good

iii. exsheets

\* 

obsolete
- Or we are interested in referring to a specific question and its “answer”, for example:
- The answer to 3.(b) is “Very True!” and the answer to 4.(c).ii is “very good”.
- Or we are interested in printing all the “answers”:
1.  $(x - 1)^2$

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

3. (a) False

(b) Very True!

4. (a) Yes

\* (b) Yes, dnf

\* (c) i. doesn’t exist for now :(

\* ii. very good

\* iii. obsolete

\*
- Another very common thing to use in my work is “multiple choice questions”, for example:
1. First type of questions

A) value

B) correct

C) value

D) value

2. Second type of questions

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

II.  $\alpha = \delta$

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

A) I only

B) II only

C) I and II only

D) I and III only

E) I, II, and III

★ 3. Third type of questions

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

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

A) value

B) value

C) value

D) value

E) value

4. Question with image and label below:

A

A)

B


B)

A

C)

A

D)



E)

5. Question with image on left side:

A) value

B) value

C) value

D) correct

E) value

B

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

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1. B),  $x = 5$

2. D)

3. C), some note
- \* 4. E), A duck

\* 5. D), “other note”

\*

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.

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

1.1 Description and usage

The `enumext` package defines enumerated environments using the `list` environment provided by  $\text{\LaTeX}$ , 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  $\text{\MiKTeX}$ , use the package manager to install. For manual installation, download `enumext.zip` and unzip it, run `lualatex enumext.dtx` and move all files to appropriate locations, then run `mktexlsr`. To produce the documentation run `lualatex enumext.dtx` two times.

enumext.sty

enumext.pdf

README.md

enumext.dtx

»

»

»

»

TDS:tex/latex/enumext/

TDS:doc/latex/enumext/

TDS:doc/latex/enumext/

TDS:source/latex/enumext/

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.

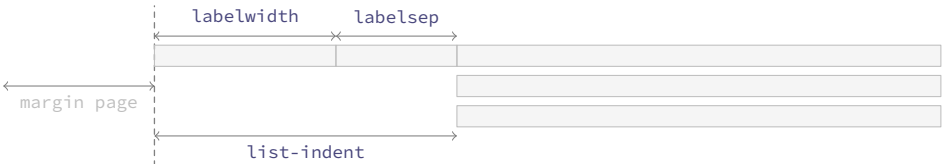


Figure 3: Default horizontal lengths `list-offset=0pt`, `list-indent=\labelwidth+\labelsep` in `enumext`.

### 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` to print all *stored content*, `\miniright` for `minipage` and `\setenumext` to config all `[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  $\text{\LaTeX}$  `\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.

- The implementation of `\label` and `\ref` together with the `save-ref` key are compatible with the `hyperref[8]` package.

1.3.6 Support for \footnote

This package provides an internal implementation for the `\footnote` command which is compatible with the `hyperref` package for the `enumext*` and `keyans*` environments, but will not produce the expected links, and if the `mini-env` key is used in `enumext` or `keyans` environments the output will look like the classic way they are displayed in the environment `minipage`.  
The best way to solve this 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) and will show the output numbered at the bottom of the page (as opposed to how it is displayed in the `minipage` environment). The way to load it is as follows:

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

2 The environments provided

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

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

2.1 The environment enumext

The `enumext` is an environment that works in the same way as the standard `enumerate` environment provided by  $\text{\LaTeX}$ , `\item` and `\item[\langle custom \rangle]` 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 `[\langle key = val \rangle]` 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 `enumerate*` environment provided by the `enumitem` package or `task` environment provided by the `task` package, `\item` and `\item[\langle custom \rangle]` work as usual. The options can be configured globally using `\setenumext` command and locally using `[\langle key = val \rangle]` 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” 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.

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.
- ★ 3. This text is in the first level.

2.3 The command \item\*

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

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 `\langle offset \rangle` set by the the second optional argument. The default values for `\langle symbol \rangle` and `\langle offset \rangle` are `\$star$ ‘★’` and the value set by `labelsep` key.

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*` = { $\langle symbol \rangle$ } default:  $\$ \star \$$   
Sets the *symbol* to be displayed in the “left” of the box containing the current  $\langle label \rangle$  set by `labelwidth` key for `\item*` in `enumext` and `enumext*`. The *symbol* can be in text or math mode, for example `item-sym*={ $\$ \backslash ast \$$ }`.

`item-pos*` = { $\langle rigid length \rangle$ } default: *by levels*  
Sets the *offset* between the box containing the current  $\langle label \rangle$  defined by `labelwidth` key and the  $\langle symbol \rangle$  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 optional “first argument” `\item( $\langle columns \rangle$ )` 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)
8. The ninth
- Z 9. The tenth (89.28171pt)

3 The command `\setenumext`

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

The command `\setenumext` sets the  $\langle keys \rangle$  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  $\langle keys \rangle$  set in the optional arguments 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 {<math>\langle key name \rangle</math>}{<math>\langle key-one = val, key-two = val, ... \rangle</math>}</code>
	<code>\setenumextmeta*{<math>\langle key name \rangle</math>}{<math>\langle key-one = val, key-two = val, ... \rangle</math>}</code>
	<code>\setenumextmeta [ <math>\langle enumext* \rangle</math> ] {<math>\langle key name \rangle</math>}{<math>\langle key-one = val, key-two = val, ... \rangle</math>}</code>
	<code>\setenumextmeta [ <math>\langle enumext, level \rangle</math> ] {<math>\langle key name \rangle</math>}{<math>\langle key-one = val, key-two = val, ... \rangle</math>}</code>

The command `\setenumextmeta` adds a new “meta-key” for the environments `enumext` and `enumext*`, the  $\{ \langle key name \rangle \}$  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 version `*` will create the new “meta-key” for the environment `enumext*` and for all levels of the environment `enumext`.



## 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

`label = { $\langle \backslash alph* | \backslash Alph* | \backslash arabic* | \backslash roman* | \backslash Roman* \rangle$ }` default: *by levels*

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

- 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 reference*” system with the `save-ref` key. You cannot use commands with  $\langle label \rangle$  as an argument, for example `\emph{\langle \backslash alph* \rangle}` will return an error. For full customization of how  $\langle label \rangle$  is displayed use the `font` or `wrap-label` keys.

`ref = { $\langle code \{ \backslash alph* | \backslash Alph* | \backslash arabic* | \backslash roman* | \backslash Roman* \} more code \rangle$ }` 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{\langle \backslash alph* \rangle}` 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`.

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

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

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

Sets the *width* of the box containing the current  $\langle label \rangle$  set by `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 using ‘0’ for `\arabic*`, ‘M’ for `\Alph*`, ‘m’ for `\alph*`, ‘VIII’ for `\Roman*` and ‘viii’ for `\roman*`.

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

Sets the `labelwidth` key pass the  $\langle integer \rangle$  or converting the  $\langle string \rangle$  of the form `\Alph`, `\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 = { $\langle font commands \rangle$ }` default: *empty*

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

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

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

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

Wraps the *current*  $\langle label \rangle$  defined by `label` key referenced by  $\{ \#1 \}$ . The  $\{ \langle code \rangle \}$  must be passed between braces. This key 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 \labelbx { s +m }
{%
  \IfBooleanTF{\#1}
  {\strut\smash{\parbox[t]{\labelwidth}{\raggedright{\#2}}}}%
  {\strut\smash{\parbox[t]{\labelwidth}{\raggedleft{\#2}}}}%
}
```

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

`wrap-label* = {⟨code {#1} more code⟩}`

default: *empty*

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

## 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`.

`partopsep = {⟨rubber length | rigid length⟩}`

default: *by levels*

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

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

`itemsep = {⟨rubber length | rigid length⟩}`

default: *by levels*

Set the *vertical space* between items, beyond the `parsep`. Internally sets the value of `\itemsep` for the current level. The default value for the first level of the environments `enumext` and `enumext*` are `4.0pt` plus `2.0pt` minus `1.0pt`, for the rest of the levels are `2.0pt` plus `1.0pt` minus `1.0pt`. For `keyans` and `keyans*` environments the default value is `4.0pt` plus `2.0pt` minus `1.0pt`.

`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 “meta-key” that does not receive an argument available only for the *first level* of environment `enumext` and environment `enumext*`. Fix the *baseline* when an environment `enumext` is nested in `enumext*` or vice versa 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`.

- The following *⟨keys⟩* 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 ‘\*’ *⟨keys⟩* applies `\vspace*` so that  $\TeX$  does *not discard* this space at page break.

`above = {⟨rubber length | rigid length⟩}`

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 on the “above” the environment without hindering the value of the `topsep` key. The space is added with `\vspace` so is “discordable”.

`above* = {⟨rubber length | rigid length⟩}`

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 on the “above” the environment without hindering the value of the `topsep` key. The space is added with `\vspace*` so is “not discordable”.

`below = {⟨rubber length | rigid length⟩}`

default: *not used*



Set the *extra vertical space* added, beyond `topsep`, to the bottom of the entire level of environment. This key is intended to give a “*fine adjustment*” of the vertical space on the “*below*” the environment without hindering the value of the `topsep` key. The space is added with `\vspace` so is “*discardable*”.

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

Set the *extra vertical space* added, beyond `topsep`, to the bottom of the entire level of environment. This key is intended to give a “*fine adjustment*” of the vertical space on the “*below*” the environment without hindering the value of the `topsep` key. The space is added with `\vspace*` so is “*not discardable*”.

### 5.2.2 Horizontal spaces

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

Extra *horizontal indentation*, beyond `labelsep`, of the “*first line*” off each item. This value is applied internally using `\hspace` and does not modify the value of `\itemindent`.

`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.

`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 environment `enumext` 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*”. This setting is equivalent (more or less) to the `wide` key provided by the `enumitem` package.

- For the `enumext*` and `keyans*` environments the keys `list-indent` and `list-offset` have the same effect.

## 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  $\text{\LaTeX}$  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*` = { $\langle code \rangle$ } default: *not used*

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

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

Executes  $\langle code \rangle$  when “*starting*” the environment. The  $\langle code \rangle$  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}{\langle arg one \rangle}{\langle arg two \rangle}{\langle code \rangle}\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.

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

Execute  $\langle code \rangle$  “*after*” finishing the environment. The  $\langle code \rangle$  must be passed between braces.

## 5.4 Keys for start, series and resume

`start` = { $\langle integer \mid integer\ expression \rangle$ } default: `1`

Sets the *start value* of the numbering on the current level. The  $\langle integer\ expression \rangle$  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*` = { $\langle integer \mid string \rangle$ } default: *not used*

Sets the *start value* of the numbering on the current level. Internally  $\langle string \rangle$  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 multicols

`columns = {⟨integer⟩}` default: `1`

Set the *number of columns* to be used by the `multicols` environment within the environment. The value must be a positive integer less than or equal to `10`.

`columns-sep = {⟨rigid length⟩}` default: *by level*

Set the *space between columns* used by the `multicols` environment within the environment. 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.

- The `\footnote{⟨text⟩}` command in the nested levels of `multicols` will not work as expected, prefer the use of `\footnotemark[⟨number⟩]` inside the environment and `\footnotetext[⟨number⟩]{⟨text⟩}` outside the environment or via the *after* key.

## 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”.

- The `\footnote{⟨text⟩}` command in `minipage` environment will work as usual. If you prefer the footnotes to be numbered (not lowercase) and outside the environment, use `\footnotemark[⟨number⟩]` inside the environment and `\footnotetext[⟨number⟩]{⟨text⟩}` outside the environment or via the *after* key (see §1.3.6 for full support).

### 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  $\langle key \rangle$  is “*active*” the `\anskey` command and the environments `anskey*`, `keyans`, `keyans*` and `keyanspic` are available.

```
\begin{enumext}[save-ans={\langle store name \rangle}]
  \item Text \anskey{answer}
  \item Text
  \begin{keyans}
    ...
  \end{keyans}
\end{enumext}
```

```
\begin{enumext}[save-ans={\langle store name \rangle}]
  \item Text \anskey{answer}
  \item Text
  \begin{keyanspic}
    ...
  \end{keyanspic}
\end{enumext}
```

By executing the key `save-ans={\langle store name \rangle}` the entire structure of the environment (excluding the first level) including the optional arguments passed to the inner levels or the environment nested in it, along with the content passed to `\anskey`, the current  $\langle labels \rangle$  for `\item*` and `\anspic*` in the environments `keyans`, `keyans*` and `keyanspic` will be stored in a  $\langle sequence \rangle$  and at the same time will be stored (without the environment structure or optional arguments) in a  $\langle prop list \rangle$ .

The optional arguments of the inner levels or the nested environment are filtered by excluding all  $\langle keys \rangle$  related to the “*stored system*” along with the keys `series`, `resume` and `resume*` when storing in  $\langle sequence \rangle$ .

### 6.1 Keys for storage system

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

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

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

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

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

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

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

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

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

#### 6.1.1 Keys for label and ref

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

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

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

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

- `wrap-ans` = {`<code> {#1} more code`} 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 {`<code>`} must be passed between braces and only affects the *argument* or *body* 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}’.
- `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.
- `mark-ans` = {`<symbol>`} 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`.
- `mark-pos` = {`<left> | <right>`} 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 `labelsep` 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.
- `no-store` `<value forbidden>` default: `not used`  
 This is a *meta-key* that does not receive an argument and disables the structure stored in the *sequence* {`<store name>`} 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`, “without” use `anskey*`, “without” interfering with the `check-ans` key and “without” storing an unwanted structure in the *sequence* {`<store name>`}.

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

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

### Example

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

- |  |   |
|--|---|
| * 1. Text containing our instructions or questions.<br>* <input type="text" value="first answer"/><br>2. Text containing our instructions or questions.<br>(a) Question.<br>* <input type="text" value="second answer"/> | 3. Text containing our instructions or questions.<br>* <input type="text" value="third answer"/><br>4. Text containing our instructions or questions.<br>* <input type="text" value="fourth answer"/> |
|--|---|

## 6.3 The environment `anskey*`

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

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

```

\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}

```

- |   |  |
|---|--|
| <p>★ 5. Text containing our instructions or questions.</p> <p>[5] <input type="text" value="First answer with verbatim"/></p> <p>6. Text containing our instructions or questions.</p> <p>(a) Question.</p> <p>[6] <input type="text" value="second answer"/></p> | <p>7. Text containing our instructions or questions.</p> <p>[7] <input type="text" value="third answer"/></p> <p>8. Text containing our instructions or questions.</p> <p>[8] <input type="text" value="fourth answer"/></p> |
|---|--|

## 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.

<pre> \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} </pre>	<pre> \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} </pre>
---	---

The `\keys` 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 `\keys` 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 `\label` which will be set to `label=\Alph*`.

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

```

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

```

The `\item*` and `\item*[\langle content \rangle]` command “*store*” the current `\label` set by `label` key next to the `\content` (if it is present) 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.

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

### 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
  \end{keyans*}
\end{enumext}

```



```
\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*[\textit{note}] 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 n^{\circ} \textit{above}, n^{\circ} \textit{below} \rangle]{\langle drawing \rangle}{\langle content \rangle}{\langle drawing \rangle}`

The `keyanspic` is a “fake enumerated list” environment that which uses the `\anspic` command instead of `\item`. It is activated by the `save-ans` key and has the same settings as the `keyans` environment. It is intended for placing “drawings” or “tabular” with an in-line or *above* and *below* layout. A representation of the output can be seen in the figure 6.

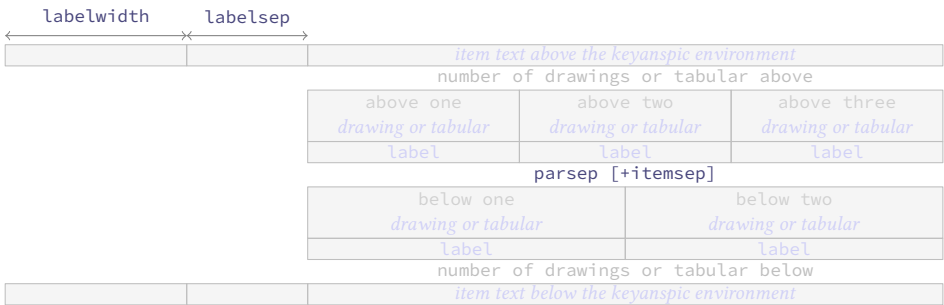


Figure 6: Representation of the `keyanspic` environment with optional argument [3,2] in `enumext`.

The optional argument determines the number drawings or tabular “above” and “below” within the environment. The vertical separation between “above” and “below” is controlled by the values set by `parsep` and `itemsep` keys passed to `keyans` environment. If the optional argument or the second part of it is omitted the drawings or tabular will be put on a single line.

6.5.1 The command \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 `\content` (if it is present) 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.

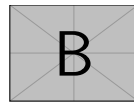
Example

```
\begin{enumext}[save-ans=test,show-ans,nosep]
\item Question with images.
\begin{keyanspic}[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*[\textit{note}]{\includegraphics[scale=0.15]{example-image-a}}
\end{keyanspic}
\end{enumext}
```

1. Question with images.



A)



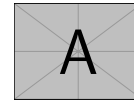
B)



C)



D)



\* E)[note]

## 6.6 Printing stored content

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

`step = {<integer>}` default: *1*  
 Sets the increment (`<step>`) applied to the value set by key `start` for each element 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 it will finish executing. 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> [ <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` environment or the `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*  $\{\langle store\ name\rangle\}$  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*{\langle store\ name\rangle}` and the *sequence*  $\{\langle store\ name\rangle\}$  already contains any `enumext*` environment an error will be returned as we cannot nest.
- If we execute `\printkeyans*{\langle store\ name\rangle}` and the *sequence*  $\{\langle store\ name\rangle\}$  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{\langle store\ name\rangle}` and the *sequence*  $\{\langle store\ name\rangle\}$  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[\langle print\rangle,\langle i\rangle]{\langle keys\rangle}` and `\setenumext[\langle print*\rangle]{\langle keys\rangle}`. If we need to set the  $\langle keys\rangle$  for the environment `enumext` “saved” in the *sequence*  $\{\langle store\ name\rangle\}$  we will use `\setenumext[\langle print\rangle,\langle level\rangle]{\langle keys\rangle}` and if we need to set the  $\langle keys\rangle$  for the environment `enumext*` “saved” in the *sequence*  $\{\langle store\ name\rangle\}$  we will use `\setenumext[\langle print\rangle,\langle *\rangle]{\langle keys\rangle}`.

Example

```
\begin{enumext}[save-ans=sample,columns=2,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)

[2]

3. Related to Linux

(a) You use linux?

[3]

(b) Rate the following package and class

i.

[4]

ii.

[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
```



- 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)  $2\alpha + 2\delta = 90^\circ$

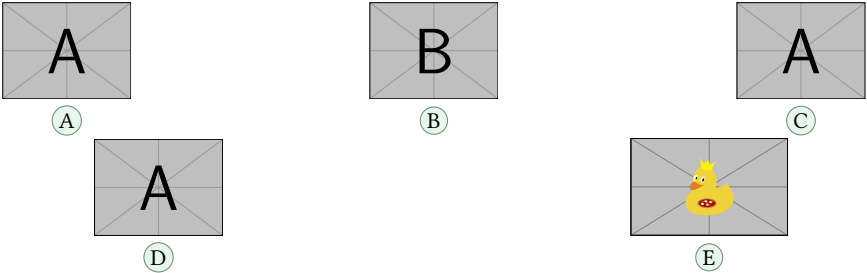
(2)  $\angle EDF = 45^\circ$

A value

B value

C value
- D value

E value
4. Question with image and label below:



5. Question with image on left 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) ~~ETX~~e 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 📄.

1

Which choice best describes what happens in the passage?

A) One character argues with another character who intrudes on her home.

B) One character receives a surprising request

from another character.

C) One character reminisces about choices she has made over the years.

D) One character criticizes another character for pursuing an unexpected course of action.

2

Which choice best describes what happens in the passage?

- A) One character argues with another character who intrudes on her home.
- B) One character receives a surprising request from another character.
- C) One character reminisces about choices she has made over the years.
- D) One character criticizes another character for pursuing an unexpected course of action.

3

Which choice best describes what happens in the passage?

- A) One character argues with another character who intrudes on her home.
- B) One character receives a surprising request

1. A)

2. C)

3. B)

4. D)

## 8 The way of non-enumerated lists

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

### 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={-\labelwidth - 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*` key 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 }
{%
  \IfBooleanTF{#1}
  {\strut\smash{\parbox[t]{\labelwidth}{\raggedright{#2}}}}%
  {\strut\smash{\parbox[t]{\labelwidth}{\raggedleft{#2}}}}%
}
```

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

- Something

A short one-line description.  
This is an entry *without* a label.
- Something

A short one-line description.
- Something long

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

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

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.

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## 10 Change history

**v1.0** 2024-06-26 – First public release.

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## 12 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.

### 12.1 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.

### 12.2 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>
```

### 12.3 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}[2024-06-01]
```

Now declare the `enumext` package.

```
4 \ProvidesExplPackage
5   {enumext}
6   {2024-06-26}
7   {1.0}
8   {Enumerate exercise sheets}
```

Finally check if the `multicol` and `scontents` packages are loaded, if not we load it.

```
9 \hook_gput_code:nnn {begindocument} {enumext}
10 {
11   \IfPackageLoadedTF { multicol }
12   {
13     \msg_info:nnn { enumext } { package-load } { multicol }
14   }
15   {
16     \msg_info:nnn { enumext } { package-not-load } { multicol }
17     \RequirePackage{multicol}[2024-05-23]
18   }
19   \IfPackageLoadedTF { scontents }
20   {
21     \msg_info:nnn { enumext } { package-load } { scontents }
22   }
23   {
24     \msg_info:nnn { enumext } { package-not-load } { scontents }
25     \RequirePackage{scontents}
26   }
27 }
```

### 12.4 Definition of variables

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

```

\l__enumext_level_int
\l__enumext_level_h_int
\l__enumext_anskey_level_int
\l__enumext_keyans_level_int
\l__enumext_keyans_level_h_int
\l__enumext_keyans_pic_level_int

```

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

```

28 \int_new:N \l__enumext_level_int
29 \int_new:N \l__enumext_level_h_int
30 \int_new:N \l__enumext_anskey_level_int
31 \int_new:N \l__enumext_keyans_level_int
32 \int_new:N \l__enumext_keyans_level_h_int
33 \int_new:N \l__enumext_keyans_pic_level_int

```

(End of definition for `\l__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:` (§12.5.1).

```

34 \bool_new:N \l__enumext_starred_bool
35 \bool_new:N \g__enumext_starred_bool
36 \bool_new:N \l__enumext_starred_first_bool
37 \bool_new:N \l__enumext_standar_bool
38 \bool_new:N \g__enumext_standar_bool
39 \bool_new:N \l__enumext_standar_first_bool
40 \bool_new:N \l__enumext_anskey_env_bool
41 \bool_new:N \l__enumext_keyans_env_bool
42 \tl_new:N \g__enumext_start_line_tl
43 \tl_new:N \g__enumext_envir_name_tl
44 \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` (§12.10) and then modified by the function `\__enumext_label_style:Nnn` used by `label` key (§12.13).

```

45 \cs_set_protected:Npn \__enumext_tmp:n #1
46 {
47   \tl_new:c { \l__enumext_counter_#1_tl }
48 }
49 \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 (§12.13).

```

50 \tl_const:Nn \c__enumext_counter_style_tl
51 { { arabic } { roman } { Roman } { alph } { Alph } }
52 \tl_new:N \l__enumext_ref_key_arg_tl
53 \tl_new:N \l__enumext_ref_the_count_tl
54 \cs_set_protected:Npn \__enumext_tmp:n #1
55 {
56   \tl_new:c { \l__enumext_renew_the_count_#1_tl }
57   \tl_new:c { \l__enumext_the_counter_#1_tl }
58   \tl_set:ce { \l__enumext_the_counter_#1_tl } { \exp_not:c { theenumX#1 } }
59 }
60 \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 (§12.24).

```

61 \int_new:N \g__enumext_resume_int
62 \int_new:N \g__enumext_resume_vii_int
63 \tl_new:N \l__enumext_resume_name_tl
64 \bool_new:N \l__enumext_resume_active_bool
65 \tl_new:N \g__enumext_standar_series_tl
66 \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` (§12.14) and `label` (§12.12) keys.

```

67 \dim_new:N \l__enumext_current_widest_dim
68 \tl_new:N \g__enumext_counter_styles_tl
69 \tl_new:N \g__enumext_widest_label_tl
70 \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 (§12.17). The variables `\l__enumext_leftmargin_X_dim` and `\l__enumext_itemindent_X_dim` are used and set by the function `\__enumext_calc_hspace:N` (§12.37.1).

```
71 \cs_set_protected:Npn \__enumext_tmp:n #1
72 {
73   \bool_new:c { \l__enumext_leftmargin_tmp_#1_bool }
74   \dim_new:c { \l__enumext_leftmargin_tmp_#1_dim }
75   \dim_new:c { \l__enumext_leftmargin_#1_dim }
76   \dim_new:c { \l__enumext_itemindent_#1_dim }
77 }
78 \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
```

Internal variables used by `columns` key §12.21).

```
79 \cs_set_protected:Npn \__enumext_tmp:n #1
80 {
81   \skip_new:c { \l__enumext_multicols_above_#1_skip }
82   \skip_new:c { \l__enumext_multicols_below_#1_skip }
83 }
84 \clist_map_inline:nn { i, ii, iii, iv, v } { \__enumext_tmp:n {#1} }
```

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

```
\g__enumext_minipage_stat_int
\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 (§12.22.4) and the keys `mini-right`, `mini-right*`, `mini-env` and `mini-sep` (§12.20, §12.22).

```
85 \int_new:N \g__enumext_minipage_stat_int
86 \skip_new:N \l__enumext_minipage_left_skip
87 \skip_new:N \l__enumext_minipage_right_skip
88 \skip_new:N \l__enumext_minipage_after_skip
89 \skip_new:N \g__enumext_minipage_right_skip
90 \skip_new:N \g__enumext_minipage_after_skip
91 \cs_set_protected:Npn \__enumext_tmp:n #1
92 {
93   \dim_new:c { \l__enumext_minipage_left_#1_dim }
94   \bool_new:c { \l__enumext_minipage_active_#1_bool }
95 }
96 \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 (§12.12), the integer `\l__enumext_start_X_int` are used by the `start` and `start*` keys (§12.14), the token list `\l__enumext_fake_item_indent_X_tl` is used by `itemindent` key (§12.17.1), the variables `\l__enumext_label_fill_left_X_tl` and `\l__enumext_label_fill_right_X_tl` are used by the `align` key (§12.12). 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 (§12.19).

```
97 \cs_set_protected:Npn \__enumext_tmp:n #1
98 {
99   \bool_new:c { \l__enumext_wrap_label_#1_bool }
100   \bool_new:c { \l__enumext_wrap_label_opt_#1_bool }
101   \int_new:c { \l__enumext_start_#1_int }
102   \tl_new:c { \l__enumext_fake_item_indent_#1_tl }
103   \tl_new:c { \l__enumext_label_fill_left_#1_tl }
104   \tl_new:c { \l__enumext_label_fill_right_#1_tl }
105   \bool_new:c { \l__enumext_vspace_a_star_#1_bool }
106   \bool_new:c { \l__enumext_vspace_b_star_#1_bool }
107 }
108 \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 (§12.25.1) activates all the mechanism related to `\anskey`, `anskey*`, `keyans`, `keyans*` and `keyanspic` environments.

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

The variable `\l__enumext_store_anskey_arg_tl` save the *argument* of `\anskey` (§12.29) and the variables `\l__enumext_store_anskey_env_tl` and `\l__enumext_store_anskey_opt_tl` save the *⟨body⟩* and the *⟨keys⟩* of the environment `anskey*` (§12.30).

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*` (§12.36) and `\anspic*` (§12.40.1) 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.

```

109 \bool_new:N \l__enumext_store_active_bool
110 \tl_new:N \l__enumext_store_name_tl
111 \tl_new:N \g__enumext_store_name_tl
112 \tl_new:N \l__enumext_store_anskey_arg_tl
113 \tl_new:N \l__enumext_store_anskey_env_tl
114 \tl_new:N \l__enumext_store_anskey_opt_tl
115 \tl_new:N \l__enumext_store_current_label_tl
116 \tl_new:N \l__enumext_store_current_opt_arg_tl
117 \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` (§12.47).

```

118 \tl_new:N \l__enumext_setkey_tmpa_tl
119 \tl_new:N \l__enumext_setkey_tmpb_tl
120 \int_new:N \l__enumext_setkey_tmpa_int
121 \seq_new:N \l__enumext_setkey_tmpa_seq
122 \seq_new:N \l__enumext_setkey_tmpb_seq

```

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

```

\l__enumext_meta_path_tl
\l__enumext_foreach_print_seq
\l__enumext_foreach_name_prop_tl
\l__enumext_foreach_default_keys_tl

```

Internal variables used by the `\printkeyans` command (§12.46) and `\foreachkeyans` command (§12.49).

```

123 \tl_new:N \l__enumext_meta_path_tl
124 \seq_new:N \l__enumext_foreach_print_seq
125 \tl_new:N \l__enumext_foreach_name_prop_tl
126 \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_mark_position_str
\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` (§12.46), `show-pos` key (§12.26), `item-sym*` key (§12.34), `save-key` key (§12.26.2) and “*storage level system*”.

```

127 \tl_new:N \l__enumext_print_keyans_starred_tl
128 \str_new:N \l__enumext_mark_position_str
129 \tl_new:N \g__enumext_item_symbol_aux_tl
130 \cs_set_protected:Npn \__enumext_tmp:n #1
131 {
132   \tl_new:c { \l__enumext_print_keyans_#1_tl }
133   \tl_new:c { \l__enumext_store_save_key_#1_tl }
134   \bool_new:c { \l__enumext_store_save_key_#1_bool }
135   \bool_new:c { \l__enumext_store_upper_level_#1_bool }
136 }
137 \clist_map_inline:nn { i, ii, iii, iv, vii } { \__enumext_tmp:n {#1} }

```

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

```

\l__enumext_keyans_pic_body_seq
\l__enumext_keyans_pic_width_dim
\l__enumext_keyans_pic_above_int
\l__enumext_keyans_pic_below_int
\l__enumext_keyans_pic_above_skip

```

Internal variables used by `keyanspic` environment (§12.40.2).

```

138 \seq_new:N \l__enumext_keyans_pic_body_seq
139 \dim_new:N \l__enumext_keyans_pic_width_dim
140 \int_new:N \l__enumext_keyans_pic_above_int
141 \int_new:N \l__enumext_keyans_pic_below_int
142 \skip_new:N \l__enumext_keyans_pic_above_skip

```

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

```

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

```

Internal variables used by “*internal check answer*” mechanism (§12.25.3) used by the `check-ans` and `no-store` keys and check for starred commands `\item*` in `keyans` and `keyans*` environments and `\anspic*` in `keyanspic` environment.

```

143 \bool_new:N \l__enumext_check_answers_bool
144 \bool_new:N \g__enumext_check_ans_key_bool
145 \tl_new:N \l__enumext_check_start_line_env_tl
146 \int_new:N \g__enumext_check_starred_cmd_int
147 \int_new:N \g__enumext_item_anskey_int
148 \int_new:N \g__enumext_item_number_int
149 \bool_new:N \l__enumext_item_number_bool
150 \int_new:N \g__enumext_item_answer_diff_int

```

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

```

\l__enumext_hyperref_bool
\l__enumext_footnotes_key_bool

```

The boolean variable `\l__enumext_hyperref_bool` will determine if the `hyperref` package is present or load in memory (§12.8). The boolean variable `\l__enumext_footnotes_key_bool` determine if `hyperref` is load with key `hyperfootnotes=true`.

```

151 \bool_new:N \l__enumext_hyperref_bool
152 \bool_new:N \l__enumext_footnotes_key_bool

```

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

```

\l__enumext_newlabel_arg_one_tl
\l__enumext_newlabel_arg_two_tl
\l__enumext_write_aux_file_tl
\l__enumext_label_copy_X_tl

```

Internal variables used by `save-ref` key (§12.26). The variables `\l__enumext_label_copy_X_tl` correspond to temporary copies of the `⟨labels⟩` defined by level on which operations will be performed.

The variables `\l__enumext_newlabel_arg_one_tl` and `\l__enumext_newlabel_arg_two_tl` will be used to form the arguments passed to the function `\__enumext_newlabel:nn` (§12.8) and the variable `\l__enumext_write_aux_file_tl` will be in charge of executing the writing code in the `.aux` file.

```

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

```

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

```

\g__enumext_footnote_int
\g__enumext_footnote_arg_seq
\g__enumext_footnote_int_seq

```

Internal variables used for redefinition of `\footnote` (§12.42).

```

161 \int_new:N \g__enumext_footnote_int
162 \seq_new:N \g__enumext_footnote_arg_seq
163 \seq_new:N \g__enumext_footnote_int_seq

```

(End of definition for `\g__enumext_footnote_int`, `\g__enumext_footnote_arg_seq`, and `\g__enumext_footnote_int_seq`.)

```

\l__enumext_item_starred_X_bool
\l__enumext_item_column_pos_X_int
\g__enumext_item_count_all_X_int
\l__enumext_joined_item_X_int
\l__enumext_joined_item_aux_X_int
\l__enumext_tmpa_X_int
\l__enumext_tmpa_X_dim
\l__enumext_item_text_X_box
\l__enumext_joined_width_X_dim
\l__enumext_item_width_X_dim
\g__enumext_item_symbol_aux_X_tl
\l__enumext_align_label_X_str
\g__enumext_minipage_active_X_bool
\l__enumext_miniright_code_X_box
\g__enumext_minipage_center_X_bool
\g__enumext_minipage_right_X_dim
\g__enumext_minipage_right_X_skip

```

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

```

164 \cs_set_protected:Npn \__enumext_tmp:n #1
165 {
166   \bool_new:c { \l__enumext_item_starred_#1_bool }
167   \int_new:c { \l__enumext_item_column_pos_#1_int }
168   \int_new:c { \g__enumext_item_count_all_#1_int }
169   \int_new:c { \l__enumext_joined_item_#1_int }
170   \int_new:c { \l__enumext_joined_item_aux_#1_int }
171   \int_new:c { \l__enumext_tmpa_#1_int }
172   \dim_new:c { \l__enumext_tmpa_#1_dim }
173   \box_new:c { \l__enumext_item_text_#1_box }
174   \dim_new:c { \l__enumext_joined_width_#1_dim }
175   \dim_new:c { \l__enumext_item_width_#1_dim }
176   \tl_new:c { \g__enumext_item_symbol_aux_#1_tl }
177   \str_new:c { \l__enumext_align_label_#1_str }
178   \bool_new:c { \g__enumext_minipage_active_#1_bool }
179   \box_new:c { \l__enumext_miniright_code_#1_box }
180   \bool_new:c { \g__enumext_minipage_center_#1_bool }
181   \dim_new:c { \g__enumext_minipage_right_#1_dim }
182   \skip_new:c { \g__enumext_minipage_right_#1_skip }
183 }
184 \clist_map_inline:nn { vii, viii } { \__enumext_tmp:n {#1} }

```

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

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

```
185 \clist_const:Nn \c__enumext_all_envs_clist
186 {
187   {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv},
188   {keyans}{v}, {enumext*}{vii}, {keyans*}{viii}
189 }
```

(End of definition for `\c__enumext_all_envs_clist`.)

## 12.5 Some utility functions

`\keys_precompile:neN` Non-standard kernel variants used by the `\printkeyans` command (§12.46) and `\foreachkeyans` command (§12.49).

`\seq_use:NV`

```
190 \cs_generate_variant:Nn \keys_precompile:nnN { neN }
191 \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.

```
192 \cs_new_protected:Npn \__enumext_at_begin_document:n #1
193 {
194   \hook_gput_code:nnn {begindocument} {enumext} { #1 }
195 }
```

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

`\__enumext_after_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.

`\__enumext_before_env:nn`

```
196 \cs_new_protected:Npn \__enumext_after_env:nn #1 #2
197 {
198   \hook_gput_code:nnn {env/#1/after} {enumext} {#2}
199 }
200 \cs_new_protected:Npn \__enumext_before_env:nn #1 #2
201 {
202   \hook_gput_code:nnn {env/#1/before} {enumext} {#2}
203 }
```

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

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

```
204 \cs_new:Nn \__enumext_level:
205 {
206   \int_to_roman:n { \__enumext_level_int }
207 }
```

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

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

`\__enumext_if_is_int:nF`

`\__enumext_if_is_int:nTF`

```
208 \prg_new_protected_conditional:Npnn \__enumext_if_is_int:n #1 { T, F, TF }
209 {
210   \regex_match:nnTF { ^[\+|-]?[\d]+$ } {#1} % $
211   { \prg_return_true: }
212   { \prg_return_false: }
213 }
```

(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.

```
214 \cs_new_protected:Nn \__enumext_regex_counter_style:
215 {
216   \tl_map_inline:Nn \c__enumext_counter_style_tl
217   {
218     \regex_replace_once:nnN { \c{##1}\* }
219     { \c{##1}\cB{\u{\l__enumext_ref_the_count_tl}\cE} } \l__enumext_ref_key_arg_tl
220   }
221 }
```

(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.

```

222 \cs_new:Npn \__enumext_show_length:nnn #1 #2 #3
223 {
224     * ~ #2
225     \prg_replicate:nn { 14 - \str_count:n {#2} } { ~ }
226     = ~ \use:c { #1_use:c } { \__enumext_#2_#3_#1 } \\
227 }

```

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

### 12.5.1 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 nested in each other and save the environment name in `\l__enumext_envir_name_tl`.

```

228 \cs_new_protected:Nn \__enumext_is_not_nested:
229 {
230     \str_case:en { \@currentenvir }
231     {
232         {enumext}
233         {
234             \tl_set:Nn \l__enumext_envir_name_tl { enumext }
235             \bool_lazy_and:nnT
236             { \bool_not_p:n { \g__enumext_standar_bool } }
237             { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
238             {
239                 \bool_gset_true:N \g__enumext_standar_bool
240             }
241         }
242         {enumext*}
243         {
244             \tl_set:Nn \l__enumext_envir_name_tl { enumext* }
245             \bool_lazy_and:nnT
246             { \bool_not_p:n { \g__enumext_starred_bool } }
247             { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
248             {
249                 \bool_gset_true:N \g__enumext_starred_bool
250             }
251         }
252     }
253 }

```

The function `\__enumext_is_on_first_level:` will set the variables `\l__enumext_standar_first_bool` (§12.25.1), `\l__enumext_starred_first_bool` (§12.25.1) and `\l__enumext_anskey_env_bool` (§12.30) 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.

```

254 \cs_new_protected:Nn \__enumext_is_on_first_level:
255 {
256     \bool_lazy_all:nT
257     {
258         { \bool_if_p:N \g__enumext_standar_bool }
259         { \int_compare_p:nNn { \l__enumext_level_int } = { 1 } }
260         { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
261     }
262     {
263         \bool_set_true:N \l__enumext_standar_first_bool
264         \bool_set_true:N \l__enumext_anskey_env_bool
265         \tl_gset:Nn \g__enumext_envir_name_tl { enumext }
266         \tl_gset:Nn \g__enumext_start_line_tl
267         {
268             on ~ line ~ \exp_not:V \inputlineno
269         }
270     }
271     \bool_lazy_all:nT
272     {
273         { \bool_if_p:N \g__enumext_starred_bool }
274         { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }

```

```

275     { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
276   }
277   {
278     \bool_set_true:N \l__enumext_starred_first_bool
279     \bool_set_true:N \l__enumext_anskey_env_bool
280     \tl_gset:Nn \g__enumext_envir_name_tl { enumext* }
281     \tl_gset:Ne \g__enumext_start_line_tl
282       {
283         on ~ line ~ \exp_not:V \inputlineno
284       }
285   }
286 }

```

(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.

```

287 \cs_new_protected:Nn \__enumext_keyans_name_and_start:
288 {
289   \str_case:en { \@currenvir }
290   {
291     {keyans}
292     {
293       \tl_set:Nn \l__enumext_envir_name_tl { keyans }
294       \tl_set:Ne \l__enumext_check_start_line_env_tl
295         {
296           in ~ 'keyans' ~ start ~ on ~ line ~ \exp_not:V \inputlineno
297         }
298     }
299     {keyans*}
300     {
301       \tl_set:Nn \l__enumext_envir_name_tl { keyans* }
302       \tl_set:Ne \l__enumext_check_start_line_env_tl
303         {
304           in ~ 'keyans*' ~ start ~ on ~ line ~ \exp_not:V \inputlineno
305         }
306     }
307     {keyanspic}
308     {
309       \tl_set:Nn \l__enumext_envir_name_tl { keyanspic }
310       \tl_set:Ne \l__enumext_check_start_line_env_tl
311         {
312           in ~ 'keyanspic' ~ start ~ on ~ line ~ \exp_not:V \inputlineno
313         }
314     }
315   }
316 }

```

(End of definition for `\__enumext_keyans_name_and_start:`)

### 12.5.2 Utilities for log and terminal

`\__enumext_reset_global_vars:`

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

`\__enumext_reset_global_int:`

`\__enumext_reset_global_bool:`

`\__enumext_reset_global_tl:`

```

317 \cs_new_protected:Nn \__enumext_reset_global_vars:
318 {
319   \__enumext_reset_global_int:
320   \__enumext_reset_global_bool:
321   \__enumext_reset_global_tl:
322 }
323 \cs_new_protected:Nn \__enumext_reset_global_int:
324 {
325   \int_gzero:N \g__enumext_item_number_int
326   \int_gzero:N \g__enumext_item_anskey_int
327   \int_gzero:N \g__enumext_item_answer_diff_int
328 }
329 \cs_new_protected:Nn \__enumext_reset_global_bool:
330 {
331   \bool_gset_false:N \g__enumext_check_ans_key_bool
332   \bool_gset_false:N \g__enumext_standar_bool
333   \bool_gset_false:N \g__enumext_starred_bool

```



```

334   }
335   \cs_new_protected:Nn \__enumext_reset_global_tl:
336   {
337     \tl_gclear:N \g__enumext_store_name_tl
338     \tl_gclear:N \g__enumext_start_line_tl
339     \tl_gclear:N \g__enumext_envir_name_tl
340   }

```

(End of definition for \\_\_enumext\_reset\_global\_vars: and others.)

\\_\_enumext\_log\_global\_vars: The function \\_\_enumext\_log\_global\_vars: will be passed to the function \\_\_enumext\_execute\_after\_env: and write to the .log file the number of elements saved in the *prop list* and *sequence* created by the *save-ans* key along with the value of the integer variable created for the *resume* key.

```

341 \cs_new_protected:Nn \__enumext_log_global_vars:
342 {
343   \msg_log:nneeee { enumext } { prop-seq-int-hook }
344   { \g__enumext_store_name_tl }
345   { \prop_count:c { g__enumext_ \g__enumext_store_name_tl _prop } }
346   { \seq_count:c { g__enumext_ \g__enumext_store_name_tl _seq } }
347   { \int_use:c { g__enumext_resume_ \g__enumext_store_name_tl _int } }
348 }

```

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.

```

349 \cs_new_protected:Nn \__enumext_log_answer_vars:
350 {
351   \msg_log:nneeee { enumext } { item-answer-hook }
352   { \int_use:N \g__enumext_item_number_int }
353   { \int_use:N \g__enumext_item_anskey_int }
354   { \int_eval:n { \g__enumext_item_number_int - \g__enumext_item_anskey_int } }
355 }

```

(End of definition for \\_\_enumext\_log\_global\_vars: and \\_\_enumext\_log\_answer\_vars:.)

## 12.6 Copying list and minipage environments

The *list* environment provided by L<sup>A</sup>T<sub>E</sub>X has the following plain form:

```

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

```

As a precaution we copy them using \\_\_enumext\_at\_begin\_document:n in case any package redefines the *list* environment or a related command.

\\_\_enumext\_start\_list:nn The functions \\_\_enumext\_start\_list:nn, \\_\_enumext\_stop\_list: and \\_\_enumext\_item\_std:w correspond to copies of \list, \endlist and \item from plain definition of list environment.

```

356 \__enumext_at_begin_document:n
357 {
358   \cs_new_eq:NN \__enumext_start_list:nn \list
359   \cs_new_eq:NN \__enumext_stop_list: \endlist
360   \cs_new_eq:NN \__enumext_item_std:w \item
361 }

```

(End of definition for \\_\_enumext\_start\_list:nn, \\_\_enumext\_stop\_list:, and \\_\_enumext\_item\_std:w.)

The *minipage* environment provided by L<sup>A</sup>T<sub>E</sub>X 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 *minipage* environment or a related command.

\\_\_enumext\_minipage:w The functions \\_\_enumext\_minipage:w, \\_\_enumext\_endminipage: and correspond to copies of \minipage, \endminipage from plain definition of minipage environment.

```

362 \__enumext_at_begin_document:n
363 {
364   \cs_new_eq:NN \__enumext_minipage:w \minipage
365   \cs_new_eq:NN \__enumext_endminipage: \endminipage
366 }

```

(End of definition for \\_\_enumext\_minipage:w and \\_\_enumext\_endminipage:.)

## 12.7 The internal minipage environment

```
\__enumext_internal_mini_page:
  __enumext_mini_env*
```

The function `\__enumext_internal_mini_page:` creates a internal `__enumext_mini_env*` 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. This function is passed to the function `\__enumext_safe_exec:` in the `enumext` environment definition (§12.38) and `\__enumext_safe_exec_vii:` in the `enumext*` environment definition (§12.43)

```
367 \cs_new_protected:Nn \__enumext_internal_mini_page:
368 {
369   \int_compare:nNtT { \l__enumext_level_int } = { 0 }
370   {
371     \DeclareDocumentEnvironment{__enumext_mini_env*}{ m }
372     {
373       \__enumext_minipage:w [ t ] { ##1 }
374       \legacy_if_gset_false:n { @minipage }
375       \skip_vertical:N \c_zero_skip
376     }
377     {
378       \skip_vertical:N \c_zero_skip
379       \__enumext_endminipage:
380     }
381   }
382 }
```

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

## 12.8 Compatibility with hyperref and footnotehyper

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

```
383 \hook_gput_code:nnn { begindocument } { enumext } { \__enumext_after_hyperref: }
384 \hook_gset_rule:nnnn { begindocument } { enumext } { after } { hyperref }
```

```
\__enumext_after_hyperref:
  \__enumext_hypertarget:nn
  \__enumext_phantomsection:
```

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

```
385 \cs_new_protected:Nn \__enumext_after_hyperref:
386 {
387   \IfPackageLoadedTF { hyperref }
388   {
389     \msg_info:nnn { enumext } { package-load } { hyperref }
390     \bool_set_true:N \l__enumext_hyprerref_bool
391     \IfHyperBoolean{hyperfootnotes}
392     {
393       \typeout{hyperfootnotes=true}
394       \bool_set_true:N \l__enumext_footnotes_key_bool
395     }
396     { \typeout{hyperfootnotes=false} }
397   }
398   { }
```

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`.

```
399 \bool_if:NT \l__enumext_footnotes_key_bool
400 {
401   \IfPackageLoadedTF { footnotehyper }
402   {
403     \msg_info:nnn { enumext } { package-load } { footnotehyper }
404   }
405   {
406     \typeout{No ~ footnotehyper ~ load}
407     \typeout{Load ~ and ~ use ~ \string\makesavenoteenv{enumext*}}
408     \bool_set_false:N \l__enumext_footnotes_key_bool
409   }
410 }
```

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

```

411 \bool_if:NTF \__enumext_hyperref_bool
412 {
413   \cs_new_eq:NN \__enumext_hypertarget:nn \hypertarget
414   \cs_new_eq:NN \__enumext_phantomsection: \phantomsection
415 }
416 {
417   \cs_new_eq:NN \__enumext_hypertarget:nn \use_none:nn
418   \cs_new_eq:NN \__enumext_phantomsection: \prg_do_nothing:
419 }
420 }
```

(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: `\__enumext_newlabel_arg_one_tl`

#2: `\__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.

```

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

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

## 12.9 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.

```

436 \dim_zero_new:N \itemwidth
```

## 12.10 Definition of counters

`\__enumext_define_counters:Nn`

`\__enumext_define_counters:cn`

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.

```

437 \cs_new_protected:Npn \__enumext_define_counters:Nn #1 #2
438 {
439   \cs_if_exist:cTF { c@ #2 }
440   { \msg_fatal:nnn { enumext } { counters } { #2 } }
441   {
442     \tl_set:Nn #1 { #2 }
443     \newcounter { #2 }
444   }
445 }
```

(End of definition for `\__enumext_define_counters:Nn`.)

```

enumXi    The counters created here are enumXi, enumXii, enumXiii and enumXiv for enumext environment, enumXv
enumXii   for keyans environment, enumXvi for keyanspic environment, enumXvii for enumext* and enumXviii
enumXiii  for the keyans* environments.
enumXiv   446 \__enumext_define_counters:Nn \__enumext_counter_i_tl { enumXi }
enumXv    447 \__enumext_define_counters:Nn \__enumext_counter_ii_tl { enumXii }
enumXvi   448 \__enumext_define_counters:Nn \__enumext_counter_iii_tl { enumXiii }
enumXvii  449 \__enumext_define_counters:Nn \__enumext_counter_iv_tl { enumXiv }
enumXviii 450 \__enumext_define_counters:Nn \__enumext_counter_v_tl { enumXv }
          451 \__enumext_define_counters:Nn \__enumext_counter_vi_tl { enumXvi }
          452 \__enumext_define_counters:Nn \__enumext_counter_vii_tl { enumXvii }
          453 \__enumext_define_counters:Nn \__enumext_counter_viii_tl { enumXviii }

```

(End of definition for enumXi and others.)

## 12.11 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` environment and the `keyans` environment, so it is necessary to get a default value for `labelwidth` from these *labels* at the same time.

```

454 \cs_new_protected:Npn \__enumext_register_counter_style:Nn #1 #2
455 {
456   \tl_const:cn { c__enumext_widest_ \cs_to_str:N #1 _tl } {#2}
457   \tl_gput_right:Nn \g__enumext_counter_styles_tl {#1}
458 }
459 \__enumext_register_counter_style:Nn \arabic { 0 }
460 \__enumext_register_counter_style:Nn \Alph { M }
461 \__enumext_register_counter_style:Nn \alph { m }
462 \__enumext_register_counter_style:Nn \Roman { VIII }
463 \__enumext_register_counter_style:Nn \roman { viii }

```

(End of definition for `\__enumext_register_counter_style:Nn`.)

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

`\__enumext_label_width_by_box:cv`

```

464 \cs_new_protected:Npn \__enumext_label_width_by_box:Nn #1 #2
465 {
466   \hbox_set:Nn \l__enumext_label_width_by_box {#2}
467   \dim_set:Nn #1 { \box_wd:N \l__enumext_label_width_by_box }
468 }
469 \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` 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.

`\__enumext_label_style:cvn`

```

470 \cs_new_protected:Npn \__enumext_label_style:Nnn #1 #2 #3
471 {
472   \tl_clear_new:N #1
473   \tl_put_right:Ne #1 { \tl_trim_spaces:n {#3} }
474   \tl_gset_eq:NN \g__enumext_widest_label_tl #1
475   \tl_map_inline:Nn \g__enumext_counter_styles_tl
476   {
477     \tl_replace_all:Nne #1 { ##1* } { \exp_not:N ##1 {#2} }
478     \tl_greplace_all:Nne \g__enumext_widest_label_tl { ##1* }
479     { \tl_use:c { c__enumext_widest_ \cs_to_str:N ##1 _tl } }
480   }
481   \__enumext_label_width_by_box:Nn \l__enumext_current_widest_dim
482   { \tl_use:N \g__enumext_widest_label_tl }
483   \tl_set_eq:cN { the #2 } #1
484 }
485 \cs_generate_variant:Nn \__enumext_label_style:Nnn { cvn }

```

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

## 12.12 Setting keys associated with label

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

```

labelsep
labelwidth
wrap-label
wrap-label*
486 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
487 {
488   \keys_define:nn { enumext / #1 }
489   {
490     font .tl_set:c = { l__enumext_label_font_style_#2_tl },
491     font .value_required:n = true,
492     labelsep .dim_set:c = { l__enumext_labelsep_#2_dim },
493     labelsep .initial:n = {0.3333em},
494     labelsep .value_required:n = true,
495     labelwidth .dim_set:c = { l__enumext_labelwidth_#2_dim },
496     labelwidth .value_required:n = true,
497     wrap-label .cs_set_protected:cp = { __enumext_wrapper_label_#2:n } ##1,
498     wrap-label .initial:n = {##1},
499     wrap-label .value_required:n = true,
500     wrap-label* .code:n = {
501       \bool_set_true:c { l__enumext_wrap_label_opt_#2_bool }
502       \keys_set:nn { enumext / #1 } { wrap-label = {##1} }
503     },
504     wrap-label* .value_required:n = true,
505   }
506 }
507 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }
```

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

- In this point, the following are set `\__enumext_wrapper_label_X:n` which will be used by `\__enumext_make_label:` for the different levels of the `enumext` environment and is set to `\__enumext_wrapper_label_v:n` which will be used by `\__enumext_keyans_make_label:` for `keyans` and `keyanspic` environments.

`align` The `align` key is implemented differently for “starred” and “non starred” environments.

```

508 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
509 {
510   \keys_define:nn { enumext / #1 }
511   {
512     align .choice:,
513     align / left .code:n =
514       {
515         \tl_clear:c { l__enumext_label_fill_left_#2_tl }
516         \tl_set:cn { l__enumext_label_fill_right_#2_tl } { \hfill }
517       },
518     align / right .code:n =
519       {
520         \tl_set:cn { l__enumext_label_fill_left_#2_tl } { \hfill }
521         \tl_clear:c { l__enumext_label_fill_right_#2_tl }
522       },
523     align / center .code:n =
524       {
525         \tl_set:cn { l__enumext_label_fill_left_#2_tl } { \hfill }
526         \tl_set:cn { l__enumext_label_fill_right_#2_tl } { \hfill }
527       },
528     align / unknown .code:n =
529       \msg_error:nnee { enumext } { unknown-choice }
530       { align } { left, ~ right, ~ center } { \exp_not:n {##1} },
531     align .initial:n = left,
532     align .value_required:n = true,
533   }
534 }
535 \clist_map_inline:nn
536 {
537   {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {keyans}{v}
538 }
539 { \__enumext_tmp:nn #1 }

540 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
541 {
542   \keys_define:nn { enumext / #1 }
543   {
544     align .choice:,
545   }
```

```

545 align / left .code:n = \str_set:cn { l__enumext_align_label_#2_str } { l },
546 align / right .code:n = \str_set:cn { l__enumext_align_label_#2_str } { r },
547 align / center .code:n = \str_set:cn { l__enumext_align_label_#2_str } { c },
548 align / unknown .code:n =
549     \msg_error:nneee { enumext } { unknown-choice }
550     { align } { left, ~ right, ~ center } { \exp_not:n {##1} },
551 align .initial:n = left,
552 align .value_required:n = true,
553 }
554 }
555 \clist_map_inline:nn { {enumext*}{vii}, {keyans*}{viii} } { \__enumext_tmp:nn #1 }

```

(End of definition for align.)

## 12.13 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.

### 12.13.1 Define and set label and ref keys for enumext environment

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

```

label \l__enumext_label_i_tl 556 \cs_set_protected:Npn \__enumext_tmp:nnn #1 #2 #3
ref   \l__enumext_label_ii_tl 557 {
558     \keys_define:nn { enumext / #1 }
559     {
560         label .code:n = {
561             \__enumext_label_style:cnv { l__enumext_label_#2_tl }
562             { l__enumext_counter_#2_tl } {##1}
563             \dim_set_eq:cN { l__enumext_labelwidth_#2_dim }
564             \l__enumext_current_widest_dim
565         },
566         label .initial:n = #3,
567         label .value_required:n = true,
568         ref .code:n = \__enumext_standar_ref:n {##1},
569         ref .value_required:n = true,
570     }
571 }
572 \__enumext_tmp:nnn { level-1 } { i } { \arabic*. }
573 \__enumext_tmp:nnn { level-2 } { ii } { (\alph*) }
574 \__enumext_tmp:nnn { level-3 } { iii } { \roman*. }
575 \__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 `\l__enumext_ref_key_arg_tl` and we will analyze its state, if it is not *empty* we will make a copy of the current counter in `\l__enumext_ref_the_count_tl` and we will execute the function `\__enumext_regex_counter_style:` which will return the modified `\l__enumext_ref_key_arg_tl` and we make the value of `\l__enumext_ref_the_count_tl` the same as that `\l__enumext_the_counter_X_tl` which contains `\theenumX` and finally we set `\l__enumext_renew_the_count_X_tl` with the renewed command.

```

576 \cs_new_protected:Npn \__enumext_standar_ref:n #1
577 {
578     \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
579     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
580     {
581         \msg_error:nnn { enumext } { key-ref-empty } { enumext }
582     }
583     {
584         \tl_set_eq:Nc
585         \l__enumext_ref_the_count_tl { l__enumext_counter_ \__enumext_level: _tl }
586         \__enumext_regex_counter_style:
587         \tl_set_eq:Nc
588         \l__enumext_ref_the_count_tl { l__enumext_the_counter_ \__enumext_level: _tl }
589         \tl_put_right:ce { l__enumext_renew_the_count_ \__enumext_level: _tl }
590         {
591             \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl }
592             { \exp_not:V \l__enumext_ref_key_arg_tl }
593         }
594     }
595 }

```



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

```

596 \cs_new_protected:Nn \__enumext_standar_ref:
597 {
598   \tl_if_empty:cF { \__enumext_renew_the_count_ \__enumext_level: _tl }
599   {
600     \tl_use:c { \__enumext_renew_the_count_ \__enumext_level: _tl }
601   }
602 }

```

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

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

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

```

\l__enumext_label_vii_tl
\l__enumext_label_viii_tl
603 \cs_set_protected:Npn \__enumext_tmp:nnn #1 #2 #3
604 {
605   \keys_define:nn { enumext / #1 }
606   {
607     label .code:n = {
608       \__enumext_label_style:cvn { \__enumext_label_#2_tl }
609       { \__enumext_counter_#2_tl } {##1}
610       \dim_set_eq:cN { \__enumext_labelwidth_#2_dim }
611       \__enumext_current_widest_dim
612     },
613     label .initial:n = #3,
614     label .value_required:n = true,
615     ref .code:n = \__enumext_starred_ref:n {##1},
616     ref .value_required:n = true,
617   }
618 }
619 \__enumext_tmp:nnn { enumext* } { vii } { \arabic*.}
620 \__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`.

```

621 \cs_new_protected:Npn \__enumext_starred_ref:n #1
622 {
623   \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
624   \int_compare:nNt { \l__enumext_level_h_int } = { 1 }
625   {
626     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
627     {
628       \msg_error:nnn { enumext } { key-ref-empty } { enumext* }
629     }
630     {
631       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_counter_vii_tl
632       \__enumext_regex_counter_style:
633       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_vii_tl
634       \tl_put_right:Ne \l__enumext_renew_the_count_vii_tl
635       {
636         \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl }
637         { \exp_not:V \l__enumext_ref_key_arg_tl }
638       }
639     }
640   }
641   \int_compare:nNt { \l__enumext_keyans_level_h_int } = { 1 }
642   {
643     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
644     {
645       \msg_error:nnn { enumext } { key-ref-empty } { keyans* }
646     }
647     {
648       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_counter_viii_tl
649       \__enumext_regex_counter_style:
650       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_viii_tl
651       \tl_put_right:Ne \l__enumext_renew_the_count_viii_tl
652       {
653         \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl }
654         { \exp_not:V \l__enumext_ref_key_arg_tl }

```

```

655         }
656     }
657 }
658 }

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.

659 \cs_new_protected:Nn \__enumext_starred_ref:
660 {
661     \int_compare:nNt { \__enumext_level_h_int } = { 1 }
662     {
663         \tl_if_empty:NF \__enumext_renew_the_count_vii_tl
664         {
665             \tl_use:N \__enumext_renew_the_count_vii_tl
666         }
667     }
668     \int_compare:nNt { \__enumext_keyans_level_h_int } = { 1 }
669     {
670         \tl_if_empty:NF \__enumext_renew_the_count_viii_tl
671         {
672             \tl_use:N \__enumext_renew_the_count_viii_tl
673         }
674     }
675 }

```

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

### 12.13.3 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` and `ref` key. The `keyanspic` environment use the same `<label>` as the `keyans` environment.

```

\__enumext_label_v_tl
\__enumext_label_vi_tl

676 \keys_define:nn { enumext / keyans }
677 {
678     label .code:n = {
679         \__enumext_label_style:cvn { \__enumext_label_v_tl }
680         { \__enumext_counter_v_tl } {#1}
681         \dim_set_eq:cN { \__enumext_labelwidth_v_dim }
682         \__enumext_current_widest_dim
683         \__enumext_label_style:cvn { \__enumext_label_vi_tl }
684         { \__enumext_counter_vi_tl } {#1}
685         \dim_set_eq:cN { \__enumext_labelwidth_v_dim }
686         \__enumext_current_widest_dim
687     },
688     label .initial:n = \Alph*,
689     label .value_required:n = true,
690     ref .code:n = \__enumext_keyans_ref:n {#1},
691     ref .value_required:n = true,
692 }

```

(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:

693 \cs_new_protected:Npn \__enumext_keyans_ref:n #1
694 {
695     \tl_set:Nn \__enumext_ref_key_arg_tl {#1}
696     \tl_if_empty:NTF \__enumext_ref_key_arg_tl
697     {
698         \msg_error:nnn { enumext } { key-ref-empty } { keyans }
699     }
700     {
701         \tl_set_eq:NN \__enumext_ref_the_count_tl \__enumext_counter_v_tl
702         \__enumext_regex_counter_style:
703         \tl_set_eq:NN \__enumext_ref_the_count_tl \__enumext_the_counter_v_tl
704         \tl_put_right:Ne \__enumext_renew_the_count_v_tl
705         {
706             \exp_not:N \renewcommand { \exp_not:V \__enumext_ref_the_count_tl }
707             { \exp_not:V \__enumext_ref_key_arg_tl }
708         }
709     }
710 }

```

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

```

711 \cs_new_protected:Nn \__enumext_keyans_ref:
712 {
713   \tl_if_empty:NF \__enumext_renew_the_count_v_tl
714   {
715     \tl_use:N \__enumext_renew_the_count_v_tl
716   }
717 }

```

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

## 12.14 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: \__enumext_label_X_tl
#2: \__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.

```

718 \cs_new_protected:Npn \__enumext_start_from:NNn #1 #2 #3
719 {
720   \__enumext_if_is_int:nTF { #3 }
721   {
722     \int_set:Nn #2 {#3}
723   }
724   {
725     \regex_match:nVT { \c{Alph} | \c{alph} } {#1}
726     { \int_set:Nn #2 { \int_from_alph:n {#3} } }
727     \regex_match:nVT { \c{Roman} | \c{roman} } {#1}
728     { \int_set:Nn #2 { \int_from_roman:n {#3} } }
729   }
730 }
731 \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: \__enumext_label_X_tl
#3: \__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.

```

732 \cs_new_protected:Npn \__enumext_widest_from:nNNn #1 #2 #3 #4
733 {
734   \__enumext_if_is_int:nTF {#4}
735   {
736     \setcounter{enumX#1} { #4 }
737   }
738   {
739     \regex_match:nVT { \c{Alph} | \c{alph} } {#2}
740     { \setcounter{enumX#1} { \int_from_alph:n {#4} } }
741     \regex_match:nVT { \c{Roman} | \c{roman} } {#2}
742     { \setcounter{enumX#1} { \int_from_roman:n {#4} } }
743   }
744   \__enumext_label_width_by_box:cv
745   { \__enumext_labelwidth_#1_dim } { \__enumext_label_#1_tl }
746 }
747 \cs_generate_variant:Nn \__enumext_widest_from:nNNn { nccn }

```

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

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

```

widest
start*
start
748 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
749 {

```

```

750 \keys_define:nn { enumext / #1 }
751 {
752   start* .code:n = {
753     \__enumext_start_from:ccn
754     { l__enumext_label_#2_tl }
755     { l__enumext_start_#2_int } {##1}
756   },
757   start* .value_required:n = true,
758   start .code:n = {
759     \__enumext_start_from:cce
760     { l__enumext_label_#2_tl }
761     { l__enumext_start_#2_int } { \int_eval:n {##1} }
762   },
763   start .initial:n = 1,
764   start .value_required:n = true,
765   widest .code:n = {
766     \__enumext_widest_from:nccn {#2}
767     { l__enumext_label_#2_tl }
768     { l__enumext_labelwidth_#2_dim } {##1}
769   },
770   widest .value_required:n = true,
771 }
772 }
773 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

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

## 12.15 Setting keys for vertical spaces

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

```

774 \cs_set_protected:Npn \__enumext_tmp:nnnnnn #1 #2 #3 #4 #5 #6
775 {
776   \keys_define:nn { enumext / #1 }
777   {
778     topsep .skip_set:c = { l__enumext_topsep_#2_skip },
779     topsep .initial:n = {#3},
780     topsep .value_required:n = true,
781     partopsep .skip_set:c = { l__enumext_partopsep_#2_skip },
782     partopsep .initial:n = {#4},
783     partopsep .value_required:n = true,
784     parsep .skip_set:c = { l__enumext_parsep_#2_skip },
785     parsep .initial:n = {#5},
786     parsep .value_required:n = true,
787     itemsep .skip_set:c = { l__enumext_itemsep_#2_skip },
788     itemsep .initial:n = {#6},
789     itemsep .value_required:n = true,
790     noitemsep .meta:n = { itemsep = 0pt, parsep = 0pt },
791     noitemsep .value_forbidden:n = true,
792     nosep .meta:n = {
793       itemsep = 0pt, parsep = 0pt,
794       topsep = 0pt, partopsep = 0pt,
795     },
796     nosep .value_forbidden:n = true,
797   }
798 }

```

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

```

799 \__enumext_tmp:nnnnnn { level-1 } { i } { 8.0pt plus 2.0pt minus 4.0pt }
800 { 2.0pt plus 1.0pt minus 1.0pt } { 4.0pt plus 2.0pt minus 1.0pt }
801 { 4.0pt plus 2.0pt minus 1.0pt }
802 \__enumext_tmp:nnnnnn { level-2 } { ii } { 4.0pt plus 2.0pt minus 1.0pt }
803 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
804 { 2.0pt plus 1.0pt minus 1.0pt }
805 \__enumext_tmp:nnnnnn { level-3 } { iii } { 2.0pt plus 1.0pt minus 1.0pt }
806 { 1.0pt minus 1.0pt } { 0pt } { 2.0pt plus 1.0pt minus 1.0pt }
807 \__enumext_tmp:nnnnnn { level-4 } { iv } { 2.0pt plus 1.0pt minus 1.0pt }
808 { 1.0pt minus 1.0pt } { 0pt } { 2.0pt plus 1.0pt minus 1.0pt }
809 \__enumext_tmp:nnnnnn { keyans } { v } { 4.0pt plus 2.0pt minus 1.0pt }
810 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
811 { 2.0pt plus 1.0pt minus 1.0pt }
812 \__enumext_tmp:nnnnnn { enumext* } { vii } { 8.0pt plus 2.0pt minus 4.0pt }

```

```

813 { 2.0pt plus 1.0pt minus 1.0pt } { 4.0pt plus 2.0pt minus 1.0pt }
814 { 4.0pt plus 2.0pt minus 1.0pt }
815 \__enumext_tmp:nnnnn { keyans* } { viii } { 4.0pt plus 2.0pt minus 1.0pt }
816 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
817 { 2.0pt plus 1.0pt minus 1.0pt }

```

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

## 12.16 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:` and then apply `\vspace{-\baselineskip}` and set `topsep=0pt` for the “first level” of the nested `enumext` or `enumext*` environments.

```

base-fix
\__enumext_nested_base_line_fix:
818 \cs_set_protected:Npn \__enumext_tmp:n #1
819 {
820   \keys_define:nn { enumext / #1 }
821   {
822     base-fix .bool_set:N = \__enumext_base_line_fix_bool,
823     base-fix .initial:n = false,
824     base-fix .value_forbidden:n = true,
825   }
826 }
827 \clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }

```

The function `\__enumext_nested_base_line_fix:` will be in charge of applying the baseline correction and adjusting the `\keys`. This function is passed to the function `\__enumext_parse_keys:n` in the `enumext` environment definition (§12.38) and to the function `\__enumext_parse_keys_vii:n` in the `enumext*` environment definition (§12.43)

```

828 \cs_new_protected:Nn \__enumext_nested_base_line_fix:
829 {
830   \bool_lazy_and:nnT
831   { \bool_if_p:N \__enumext_standar_first_bool }
832   { \bool_if_p:N \__enumext_base_line_fix_bool }
833   {
834     \mode_leave_vertical:
835     \vspace { -\baselineskip }
836     \keys_set:nn { enumext / level-1 }
837     {
838       topsep = 0pt, above = 0pt, above* = 0pt,
839     }
840   }
841   \bool_lazy_and:nnT
842   { \bool_if_p:N \__enumext_starred_first_bool }
843   { \bool_if_p:N \__enumext_base_line_fix_bool }
844   {
845     \mode_leave_vertical:
846     \vspace { -\baselineskip }
847     \keys_set:nn { enumext / enumext* }
848     {
849       topsep = 0pt, above = 0pt, above* = 0pt,
850     }
851   }
852   \bool_set_false:N \__enumext_base_line_fix_bool
853 }

```

👉 This key is enabled by default in the command `\printkeyans` (§12.46).

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

## 12.17 Setting keys for horizontal spaces

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

```

listparindent
list-offset
list-indent
854 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
855 {
856   \keys_define:nn { enumext / #1 }
857   {
858     itemindent .dim_set:c = { \__enumext_fake_item_indent_#2_dim },
859     itemindent .value_required:n = true,
860     rightmargin .dim_set:c = { \__enumext_rightmargin_#2_dim },

```

```

861     rightmargin .value_required:n = true,
862     listparindent .dim_set:c = { l__enumext_listparindent_#2_dim },
863     listparindent .value_required:n = true,
864     list-offset .dim_set:c = { l__enumext_listoffset_#2_dim },
865     list-offset .value_required:n = true,
866     list-indent .code:n =
867         \bool_set_true:c { l__enumext_leftmargin_tmp_#2_bool }
868         \dim_set:cn { l__enumext_leftmargin_tmp_#2_dim } {##1},
869     list-indent .value_required:n = true,
870 }
871 }
872 \clist_map_inline:nn
873 {
874     {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {keyans}{v}
875 }
876 { \__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.

```

877 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
878 {
879     \keys_define:nn { enumext / #1 }
880     {
881         itemindent .dim_set:c = { l__enumext_fake_item_indent_#2_dim },
882         itemindent .value_required:n = true,
883         rightmargin .dim_set:c = { l__enumext_rightmargin_#2_dim },
884         rightmargin .value_required:n = true,
885         listparindent .dim_set:c = { l__enumext_listparindent_#2_dim },
886         listparindent .value_required:n = true,
887         list-offset .dim_set:c = { l__enumext_listoffset_#2_dim },
888         list-offset .value_required:n = true,
889         list-indent .meta:n = { list-offset = ##1 },
890         list-indent .value_required:n = true,
891     }
892 }
893 \clist_map_inline:nn
894 {
895     {enumext*}{vii}, {keyans*}{viii}
896 }
897 { \__enumext_tmp:nn #1 }

```

### 12.17.1 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.

```

898 \cs_set_protected:Nn \__enumext_fake_item:
899 {
900     \dim_compare:nNnT
901     { \dim_use:c { l__enumext_fake_item_indent_ \__enumext_level: _dim } }
902     >
903     { \c_zero_dim }
904     {
905         \tl_set:ce { l__enumext_fake_item_indent_ \__enumext_level: _tl }
906         {
907             \exp_not:N \mode_leave_vertical:
908             \exp_not:n { \skip_horizontal:n }
909             { \dim_use:c { l__enumext_fake_item_indent_ \__enumext_level: _dim } }
910             \ignorespaces
911         }
912     }
913 }
914 \cs_set_protected:Nn \__enumext_keyans_fake_item:
915 {
916     \dim_compare:nNnT
917     { \l__enumext_fake_item_indent_v_dim } > { \c_zero_dim }
918     {
919         \tl_set:Nc \l__enumext_fake_item_indent_v_tl
920         {

```



```

921         \exp_not:N \mode_leave_vertical:
922         \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_v_dim
923     }
924 }
925 }
926 \cs_set_protected:Nn \__enumext_fake_item_vii:
927 {
928     \dim_compare:nNnT
929     { \l__enumext_fake_item_indent_vii_dim } > { \c_zero_dim }
930     {
931         \tl_set:Nc \l__enumext_fake_item_indent_vii_tl
932         {
933             \exp_not:N \mode_leave_vertical:
934             \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_vii_dim
935         }
936     }
937 }
938 \cs_set_protected:Nn \__enumext_fake_item_viii:
939 {
940     \dim_compare:nNnT
941     { \l__enumext_fake_item_indent_viii_dim } > { \c_zero_dim }
942     {
943         \tl_set:Nc \l__enumext_fake_item_indent_viii_tl
944         {
945             \exp_not:N \mode_leave_vertical:
946             \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_viii_dim
947         }
948     }
949 }

```

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

## 12.18 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.

```

950 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
951 {
952     \keys_define:nn { enumext / #1 }
953     {
954         show-length .bool_set:c = { \l__enumext_show_length_#2_bool },
955         show-length .initial:n = false,
956     }
957 }
958 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

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

## 12.19 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.

```

959 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
960 {
961     \keys_define:nn { enumext / #1 }
962     {
963         before .tl_set:c = { \l__enumext_before_no_starred_key_#2_tl },
964         before .value_required:n = true,
965         before* .tl_set:c = { \l__enumext_before_starred_key_#2_tl },
966         before* .value_required:n = true,
967         after .tl_set:c = { \l__enumext_after_stop_list_#2_tl },
968         after .value_required:n = true,
969         first .tl_set:c = { \l__enumext_after_list_args_#2_tl },
970         first .value_required:n = true,
971     }
972 }
973 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

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

### 12.19.1 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⟩}`.

```
974 \cs_new_protected:Nn \__enumext_before_args_exec:
975 {
976   \tl_use:c { l__enumext_before_starred_key_ \__enumext_level: _tl }
977 }
```

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⟩}}`

```
978 \cs_new_protected:Nn \__enumext_before_keys_exec:
979 {
980   \tl_use:c { l__enumext_before_no_starred_key_ \__enumext_level: _tl }
981 }
```

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

```
982 \cs_new_protected:Nn \__enumext_after_stop_list:
983 {
984   \tl_use:c { l__enumext_after_stop_list_ \__enumext_level: _tl }
985 }
```

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.`

```
986 \cs_new_protected:Nn \__enumext_after_args_exec:
987 {
988   \tl_use:c { l__enumext_after_list_args_ \__enumext_level: _tl }
989 }
```

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

### 12.19.2 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:

990 \cs_new_protected:Nn \__enumext_before_args_exec_v:
991 {
992   \tl_use:N \l__enumext_before_starred_key_v_tl
993 }
994 \cs_new_protected:Nn \__enumext_before_keys_exec_v:
995 {
996   \tl_use:N \l__enumext_before_no_starred_key_v_tl
997 }
998 \cs_new_protected:Nn \__enumext_after_stop_list_v:
999 {
1000   \tl_use:N \l__enumext_after_stop_list_v_tl
1001 }
1002 \cs_new_protected:Nn \__enumext_after_args_exec_v:
1003 {
1004   \tl_use:N \l__enumext_after_list_args_v_tl
1005 }
```

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

### 12.19.3 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:

1006 \cs_new_protected:Nn \__enumext_before_args_exec_vii:
1007 {
1008   \tl_use:N \l__enumext_before_starred_key_vii_tl
1009 }
1010 \cs_new_protected:Nn \__enumext_before_args_exec_viii:
1011 {
1012   \tl_use:N \l__enumext_before_starred_key_viii_tl
1013 }
1014 \cs_new_protected:Nn \__enumext_before_keys_exec_vii:
1015 {
1016   \tl_use:N \l__enumext_before_no_starred_key_vii_tl
1017 }
1018 \cs_new_protected:Nn \__enumext_before_keys_exec_viii:
1019 {
```

```

1020     \tl_use:N \l__enumext_before_no_starred_key_viii_tl
1021   }
1022   \cs_new_protected:Nn \__enumext_after_stop_list_vii:
1023   {
1024     \tl_use:N \l__enumext_after_stop_list_vii_tl
1025   }
1026   \cs_new_protected:Nn \__enumext_after_stop_list_viii:
1027   {
1028     \tl_use:N \l__enumext_after_stop_list_viii_tl
1029   }
1030   \cs_new_protected:Nn \__enumext_after_args_exec_vii:
1031   {
1032     \tl_use:N \l__enumext_after_list_args_vii_tl
1033   }
1034   \cs_new_protected:Nn \__enumext_after_args_exec_viii:
1035   {
1036     \tl_use:N \l__enumext_after_list_args_viii_tl
1037   }

```

(End of definition for \\_\_enumext\_before\_args\_exec\_vii: and others.)

## 12.20 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.

```

1038   \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1039   {
1040     \keys_define:nn { enumext / #1 }
1041     {
1042       mini-env .dim_set:c = { l__enumext_minipage_right_#2_dim },
1043       mini-env .value_required:n = true,
1044       mini-sep .dim_set:c = { l__enumext_minipage_hsep_#2_dim },
1045       mini-sep .initial:n = 0.3333em,
1046       mini-sep .value_required:n = true,
1047       columns-sep .dim_set:c = { l__enumext_columns_sep_#2_dim },
1048       columns-sep .value_required:n = true,
1049       columns .int_set:c = { l__enumext_columns_#2_int },
1050       columns .initial:n = 1,
1051       columns .value_required:n = true,
1052     }
1053   }
1054   \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.

```

1055   \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1056   {
1057     \keys_define:nn { enumext / #1 }
1058     {
1059       mini-right .tl_gset:c = { g__enumext_miniright_code_#2_tl },
1060       mini-right .value_required:n = true,
1061       mini-right* .code:n = {
1062         \bool_gset_true:c { g__enumext_minipage_center_#2_bool }
1063         \keys_set:nn { enumext / #1 } { mini-right = {##1} }
1064       },
1065       mini-right* .value_required:n = true,
1066     }
1067   }
1068   \clist_map_inline:nn { {enumext*}{vii}, {keyans*}{viii} } { \__enumext_tmp:nn #1 }

```

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

## 12.21 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.

### 12.21.1 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*.

```

1069 \cs_new_protected:Nn \__enumext_multi_set_vskip:
1070 {
1071   \skip_set:cn { \l__enumext_multicols_above_ \__enumext_level: } _skip {
1072     {
1073       \skip_use:c { \l__enumext_topsep_ \__enumext_level: } _skip {
1074         }
1075     }
1076   \skip_set:cn { \l__enumext_multicols_below_ \__enumext_level: } _skip {
1077     {
1078       \skip_use:c { \l__enumext_topsep_ \__enumext_level: } _skip {
1079         }
1080     }
1081   }

```

(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*.

```

1081 \cs_new_protected:Nn \__enumext_add_pre_parsep:
1082 {
1083   \int_case:nn { \l__enumext_level_int }
1084   {
1085     { 2 }{
1086       \skip_if_eq:nnF { \l__enumext_parsep_i_skip } { \c_zero_skip } {
1087         {
1088           \skip_add:Nn \l__enumext_multicols_above_ii_skip { \l__enumext_parsep_i_skip }
1089         }
1090       }
1091     { 3 }{
1092       \skip_if_eq:nnF { \l__enumext_parsep_ii_skip } { \c_zero_skip } {
1093         {
1094           \skip_add:Nn \l__enumext_multicols_above_iii_skip { \l__enumext_parsep_ii_skip }
1095         }
1096       }
1097     { 4 }{
1098       \skip_if_eq:nnF { \l__enumext_parsep_iii_skip } { \c_zero_skip } {
1099         {
1100           \skip_add:Nn \l__enumext_multicols_above_iv_skip { \l__enumext_parsep_iii_skip }
1101         }
1102       }
1103     }
1104   }

```

(End of definition for `\__enumext_add_pre_parsep:`)

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

```

1105 \cs_new_protected:Nn \__enumext_multi_addvspace:
1106 {
1107   \__enumext_multi_set_vskip:
1108   \mode_if_vertical:T
1109   {
1110     \skip_add:cn { l__enumext_multicols_above_ \__enumext_level: _skip }
1111     {
1112       \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
1113     }
1114     \skip_add:cn { l__enumext_multicols_below_ \__enumext_level: _skip }
1115     {
1116       \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
1117     }
1118   }
1119   \par\nopagebreak
1120   \addvspace{ \skip_use:c { l__enumext_multicols_above_ \__enumext_level: _skip } }
1121 }

```

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

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

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

`\__enumext_keyans_multi_addvspace:`

```

1122 \cs_new_protected:Nn \__enumext_keyans_multi_set_vskip:
1123 {
1124   \skip_set:Nn \l__enumext_multicols_above_v_skip
1125   {
1126     \l__enumext_topsep_v_skip
1127   }
1128   \skip_set:Nn \l__enumext_multicols_below_v_skip
1129   {
1130     \l__enumext_topsep_v_skip
1131   }
1132 }
1133 \cs_new_protected:Nn \__enumext_keyans_multi_addvspace:
1134 {
1135   \__enumext_keyans_multi_set_vskip:
1136   \mode_if_vertical:T
1137   {
1138     \skip_add:Nn \l__enumext_multicols_above_v_skip
1139     {
1140       \skip_use:N \l__enumext_partopsep_v_skip
1141     }
1142     \skip_add:Nn \l__enumext_multicols_below_v_skip
1143     {
1144       \skip_use:N \l__enumext_partopsep_v_skip
1145     }
1146   }
1147   \par\nopagebreak
1148   \addvspace{ \l__enumext_multicols_above_v_skip }
1149 }

```

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

### 12.22 Adjustment of vertical spaces for minipage

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

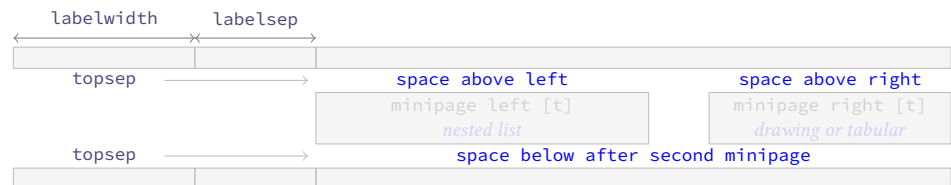


Figure 8: Representation of the `minipage` spacing adjustment for a nested level.

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

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

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

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

`\__enumext_mini_set_vskip:`

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

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

First determine if the `multicols` environment is active by comparing the value of the `\l__enumext_columns_X_int` variable handled by the `columns` key, according to this comparison we set the adjusted values for `\l__enumext_minipage_left_skip`, `\l__enumext_minipage_right_skip` and `\l__enumext_minipage_after_skip`.

```

1150 \cs_new_protected:Nn \__enumext_mini_set_vskip:
1151 {
1152   \int_compare:nNnTF
1153     { \int_use:c { \l__enumext_columns_ \__enumext_level: _int } } > { 1 }
1154     {

```

If `multicols` environment is nested in `\__enumext_mini_env*` environment, we will apply a correction factor to the *vertical spaces* taking into account the value of `\topsep` of the current level and the value of `\parsep` of the previous level, if these are zero we will use `\strutbox` as the basis for the calculations.

```

1155     \skip_if_eq:nnTF
1156       { \skip_use:c { \l__enumext_topsep_ \__enumext_level: _skip } } { \c_zero_skip }
1157     {
1158       \skip_set:Nn \l__enumext_minipage_left_skip
1159       {
1160         -0.150\box_dp:N \strutbox
1161       }
1162       \skip_set:Nn \l__enumext_minipage_right_skip
1163       {
1164         0.695\box_dp:N \strutbox
1165       }
1166       \skip_set:Nn \l__enumext_minipage_after_skip
1167       {
1168         \box_dp:N \strutbox
1169       }
1170       \__enumext_zero_parsep:
1171     }
1172     {
1173       \skip_set:Nn \l__enumext_minipage_left_skip
1174       {
1175         \skip_use:c { \l__enumext_topsep_ \__enumext_level: _skip }
1176       }
1177       \skip_set:Nn \l__enumext_minipage_right_skip
1178       {
1179         0.695\box_dp:N \strutbox
1180       }
1181       \skip_set:Nn \l__enumext_minipage_after_skip
1182       {
1183         1.85\box_dp:N \strutbox
1184         + \skip_use:c { \l__enumext_topsep_ \__enumext_level: _skip }
1185       }
1186     }
1187   }
1188   {

```

If only `enumext` environment is nested in `\__enumext_mini_env*` environment, we will apply a correction factor to the *vertical spaces* taking into account the value of `\topsep`, if this is zero we will use `\strutbox` as the basis for the calculations.



```

1189 \skip_if_eq:nnTF
1190 { \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip } } { \c_zero_skip }
1191 {
1192   \skip_set:Nn \l__enumext_minipage_left_skip
1193   {
1194     0.5\box_dp:N \strutbox
1195     - \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
1196   }
1197   \skip_set:Nn \l__enumext_minipage_right_skip
1198   {
1199     \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
1200   }
1201   \skip_set:Nn \l__enumext_minipage_after_skip
1202   {
1203     1.6\box_dp:N \strutbox
1204   }
1205 }
1206 {
1207   \skip_set:Nn \l__enumext_minipage_left_skip
1208   {
1209     0.5875\box_dp:N \strutbox
1210     - \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
1211   }
1212   \skip_set:Nn \l__enumext_minipage_right_skip
1213   {
1214     + \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip }
1215     + \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
1216   }
1217   \skip_set:Nn \l__enumext_minipage_after_skip
1218   {
1219     0.325\box_dp:N \strutbox
1220     + \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip }
1221   }
1222 }
1223 }
1224 }

```

(End of definition for `\__enumext_mini_set_vskip:`)

`\__enumext_zero_parsep:` The function `\__enumext_zero_parsep:` “*adjusted*” the value of `\l__enumext_minipage_after_skip` detecting the value of `\parsep` from the previous level. This is necessary since `\parsep` from the previous level affects the *vertical spaces* and this is noticeable when using the `nosep` or `noitemsep` keys.

```

1225 \cs_new_protected:Nn \__enumext_zero_parsep:
1226 {
1227   \int_case:nn { \l__enumext_level_int }
1228   {
1229     { 2 }{
1230       \skip_if_eq:nnF { \l__enumext_parsep_i_skip } { \c_zero_skip }
1231       {
1232         \skip_add:Nn \l__enumext_minipage_after_skip { 2.15\box_dp:N \strutbox }
1233       }
1234     }
1235     { 3 }{
1236       \skip_if_eq:nnF { \l__enumext_parsep_ii_skip } { \c_zero_skip }
1237       {
1238         \skip_add:Nn \l__enumext_minipage_after_skip { 2.15\box_dp:N \strutbox }
1239       }
1240     }
1241     { 4 }{
1242       \skip_if_eq:nnF { \l__enumext_parsep_iii_skip } { \c_zero_skip }
1243       {
1244         \skip_add:Nn \l__enumext_minipage_after_skip { 2.15\box_dp:N \strutbox }
1245       }
1246     }
1247   }
1248 }

```

(End of definition for `\__enumext_zero_parsep:`)

`\__enumext_mini_addvspace:` The function `\__enumext_mini_addvspace:` will apply the spaces set using `\addvspace` “*above*” the `\__enumext_mini_env*` environment in `enumext`, taking into account whether  $\text{\TeX}$  is in *(horizontal mode)* or

(*vertical mode*). For the latter we will make some adjustments since the `\partopsep` parameter comes into play and this affects the *vertical spacing*.

```

1249 \cs_new_protected:Nn \__enumext_mini_addvspace:
1250 {
1251   \__enumext_mini_set_vskip:
1252   \mode_if_vertical:T
1253   {
1254     \skip_add:Nn \l__enumext_minipage_left_skip
1255     {
1256       \skip_use:c { \l__enumext_partopsep_ \l__enumext_level: _skip }
1257     }
1258     \skip_add:Nn \l__enumext_minipage_after_skip
1259     {
1260       \skip_use:c { \l__enumext_partopsep_ \l__enumext_level: _skip }
1261     }
1262   }
1263   \par\nopagebreak
1264   \addvspace { \l__enumext_minipage_left_skip }
1265 }

```

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

### 12.22.2 Adjustment of vertical spaces for minipage in keyans

`\__enumext_keyans_mini_set_vskip:`

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_env*` environment in *keyans*. The implementation of this function is the same as the one used in *enumext*.

```

1266 \cs_new_protected:Nn \__enumext_keyans_mini_set_vskip:
1267 {
1268   \skip_zero_new:N \l__enumext_minipage_after_skip
1269   \skip_zero_new:N \l__enumext_minipage_left_skip
1270   \skip_zero_new:N \l__enumext_minipage_right_skip
1271   \int_compare:nNnTF { \l__enumext_columns_v_int } > { 1 }
1272   {
1273     \skip_if_eq:nnTF { \l__enumext_topsep_v_skip } { \c_zero_skip }
1274     {
1275       \skip_set:Nn \l__enumext_minipage_left_skip { -0.25\box_dp:N \strutbox }
1276       \skip_set:Nn \l__enumext_minipage_right_skip { 0.705\box_dp:N \strutbox }
1277       \skip_set:Nn \l__enumext_minipage_after_skip { \box_dp:N \strutbox }
1278       \skip_if_eq:nnF { \l__enumext_parsep_i_skip } { \c_zero_skip }
1279       {
1280         \skip_add:Nn \l__enumext_minipage_after_skip { 2.15\box_dp:N \strutbox }
1281       }
1282     }
1283     {
1284       \skip_set:Nn \l__enumext_minipage_left_skip
1285       {
1286         \skip_use:N \l__enumext_topsep_v_skip
1287       }
1288       \skip_set:Nn \l__enumext_minipage_right_skip
1289       {
1290         0.705\box_dp:N \strutbox
1291       }
1292       \skip_set:Nn \l__enumext_minipage_after_skip
1293       {
1294         1.85\box_dp:N \strutbox + \l__enumext_topsep_v_skip
1295       }
1296     }
1297   }
1298   {
1299     \skip_if_eq:nnTF { \l__enumext_topsep_v_skip } { \c_zero_skip }
1300     {
1301       \skip_set:Nn \l__enumext_minipage_left_skip
1302       {
1303         0.5\box_dp:N \strutbox
1304         + \l__enumext_partopsep_v_skip
1305       }
1306       \skip_set:Nn \l__enumext_minipage_right_skip
1307       {
1308         \l__enumext_partopsep_v_skip
1309       }
1310     }
1311   }

```

```

1310         \skip_set:Nn \l__enumext_minipage_after_skip { 1.6\box_dp:N \strutbox }
1311     }
1312     {
1313         \skip_set:Nn \l__enumext_minipage_left_skip
1314         {
1315             0.5875\box_dp:N \strutbox - \l__enumext_partopsep_v_skip
1316         }
1317         \skip_set:Nn \l__enumext_minipage_right_skip
1318         {
1319             \l__enumext_topsep_v_skip + \l__enumext_partopsep_v_skip
1320         }
1321         \skip_set:Nn \l__enumext_minipage_after_skip
1322         {
1323             0.325\box_dp:N \strutbox + \l__enumext_topsep_v_skip
1324         }
1325     }
1326 }
1327 }

```

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

`\__enumext_keyans_mini_addvspace:`

The function `\__enumext_keyans_mini_addvspace:` will apply the spaces set using `\addvspace` “above” the `\__enumext_mini_env*` environment in `keyans`, taking into account whether  $\text{\TeX}$  is in *horizontal mode* or *vertical mode*. For the latter we will make some adjustments since the `\partopsep` parameter comes into play and this affects the *vertical spacing*. The implementation of this function is the same as the one used in `enumext`.

```

1328 \cs_new_protected:Nn \__enumext_keyans_mini_addvspace:
1329 {
1330     \__enumext_keyans_mini_set_vskip:
1331     \mode_if_vertical:T
1332     {
1333         \skip_add:Nn \l__enumext_minipage_left_skip
1334         {
1335             \l__enumext_partopsep_v_skip
1336         }
1337         \skip_add:Nn \l__enumext_minipage_after_skip
1338         {
1339             \l__enumext_partopsep_v_skip
1340         }
1341     }
1342     \par\nopagebreak
1343     \addvspace { \l__enumext_minipage_left_skip }
1344 }

```

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

### 12.22.3 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_env*` environment in `enumext*` and `keyans*`.

```

1345 \cs_new_protected:Nn \__enumext_mini_set_vskip_vii:
1346 {
1347     \skip_zero_new:N \l__enumext_minipage_left_skip
1348     \skip_gzero_new:N \g__enumext_minipage_right_skip
1349     \skip_gzero_new:N \g__enumext_minipage_after_skip
1350     \skip_if_eq:nnTF { \l__enumext_topsep_vii_skip } { \c_zero_skip }
1351     {
1352         \skip_set:Nn \l__enumext_minipage_left_skip { 0.5\box_dp:N \strutbox }
1353         \skip_gset:Nn \g__enumext_minipage_right_skip { 0.325\box_dp:N \strutbox }
1354     }
1355     {
1356         \skip_set:Nn \l__enumext_minipage_left_skip { 0.5875\box_dp:N \strutbox }
1357         \skip_gset:Nn \g__enumext_minipage_right_skip
1358         {
1359             \l__enumext_topsep_vii_skip
1360         }
1361         \skip_gset:Nn \g__enumext_minipage_after_skip
1362         {
1363             0.325\box_dp:N \strutbox + \l__enumext_topsep_vii_skip
1364         }
1365     }
1366 }

```

```

1365     }
1366   }
1367   \cs_new_protected:Nn \__enumext_mini_set_vskip_viii:
1368   {
1369     \skip_zero_new:N \l__enumext_minipage_after_skip
1370     \skip_zero_new:N \l__enumext_minipage_left_skip
1371     \skip_zero_new:N \l__enumext_minipage_right_skip
1372     \skip_if_eq:nnTF { \l__enumext_topsep_viii_skip } { \c_zero_skip }
1373     {
1374       \skip_set:Nn \l__enumext_minipage_left_skip
1375       {
1376         0.5\box_dp:N \strutbox
1377       }
1378       \skip_set:Nn \l__enumext_minipage_right_skip
1379       {
1380         \l__enumext_partopsep_viii_skip
1381       }
1382       \skip_set:Nn \l__enumext_minipage_after_skip
1383       {
1384         1.6\box_dp:N \strutbox
1385       }
1386     }
1387     {
1388       \skip_set:Nn \l__enumext_minipage_left_skip
1389       {
1390         0.5875\box_dp:N \strutbox
1391       }
1392       \skip_set:Nn \l__enumext_minipage_right_skip
1393       {
1394         \l__enumext_topsep_viii_skip
1395       }
1396       \skip_set:Nn \l__enumext_minipage_after_skip
1397       {
1398         0.325\box_dp:N \strutbox + \l__enumext_topsep_viii_skip
1399       }
1400     }
1401   }

```

(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_env*` 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.

```

1402 \cs_new_protected:Nn \__enumext_mini_addvspace_vii:
1403 {
1404   \__enumext_mini_set_vskip_vii:
1405   \par\nopagebreak
1406   \addvspace { \l__enumext_minipage_left_skip }
1407 }
1408 \cs_new_protected:Nn \__enumext_mini_addvspace_viii:
1409 {
1410   \__enumext_mini_set_vskip_viii:
1411   \par\nopagebreak
1412   \addvspace { \l__enumext_minipage_left_skip }
1413 }

```

(End of definition for \\_\_enumext\_mini\_addvspace\_vii: and \\_\_enumext\_mini\_addvspace\_viii:.)

#### 12.22.4 The command \miniright

The command `\miniright` will close the `\__enumext_mini_env*` environment on the “left side”, open the `\__enumext_mini_env*` 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_env*` 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.

```

1414 \NewDocumentCommand \miniright { s }
1415 {
1416   \int_compare:nNt { \l__enumext_keyans_pic_level_int } = { 1 }
1417   {
1418     \msg_error:nnn { enumext } { wrong-miniright-place }
1419   }
1420   % outside
1421   \bool_lazy_and:nnT
1422   { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
1423   { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
1424   {
1425     \msg_error:nnn { enumext } { wrong-miniright-place }
1426   }
1427   % starred env
1428   \bool_if:NT \l__enumext_starred_bool
1429   {
1430     \msg_error:nnn { enumext } { wrong-miniright-starred }
1431   }
1432   \int_compare:nNtF { \l__enumext_keyans_level_int } = { 1 }
1433   {
1434     \__enumext_keyans_mini_right_cmd:n {#1}
1435   }
1436   { \__enumext_mini_right_cmd:n {#1} }
1437 }

```

(End of definition for `\miniright`. This function is documented on page 10.)

`\__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_env*` environment on the “left side”, then we open the `\__enumext_mini_env*` 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.

```

1438 \cs_new_protected:Npn \__enumext_mini_right_cmd:n #1
1439 {
1440   \dim_compare:nNtF
1441   { \dim_use:c { \l__enumext_minipage_right_ \__enumext_level: _dim } } > { \c_zero_dim }
1442   {
1443     \__enumext_multicols_stop:
1444     \end{__enumext_mini_env*}
1445     \hfill
1446     \begin{__enumext_mini_env*}
1447     { \dim_use:c { \l__enumext_minipage_right_ \__enumext_level: _dim } }
1448     \par\addvspace { \l__enumext_minipage_right_skip }
1449     \bool_if:nF {#1}
1450     {
1451       \centering
1452     }
1453     \int_gzero:N \g__enumext_minipage_stat_int
1454   }
1455   { \msg_error:nnn { enumext } { wrong-miniright-use } }
1456   % paranoia
1457   \RenewDocumentCommand \miniright { s }
1458   {
1459     \msg_error:nn { enumext } { many-miniright-used }
1460   }
1461 }

```

(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.

```

1462 \cs_new_protected:Npn \__enumext_keyans_mini_right_cmd:n #1
1463 {
1464   \dim_compare:nNtF { \l__enumext_minipage_right_v_dim } > { \c_zero_dim }
1465   {
1466     \__enumext_keyans_multicols_stop:
1467     \end{__enumext_mini_env*}
1468     \hfill
1469     \begin{__enumext_mini_env*}{ \l__enumext_minipage_right_v_dim }

```

```

1470         \par\addvspace { \l__enumext_minipage_right_skip }
1471         \bool_if:nF {#1}
1472         {
1473             \centering
1474         }
1475         \int_gzero:N \g__enumext_minipage_stat_int
1476     }
1477     { \msg_error:nnn { enumext } { wrong-miniright-use } }
1478 \RenewDocumentCommand \miniright { s }
1479 {
1480     \msg_error:nn { enumext } { many-miniright-used }
1481 }
1482 }

```

(End of definition for \\_\_enumext\_keyans\_mini\_right\_cmd:n.)

### 12.23 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.

above Define `above`, `above*`, `below` and `below*` keys for `enumext` and `keyans` environments.

```

above* \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
below {
below* \keys_define:nn { enumext / #1 }
{
1487     above .skip_set:c = { \l__enumext_vspace_above_#2_skip },
1488     above .value_required:n = true,
1489     above* .code:n = \bool_set_true:c { \l__enumext_vspace_a_star_#2_bool }
1490                 \keys_set:nn { enumext / #1 } { above = {##1} },
1491     above* .value_required:n = true,
1492     below .skip_set:c = { \l__enumext_vspace_below_#2_skip },
1493     below .value_required:n = true,
1494     below* .code:n = \bool_set_true:c { \l__enumext_vspace_b_star_#2_bool }
1495                 \keys_set:nn { enumext / #1 } { below = {##1} },
1496     below* .value_required:n = true,
1497 }
1498 }
1499 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

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

#### 12.23.1 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.

```

1500 \cs_new_protected:Nn \__enumext_vspace_above:
1501 {
1502     \skip_if_eq:nnF
1503     { \skip_use:c { \l__enumext_vspace_above_ \__enumext_level: _skip } } { \c_zero_skip }
1504     {
1505         \bool_if:cTF { \l__enumext_vspace_a_star_ \__enumext_level: _bool }
1506         {
1507             \vspace*{ \skip_use:c { \l__enumext_vspace_above_ \__enumext_level: _skip } }
1508         }
1509         {
1510             \vspace { \skip_use:c { \l__enumext_vspace_above_ \__enumext_level: _skip } }
1511         }
1512     }
1513 }

```

(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.

```

1514 \cs_new_protected:Nn \__enumext_vspace_below:
1515 {
1516     \skip_if_eq:nnF
1517     { \skip_use:c { \l__enumext_vspace_below_ \__enumext_level: _skip } } { \c_zero_skip }

```



```

1518     {
1519         \bool_if:cTF { l__enumext_vspace_b_star_ \__enumext_level: _bool }
1520         {
1521             \vspace*{ \skip_use:c { l__enumext_vspace_below_ \__enumext_level: _skip } }
1522         }
1523         {
1524             \vspace { \skip_use:c { l__enumext_vspace_below_ \__enumext_level: _skip } }
1525         }
1526     }
1527 }

```

(End of definition for \\_\_enumext\_vspace\_below:.)

### 12.23.2 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.

```

1528 \cs_new_protected:Nn \__enumext_vspace_above_v:
1529 {
1530     \skip_if_eq:nnF { \l__enumext_vspace_above_v_skip } { \c_zero_skip }
1531     {
1532         \bool_if:NTF \l__enumext_vspace_a_star_v_bool
1533         {
1534             \vspace*{ \l__enumext_vspace_above_v_skip }
1535         }
1536         { \vspace { \l__enumext_vspace_above_v_skip } }
1537     }
1538 }

```

(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.

```

1539 \cs_new_protected:Nn \__enumext_vspace_below_v:
1540 {
1541     \skip_if_eq:nnF { \l__enumext_vspace_below_v_skip } { \c_zero_skip }
1542     {
1543         \bool_if:NTF \l__enumext_vspace_b_star_v_bool
1544         {
1545             \vspace*{ \l__enumext_vspace_below_v_skip }
1546         }
1547         { \vspace { \l__enumext_vspace_below_v_skip } }
1548     }
1549 }

```

(End of definition for \\_\_enumext\_vspace\_below\_v:.)

### 12.23.3 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.

```

1550 \cs_new_protected:Nn \__enumext_vspace_above_vii:
1551 {
1552     \skip_if_eq:nnF { \l__enumext_vspace_above_vii_skip } { \c_zero_skip }
1553     {
1554         \bool_if:NTF \l__enumext_vspace_a_star_vii_bool
1555         {
1556             \vspace*{ \l__enumext_vspace_above_vii_skip }
1557         }
1558         { \vspace { \l__enumext_vspace_above_vii_skip } }
1559     }
1560 }
1561 \cs_new_protected:Nn \__enumext_vspace_above_viii:
1562 {
1563     \skip_if_eq:nnF { \l__enumext_vspace_above_viii_skip } { \c_zero_skip }
1564     {
1565         \bool_if:NTF \l__enumext_vspace_a_star_viii_bool
1566         {
1567             \vspace*{ \l__enumext_vspace_above_viii_skip }
1568         }
1569         { \vspace { \l__enumext_vspace_above_viii_skip } }
1570     }
1571 }

```

(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.

```

1572 \cs_new_protected:Nn \__enumext_vspace_below_vii:
1573 {
1574   \skip_if_eq:nnF { \__enumext_vspace_below_vii_skip } { \c_zero_skip }
1575   {
1576     \bool_if:NTF \__enumext_vspace_b_star_vii_bool
1577     {
1578       \vspace*{ \__enumext_vspace_below_vii_skip }
1579     }
1580     { \vspace { \__enumext_vspace_below_vii_skip } }
1581   }
1582 }
1583 \cs_new_protected:Nn \__enumext_vspace_below_viii:
1584 {
1585   \skip_if_eq:nnF { \__enumext_vspace_below_viii_skip } { \c_zero_skip }
1586   {
1587     \bool_if:NTF \__enumext_vspace_b_star_viii_bool
1588     {
1589       \vspace*{ \__enumext_vspace_below_viii_skip }
1590     }
1591     { \vspace { \__enumext_vspace_below_viii_skip } }
1592   }
1593 }

```

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

## 12.24 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 `<keys>` passed to the optional argument of the “*first level*” of the environments `enumext` and `enumext*`, but, discarding some specific `<keys>`. 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*
1594 \cs_set_protected:Npn \__enumext_tmp:n #1
1595 {
1596   \keys_define:nn { enumext / #1 }
1597   {
1598     series .str_set:N = \__enumext_series_str,
1599     series .value_required:n = true,
1600     resume .code:n = \__enumext_resume_series:n {##1},
1601     resume* .code:n = \__enumext_resume_starred:,
1602     resume* .value_forbidden:n = true,
1603   }
1604 }
1605 \clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }

```

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

### 12.24.1 Internal functions for series key

The function `\__enumext_filter_series:n` will be in charge of filtering the `<keys>` we want to store where `{#1}` represents the optional value passed to the environment.

```

1606 \cs_new:Npn \__enumext_filter_series:n #1
1607 {
1608   \use:e
1609   {
1610     \keyval_parse:Nn
1611     \__enumext_filter_series_key:n
1612     \__enumext_filter_series_pair:nn {#1}
1613   }
1614 }

```

The function `\__enumext_filter_series_key:n` will be responsible for filtering the `<keys>` that are passed “*without value*” by excluding the `resume`, `resume*` and `base-fix` keys.

```

1615 \cs_new:Npn \__enumext_filter_series_key:n #1
1616 {
1617   \str_case:nnF {#1}
1618   {
1619     { resume } {} { resume* } {} { base-fix } {}

```

```

1620     }
1621     { , { \exp_not:n {#1} } }
1622 }

```

The function `\__enumext_filter_series_pair:nn` will be responsible for filtering the *(keys)* that are passed “with value” by excluding the `series`, `resume`, `start`, `start*`, `save-ans` and `save-key` keys.

```

1623 \cs_new:Npn \__enumext_filter_series_pair:nn #1#2
1624 {
1625   \str_case:nnF {#1}
1626   {
1627     { series } {} { resume } {} { start } {}
1628     { start* } {} { save-ans } {} { save-key } {}
1629   }
1630   { , { \exp_not:n {#1} } = { \exp_not:n {#2} } }
1631 }

```

(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 `\__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 `\__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 (§12.38) and to the function `\__enumext_parse_keys_vii:n` in the `enumext*` environment definition (§12.43).

```

1632 \cs_new_protected:Npn \__enumext_parse_series:n #1
1633 {
1634   \str_if_empty:NTF \l__enumext_series_str
1635   {
1636     \bool_if:NF \__enumext_resume_active_bool
1637     {
1638       \__enumext_resume_last:n {#1}
1639     }
1640   }
1641   {
1642     \tl_gclear_new:c { g__enumext_series_ \l__enumext_series_str_tl }
1643     \tl_gset:ce { g__enumext_series_ \l__enumext_series_str_tl }
1644     { \__enumext_filter_series:n {#1} }
1645     \int_if_exist:cF { g__enumext_series_ \l__enumext_series_str_int }
1646     {
1647       \int_new:c { g__enumext_series_ \l__enumext_series_str_int }
1648     }
1649   }
1650 }

```

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. Here we must use `\bool_lazy_all:nT` to make sure that the default values are not overwritten when the environment is nested and the `series` key is not being used.

```

1651 \cs_new_protected:Npn \__enumext_resume_last:n #1
1652 {
1653   \bool_if:NT \l__enumext_standar_first_bool
1654   {
1655     \tl_gclear:N \g__enumext_standar_series_tl
1656     \tl_gset:Ne \g__enumext_standar_series_tl { \__enumext_filter_series:n {#1} }
1657   }
1658   \bool_if:NT \l__enumext_starred_first_bool
1659   {
1660     \tl_gclear:N \g__enumext_starred_series_tl
1661     \tl_gset:Ne \g__enumext_starred_series_tl { \__enumext_filter_series:n {#1} }
1662   }
1663 }

```

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

### 12.24.2 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 (§12.38) and the `enumext*` environment definition (§12.43).

```

1664 \cs_new_protected:Nn \__enumext_resume_save_counter:
1665 {
1666   \bool_if:NT \g__enumext_standar_bool
1667   {
1668     \tl_if_empty:NF \l__enumext_series_str
1669     {
1670       \int_gset_eq:cN
1671       { g__enumext_series_ \l__enumext_series_str_int } \value{enumXi}
1672     }
1673     \tl_if_empty:NTF \l__enumext_resume_name_tl
1674     {
1675       \str_if_empty:NT \l__enumext_series_str
1676       {
1677         \int_gset_eq:NN \g__enumext_resume_int \value{enumXi}
1678       }
1679     }
1680     {
1681       \int_if_exist:cT { g__enumext_series_ \l__enumext_resume_name_tl_int }
1682       {
1683         \int_gset_eq:cN
1684         { g__enumext_series_ \l__enumext_resume_name_tl_int } \value{enumXi}
1685       }
1686     }
1687     \int_if_exist:cT { g__enumext_resume_ \l__enumext_store_name_tl_int }
1688     {
1689       \int_gset_eq:cN
1690       { g__enumext_resume_ \l__enumext_store_name_tl_int } \value{enumXi}
1691     }
1692   }
1693   \bool_if:NT \g__enumext_starred_bool
1694   {
1695     \tl_if_empty:NF \l__enumext_series_str
1696     {
1697       \int_gset_eq:cN
1698       { g__enumext_series_ \l__enumext_series_str_int } \value{enumXvii}
1699     }
1700     \tl_if_empty:NTF \l__enumext_resume_name_tl
1701     {
1702       \str_if_empty:NT \l__enumext_series_str
1703       {
1704         \int_gset_eq:NN \g__enumext_resume_vii_int \value{enumXvii}
1705       }
1706     }
1707     {
1708       \int_if_exist:cT { g__enumext_series_ \l__enumext_resume_name_tl_int }
1709       {
1710         \int_gset_eq:cN
1711         { g__enumext_series_ \l__enumext_resume_name_tl_int } \value{enumXvii}
1712       }
1713     }
1714     \int_if_exist:cT { g__enumext_resume_ \l__enumext_store_name_tl_int }
1715     {
1716       \int_gset_eq:cN
1717       { g__enumext_resume_ \l__enumext_store_name_tl_int } \value{enumXvii}
1718     }
1719   }
1720 }

```

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

### 12.24.3 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.

```

1721 \cs_new_protected:Npn \__enumext_resume_series:n #1
1722 {
1723   \tl_if_empty:NTF {#1}
1724   {
1725     \__enumext_resume_counter:n { }
1726   }
1727   {
1728     \tl_if_exist:cTF { g__enumext_series_ \tl_to_str:n {#1} _tl }
1729     {
1730       \__enumext_resume_counter:n {#1}
1731       \bool_if:NT \g__enumext_standar_bool
1732       {
1733         \keys_set:nv { enumext / level-1 }
1734         { g__enumext_series_ \tl_to_str:n {#1} _tl }
1735       }
1736       \bool_if:NT \g__enumext_starred_bool
1737       {
1738         \keys_set:nv { enumext / enumext* }
1739         { g__enumext_series_ \tl_to_str:n {#1} _tl }
1740       }
1741     }
1742     {
1743       \bool_if:NT \g__enumext_standar_bool
1744       {
1745         \msg_error:nnn { enumext } { unknown-series } {#1}
1746       }
1747       \bool_if:NT \g__enumext_starred_bool
1748       {
1749         \msg_error:nnn { enumext } { unknown-series } {#1}
1750       }
1751     }
1752   }
1753 }

```

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

`\__enumext_resume_counter:n`

`\__enumext_resume_counter:`

`\__enumext_resume_counter_series:`

`\__enumext_resume_counter_save_ans:`

The function `\__enumext_resume_counter:n` will set the variable `\l__enumext_resume_active_bool` to true and pass the value of the key `resume` to the variable `\l__enumext_series_name_tl` which will contain the `{⟨series name⟩}`. If the variable `\l__enumext_series_name_tl` is empty, that is, we are passing the key `resume without value`, we will execute the function `\__enumext_resume_counter:`; otherwise, when we pass `resume={⟨series name⟩}` we will execute the function `\__enumext_resume_counter_series:`, finally we will execute the function `\__enumext_resume_counter_save_ans:` which is associated with the key `save-ans`.

```

1754 \cs_new_protected:Npn \__enumext_resume_counter:n #1
1755 {
1756   \bool_set_true:N \l__enumext_resume_active_bool
1757   \tl_set:Nn \l__enumext_resume_name_tl {#1}
1758   \tl_if_empty:NTF \l__enumext_resume_name_tl
1759   {
1760     \__enumext_resume_counter:
1761   }
1762   {
1763     \__enumext_resume_counter_series:
1764   }
1765   \__enumext_resume_counter_save_ans:
1766 }

```

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.

```

1767 \cs_new_protected:Nn \__enumext_resume_counter:
1768 {
1769   \bool_if:NT \g__enumext_standar_bool

```

```

1770     {
1771         \int_gincr:N \g__enumext_resume_int
1772         \int_set_eq:NN \l__enumext_start_i_int \g__enumext_resume_int
1773     }
1774     \bool_if:NT \g__enumext_starred_bool
1775     {
1776         \int_gincr:N \g__enumext_resume_vii_int
1777         \int_set_eq:NN \l__enumext_start_vii_int \g__enumext_resume_vii_int
1778     }
1779 }

```

The function `\__enumext_resume_counter_series:` will be executed when the `resume={⟨series name⟩}` key is active, setting the counters for the “*first level*” of the environments according to the value of the integer variables created by the `series` key.

```

1780 \cs_new_protected:Nn \__enumext_resume_counter_series:
1781 {
1782     \bool_if:NT \g__enumext_standar_bool
1783     {
1784         \int_set:Nn \l__enumext_start_i_int
1785         {
1786             \int_use:c { g__enumext_series_ \l__enumext_resume_name_tl _int } + 1
1787         }
1788     }
1789     \bool_if:NT \g__enumext_starred_bool
1790     {
1791         \int_set:Nn \l__enumext_start_vii_int
1792         {
1793             \int_use:c { g__enumext_series_ \l__enumext_resume_name_tl _int } + 1
1794         }
1795     }
1796 }

```

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.

```

1797 \cs_new_protected:Nn \__enumext_resume_counter_save_ans:
1798 {
1799     \bool_lazy_and:nnT
1800     { \bool_if_p:N \l__enumext_standar_first_bool }
1801     { \bool_if_p:N \l__enumext_store_active_bool }
1802     {
1803         \int_set:Nn \l__enumext_start_i_int
1804         {
1805             \int_use:c { g__enumext_resume_ \l__enumext_store_name_tl _int } + 1
1806         }
1807     }
1808     \bool_lazy_and:nnT
1809     { \bool_if_p:N \l__enumext_starred_first_bool }
1810     { \bool_if_p:N \l__enumext_store_active_bool }
1811     {
1812         \int_set:Nn \l__enumext_start_vii_int
1813         {
1814             \int_use:c { g__enumext_resume_ \l__enumext_store_name_tl _int } + 1
1815         }
1816     }
1817 }

```

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

#### 12.24.4 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.

```

1818 \cs_new_protected:Nn \__enumext_resume_starred:
1819 {
1820     \bool_if:NT \g__enumext_standar_bool
1821     {
1822         \tl_if_empty:NF \g__enumext_standar_series_tl
1823         {
1824             \__enumext_resume_counter:n { }

```

```

1825         \keys_set:nV { enumext / level-1 } \g__enumext_standar_series_tl
1826     }
1827 }
1828 \bool_if:NT \g__enumext_starred_bool
1829 {
1830     \tl_if_empty:NF \g__enumext_starred_series_tl
1831     {
1832         \__enumext_resume_counter:n { }
1833         \keys_set:nV { enumext / enumext* } \g__enumext_starred_series_tl
1834     }
1835 }
1836 }

```

(End of definition for \\_\_enumext\_resume\_starred:.)

## 12.25 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.

### 12.25.1 Setting save-ans key

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

```

1837 \cs_set_protected:Npn \__enumext_tmp:n #1
1838 {
1839     \keys_define:nn { enumext / #1 }
1840     {
1841         save-ans .code:n = \__enumext_storing_set:n {##1},
1842         save-ans .value_required:n = true,
1843     }
1844 }
1845 \clist_map_inline:nn { level-1, enumext* } { { \__enumext_tmp:n {#1} } }

```

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

### 12.25.2 Internal functions for save-ans key

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

```

1846 \cs_new_protected:Nn \__enumext_start_save_ans_msg:
1847 {
1848     \msg_term:nnVV { enumext } { save-ans-log }
1849     \g__enumext_envir_name_tl \l__enumext_store_name_tl
1850 }
1851 \cs_new_protected:Nn \__enumext_stop_save_ans_msg:
1852 {
1853     \msg_term:nnVV { enumext } { save-ans-log-hook }
1854     \g__enumext_envir_name_tl \g__enumext_store_name_tl
1855 }

```

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

`\__enumext_storing_set:n` 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.

```

1856 \cs_new_protected:Npn \__enumext_storing_set:n #1
1857 {
1858     \tl_set:Ne \l__enumext_store_name_tl {#1}
1859     \tl_if_empty:NTF \l__enumext_store_name_tl
1860     {
1861         \bool_lazy_or:nnT
1862         { \l__enumext_standar_first_bool } { \l__enumext_starred_first_bool }
1863         {
1864             \msg_error:nnV { enumext } { save-ans-empty } \g__enumext_envir_name_tl
1865         }
1866     }
1867     {
1868         \bool_lazy_or:nnT

```



```

1869         { \l__enumext_standar_first_bool } { \l__enumext_starred_first_bool }
1870     {
1871         \__enumext_start_save_ans_msg:
1872         \__enumext_storing_exec:
1873     }
1874 }
1875 }

```

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 `keyans`, `keyans*` and `keyanspic` environments and will set to true the variable `\l__enumext_check_answers_bool` used for checking answers by the `check-ans` and `no-store` keys, copy `{\store name}` into the global variable `\g__enumext_store_name_tl` and execute the function `\__enumext_anskey_env_make:V` creating the environment `anskey*` (§12.30). 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*`.

```

1876 \cs_new_protected:Nn \__enumext_storing_exec:
1877 {
1878     \bool_set_true:N \l__enumext_store_active_bool
1879     \bool_set_true:N \l__enumext_check_answers_bool
1880     \tl_gset:NV \g__enumext_store_name_tl \l__enumext_store_name_tl
1881     \__enumext_anskey_env_make:V \l__enumext_store_name_tl
1882     \prop_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _prop }
1883     {
1884         \msg_log:nnV { enumext } { store-prop } \l__enumext_store_name_tl
1885         \prop_new:c { g__enumext_ \l__enumext_store_name_tl _prop }
1886     }
1887     \seq_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _seq }
1888     {
1889         \msg_log:nnV { enumext } { store-seq } \l__enumext_store_name_tl
1890         \seq_new:c { g__enumext_ \l__enumext_store_name_tl _seq }
1891     }
1892     \int_if_exist:cF { g__enumext_resume_ \l__enumext_store_name_tl _int }
1893     {
1894         \msg_log:nnV { enumext } { store-int } \l__enumext_store_name_tl
1895         \int_new:c { g__enumext_resume_ \l__enumext_store_name_tl _int }
1896     }
1897 }

```

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

### 12.25.3 The check answer mechanism

The mechanism for checking that all questions are answered 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.

### 12.25.4 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 1898 \cs_set_protected:Npn \__enumext_tmp:n #1
no-store 1899 {
1900   \keys_define:nn { enumext / #1 }
1901   {
1902     check-ans .bool_set:N = \__enumext_check_ans_key_bool,
1903     check-ans .initial:n = false,
1904     check-ans .value_required:n = true,
1905     no-store .code:n = {
1906       \bool_set_false:N \__enumext_check_answers_bool
1907       \bool_set_false:N \__enumext_check_ans_key_bool
1908     },
1909     no-store .value_forbidden:n = true,
1910   }
1911 }
1912 \clist_map_inline:nn
1913 {
1914   level-1, level-2, level-3, level-4, enumext*
1915 }
1916 { \__enumext_tmp:n {#1} }
```

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

### 12.25.5 Set-up check answer mechanism

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

```

1917 \cs_new_protected:Nn \__enumext_check_ans_active:
1918 {
1919   \tl_if_empty:NF \__enumext_store_name_tl
1920   {
1921     \bool_if:NT \__enumext_check_answers_bool
1922     {
1923       \__enumext_check_ans_level:
1924     }
1925   }
1926 }
```

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

```

1927 \cs_new_protected:Nn \__enumext_check_ans_level:
1928 {
1929   \int_case:nn { \__enumext_level_int }
1930   {
1931     { 1 }{
1932       \bool_lazy_all:nT
1933       {
1934         { \bool_if_p:N \g__enumext_starred_bool }
1935         { \int_compare_p:nNn { \__enumext_level_h_int } = { 1 } }
1936       }
1937       {
1938         \int_gdecr:N \g__enumext_item_number_int
1939         \bool_set_false:N \__enumext_item_number_bool
1940       }
1941     }
1942     { 2 }{
1943       \int_gdecr:N \g__enumext_item_number_int
1944       \bool_set_false:N \__enumext_item_number_bool
1945     }
1946     { 3 }{
1947       \int_gdecr:N \g__enumext_item_number_int
1948       \bool_set_false:N \__enumext_item_number_bool
1949     }
1950     { 4 }{
1951       \int_gdecr:N \g__enumext_item_number_int
1952       \bool_set_false:N \__enumext_item_number_bool

```

```

1953         }
1954     }

```

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.

```

1955     \int_case:nn { \l__enumext_level_h_int }
1956     {
1957         { 1 }{
1958             \bool_lazy_all:nT
1959             {
1960                 { \bool_if_p:N \g__enumext_standar_bool }
1961                 { \int_compare_p:nNn { \l__enumext_level_int } = { 1 } }
1962             }
1963             {
1964                 \int_gdecr:N \g__enumext_item_number_int
1965                 \bool_set_false:N \l__enumext_item_number_bool
1966             }
1967         }
1968     }
1969 }

```

(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.

```

1970 \cs_new_protected:Nn \__enumext_check_ans_key_hook:
1971 {
1972     \bool_lazy_and:nnT
1973     { \bool_if_p:N \l__enumext_check_ans_key_bool }
1974     { \bool_if_p:N \g__enumext_standar_bool }
1975     {
1976         \bool_gset_true:N \g__enumext_check_ans_key_bool
1977     }
1978     \bool_lazy_and:nnT
1979     { \bool_if_p:N \l__enumext_check_ans_key_bool }
1980     { \bool_if_p:N \g__enumext_starred_bool }
1981     {
1982         \bool_gset_true:N \g__enumext_check_ans_key_bool
1983     }
1984 }

```

(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:`.

```

1985 \cs_new_protected:Nn \__enumext_item_answer_diff:
1986 {
1987     \int_gset:Nn \g__enumext_item_answer_diff_int
1988     {
1989         \int_sign:n { \g__enumext_item_number_int - \g__enumext_item_anskey_int }
1990     }
1991 }

```

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

`\__enumext_check_ans_show:`

The function `\__enumext_check_ans_show:` will be executed within the function `\__enumext_execute_after_env:` when the key `check-ans` is active, that is, when `\g__enumext_check_ans_key_bool` is “*true*” and will return the appropriate message according to the value of `\g__enumext_item_answer_diff_int` set by the function `\__enumext_item_answer_diff:`.

```

1992 \cs_new_protected:Nn \__enumext_check_ans_show:
1993 {
1994     \int_case:nn { \g__enumext_item_answer_diff_int }
1995     {
1996         { -1 }{ \__enumext_check_ans_msg_less: }
1997         { 0 }{ \__enumext_check_ans_msg_same_ok: }
1998         { 1 }{ \__enumext_check_ans_msg_greater: }
1999     }
2000 }

```

```

2001 \cs_new_protected:Nn \__enumext_check_ans_msg_less:
2002 {
2003   \msg_warning:nneee { enumext } { item-less-answer } { \g__enumext_store_name_tl }
2004   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2005 }
2006 \cs_new_protected:Nn \__enumext_check_ans_msg_same_ok:
2007 {
2008   \msg_term:nneee { enumext } { items-same-answer } { \g__enumext_store_name_tl }
2009   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2010 }
2011 \cs_new_protected:Nn \__enumext_check_ans_msg_greater:
2012 {
2013   \msg_warning:nneee { enumext } { item-greater-answer } { \g__enumext_store_name_tl }
2014   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2015 }

```

(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:`.

```

2016 \cs_new_protected:Nn \__enumext_check_ans_log:
2017 {
2018   \int_case:nn { \g__enumext_item_answer_diff_int }
2019   {
2020     { -1 } { \__enumext_check_ans_log_msg_less: }
2021     { 0 } { \__enumext_check_ans_log_msg_same_ok: }
2022     { 1 } { \__enumext_check_ans_log_msg_greater: }
2023   }
2024 }
2025 \cs_new_protected:Nn \__enumext_check_ans_log_msg_less:
2026 {
2027   \msg_log:nneee { enumext } { item-less-answer } { \g__enumext_store_name_tl }
2028   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2029 }
2030 \cs_new_protected:Nn \__enumext_check_ans_log_msg_same_ok:
2031 {
2032   \msg_log:nneee { enumext } { items-same-answer } { \g__enumext_store_name_tl }
2033   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2034 }
2035 \cs_new_protected:Nn \__enumext_check_ans_log_msg_greater:
2036 {
2037   \msg_log:nneee { enumext } { item-greater-answer } { \g__enumext_store_name_tl }
2038   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2039 }

```

(End of definition for \\_\_enumext\_check\_ans\_log: and others.)

### 12.25.6 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.

```

2040 \cs_new_protected:Npn \__enumext_check_starred_cmd:n #1
2041 {
2042   \int_compare:nNnT
2043   { \g__enumext_check_starred_cmd_int } = { 0 }
2044   {
2045     \msg_warning:nnnV
2046     { enumext } { missing-starred } { #1 } \l__enumext_check_start_line_env_tl
2047   }
2048   \int_compare:nNnT
2049   { \g__enumext_check_starred_cmd_int } > { 1 }
2050   {
2051     \msg_warning:nnnV
2052     { enumext } { many-starred } { #1 } \l__enumext_check_start_line_env_tl
2053   }
2054   \int_gzero:N \g__enumext_check_starred_cmd_int
2055   \tl_clear:N \l__enumext_check_start_line_env_tl
2056 }

```

(End of definition for \\_\_enumext\_check\_starred\_cmd:n.)

## 12.26 Keys and functions associated with storage

We add the keys `wrap-ans`, `wrap-opt`, `save-sep`, `mark-ans`, `mark-pos`, `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*`.

```

2057 \cs_set_protected:Npn \__enumext_tmp:n #1
2058 {
2059   \keys_define:nn { enumext / #1 }
2060   {
2061     wrap-ans .cs_set_protected:Np = \__enumext_anskey_wrapper:n ##1,
2062     wrap-ans .initial:n =
2063       {
2064         \fbox{\parbox[t]{\dimeval{\itemwidth -2\fboxsep -2\fboxrule}}{##1}}
2065       },
2066     wrap-ans .value_required:n = true,
2067     wrap-opt .cs_set_protected:Np = \__enumext_keyans_wrapper_opt:n ##1,
2068     wrap-opt .initial:n = [{##1}],
2069     wrap-opt .value_required:n = true,
2070     save-sep .tl_set:N = \__enumext_store_keyans_item_opt_sep_tl,
2071     save-sep .initial:n = {, ~ },
2072     save-sep .value_required:n = true,
2073     mark-ans .tl_set:N = \__enumext_mark_answer_sym_tl,
2074     mark-ans .initial:n = \textasteriskcentered,
2075     mark-ans .value_required:n = true,
2076     mark-pos .choice:,
2077     mark-pos / left .code:n = \str_set:Nn \__enumext_mark_position_str { l },
2078     mark-pos / right .code:n = \str_set:Nn \__enumext_mark_position_str { r },
2079     mark-pos / unknown .code:n =
2080       \msg_error:nneee { enumext } { unknown-choice }
2081       { mark-pos } { left, ~ right } { \exp_not:n {##1} },
2082     mark-pos .initial:n = right,
2083     mark-pos .value_required:n = true,
2084     show-ans .bool_set:N = \__enumext_show_answer_bool,
2085     show-ans .initial:n = false,
2086     show-ans .value_required:n = true,
2087     show-pos .bool_set:N = \__enumext_show_position_bool,
2088     show-pos .initial:n = false,
2089     show-pos .value_required:n = true,
2090     mark-ref .tl_set:N = \__enumext_mark_ref_sym_tl,
2091     mark-ref .initial:n = \textasteriskcentered,
2092     mark-ref .value_required:n = true,
2093     save-ref .bool_set:N = \__enumext_store_ref_key_bool,
2094     save-ref .initial:n = false,
2095     save-ref .value_required:n = true,
2096   }
2097 }
2098 \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-pos`, `show-ans` and `show-pos`.

```

2099 \cs_set_protected:Npn \__enumext_tmp:n #1
2100 {
2101   \keys_define:nn { enumext / #1 }
2102   {
2103     mark-pos .choice:,
2104     mark-pos / left .code:n = \str_set:Nn \__enumext_mark_position_str { l },
2105     mark-pos / right .code:n = \str_set:Nn \__enumext_mark_position_str { r },
2106     mark-pos .initial:n = right,
2107     mark-pos .value_required:n = true,
2108     show-ans .bool_set:N = \__enumext_show_answer_bool,
2109     show-ans .initial:n = false,
2110     show-ans .value_required:n = true,
2111     show-pos .bool_set:N = \__enumext_show_position_bool,
2112     show-pos .initial:n = false,
2113     show-pos .value_required:n = true,
2114   }
2115 }
2116 \clist_map_inline:nn { keyans, keyans* } { \__enumext_tmp:n {#1} }

```

(End of definition for `mark-pos`, `show-ans`, and `show-pos`.)

### 12.26.1 Store optional arguments of the environments

The idea behind “*storing*” 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 arguments passed to the levels of the environment in which it is executed and “*storing*” them.

```

__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 “*storing*” the *(keys)* filtered from the optional arguments 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)*.

```

2117 \cs_new_protected:Npn __enumext_store_active_keys:n #1
2118 {
2119   \bool_if:cF { __enumext_store_save_key_ __enumext_level: _bool }
2120   {
2121     \tl_clear:c { __enumext_save_key_ __enumext_level: _tl }
2122     \tl_set:ce
2123       { __enumext_store_save_key_ __enumext_level: _tl }
2124       { __enumext_filter_save_key:n {#1} }
2125   }
2126 }
2127 \cs_new_protected:Npn __enumext_store_active_keys_vii:n #1
2128 {
2129   \bool_if:NF \__enumext_store_save_key_vii_bool
2130   {
2131     \tl_clear:N \__enumext_store_save_key_vii_tl
2132     \tl_set:Ne \__enumext_store_save_key_vii_tl { __enumext_filter_save_key:n {#1} }
2133   }
2134 }

```

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

### 12.26.2 Setting save-key key

Since this list structure will be stored in the *(sequence)* established by the `save-ans` key when executing `\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 list stored in the *(sequence)*.

`save-key`

The values set by this key passed in the optional arguments 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`.

Define the key `save-key` for all levels of `enumext` and `enumext*` environments.

```

2135 \cs_set_protected:Npn __enumext_tmp:n #1
2136 {
2137   \keys_define:nn { enumext / enumext* }
2138   {
2139     save-key .code:n = __enumext_parse_save_key_vii:n {##1},
2140     save-key .value_required:n = true,
2141   }
2142   \keys_define:nn { enumext / #1 }
2143   {
2144     save-key .code:n = __enumext_parse_save_key:n {##1},
2145     save-key .value_required:n = true,
2146   }
2147 }
2148 \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 the filtered *(keys)* in the variable `__enumext_store_save_key_X_tl` for `enumext` and `enumext*`.

```

2149 \cs_new_protected:Npn __enumext_parse_save_key:n #1
2150 {
2151   \bool_set_true:c { __enumext_store_save_key_ __enumext_level: _bool }
2152   \tl_clear:c { __enumext_save_key_ __enumext_level: _tl }
2153   \tl_set:ce
2154     { __enumext_store_save_key_ __enumext_level: _tl }
2155     { __enumext_filter_save_key:n {#1} }
2156 }

```

```

2157 \cs_new_protected:Npn \__enumext_parse_save_key_vii:n #1
2158 {
2159     \bool_set_true:N \l__enumext_store_save_key_vii_bool
2160     \tl_clear:N \l__enumext_store_save_key_vii_tl
2161     \tl_set:Ne \l__enumext_store_save_key_vii_tl { \__enumext_filter_save_key:n {#1} }
2162 }

```

(End of definition for \\_\_enumext\_parse\_save\_key:n and \\_\_enumext\_parse\_save\_key\_vii:n.)

### 12.26.3 Internal functions to store optional arguments

The function \\_\_enumext\_filter\_save\_key:n will be in charge of filtering the *⟨keys⟩* we want to *store* in *⟨sequence⟩* where {#1} represents the optional value passed to the environment.

```

\__enumext_filter_save_key:n
  \__enumext_filter_save_key_key:n
  \__enumext_filter_save_key_pair:nn

```

```

2163 \cs_new:Npn \__enumext_filter_save_key:n #1
2164 {
2165     \use:e
2166     {
2167         \keyval_parse:NNn
2168         \__enumext_filter_save_key_key:n
2169         \__enumext_filter_save_key_pair:nn {#1}
2170     }
2171 }

```

The function \\_\_enumext\_filter\_save\_key\_key:n will be responsible for filtering the *⟨keys⟩* that are passed “without value” by excluding the *resume*, *resume\**, *no-store* and *base-fix* keys.

```

2172 \cs_new:Npn \__enumext_filter_save_key_key:n #1
2173 {
2174     \str_case:nnF {#1}
2175     {
2176         { resume } {} { resume* } {} { no-store } {} { base-fix } {}
2177     }
2178     { , { \exp_not:n {#1} } }
2179 }

```

The function \\_\_enumext\_filter\_save\_key\_pair:nn will be responsible for filtering the *⟨keys⟩* that are passed “with value” by excluding the *series*, *resume*, *save-ans*, *save-ref*, *check-ans*, *show-ans*, *save-pos*, *wrap-ans*, *mark-ans*, *wrap-opt*, *save-sep*, *mark-ref*, *mini-env*, *mini-sep*, *mini-right* and *mini-right\** keys.

```

2180 \cs_new:Npn \__enumext_filter_save_key_pair:nn #1#2
2181 {
2182     \str_case:nnF {#1}
2183     {
2184         { series } {} { resume } {} { save-ans } {} { save-ref } {}
2185         { save-key } {} { check-ans } {} { show-ans } {} { show-pos } {}
2186         { wrap-ans } {} { mark-ans } {} { wrap-opt } {} { save-sep } {}
2187         { mark-ref } {} { mini-env } {} { mini-sep } {} { mini-right } {}
2188         { mini-right* } {}
2189     }
2190     { , { \exp_not:n {#1} } = { \exp_not:n {#2} } }
2191 }

```

(End of definition for \\_\_enumext\_filter\_save\_key:n, \\_\_enumext\_filter\_save\_key\_key:n, and \\_\_enumext\_filter\_save\_key\_pair:nn.)

### 12.26.4 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 *\getkeysans* 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.

```

2192 \cs_new_protected:Npn \__enumext_store_addto_prop:n #1
2193 {
2194     \prop_gput_if_not_in:cen { g__enumext_ \l__enumext_store_name_tl _prop }
2195     {
2196         \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } + 1 }
2197     }
2198     { #1 }
2199 }
2200 \cs_generate_variant:Nn \__enumext_store_addto_prop:n { V, e }

```

(End of definition for \\_\_enumext\_store\_addto\_prop:n.)



### 12.26.5 Function for storing content in sequence

The function `\__enumext_store_addto_seq:n` stores the content 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 content is stored in *⟨sequence⟩* is in an 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.

```

2201 \cs_new_protected:Npn \__enumext_store_addto_seq:n #1
2202 {
2203   \seq_gput_right:cn { g__enumext_ \__enumext_store_name_tl_seq } { #1 }
2204 }
2205 \cs_generate_variant:Nn \__enumext_store_addto_seq:n { v, V, e }

```

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

### 12.26.6 Functions for storing the list structure in the sequence

The memorization structure of the list is handled by the functions `\__enumext_store_level_open:` and `\__enumext_store_level_close:` which are executed per level within the `enumext` environment.

```

2206 \cs_new_protected:Nn \__enumext_store_level_open:
2207 {
2208   \bool_if:NT \__enumext_check_answers_bool
2209   {
2210     \tl_if_empty:cTF { l__enumext_store_save_key_ \__enumext_level: _tl }
2211     {
2212       \__enumext_store_addto_seq:n
2213       {
2214         \item \begin{enumext}
2215       }
2216     }
2217     {
2218       \tl_put_left:cn { l__enumext_store_save_key_ \__enumext_level: _tl }
2219       {
2220         \item \begin{enumext} [
2221         }
2222       \tl_put_right:cn { l__enumext_store_save_key_ \__enumext_level: _tl }
2223       {
2224         ]
2225       }
2226       \__enumext_store_addto_seq:v { l__enumext_store_save_key_ \__enumext_level: _tl }
2227     }
2228   }
2229 }
2230 \cs_new_protected:Nn \__enumext_store_level_close:
2231 {
2232   \bool_if:NT \__enumext_check_answers_bool
2233   {
2234     \__enumext_store_addto_seq:n { \end{enumext} }
2235   }
2236 }

```

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

The memorization structure of the list is handled by the functions `\__enumext_store_level_open_vii:` and `\__enumext_store_level_close_vii:` which are executed in the `enumext*` environment.

```

2237 \cs_new_protected:Nn \__enumext_store_level_open_vii:
2238 {
2239   \bool_if:NT \__enumext_check_answers_bool
2240   {
2241     \tl_if_empty:NTF l__enumext_store_save_key_vii_tl
2242     {
2243       \__enumext_store_addto_seq:n
2244       {
2245         \item \begin{enumext*}
2246       }
2247     }
2248     {
2249       \tl_put_left:Nn l__enumext_store_save_key_vii_tl
2250       {
2251         \item \begin{enumext*}[
2252       }
2253       \tl_put_right:Nn l__enumext_store_save_key_vii_tl

```

```

2254         {
2255         }
2256     }
2257     \__enumext_store_addto_seq:V \__enumext_store_save_key_vii_tl
2258 }
2259 }
2260 }
2261 \cs_new_protected:Nn \__enumext_store_level_close_vii:
2262 {
2263     \bool_if:NT \__enumext_check_answers_bool
2264     {
2265         \__enumext_store_addto_seq:n { \end{enumext*} }
2266     }
2267 }

```

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

### 12.26.7 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

```

2268 \cs_new_protected:Nn \__enumext_print_keyans_box:NN
2269 {
2270     \mode_leave_vertical:
2271     \skip_horizontal:n { -\dim_use:N #2 }
2272     \makebox[0pt][ r ]
2273     {
2274         \makebox[ \dim_use:N #1 ][ \l__enumext_mark_position_str ]
2275         {
2276             \tl_use:N \l__enumext_mark_answer_sym_tl
2277         }
2278     }
2279     \skip_horizontal:n { \dim_use:N #2 }
2280 }
2281 \cs_generate_variant:Nn \__enumext_print_keyans_box:NN { cc }

```

(End of definition for \\_\_enumext\_print\_keyans\_box:NN.)

### 12.27 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.

```

2282 \cs_new_protected:Nn \__enumext_store_internal_ref:
2283 {
2284     \cs_set_protected:Npn \__enumext_tmp:n ##1
2285     {
2286         \tl_set_eq:cc { \l__enumext_label_copy_##1_tl } { \l__enumext_label_##1_tl }
2287         \tl_reverse:c { \l__enumext_label_copy_##1_tl }
2288         \tl_remove_once:cn { \l__enumext_label_copy_##1_tl } { . }
2289         \tl_reverse:c { \l__enumext_label_copy_##1_tl }
2290     }
2291     \clist_map_inline:nn { i, ii, iii, iv, vii } { \__enumext_tmp:n {##1} }
2292     \cs_set:Npn \__enumext_tmp:n ##1
2293     { . \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.

```

2294     \bool_lazy_all:nT
2295     {
2296         { \bool_if_p:N \g__enumext_starred_bool }
2297         { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
2298     }
2299     {
2300         \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2301         { \tl_use:N \l__enumext_label_copy_vii_tl }
2302     }

```

```

2303 \bool_lazy_all:nT
2304 {
2305   { \bool_not_p:n { \g__enumext_standar_bool } }
2306   { \bool_if_p:N \l__enumext_standar_bool }
2307   { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } } }
2308 }
2309 {
2310   \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2311   {
2312     \tl_use:N \l__enumext_label_copy_vii_tl
2313     \int_step_function:nnN { 1 } { \l__enumext_level_int } \__enumext_tmp:n
2314   }
2315 }

```

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.

```

2316 \bool_lazy_all:nT
2317 {
2318   { \bool_if_p:N \g__enumext_standar_bool }
2319   { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } } }
2320 { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } } }
2321 }
2322 {
2323   \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2324   {
2325     \tl_use:N \l__enumext_label_copy_i_tl
2326     \int_step_function:nnN { 2 } { \l__enumext_level_int } \__enumext_tmp:n
2327   }
2328 }
2329 \cs_set:Npn \__enumext_tmp:n ##1
2330 { \tl_use:c { l__enumext_label_copy_ \int_to_roman:n {##1} _tl } . }
2331 \bool_lazy_all:nT
2332 {
2333   { \bool_if_p:N \g__enumext_standar_bool }
2334   { \bool_if_p:N \l__enumext_starred_bool }
2335   { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } } }
2336 }
2337 {
2338   \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2339   {
2340     \int_step_function:nnN { 1 } { \l__enumext_level_int } \__enumext_tmp:n
2341     \tl_use:N \l__enumext_label_copy_vii_tl
2342   }
2343 }

```

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

```

2344 \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
2345 {
2346   \l__enumext_store_name_tl \c_colon_str
2347   \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } }
2348 }

```

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.

```

2349 \tl_put_right:Ne \l__enumext_write_aux_file_tl
2350 {
2351   \__enumext_newlabel:nn
2352   { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2353   { \l__enumext_newlabel_arg_two_tl }
2354 }
2355 \l__enumext_write_aux_file_tl
2356 }

```

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

## 12.28 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  $\langle \textit{prop list} \rangle$ , 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*”  $\langle \textit{argument} \rangle$ .

```

2357 \cs_new_protected:Npn \__enumext_store_anskey_code:n #1
2358 {

```

```

2359 \int_gincr:N \g__enumext_item_anskey_int
2360 \__enumext_store_addto_prop:n {#1}
2361 \bool_if:NT \l__enumext_store_ref_key_bool
2362 {
2363   \__enumext_store_internal_ref:
2364 }
2365 \__enumext_anskey_show_wrap_left:n { #1 }

```

Now we start processing the [ $\langle key = val \rangle$ ] passed to the command to build our  $\backslash item$  in the variable  $\backslash l\_enumext\_store\_anskey\_arg\_tl$  which we will “store” in the  $\langle sequence \rangle$ . First we clear the variable  $\backslash l\_enumext\_store\_anskey\_arg\_tl$  and process the  $\langle keys \rangle$ , if the `break-col` key is present and the command is running under `enumext` (not in `enumext*`) we will add  $\backslash columnbreak$  and then  $\backslash item$ .

```

2366 \tl_clear:N \l__enumext_store_anskey_arg_tl
2367 \bool_lazy_and:nnT
2368 { \bool_if_p:N \l__enumext_store_columns_break_bool }
2369 { \bool_not_p:n { \l__enumext_starred_bool } }
2370 {
2371   \tl_put_left:Nn \l__enumext_store_anskey_arg_tl { \columnbreak }
2372 }
2373 \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 ( $\langle number \rangle$ ) to  $\backslash l\_enumext\_store\_anskey\_arg\_tl$ .

```

2374 \bool_lazy_and:nnT
2375 { \bool_not_p:n { \l__enumext_starred_bool } }
2376 { \int_compare_p:nNn { \l__enumext_store_item_join_int } > { 1 } }
2377 {
2378   \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2379   {
2380     ( \exp_not:V \l__enumext_store_item_join_int )
2381   }
2382 }

```

And now we will review the keys `item-star`, `item-sym*` and `item-pos*` and pass them to  $\backslash l\_enumext\_store\_anskey\_arg\_tl$  along with the  $\langle argument \rangle$  for  $\backslash anskey$  or  $\langle body \rangle$  for `anskey*`.

```

2383 \bool_if:NTF \l__enumext_store_item_star_bool
2384 {
2385   \tl_put_right:Nn \l__enumext_store_anskey_arg_tl { * }
2386   \tl_if_empty:NF \l__enumext_store_item_symbol_tl
2387   {
2388     \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2389     {
2390       [ \exp_not:V \l__enumext_store_item_symbol_tl ]
2391     }
2392   }
2393   \dim_compare:nT
2394   {
2395     \l__enumext_store_item_symbol_sep_dim != \c_zero_dim
2396   }
2397   {
2398     \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2399     {
2400       [ \exp_not:V \l__enumext_store_item_symbol_sep_dim ]
2401     }
2402   }
2403   \tl_put_right:Nn \l__enumext_store_anskey_arg_tl {#1}
2404 }
2405 {
2406   \tl_put_right:Nn \l__enumext_store_anskey_arg_tl {#1}
2407 }

```

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  $\backslash hyperlink$  with `symbol` set by `mark-ref` key and then store in  $\langle sequence \rangle$ .

```

2408 \bool_lazy_and:nnT
2409 { \bool_if_p:N \l__enumext_store_ref_key_bool }
2410 { \bool_if_p:N \l__enumext_hyperref_bool }
2411 {
2412   \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2413   {
2414     \hfill \exp_not:N \hyperlink { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2415     { \exp_not:V \l__enumext_mark_ref_sym_tl }
2416   }

```

```

2417     }
2418     \__enumext_store_addto_seq:V \l__enumext_store_anskey_arg_tl
2419 }

```

(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.

```

2420 \cs_new_protected:Npn \__enumext_anskey_show_wrap_arg:n #1
2421 {
2422   \par
2423   \bool_if:NTF \l__enumext_starred_bool
2424   {
2425     \__enumext_print_keyans_box:NN \l__enumext_labelwidth_vii_dim \l__enumext_labelsep_vii_dim
2426   }
2427   {
2428     \__enumext_print_keyans_box:cc
2429     { \l__enumext_labelwidth_ \l__enumext_level: _dim }
2430     { \l__enumext_labelsep_ \l__enumext_level: _dim }
2431   }
2432   \__enumext_anskey_wrapper:n { #1 }
2433 }

```

(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 content stored in the  $\langle prop list \rangle$  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.

```

2434 \cs_new_protected:Npn \__enumext_anskey_show_wrap_left:n #1
2435 {
2436   \bool_if:NT \l__enumext_show_answer_bool
2437   {
2438     \__enumext_anskey_show_wrap_arg:n { #1 }
2439   }
2440   \bool_if:NT \l__enumext_show_position_bool
2441   {
2442     \tl_set:Nx \l__enumext_mark_answer_sym_tl
2443     {
2444       \group_begin:
2445       \exp_not:N \normalfont
2446       \exp_not:N \footnotesize [ \int_eval:n
2447       {
2448         \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
2449       }
2450       ]
2451       \group_end:
2452     }
2453     \__enumext_anskey_show_wrap_arg:n { #1 }
2454   }
2455 }

```

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

## 12.29 The command \anskey

Since we will be “storing content” in a list environment within  $\langle sequences \rangle$  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[ $\langle key = val \rangle$ ]{ $\langle content \rangle$ }.

\\_\_enumext\_anskey\_unknown:n

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

\\_\_enumext\_anskey\_unknown:nn

```

2456 \keys_define:nn { enumext / anskey }
2457 {
2458   break-col .bool_set:N = \l__enumext_store_columns_break_bool,
2459   break-col .default:n = true,
2460   break-col .value_forbidden:n = true,
2461   item-join .int_set:N = \l__enumext_store_item_join_int,
2462   item-join .value_required:n = true,
2463   item-star .bool_set:N = \l__enumext_store_item_star_bool,
2464   item-star .default:n = true,

```

```

2465     item-star .value_forbidden:n = true,
2466     item-sym* .tl_set:N = \l__enumext_store_item_symbol_tl,
2467     item-sym* .value_required:n = true,
2468     item-pos* .dim_set:N = \l__enumext_store_item_symbol_sep_dim,
2469     item-pos* .value_required:n = true,
2470     unknown .code:n = { \l__enumext_anskey_unknown:n {#1} },
2471 }

```

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`.

```

2472 \cs_new_protected:Npn \l__enumext_anskey_unknown:n #1
2473 {
2474     \exp_args:NV \l__enumext_anskey_unknown:nn \l_keys_key_str {#1}
2475 }
2476 \cs_new_protected:Npn \l__enumext_anskey_unknown:nn #1 #2
2477 {
2478     \tl_if_blank:nTF {#2}
2479     {
2480         \msg_error:nnn { enumext } { anskey-cmd-key-unknown } {#1}
2481     }
2482     {
2483         \msg_error:nnnn { enumext } { anskey-cmd-key-value-unknown } {#1} {#2}
2484     }
2485 }

```

(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`.

```

2486 \NewDocumentCommand \anskey { o +m }
2487 {
2488     \l__enumext_anskey_safe_outer:
2489     \group_begin:
2490         \bool_if:NT \l__enumext_check_answers_bool
2491         {
2492             \tl_if_novalue:nF {#1}
2493             {
2494                 \keys_set:nn { enumext / anskey } {#1}
2495             }
2496             \tl_if_blank:nTF {#2}
2497             {
2498                 \msg_error:nn { enumext } { anskey-empty-arg }
2499             }
2500             {
2501                 \l__enumext_anskey_safe_inner:
2502                 \l__enumext_store_anskey_code:n {#2}
2503             }
2504         }
2505     \group_end:
2506 }

```

(End of definition for `\anskey`. This function is documented on page 12.)

### 12.29.1 Internal functions for the command

`\l__enumext_anskey_safe_outer:` The `\l__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.

`\l__enumext_anskey_safe_inner:`

```

2507 \cs_new_protected:Nn \l__enumext_anskey_safe_outer:
2508 {
2509     \bool_if:NF \l__enumext_store_active_bool
2510     {
2511         \msg_error:nnnn { enumext } { anskey-wrong-place } { anskey } { enumext }
2512     }
2513     \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
2514     {
2515         \msg_error:nnnn { enumext } { command-wrong-place } { anskey } { keyans }
2516     }
2517 }

```

```

2516     }
2517     \int_compare:nNt { \l__enumext_keyans_level_h_int } = { 1 }
2518     {
2519         \msg_error:nnnn { enumext } { command-wrong-place } { anskey } { keyans* }
2520     }
2521     \int_compare:nNt { \l__enumext_keyans_pic_level_int } = { 1 }
2522     {
2523         \msg_error:nnnn { enumext } { command-wrong-place } { anskey } { keyanspic }
2524     }
2525 }

```

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.

```

2526 \cs_new_protected:Nn \__enumext_anskey_safe_inner:
2527 {
2528     \int_incr:N \l__enumext_anskey_level_int
2529     \int_compare:nNt { \l__enumext_anskey_level_int } > { 1 }
2530     {
2531         \msg_error:nn { enumext } { anskey-nested }
2532     }
2533     \bool_if:NF \l__enumext_item_number_bool
2534     {
2535         \msg_error:nn { enumext } { anskey-unnumber-item }
2536     }
2537     \mode_if_math:T
2538     {
2539         \msg_error:nne { enumext } { anskey-math-mode } { \c_backslash_str anskey }
2540     }
2541 }

```

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

## 12.30 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:` (§12.31) which is executed after the environment in which the key `save-ans` is active.

```

2542 \cs_new_protected:Nn \__enumext_undefine_anskey_env:
2543 {
2544     \cs_undefine:c { anskey* }
2545     \cs_undefine:c { endanskey* }
2546     \cs_undefine:c { __scontents_anskey*_env_begin: }
2547     \cs_undefine:c { __scontents_anskey*_env_end: }
2548 }

```

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

```

2549 \__enumext_before_env:nn { enumext }
2550 {
2551     \bool_lazy_and:nnT
2552     { \int_compare_p:nNt { \l__enumext_level_int } = { 0 } }
2553     { \int_compare_p:nNt { \l__enumext_level_h_int } = { 0 } }
2554     {
2555         \cs_if_free:cF { __scontents_anskey*_env_begin: }
2556         {
2557             \msg_error:nnn { enumext } { anskey-env-error } { anskey* }
2558         }
2559     }

```



```

2560 }
2561 \__enumext_before_env:nn { enumext* }
2562 {
2563   \bool_lazy_and:nnT
2564     { \int_compare_p:nNn { \__enumext_level_int } = { 0 } }
2565     { \int_compare_p:nNn { \__enumext_level_h_int } = { 0 } }
2566     {
2567       \cs_if_free:cF { __scontents_anskey*_env_begin: }
2568       {
2569         \msg_error:nnn { enumext } { anskey-env-error } { anskey* }
2570       }
2571     }
2572 }

```

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.

```

2573 \__enumext_before_env:nn { anskey* }
2574 {
2575   \int_compare:nNnT { \__enumext_keyans_level_int } = { 1 }
2576   {
2577     \msg_error:nnn { enumext } { anskey-env-wrong } { keyans }
2578   }
2579   \int_compare:nNnT { \__enumext_keyans_level_h_int } = { 1 }
2580   {
2581     \msg_error:nnn { enumext } { anskey-env-wrong } { keyans* }
2582   }
2583   \int_compare:nNnT { \__enumext_keyans_pic_level_int } = { 1 }
2584   {
2585     \msg_error:nnn { enumext } { anskey-env-wrong } { keyanspic }
2586   }
2587   \bool_if:NF \__enumext_item_number_bool
2588   {
2589     \msg_error:nn { enumext } { anskey-unnumber-item }
2590   }
2591   \mode_if_math:T
2592   {
2593     \msg_error:nnn { enumext } { anskey-math-mode } { anskey* }
2594   }
2595 }

```

(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: (§12.25.1)` 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`.

```

2596 \cs_new_protected:Npn \__enumext_anskey_env_make:n #1
2597 {
2598   \bool_if:NT \__enumext_anskey_env_bool
2599   {
2600     \newenvsc{anskey*}[store-env=#1,print-env=false]
2601     \__enumext_anskey_env_exec:
2602   }
2603 }
2604 \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`.

```

2605 \cs_new_protected:Nn \__enumext_anskey_env_define_keys:
2606 {
2607   \keys_define:nn { scontents / scontents }
2608   {
2609     break-col .bool_gset:N = \g__enumext_store_columns_break_bool,
2610     break-col .default:n = true,
2611     break-col .value_forbidden:n = true,
2612     item-join .int_gset:N = \g__enumext_store_item_join_int,
2613     item-join .value_required:n = true,

```

```

2614     item-star .bool_gset:N = \g__enumext_store_item_star_bool,
2615     item-star .default:n   = true,
2616     item-star .value_forbidden:n = true,
2617     item-sym* .tl_gset:N   = \g__enumext_store_item_symbol_tl,
2618     item-sym* .value_required:n = true,
2619     item-pos* .dim_gset:N   = \g__enumext_store_item_symbol_sep_dim,
2620     item-pos* .value_required:n = true,
2621     print-env .undefine:,
2622     store-env .undefine:,
2623     write-out .undefine:,
2624     unknown   .code:n      = { \__enumext_anskey_env_unknown:n {##1} },
2625   }
2626 }

```

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`.

```

2627 \cs_new_protected:Npn \__enumext_anskey_env_unknown:n #1
2628 {
2629   \exp_args:NV \__enumext_anskey_env_unknown:nn \l_keys_key_str {#1}
2630 }
2631 \cs_new_protected:Npn \__enumext_anskey_env_unknown:nn #1#2
2632 {
2633   \tl_if_blank:nTF {#2}
2634   {
2635     \msg_error:nnn { enumext } { anskey-env-key-unknown } {#1}
2636   }
2637   {
2638     \msg_error:nnnn { enumext } { anskey-env-key-value-unknown } {#1} {#2}
2639   }
2640 }

```

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`.

```

2641 \cs_new_protected:Nn \__enumext_anskey_env_reset_keys:
2642 {
2643   \keys_define:nn { scontents / scontents }
2644   {
2645     break-col .undefine:,
2646     item-join .undefine:,
2647     item-star .undefine:,
2648     item-sym* .undefine:,
2649     item-pos* .undefine:,
2650     write-out .code:n   = {
2651       \bool_set_false:N \l__scontents_storing_bool
2652       \bool_set_true:N  \l__scontents_writing_bool
2653       \tl_set:Nn \l__scontents_fname_out_tl {##1}
2654     },
2655     write-out .value_required:n = true,
2656     print-env .meta:nn         = { scontents } { print-env = ##1 },
2657     print-env .default:n       = true,
2658     store-env .meta:nn         = { scontents } { store-env = ##1 },
2659     unknown   .code:n          = { \__scontents_parse_environment_keys:n {##1} },
2660   }
2661 }

```

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*.

```

2662 \cs_new_protected:Npn \__enumext_rescan_anskey_env:n #1
2663 {
2664   \group_begin:
2665     \int_set:Nn \tex_newlinechar:D { `^^J }
2666     \__scontents_rescan_tokens:x
2667     {
2668       \endgroup % This assumes \catcode`\=0... Things might go off otherwise.
2669       #1
2670     }
2671 }

```

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

`\__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)`.

```
2672 \cs_new_protected:Nn \__enumext_anskey_env_exec:
2673 {
2674   \__enumext_before_env:nn { anskey* }
2675   {
2676     \__enumext_anskey_env_define_keys:
2677   }
```

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.

```
2678   \hook_if_empty:nF {env/anskey*/after}
2679   {
2680     \hook_gremove_code:nn {env/anskey*/after} { * }
2681   }
2682   \__enumext_after_env:nn { anskey* }
2683   {
2684     \__enumext_anskey_env_save_keys:
2685     \tl_clear:N \l__enumext_store_anskey_env_tl
2686     \tl_clear:N \l__enumext_store_anskey_opt_tl
2687     \bool_if:NT \l__enumext_check_answers_bool
2688     {
2689       \tl_gset:Ne \l__enumext_store_anskey_env_tl
2690       {
2691         \seq_item:ce { g__scontents_name_ \l__enumext_store_name_tl _seq } { -1 }
2692       }
2693       \regex_match:nVTF
2694       { ^\s* \z | ^\s* \u{c__scontents_hidden_space_str} \z }
2695       \l__enumext_store_anskey_env_tl
2696       {
2697         \msg_error:nn { enumext } { anskey-empty-arg }
2698       }
2699       {
2700         \__enumext_anskey_env_store:
2701       }
2702     }
2703     \__enumext_anskey_env_clean_vars:
2704     \__enumext_anskey_env_reset_keys:
2705   }
2706 }
```

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:` 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`.

`\__enumext_anskey_env_store:`

`\__enumext_anskey_env_clean_vars:`

```
2707 \cs_new_protected:Nn \__enumext_anskey_env_save_keys:
2708 {
2709   \bool_lazy_and:nnT
2710   { \bool_if_p:N \g__enumext_store_columns_break_bool }
2711   { \bool_not_p:n { \l__enumext_starred_bool } }
2712   {
2713     \tl_put_left:Ne \l__enumext_store_anskey_opt_tl { ,break-col, }
2714   }
```

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

```
2715   \bool_lazy_and:nnT
2716   { \bool_not_p:n { \l__enumext_starred_bool } }
2717   { \int_compare_p:nNn { \g__enumext_store_item_join_int } > { 1 } }
2718   {
2719     \tl_put_left::Ne \l__enumext_store_anskey_opt_tl
2720     {
2721       ,item-join = \exp_not:V \g__enumext_store_item_join_int,
2722     }
2723   }
```

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

```

2724 \bool_if:NT \g__enumext_store_item_star_bool
2725 {
2726   \tl_put_left:Ne \l__enumext_store_anskey_opt_tl
2727   {
2728     ,item-star,
2729   }
2730   \tl_if_empty:NF \g__enumext_store_item_symbol_tl
2731   {
2732     \tl_put_left:Ne \l__enumext_store_anskey_opt_tl
2733     {
2734       ,item-sym* = \exp_not:V \g__enumext_store_item_symbol_tl,
2735     }
2736   }
2737   \dim_compare:nT
2738   {
2739     \g__enumext_store_item_symbol_sep_dim != \c_zero_dim
2740   }
2741   {
2742     \tl_put_left:Ne \l__enumext_store_anskey_opt_tl
2743     {
2744       ,item-pos* = \exp_not:V \g__enumext_store_item_symbol_sep_dim,
2745     }
2746   }
2747 }
2748 }

```

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`.

```

2749 \cs_new_protected:Nn \__enumext_anskey_env_store:
2750 {
2751   \group_begin:
2752   \tl_if_empty:NTF \l__enumext_store_anskey_opt_tl
2753   {
2754     \exp_args:Ne
2755     \__enumext_store_anskey_code:n
2756     {
2757       \__enumext_rescan_anskey_env:n { \l__enumext_store_anskey_env_tl }
2758     }
2759   }
2760   {
2761     \keys_set_known:nV { enumext / anskey } \l__enumext_store_anskey_opt_tl
2762     \exp_args:Ne
2763     \__enumext_store_anskey_code:n
2764     {
2765       \__enumext_rescan_anskey_env:n { \l__enumext_store_anskey_env_tl }
2766     }
2767   }
2768   \group_end:
2769 }

```

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

```

2770 \cs_new_protected:Nn \__enumext_anskey_env_clean_vars:
2771 {
2772   \bool_gset_false:N \g__enumext_store_columns_break_bool
2773   \int_gzero:N \g__enumext_store_item_join_int
2774   \bool_gset_false:N \g__enumext_store_item_star_bool
2775   \tl_gclear:N \g__enumext_store_item_symbol_tl
2776   \dim_gzero:N \g__enumext_store_item_symbol_sep_dim
2777 }

```

(End of definition for `\__enumext_anskey_env_save_keys:`, `\__enumext_anskey_env_store:`, and `\__enumext_anskey_env_clean_vars:`.)

### 12.31 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*` (§12.30) 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.

```

2778 \cs_new_protected:Nn \__enumext_execute_after_env:
2779 {
2780   \int_compare:nNt { \__enumext_level_int } = { 0 }
2781   {
2782     \tl_if_empty:NF \g__enumext_store_name_tl
2783     {
2784       \__enumext_stop_save_ans_msg:
2785       \__enumext_item_answer_diff:
2786       \__enumext_log_global_vars:
2787       \__enumext_log_answer_vars:
2788       \bool_if:NTF \g__enumext_check_ans_key_bool
2789       {
2790         \__enumext_check_ans_show:
2791       }
2792       { \__enumext_check_ans_log: }
2793       \__enumext_undefine_anskey_env:
2794     }
2795     \__enumext_reset_global_vars:
2796   }
2797 }

```

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

- This function is passed to the function `\__enumext_after_env:n` for the environments `enumext` (§12.38) and `enumext*` (§12.43) and it is executed only when the environments are not nested or at some level of these..

## 12.32 Common functions for `keyans`, `keyans*` and `keyanspic`

### 12.32.1 Storing content in prop list

`\__enumext_keyans_addto_prop:n`

The function `\__enumext_keyans_addto_prop:n` will pass the contents of the current `<label>` `\l__enumext_label_v_tl` for the `keyans` environment and the current `<label>` `\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, which will be passed to the *<prop list>* defined by the `save-ans` key using the `\__enumext_store_addto_prop:V`.

```

2798 \cs_new_protected:Npn \__enumext_keyans_addto_prop:n #1
2799 {
2800   \tl_clear:N \l__enumext_store_current_label_tl
2801   \int_compare:nNtF { \__enumext_keyans_pic_level_int } = { 1 }
2802   {
2803     \tl_put_right:Ne \l__enumext_store_current_label_tl { \l__enumext_label_vi_tl }
2804   }
2805   {
2806     \tl_put_right:Ne \l__enumext_store_current_label_tl { \l__enumext_label_v_tl }
2807   }
2808   \tl_if_novalue:NF { #1 }
2809   {
2810     % Set save-sep
2811     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_tl
2812     {
2813       \tl_put_right:Ne \l__enumext_store_current_label_tl { \l__enumext_store_keyans_item_opt_sep_tl }
2814     }
2815     \tl_put_right:Ne \l__enumext_store_current_label_tl { #1 }
2816   }
2817   \__enumext_store_addto_prop:V \l__enumext_store_current_label_tl
2818 }

```

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

### 12.32.2 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 the `\anskey` command, basically because in this environments we are interested in the current `<label>`. 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 our references.

```

2819 \cs_new_protected:Nn \__enumext_keyans_store_ref:
2820 {
2821   \bool_if:NT \l__enumext_store_ref_key_bool
2822   {
2823     \cs_set_protected:Npn \__enumext_tmp:n ##1
2824     {
2825       \tl_set_eq:cc { \l__enumext_label_copy_##1_tl } { \l__enumext_label_##1_tl }
2826       \tl_reverse:c { \l__enumext_label_copy_##1_tl }
2827       \tl_remove_once:cn { \l__enumext_label_copy_##1_tl } { . }
2828       \tl_reverse:c { \l__enumext_label_copy_##1_tl }
2829     }
2830     \clist_map_inline:nn { i, v, vi, vii, viii } { \__enumext_tmp:n {##1} }
2831     \__enumext_keyans_store_ref_aux_i:
2832   }
2833 }

```

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

```

2834 \cs_new_protected:Nn \__enumext_keyans_store_ref_aux_i:
2835 {
2836   \bool_if:NT \g__enumext_starred_bool
2837   {
2838     \tl_set_eq:NN \l__enumext_label_copy_i_tl \l__enumext_label_copy_vii_tl
2839   }
2840   \int_compare:nNt { \l__enumext_keyans_pic_level_int } = { 1 }
2841   {
2842     \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2843     { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_vi_tl }
2844   }
2845   \int_compare:nNt { \l__enumext_keyans_level_int } = { 1 }
2846   {
2847     \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2848     { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_v_tl }
2849   }
2850   \int_compare:nNt { \l__enumext_keyans_level_h_int } = { 1 }
2851   {
2852     \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2853     { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_viii_tl }
2854   }
2855   \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
2856   {
2857     \l__enumext_store_name_tl \c_colon_str
2858     \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } }
2859   }
2860   \__enumext_keyans_store_ref_aux_ii:
2861 }

```

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.

```

2862 \cs_new_protected:Nn \__enumext_keyans_store_ref_aux_ii:
2863 {
2864   \tl_put_right:Ne \l__enumext_write_aux_file_tl
2865   {
2866     \__enumext_newlabel:nn
2867     { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2868     { \l__enumext_newlabel_arg_two_tl }
2869   }
2870   \l__enumext_write_aux_file_tl
2871 }

```

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

### 12.32.3 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  $\langle \textit{label} \rangle$  `\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  $\langle \textit{contents} \rangle$  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.

```

2872 \cs_new_protected:Npn \__enumext_keyans_addto_seq:n #1

```

```

2873 {
2874   \tl_clear:N \l__enumext_store_current_label_tl
2875   \int_compare:nNnTF { \l__enumext_keyans_pic_level_int } = { 1 }
2876   {
2877     \tl_put_right:Ne \l__enumext_store_current_label_tl { \item \l__enumext_label_vi_tl }
2878   }
2879   {
2880     \tl_put_right:Ne \l__enumext_store_current_label_tl { \item \l__enumext_label_v_tl }
2881   }
2882   \tl_if_novalue:nF { #1 }
2883   {
2884     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_tl
2885     {
2886       \tl_put_right:Ne \l__enumext_store_current_label_tl
2887       {
2888         \l__enumext_store_keyans_item_opt_sep_tl
2889       }
2890     }
2891     \tl_put_right:Ne \l__enumext_store_current_label_tl { #1 }
2892   }
2893   \__enumext_keyans_addto_seq_link:
2894 }

```

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.

```

2895 \cs_new_protected:Nn \__enumext_keyans_addto_seq_link:
2896 {
2897   \bool_lazy_and:nnT
2898   { \bool_if_p:N \l__enumext_store_ref_key_bool }
2899   { \bool_if_p:N \l__enumext_hyperref_bool }
2900   {
2901     \tl_put_right:Ne \l__enumext_store_current_label_tl
2902     {
2903       \hfill \exp_not:N \hyperlink
2904       {
2905         \exp_not:V \l__enumext_newlabel_arg_one_tl
2906       }
2907       { \exp_not:V \l__enumext_mark_ref_sym_tl }
2908     }
2909   }
2910   \__enumext_store_addto_seq:V \l__enumext_store_current_label_tl
2911   \bool_if:NT \l__enumext_check_answers_bool
2912   {
2913     \int_gincr:N \g__enumext_item_anskey_int
2914   }
2915 }

```

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

### 12.32.4 The show-ans and show-pos keys for keyans and keyanspic

The code is very similar to the `\anskey` code, but, if I change the order of the operations the counter off `\label` are incorrect.

```

\__enumext_keyans_show_left:n
\__enumext_keyans_show_ans:
\__enumext_keyans_show_pos:
\__enumext_keyans_show_item_opt:

```

Common function to show *starred commands* `\item*` and `\position` of stored content in `\prop list` for `keyans` and `keyanspic`. Need add `1` to `\g__enumext_⟨store name⟩_prop` for `show-pos` key.

```

2916 \cs_new_protected:Npn \__enumext_keyans_show_left:n #1
2917 {
2918   \tl_if_novalue:nF { #1 }
2919   {
2920     \tl_set:Ne \l__enumext_store_current_opt_arg_tl { #1 }
2921   }
2922   \bool_if:NT \l__enumext_show_answer_bool
2923   {
2924     \__enumext_keyans_show_ans:
2925   }
2926   \bool_if:NT \l__enumext_show_position_bool
2927   {

```



```

2928     \__enumext_keyans_show_pos:
2929   }
2930 }
2931 \cs_new_protected:Nn \__enumext_keyans_show_item_opt:
2932 {
2933   \tl_if_empty:NF \l__enumext_store_current_opt_arg_tl
2934   {
2935     \bool_lazy_or:nnT
2936       { \bool_if_p:N \l__enumext_show_answer_bool }
2937       { \bool_if_p:N \l__enumext_show_position_bool }
2938       {
2939         \__enumext_keyans_wrapper_opt:n { \l__enumext_store_current_opt_arg_tl } \c_space_tl
2940       }
2941   }
2942 }
2943 \cs_new_protected:Nn \__enumext_keyans_show_ans:
2944 {
2945   \bool_if:NT \l__enumext_starred_bool
2946   {
2947     \dim_set_eq:NN \l__enumext_labelwidth_i_dim \l__enumext_labelwidth_vii_dim
2948     \dim_set_eq:NN \l__enumext_labelsep_i_dim \l__enumext_labelsep_vii_dim
2949   }
2950   \tl_put_left:Nn \l__enumext_label_v_tl
2951   {
2952     \__enumext_print_keyans_box:NN
2953     \l__enumext_labelwidth_i_dim \l__enumext_labelsep_i_dim
2954   }
2955 }
2956 \cs_new_protected:Nn \__enumext_keyans_show_pos:
2957 {
2958   \bool_if:NT \l__enumext_starred_bool
2959   {
2960     \dim_set_eq:NN \l__enumext_labelwidth_i_dim \l__enumext_labelwidth_vii_dim
2961     \dim_set_eq:NN \l__enumext_labelsep_i_dim \l__enumext_labelsep_vii_dim
2962   }
2963   \int_compare:nNnTF { \l__enumext_keyans_pic_level_int } = { 1 }
2964   {
2965     \tl_set:Ne \l__enumext_mark_answer_sym_tl
2966     {
2967       \group_begin:
2968       \exp_not:N \normalfont
2969       \exp_not:N \footnotesize [ \int_eval:n
2970         {
2971           \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
2972         }
2973       ]
2974       \group_end:
2975     }
2976   }
2977   {
2978     \tl_set:Ne \l__enumext_mark_answer_sym_tl
2979     {
2980       \group_begin:
2981       \exp_not:N \normalfont
2982       \exp_not:N \footnotesize [ \int_eval:n
2983         {
2984           \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } + 1
2985         }
2986       ]
2987       \group_end:
2988     }
2989   }
2990   \tl_put_left:Nn \l__enumext_label_v_tl
2991   {
2992     \__enumext_print_keyans_box:NN
2993     \l__enumext_labelwidth_i_dim \l__enumext_labelsep_i_dim
2994   }
2995 }

```

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

### 12.33 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.

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`.

```

2996 \cs_new_protected:Npn \__enumext_default_item:n #1
2997 {
2998   \tl_if_novalue:nTF {#1}
2999   {
3000     \bool_if:NT \l__enumext_check_answers_bool
3001     {
3002       \int_gincr:N \g__enumext_item_number_int
3003       \bool_set_true:N \l__enumext_item_number_bool
3004     }
3005     \bool_set_true:c { \l__enumext_wrap_label_ \__enumext_level: _bool }
3006     \__enumext_item_std:w \tl_use:c { \l__enumext_fake_item_indent_ \__enumext_level: _tl }
3007   }
3008   {
3009     \bool_set_eq:cc
3010     { \l__enumext_wrap_label_ \__enumext_level: _bool }
3011     { \l__enumext_wrap_label_opt_ \__enumext_level: _bool }
3012     \__enumext_item_std:w [#1] \tl_use:c { \l__enumext_fake_item_indent_ \__enumext_level: _tl }
3013   }
3014 }

```

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

`__enumext_starred_item:nn`

`__enumext_item_star_exec:`

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 value the second optional argument `⟨offset⟩`.

```

#1: \l__enumext_item_symbol_X_tl
#2: \l__enumext_item_symbol_sep_X_dim

```

First we will make a copy of `\l__enumext_item_symbol_X_tl` which is set by the key `item-sym*` or passed as “first” optional argument in the global variable `\g__enumext_item_symbol_aux_tl`, followed by setting the variable `\l__enumext_item_symbol_sep_X_dim` set by the key `item-pos*` or by the “second” optional argument, then we will see the state of the variable `\l__enumext_check_answers_bool` set by the key `no-store`, set the boolean variable `\l__enumext_wrap_label_X_bool` to “true” for the key `wrap-label` and execute `\__enumext_item_std:w` and the key `itemindent`.

```

3015 \cs_new_protected:Npn \__enumext_starred_item:nn #1 #2
3016 {
3017   \tl_if_novalue:nTF {#1}
3018   {
3019     \tl_gset_eq:Nc
3020     \g__enumext_item_symbol_aux_tl { \l__enumext_item_symbol_ \__enumext_level: _tl }
3021   }
3022   {
3023     \tl_gset:Nn \g__enumext_item_symbol_aux_tl {#1}
3024   }
3025   \tl_if_novalue:nTF {#2}
3026   {
3027     \dim_set_eq:cc
3028     { \l__enumext_item_symbol_sep_ \__enumext_level: _dim }
3029     { \l__enumext_labelsep_ \__enumext_level: _dim }
3030   }
3031   {
3032     \dim_set:cn { \l__enumext_item_symbol_sep_ \__enumext_level: _dim } {#2}
3033   }
3034   \bool_if:NT \l__enumext_check_answers_bool
3035   {
3036     \int_gincr:N \g__enumext_item_number_int
3037     \bool_set_true:N \l__enumext_item_number_bool

```

```

3038     }
3039     \bool_set_true:c { l__enumext_wrap_label_ \__enumext_level: _bool }
3040     \__enumext_item_std:w \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
3041 }

```

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

```

3042 \cs_new_protected:Nn \__enumext_item_star_exec:
3043 {
3044     \tl_if_empty:cF { l__enumext_item_symbol_ \__enumext_level: _tl }
3045     {
3046         \mode_leave_vertical:
3047         \skip_horizontal:n { -\dim_use:c { l__enumext_item_symbol_sep_ \__enumext_level: _dim } }
3048         \makebox[0pt][r]{\g__enumext_item_symbol_aux_tl }
3049         \skip_horizontal:n { \dim_use:c { l__enumext_item_symbol_sep_ \__enumext_level: _dim } }
3050     }
3051 }

```

(End of definition for `\__enumext_starred_item:nn` and `\__enumext_item_star_exec:`.)

```

\__enumext_redefine_item:
\__enumext_make_label

```

The function `\__enumext_redefine_item:` will redefine the `\item` command in the `enumext` environment adding `\item*`.

```

3052 \cs_new_protected:Nn \__enumext_redefine_item:
3053 {
3054     \RenewDocumentCommand \item { s o o }
3055     {
3056         \bool_if:nTF {##1}
3057         {
3058             \__enumext_starred_item:nn {##2} {##3}
3059         }
3060         { \__enumext_default_item:n {##2} }
3061     }
3062 }

```

The function `\__enumext_make_label:` redefine `\make_label` for the keys `align`, `font`, `wrap-label`, `wrap-label*` and `\item*` for `enumext` environment.

```

3063 \cs_new_protected:Nn \__enumext_make_label:
3064 {
3065     \RenewDocumentCommand \make_label { m }
3066     {
3067         \tl_use:c { l__enumext_label_fill_left_ \__enumext_level: _tl }
3068         \tl_use:c { l__enumext_label_font_style_ \__enumext_level: _tl }
3069         \bool_if:cTF { l__enumext_wrap_label_ \__enumext_level: _bool }
3070         {
3071             \__enumext_item_star_exec:
3072             \use:c { __enumext_wrapper_label_ \__enumext_level: :n } { ##1 }
3073         }
3074         { ##1 }
3075         \tl_use:c { l__enumext_label_fill_right_ \__enumext_level: _tl }
3076         \tl_gclear:N \g__enumext_item_symbol_aux_tl
3077     }
3078 }

```

(End of definition for `\__enumext_redefine_item:` and `\__enumext_make_label:`.)

🔗 This functions are passed to `\__enumext_list_arg_two_X:` used in the definition of the `enumext` environment (§12.38).

## 12.34 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*
3079 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
3080 {
3081     \keys_define:nn { enumext / #1 }
3082     {
3083         item-sym* .tl_set:c = { l__enumext_item_symbol_#2_tl },
3084         item-sym* .value_required:n = true,
3085         item-sym* .initial:n = {${\star$}},
3086         item-pos* .dim_set:c = { l__enumext_item_symbol_sep_#2_dim },
3087         item-pos* .value_required:n = true,
3088     }

```

```

3089     }
3090     \clist_map_inline:nn
3091     {
3092         {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {enumext*}{vii}
3093     }
3094     { \__enumext_tmp:nn #1 }

```

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

## 12.35 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).

### 12.35.1 Handling unknown keys for `keyans` and `keyans*`

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

```

unknown
\__enumext_keyans_unknown_keys:n
\__enumext_keyans_unknown_keys:nn
3095 \cs_set_protected:Npn \__enumext_tmp:n #1
3096 {
3097     \keys_define:nn { enumext / #1 }
3098     {
3099         unknown .code:n = { \__enumext_keyans_unknown_keys:n {##1} }
3100     }
3101 }
3102 \clist_map_inline:nn { keyans, keyans* } { \__enumext_tmp:n {#1} }

```

Internal functions for handling `unknown` key.

```

3103 \cs_new_protected:Npn \__enumext_keyans_unknown_keys:n #1
3104 {
3105     \exp_args:NV \__enumext_keyans_unknown_keys:nn \l_keys_key_str {#1}
3106 }
3107 \cs_new_protected:Npn \__enumext_keyans_unknown_keys:nn #1#2
3108 {
3109     \tl_if_blank:nTF {#2}
3110     {
3111         \msg_error:nnn { enumext } { keyans-unknown-key } {#1}
3112     }
3113     {
3114         \msg_error:nnnn { enumext } { keyans-unknown-key-value } {#1} {#2}
3115     }
3116 }

```

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

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

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

```

unknown
\__enumext_starred_unknown_keys:n
\__enumext_starred_unknown_keys:nn
3117 \keys_define:nn { enumext / enumext* }
3118 {
3119     unknown .code:n = { \__enumext_starred_unknown_keys:n {#1} }
3120 }

```

Internal functions for handling `unknown` key.

```

3121 \cs_new_protected:Npn \__enumext_starred_unknown_keys:n #1
3122 {
3123     \exp_args:NV \__enumext_starred_unknown_keys:nn \l_keys_key_str {#1}
3124 }
3125 \cs_new_protected:Npn \__enumext_starred_unknown_keys:nn #1#2
3126 {
3127     \tl_if_blank:nTF {#2}
3128     {
3129         \msg_error:nnn { enumext } { starred-unknown-key } {#1}
3130     }
3131     {
3132         \msg_error:nnnn { enumext } { starred-unknown-key-value } {#1} {#2}
3133     }
3134 }

```

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

### 12.35.3 Handling unknown keys for enumext

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

```

3135 \cs_set_protected:Npn \__enumext_tmp:n #1
3136 {
3137   \keys_define:nn { enumext / #1 }
3138   {
3139     unknown .code:n = { \__enumext_standar_unknown_keys:n {##1} }
3140   }
3141 }
3142 \clist_map_inline:nn { level-1,level-2,level-3,level-4 } { \__enumext_tmp:n {#1} }

```

Internal functions for handling `unknown` key.

```

3143 \cs_new_protected:Npn \__enumext_standar_unknown_keys:n #1
3144 {
3145   \exp_args:NV \__enumext_standar_unknown_keys:nn \l_keys_key_str {#1}
3146 }
3147 \cs_new_protected:Npn \__enumext_standar_unknown_keys:nn #1#2
3148 {
3149   \tl_if_blank:nTF {#2}
3150   {
3151     \msg_error:nnn { enumext } { standar-unknown-key } {#1}
3152   }
3153   {
3154     \msg_error:nnnn { enumext } { standar-unknown-key-value } {#1} {#2}
3155   }
3156 }

```

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

### 12.36 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`.

```

3157 \cs_new_protected:Npn \__enumext_keyans_default_item:n #1
3158 {
3159   \tl_if_novalue:nTF { #1 }
3160   {
3161     \bool_set_true:N \__enumext_wrap_label_v_bool
3162     \__enumext_item_std:w \tl_use:N \__enumext_fake_item_indent_v_tl
3163   }
3164   {
3165     \bool_set_eq:NN \__enumext_wrap_label_v_bool \__enumext_wrap_label_opt_v_bool
3166     \__enumext_item_std:w [ #1 ] \tl_use:N \__enumext_fake_item_indent_v_tl
3167   }
3168 }

```

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

`\__enumext_keyans_starred_item:n` The function `\__enumext_keyans_starred_item:n` which will make a temporary copy of the current `⟨label⟩`, execute the `show-ans` or `show-pos` keys using the function `\__enumext_keyans_show_left:n` and will display the contents of that item using the internal copy `\__enumext_item_std:w`, this is necessary to prevent incrementing the current “*counter*” of the original `⟨label⟩`.

```

3169 \cs_new_protected:Npn \__enumext_keyans_starred_item:n #1
3170 {
3171   \tl_set_eq:NN \__enumext_store_current_label_tmp_tl \__enumext_label_v_tl
3172   \__enumext_keyans_show_left:n { #1 }
3173   \bool_set_true:N \__enumext_wrap_label_v_bool
3174   \__enumext_item_std:w \tl_use:N \__enumext_fake_item_indent_v_tl \__enumext_keyans_show_item

```

Recover the original value of the current `⟨label⟩` and *store* it first in the `⟨prop list⟩` (including the optional argument), run the internal “*label and ref*” system if the `save-ref` key is active and finally *store* it in the `⟨sequence⟩`.

```

3175   \tl_set_eq:NN \__enumext_label_v_tl \__enumext_store_current_label_tmp_tl
3176   \__enumext_keyans_addto_prop:n { #1 }
3177   \__enumext_keyans_store_ref:
3178   \__enumext_keyans_addto_seq:n { #1 }
3179   \int_gincr:N \g__enumext_check_starred_cmd_int
3180 }

```

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

`\item*` The function `\__enumext_keyans_redefine_item:` is responsible for adding the *starred* and *optional* argument by the `\__enumext_list_arg_two_v:` function in the definition of the `keyans` environment. Here we need to use `\peek_remove_spaces:n` to prevent an unwanted space when using `\item*` in conjunction with the `itemindent` key.

```

3181 \cs_new_protected:Nn \__enumext_keyans_redefine_item:
3182 {
3183   \RenewDocumentCommand \item { s o }
3184   {
3185     \bool_if:nTF {##1}
3186     {
3187       \peek_remove_spaces:n
3188       {
3189         \__enumext_keyans_starred_item:n {##2}
3190       }
3191     }
3192     {
3193       \__enumext_keyans_default_item:n {##2}
3194     }
3195   }
3196 }

```

The function `\__enumext_keyans_make_label:` redefine `\makeLabel` for the keys `align`, `font`, `wrap-label`, `wrap-label*` and `\item*` for `keyans` environment.

```

3197 \cs_new_protected:Nn \__enumext_keyans_make_label:
3198 {
3199   \RenewDocumentCommand \makeLabel { m }
3200   {
3201     \tl_use:N \l__enumext_label_fill_left_v_tl
3202     \tl_use:N \l__enumext_label_font_style_v_tl
3203     \bool_if:nTF \l__enumext_wrap_label_v_bool
3204     {
3205       \__enumext_wrapper_label_v:n { ##1 }
3206     }
3207     { ##1 }
3208     \tl_use:N \l__enumext_label_fill_right_v_tl
3209   }
3210 }

```

(End of definition for `\item*`, `\__enumext_keyans_redefine_item:`, and `\__enumext_keyans_make_label:`. This function is documented on page 14.)

- This functions are passed to `\__enumext_list_arg_two_v:` used in the definition of the `keyans` environment (§12.37.2).

## 12.37 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`.

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

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

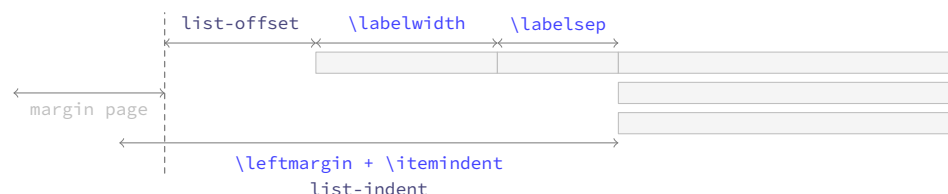


Figure 9: Representation of standard horizontal lengths in `list` environment.

The idea is to have control over these margins so that our list does not overlap the left margin of the page. The key relationship is that the right edge of the `\labelsep` equals the right edge of the `\itemindent`, so that the left edge of the *label box* is at `\leftmargin + \itemindent` minus `\labelwidth + \labelsep`. Thus, the handling of the margins by the package will be as shown in the figure 10.

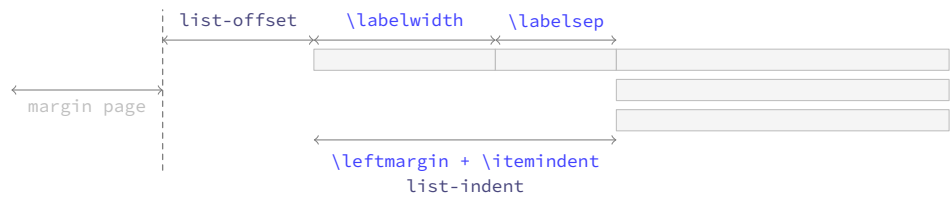
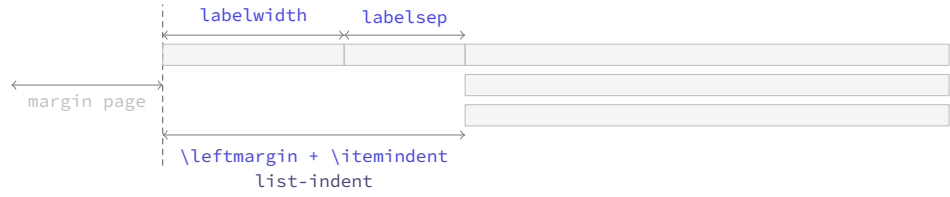
Where the default values will look like in the figure 11.

```

\__enumext_calc_hspace:NNNNNNN
\__enumext_calc_hspace:ccccccc

```

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

Figure 10: Representation of horizontal lengths concept in list in `enumext`.Figure 11: Default horizontal lengths in `enumext`.

```

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

```

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

This function is passed to `\__enumext_list_arg_two_X`: which is used in the definition of the `enumext` and `keyans` environments (§12.37.2).

```

3211 \cs_new_protected:Npn \__enumext_calc_hspace:NNNNNN #1 #2 #3 #4 #5 #6 #7
3212 {
3213   \dim_compare:nNnT { #1 } < { \c_zero_dim }
3214   {
3215     \msg_warning:nnnV { enumext } { width-non-positive } { labelwidth } { #1 }
3216     \dim_set:Nn #1 { \dim_abs:n { #1 } }
3217   }
3218   \dim_compare:nNnT { #2 } < { \c_zero_dim }
3219   {
3220     \msg_warning:nnnV { enumext } { width-negative } { labelsep } { #2 }
3221     \dim_set:Nn #2 { \dim_abs:n { #2 } }
3222   }

```

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

```

3223   \bool_if:nF #7 { \dim_set:Nn #4 { #1 + #2 } }

```

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

```

3224   \dim_compare:nNnTF { #4 } < { \c_zero_dim }
3225   {
3226     \dim_set:Nn #6 { #1 + #2 - #4 }
3227     \dim_set:Nn #5 { #1 + #2 + #3 - #6 }
3228   }
3229   {
3230     \dim_compare:nNnT { #4 } = { #1 + #2 }
3231     { \dim_set:Nn #6 { \c_zero_dim } }
3232     \dim_compare:nNnT { #4 } < { #1 + #2 }
3233     { \dim_set:Nn #6 { #1 + #2 - #4 } }
3234     \dim_compare:nNnT { #4 } > { #1 + #2 }
3235     {
3236       \dim_set:Nn #6 { -#1 - #2 + #4 }
3237       \dim_set:Nn #6 { #6*-1 }
3238     }
3239     \dim_set:Nn #5 { #1 + #2 + #3 - #6 }
3240   }
3241 }
3242 \cs_generate_variant:Nn \__enumext_calc_hspace:NNNNNN { ccccccc }

```

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



### 12.37.2 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.

```

3243 \cs_set_protected:Npn \__enumext_tmp:n #1
3244 {
3245   \cs_new_protected:cpn { __enumext_list_arg_two_#1: }
3246   {
3247     \__enumext_calc_hspace:ccccc
3248     { \__enumext_labelwidth_#1_dim } { \__enumext_labelsep_#1_dim }
3249     { \__enumext_listoffset_#1_dim } { \__enumext_leftmargin_tmp_#1_dim }
3250     { \__enumext_leftmargin_#1_dim } { \__enumext_itemindent_#1_dim }
3251     { \__enumext_leftmargin_tmp_#1_bool }
3252     \clist_map_inline:nn
3253       { labelsep, labelwidth, itemindent, leftmargin, rightmargin, listparindent }
3254       { \dim_set_eq:cc {####1} { \__enumext_####1_#1_dim } }
3255     \clist_map_inline:nn { topsep, parsep, partopsep, itemsep }
3256       { \skip_set_eq:cc {####1} { \__enumext_####1_#1_skip } }
3257     \usecounter { enumX#1 }
3258     \setcounter { enumX#1 } { \int_eval:n { \int_use:c { \__enumext_start_#1_int } - 1 } }
3259     \str_if_eq:nnTF {#1} { v }
3260     {
3261       \__enumext_keyans_redefine_item:
3262       \__enumext_keyans_make_label:
3263       \__enumext_keyans_ref:
3264       \__enumext_keyans_fake_item:
3265       \bool_if:cT { \__enumext_show_length_#1_bool }
3266       {
3267         \msg_term:nnnn { enumext } { list-lengths-not-nested } { v } { keyans }
3268       }
3269     }
3270     {
3271       \__enumext_redefine_item:
3272       \__enumext_make_label:
3273       \__enumext_standar_ref:
3274       \__enumext_fake_item:
3275       \bool_if:cT { \__enumext_show_length_#1_bool }
3276       {
3277         \msg_term:nnne { enumext } { list-lengths } {#1} { \int_use:N \__enumext_level_int }
3278       }
3279     }
3280   }
3281 }
3282 \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 `\parskip` locally.

```

3283 \cs_set_protected:Npn \__enumext_tmp:n #1
3284 {
3285   \cs_new_protected:cpn { __enumext_list_arg_two_#1: }
3286   {
3287     \bool_set_true:c { \__enumext_leftmargin_tmp_#1_bool }
3288     \dim_zero:c { \__enumext_leftmargin_tmp_#1_dim }
3289     \__enumext_calc_hspace:ccccc
3290     { \__enumext_labelwidth_#1_dim } { \__enumext_labelsep_#1_dim }
3291     { \__enumext_listoffset_#1_dim } { \__enumext_leftmargin_tmp_#1_dim }
3292     { \__enumext_leftmargin_#1_dim } { \__enumext_itemindent_#1_dim }
3293     { \__enumext_leftmargin_tmp_#1_bool }
3294     \clist_map_inline:nn
3295       { labelsep, labelwidth, itemindent, leftmargin, rightmargin, listparindent }
3296       { \dim_set_eq:cc {####1} { \__enumext_####1_#1_dim } }
3297     \clist_map_inline:nn { topsep, parsep, partopsep, itemsep }
3298       { \skip_set_eq:cc {####1} { \__enumext_####1_#1_skip } }
3299     \skip_set_eq:Nc \parsep { \__enumext_itemsep_#1_skip }
3300     \skip_zero:N \partopsep
3301     \usecounter { enumX#1 }
3302     \setcounter { enumX#1 } { \int_eval:n { \int_use:c { \__enumext_start_#1_int } - 1 } }

```

```

3303     \__enumext_starred_ref:
3304     \str_if_eq:nnTF {#1} { vii }
3305     {
3306         \__enumext_fake_item_vii:
3307         \bool_if:cT { \__enumext_show_length_vii_bool }
3308         { \msg_term:nnnn { enumext } { list-lengths-not-nested } { vii } { enumext* } }
3309     }
3310     {
3311         \__enumext_fake_item_viii:
3312         \bool_if:cT { \__enumext_show_length_#1_bool }
3313         { \msg_term:nnnn { enumext } { list-lengths-not-nested } { #1 } { keyans* } }
3314     }
3315 }
3316 }
3317 \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:.)

## 12.38 The environment enumext

`enumext` We create the `enumext` environment based on `list` environment by levels.

```

3318 \NewDocumentEnvironment{enumext}{ 0{} }
3319 {
3320     \__enumext_safe_exec:
3321     \__enumext_parse_keys:n {#1}
3322     \__enumext_before_list:
3323     \__enumext_start_store_level:
3324     \__enumext_start_list:nn
3325     { \tl_use:c { \__enumext_label_ \__enumext_level: _tl } }
3326     {
3327         \use:c { __enumext_list_arg_two_ \__enumext_level: : }
3328         \__enumext_before_keys_exec:
3329     }
3330     \__enumext_set_item_width:
3331     \__enumext_after_args_exec:
3332 }
3333 {
3334     \__enumext_stop_list:
3335     \__enumext_stop_store_level:
3336     \__enumext_after_list:
3337 }

```

(End of definition for `enumext`. This function is documented on page 4.)

`\__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.

```

3338 \cs_new_protected:Nn \__enumext_set_item_width:
3339 {
3340     \dim_set:Nn \itemwidth
3341     {
3342         \linewidth
3343     }
3344     \dim_compare:nT
3345     {
3346         \dim_use:c { \__enumext_listoffset_ \__enumext_level: _dim } != \c_zero_dim
3347     }
3348     {
3349         \dim_sub:Nn \itemwidth
3350         {
3351             \dim_use:c { \__enumext_listoffset_ \__enumext_level: _dim }
3352         }
3353     }
3354 }

```

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

`\__enumext_safe_exec:` The `\__enumext_safe_exec:` function first call the function `\__enumext_internal_mini_page:` to create the environment `__enumext_mini_env*`, then the function `\__enumext_is_not_nested:` which sets `\g__enumext_standar_bool` to “true” if we are not nested within `enumext*`, we will increment `\__enumext_level_int` to restrict nesting of the environment, set `\__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”.

```

3355 \cs_new_protected:Nn \__enumext_safe_exec:
3356 {
3357   \__enumext_internal_mini_page:
3358   \__enumext_is_not_nested:
3359   \int_incr:N \l__enumext_level_int
3360   \int_compare:nNnT { \l__enumext_level_int } > { 4 }
3361     { \msg_fatal:nn { enumext } { list-too-deep } }
3362   \bool_set_true:N \l__enumext_standar_bool
3363   \bool_set_false:N \l__enumext_starred_bool
3364   \__enumext_is_on_first_level:
3365 }

```

(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 storage `(sequence)` if the key `save-key` is not active.

```

3366 \cs_new_protected:Npn \__enumext_parse_keys:n #1
3367 {
3368   \tl_if_novalue:nF {#1}
3369   {
3370     \str_clear:N \l__enumext_series_str
3371     \int_compare:nNnTF { \l__enumext_level_int } = { 1 }
3372     {
3373       \keys_set:nn { enumext / level-1 } {#1}
3374       \__enumext_parse_series:n {#1}
3375       \__enumext_nested_base_line_fix:
3376     }
3377     {
3378       \exp_args:Ne \keys_set:nn
3379         { enumext / level-\int_use:N \l__enumext_level_int } {#1}
3380     }
3381     \__enumext_store_active_keys:n {#1}
3382   }
3383 }

```

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

`\__enumext_start_store_level:`

The `\__enumext_start_store_level:` and `\__enumext_stop_store_level:` functions activate the level saving mechanism for storage in `(sequence)` for the command `\anskey` and the environment `anskey*`.

```

3384 \cs_new_protected:Nn \__enumext_start_store_level:
3385 {
3386   \bool_lazy_all:nT
3387   {
3388     { \bool_if_p:N \l__enumext_store_active_bool }
3389     { \bool_not_p:n { \l__enumext_keyans_env_bool } }
3390     { \bool_if_p:N \g__enumext_standar_bool }
3391   }
3392   {
3393     \int_compare:nNnT { \l__enumext_level_int } > { 1 }
3394     {
3395       \bool_set_true:c { l__enumext_store_upper_level_ \__enumext_level: _bool }
3396       \__enumext_store_level_open:
3397     }
3398   }

```

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

```

3399   \bool_lazy_all:nT
3400   {
3401     { \bool_if_p:N \l__enumext_store_active_bool }
3402     { \bool_not_p:n { \l__enumext_keyans_env_bool } }
3403     { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
3404   }
3405   {
3406     \int_compare:nNnT { \l__enumext_level_int } > { 0 }
3407     {

```

```

3408         \bool_set_true:c { l__enumext_store_upper_level_ \__enumext_level: _bool }
3409         \__enumext_store_level_open:
3410     }
3411 }
3412 }

```

Close the stored structure.

```

3413 \cs_new_protected:Nn \__enumext_stop_store_level:
3414 {
3415     \bool_if:cT { l__enumext_store_upper_level_ \__enumext_level: _bool }
3416     {
3417         \__enumext_store_level_close:
3418     }
3419 }

```

(End of definition for \\_\_enumext\_start\_store\_level: and \\_\_enumext\_stop\_store\_level:.)

`\__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.

```

3420 \cs_new_protected:Nn \__enumext_before_list:
3421 {
3422     \__enumext_vspace_above:
3423     \__enumext_before_args_exec:
3424     \__enumext_check_ans_active:

```

When the `mini-env` key is active it will set the value of the `\l__enumext_minipage_right_X_dim` to be the *width* of the `\__enumext_mini_env*` environment on the “right side”, using this value together with the value of the `\l__enumext_minipage_hsep_X_dim` set by the `mini-sep` key, the value of `\l__enumext_minipage_left_X_dim` will be set, which will be the *width* of `\__enumext_mini_env*` environment on the “left side”, always having a current `\linewidth` as *maximum width* between them.

```

3425     \dim_compare:nNt
3426     { \dim_use:c { l__enumext_minipage_right_ \__enumext_level: _dim } } > { \c_zero_dim }
3427     {
3428         \dim_set:cn { l__enumext_minipage_left_ \__enumext_level: _dim }
3429         {
3430             \linewidth
3431             - \dim_use:c { l__enumext_minipage_right_ \__enumext_level: _dim }
3432             - \dim_use:c { l__enumext_minipage_hsep_ \__enumext_level: _dim }
3433         }

```

The boolean variable `\l__enumext_minipage_active_X_bool` will be activated and the integer variable `\g__enumext_minipage_stat_int` used by the `\miniright` command will be incremented, then the function `\__enumext_mini_addvspace:` is called and the `\__enumext_mini_env*` 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.

Here we use the plain TeX macro `\nointerlineskip` to prevent baseline “glue” being added between the next pair of boxes in a *vertical list*.

```

3434         \bool_set_true:c { l__enumext_minipage_active_ \__enumext_level: _bool }
3435         \int_gincr:N \g__enumext_minipage_stat_int
3436         \__enumext_mini_addvspace:
3437         \nointerlineskip\noindent
3438         \begin{\__enumext_mini_env*}
3439         { \dim_use:c { l__enumext_minipage_left_ \__enumext_level: _dim } }
3440     }
3441     \__enumext_multicols_start:
3442 }

```

(End of definition for \\_\_enumext\_before\_list:.)

`\__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.

```

3443 \cs_new_protected:Nn \__enumext_multicols_start:
3444 {
3445     \int_compare:nNt
3446     { \int_use:c { l__enumext_columns_ \__enumext_level: _int } } > { 1 }
3447     {
3448         \dim_compare:nNt
3449         { \dim_use:c { l__enumext_columns_sep_ \__enumext_level: _dim } } = { \c_zero_dim }

```

```

3450         {
3451             \dim_set:cn { l__enumext_columns_sep_ \__enumext_level: _dim }
3452             {
3453                 ( \dim_use:c { l__enumext_labelwidth_ \__enumext_level: _dim }
3454                   + \dim_use:c { l__enumext_labelsep_ \__enumext_level: _dim }
3455                   ) / \int_use:c { l__enumext_columns_ \__enumext_level: _int }
3456                   - \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim }
3457             }
3458         }
3459         \dim_set_eq:Nc \columnsep { l__enumext_columns_sep_ \__enumext_level: _dim }
3460         \skip_zero:N \multicolsep
3461         \int_compare:nNnT { \l__enumext_level_int } > { 1 }
3462         {
3463             \dim_zero:N \columnseprule
3464         }

```

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.

```

3465         \bool_if:cF { l__enumext_minipage_active_ \__enumext_level: _bool }
3466         {
3467             \__enumext_multi_addvspace:
3468         }
3469         \raggedcolumns
3470         \begin{multicols}{ \int_use:c { l__enumext_columns_ \__enumext_level: _int } }
3471     }
3472 }

```

(End of definition for `\__enumext_multicols_start:`)

`\__enumext_multicols_stop:`

The function `\__enumext_multicols_stop:` will stop the `multicols` environment. If the boolean variable `\l__enumext_minipage_active_X_bool` is false (not nested in `__enumext_mini_env*`) we will apply our “*vertical adjust*” spacing.

```

3473 \cs_new_protected:Nn \__enumext_multicols_stop:
3474 {
3475     \int_compare:nNnT
3476     { \int_use:c { l__enumext_columns_ \__enumext_level: _int } } > { 1 }
3477     {
3478         \end{multicols}
3479         \bool_if:cF { l__enumext_minipage_active_ \__enumext_level: _bool }
3480         {
3481             \par\addvspace{ \skip_use:c { l__enumext_multicols_below_ \__enumext_level: _skip } }
3482         }
3483     }
3484 }

```

(End of definition for `\__enumext_multicols_stop:`)

`\__enumext_after_list:`

The function `\__enumext_after_list:` 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_env*` environment has not been closed), then close `__enumext_mini_env*` and add the *adjusted vertical space* `\l__enumext_minipage_after_skip`, otherwise we will close the `multicols` environment.

```

3485 \cs_new_protected:Nn \__enumext_after_list:
3486 {
3487     \bool_if:cTF { l__enumext_minipage_active_ \__enumext_level: _bool }
3488     {
3489         \int_compare:nNnT { \g__enumext_minipage_stat_int } = { 1 }
3490         {
3491             \msg_warning:nn { enumext } { missing-miniright }
3492             \miniright
3493         }
3494         \int_gzero:N \g__enumext_minipage_stat_int
3495         \end{__enumext_mini_env*}
3496         \par\addvspace { \l__enumext_minipage_after_skip }
3497     }
3498     { \__enumext_multicols_stop: }

```

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.

```

3499     \__enumext_after_stop_list:
3500     \__enumext_check_ans_key_hook:
3501     \__enumext_vspace_below:
3502     \bool_set_false:N \l__enumext_standar_bool
3503     \__enumext_resume_save_counter:
3504 }

```

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`.

```

3505 \__enumext_after_env:nn {enumext} { \__enumext_execute_after_env: }

```

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

### 12.39 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”.

**keyans** Now we define the environment `keyans` also based on lists.

```

3506 \NewDocumentEnvironment{keyans}{ 0{} }
3507 {
3508     \__enumext_keyans_safe_exec:
3509     \__enumext_keyans_parse_keys:n {#1}
3510     \__enumext_before_list_v:
3511     \__enumext_start_list:nn
3512     { \tl_use:N \l__enumext_label_v_tl }
3513     {
3514         \__enumext_list_arg_two_v:
3515         \__enumext_before_keys_exec_v:
3516     }
3517     \__enumext_keyans_set_item_width:
3518     \__enumext_after_args_exec_v:
3519 }
3520 {
3521     \__enumext_check_starred_cmd:n { item }
3522     \__enumext_stop_list:
3523     \__enumext_after_list_v:
3524 }

```

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

`\__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.

```

3525 \cs_new_protected:Nn \__enumext_keyans_set_item_width:
3526 {
3527     \dim_set:Nn \itemwidth
3528     {
3529         \linewidth
3530     }
3531     \dim_compare:nT
3532     {
3533         \l__enumext_listoffset_v_dim != \c_zero_dim
3534     }
3535     {
3536         \dim_sub:Nn \itemwidth
3537         {
3538             \l__enumext_listoffset_v_dim
3539         }
3540     }
3541 }

```

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

`\__enumext_keyans_safe_exec:`

The `keyans` environment will only be available if the `save-ans` key is active and can only be used at the “first level” within the `enumext` environment. We do not want the environment to be nested, so we will set a maximum at this point. If the conditions are not met, an error message will be returned.

```

3542 \cs_new_protected:Nn \__enumext_keyans_safe_exec:
3543 {
3544     \bool_if:NF \l__enumext_store_active_bool
3545     {
3546         \msg_error:nnnn { enumext } { wrong-place } { keyans } { save-ans }

```

```

3547     }
3548     \int_incr:N \l__enumext_keyans_level_int
3549     \bool_set_true:N \l__enumext_keyans_env_bool
3550     \__enumext_keyans_name_and_start:
3551     % Set false for interfering with enumext nested in keyans (yes, its possible and crayze)
3552     \bool_set_false:N \l__enumext_store_active_bool
3553     \int_compare:nNtT { \l__enumext_keyans_level_int } > { 1 }
3554     {
3555         \msg_error:nn { enumext } { keyans-nested }
3556     }
3557     \int_compare:nNtT { \l__enumext_level_int } > { 1 }
3558     {
3559         \msg_error:nn { enumext } { keyans-wrong-level }
3560     }
3561 }

```

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

\\_\_enumext\_keyans\_parse\_keys:n Parse [*key = val*] for **keyans** environment.

```

3562 \cs_new_protected:Npn \__enumext_keyans_parse_keys:n #1
3563 {
3564     \keys_set:nn { enumext / keyans } {#1}
3565 }

```

(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_after_list_v:
3566 \cs_new_protected:Nn \__enumext_before_list_v:
3567 {
3568     \__enumext_vspace_above_v:
3569     \__enumext_before_args_exec_v:
3570     \dim_compare:nNtT { \l__enumext_minipage_right_v_dim } > { \c_zero_dim }
3571     {
3572         \dim_set:Nn \l__enumext_minipage_left_v_dim
3573         {
3574             \linewidth - \l__enumext_minipage_right_v_dim - \l__enumext_minipage_hsep_v_dim
3575         }
3576         \bool_set_true:N \l__enumext_minipage_active_v_bool
3577         \int_gincr:N \g__enumext_minipage_stat_int
3578         \__enumext_keyans_mini_addvspace:
3579         \nointerlineskip\noindent
3580         \begin{__enumext_mini_env*}{ \l__enumext_minipage_left_v_dim }
3581     }
3582     \__enumext_keyans_multicols_start:
3583 }
3584 \cs_new_protected:Nn \__enumext_keyans_multicols_start:
3585 {
3586     \int_compare:nNtT { \l__enumext_columns_v_int } > { 1 }
3587     {
3588         \dim_compare:nNtT { \l__enumext_columns_sep_v_dim } = { \c_zero_dim }
3589         {
3590             \dim_set:Nn \l__enumext_columns_sep_v_dim
3591             {
3592                 (
3593                     \l__enumext_labelwidth_v_dim + \l__enumext_labelsep_v_dim
3594                 ) / \l__enumext_columns_v_int
3595                 - \l__enumext_listoffset_v_dim
3596             }
3597         }
3598         \dim_set_eq:NN \columnsep \l__enumext_columns_sep_v_dim
3599         \skip_zero:N \multicolsep
3600         \dim_zero:N \columnseprule % no rule here
3601         \bool_if:NF \l__enumext_minipage_active_v_bool
3602         {
3603             \__enumext_keyans_multi_addvspace:
3604         }
3605         \raggedcolumns
3606         \begin{multicols}{ \l__enumext_columns_v_int }
3607     }
3608 }
3609 \cs_new_protected:Nn \__enumext_keyans_multicols_stop:

```



```

3610 {
3611   \int_compare:nNt { \l__enumext_columns_v_int } > { 1 }
3612   {
3613     \end{multicols}
3614     \bool_if:NF \l__enumext_minipage_active_v_bool
3615     {
3616       \par\addvspace{ \l__enumext_multicols_below_v_skip }
3617     }
3618   }
3619 }
3620 \cs_new_protected:Nn \__enumext_after_list_v:
3621 {
3622   \bool_if:NTF \l__enumext_minipage_active_v_bool
3623   {
3624     \int_compare:nNt { \g__enumext_minipage_stat_int } = { 1 }
3625     {
3626       \msg_warning:nn { enumext } { missing-miniright }
3627       \miniright
3628     }
3629     \int_gzero:N \g__enumext_minipage_stat_int
3630     \end{__enumext_mini_env*}
3631     \par\addvspace{ \l__enumext_minipage_after_skip }
3632   }
3633   {
3634     \__enumext_keyans_multicols_stop:
3635   }
3636   \bool_set_false:N \l__enumext_keyans_env_bool
3637   \__enumext_after_stop_list_v:
3638   \__enumext_vspace_below_v:
3639 }

```

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

## 12.40 The environment `keyanspic` and `\anspic`

The `keyanspic` environment is a list-based environment that uses the same configuration for “*spacing*” and `<label>` as the `keyans` environment, but it does not use `\item`.

The contents are passed to the environment by means of the `\anspic` command and are placed inside `minipage` environments, with the `<label>` underneath, adjusting widths according to the options passed to the environment.

Again it is necessary to “adjust” the spacing, both vertical and horizontal, to obtain an output like the one shown in the figure 12.

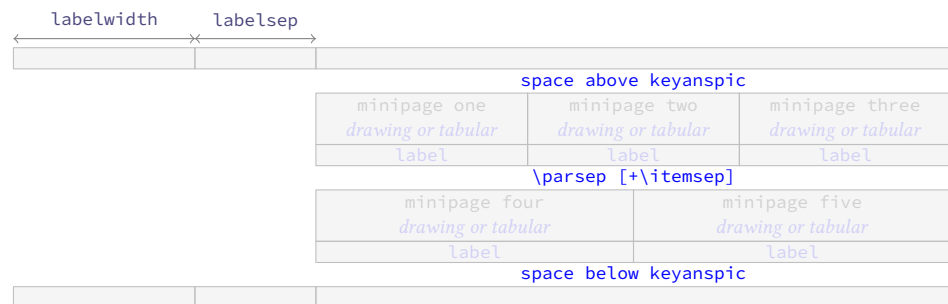


Figure 12: Representation of the `keyanspic` spacing in `enumext`.

This implementation is adapted from the answer given by Enrico Gregorio in [How to process the body of an environment and divide it by a `\macro`?](#).

### 12.40.1 The command `\anspic`

`\anspic` The `\anspic` command take three arguments, the starred (\*) versions `\anspic*` and `\anspic* [<content>]` store the current `<label>` next to the `[<content>]` if it is present in the `<sequence>` and `<prop list>` defined by `save-ans` key. This command is used as a replacement for `\item` in the `keyanspic` environment.

```

3640 \NewDocumentCommand \anspic { s o +m }
3641 {

```

We check that the command is active in the `keyanspic` environment only if the `save-ans` key is present, otherwise we return an error.

```

3642   \bool_if:NF \l__enumext_store_active_bool
3643   {
3644     \msg_error:nnnn { enumext } { wrong-place } { keyanspic } { save-ans }
3645   }
3646   \int_compare:nNt { \l__enumext_level_int } > { 1 }

```

```

3647     {
3648         \msg_error:nn { enumext } { keyanspic-wrong-level }
3649     }
3650     \int_compare:nNt { \__enumext_keyans_level_int } = { 1 }
3651     {
3652         \msg_error:nnnn { enumext } { command-wrong-place }{ anspic }{ keyans }
3653     }

```

The three arguments are handled by the function `\__enumext_keyans_anspic_code:nnn` and stored in the sequence `\__enumext_keyans_pic_body_seq` which is processed by the `keyanspic` environment.

```

3654     \seq_put_right:Nn \__enumext_keyans_pic_body_seq
3655     {
3656         \__enumext_keyans_anspic_code:nnn { #1 } { #2 } { #3 }
3657     }
3658 }

```

(End of definition for `\anspic`. This function is documented on page 15.)

`\__enumext_keyans_anspic_code:nnn`

The function `\__enumext_keyans_anspic_code:nnn` will be in charge of handling the “counter” and *⟨label⟩*, which will have the same configuration as the `keyans` environment.

```

3659 \cs_new_protected:Nn \__enumext_keyans_anspic_code:nnn
3660 {
3661     \stepcounter { enumXvi }
3662     #3 \\\
3663     \bool_if:nT { #1 }
3664     {
3665         \__enumext_keyans_addto_prop:n { #2 }
3666         \__enumext_keyans_store_ref:
3667         \__enumext_keyans_addto_seq:n { #2 }
3668         \int_gincr:N \g__enumext_check_starred_cmd_int
3669         \bool_lazy_or:nnT
3670         { \bool_if_p:N \__enumext_show_answer_bool }
3671         { \bool_if_p:N \__enumext_show_position_bool }
3672         {
3673             \tl_set_eq:NN \__enumext_label_v_tl \__enumext_label_vi_tl
3674             \__enumext_keyans_show_left:n { #2 }
3675             \tl_set_eq:NN \__enumext_label_vi_tl \__enumext_label_v_tl
3676         }
3677     }
3678     \tl_use:N \__enumext_label_font_style_v_tl
3679     \__enumext_wrapper_label_v:n { \__enumext_label_vi_tl } \__enumext_keyans_show_item_opt:
3680 }

```

(End of definition for `\__enumext_keyans_anspic_code:nnn`.)

#### 12.40.2 The environment `keyanspic`

`keyanspic` Now we define the environment `keyanspic` based on list. The optional argument [*⟨number above, number below⟩*] will determine the number of `minipage` environments that will be above and below separated by `\parsep+ \itemsep` within it.

```

3681 \NewDocumentEnvironment{keyanspic}{ o }
3682 {
3683     \__enumext_keyans_pic_safe_exec:
3684     \__enumext_start_list:nn
3685     { }
3686     {
3687         \__enumext_keyans_pic_arg_two:
3688     }

```

We apply the “adjusted” vertical spacing above the environment

```

3689     \vspace { \__enumext_keyans_pic_above_skip }
3690 }

```

If the optional argument is not present, the number of times the `\anspic` command appears will be counted from `\__enumext_keyans_pic_body_seq` and placed in `minipage` environments on a single line. Finally we check if `\anspic*` has been used, set the counter to zero and apply our “adjusted” vertical space below the environment.

```

3691 {
3692     \tl_if_novalue:nTF { #1 }
3693     {
3694         \__enumext_keyans_pic_do:e { \seq_count:N \__enumext_keyans_pic_body_seq }
3695     }
3696     { \__enumext_keyans_pic_do:n { #1 } }

```

```

3697   \__enumext_stop_list:
3698   \__enumext_check_starred_cmd:n { anspic }
3699   \setcounter { enumXvi } { 0 }
3700   \vspace { \__enumext_topsep_v_skip }
3701   %\bool_set_false:N \__enumext_store_active_bool
3702   }

```

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

`\__enumext_keyans_pic_safe_exec:` The function `\__enumext_keyans_pic_safe_exec:` check nested and level position inside the `enumext` environment.

```

3703 \cs_new_protected:Nn \__enumext_keyans_pic_safe_exec:
3704 {
3705   \int_incr:N \__enumext_keyans_pic_level_int
3706   \int_compare:nNtT { \__enumext_keyans_pic_level_int } > { 1 }
3707   {
3708     \msg_error:nn { enumext } { keyanspic-nested }
3709   }
3710   \__enumext_keyans_name_and_start:
3711   }

```

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

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

```

3712 \cs_new_protected:Npn \__enumext_keyans_pic_skip_abs:N #1
3713 {
3714   \dim_compare:nNtT { #1 } < { 0pt }
3715   { \skip_set:Nn #1 { -#1 } }
3716   }

```

(End of definition for `\__enumext_keyans_pic_skip_abs:N`.)

`\__enumext_keyans_pic_arg_two:` The function `\__enumext_keyans_pic_arg_two:` will be used in the second argument of the `\__enumext_start_list:nn` function that defines the `keyanspic` environment, it will handle the setting of spaces.

```

3717 \cs_new_protected:Nn \__enumext_keyans_pic_arg_two:
3718 {

```

The first thing to do is to set the boolean variable `\__enumext_leftmargin_tmp_v_bool` handled by the `list-indent` key to false, then we copy the definition of the second list argument from the `keyans` environment.

```

3719   \bool_set_false:N \__enumext_leftmargin_tmp_v_bool
3720   \__enumext_list_arg_two_v:

```

We will add the value of `\itemsep` to `\parsep` which we will use as vertical spacing between the above and below `minipage` environments. and adjust the value of `\leftmargin`, the label and counter are handled directly by the `\anspic` command. Then we make equal to zero `\labelwidth`, `\labelsep`, `\partopsep` and `\itemsep` so that the horizontal and vertical spacing is not affected.

```

3721   \skip_add:Nn \parsep { \itemsep }
3722   \dim_add:Nn \leftmargin { -\labelwidth - \labelsep }
3723   \dim_zero:N \labelwidth
3724   \dim_zero:N \listparindent
3725   \dim_zero:N \labelsep
3726   \skip_zero:N \partopsep
3727   \skip_zero:N \itemsep

```

We set the value of `\__enumext_keyans_pic_above_skip` which we will use to apply our “adjust” space above `keyanspic`, finally we call `\__enumext_item_std:w` followed by `\scan_stop:` to prevent the error message returned by  $\TeX$  when not using the `\item` command.

```

3728   \__enumext_keyans_pic_skip_abs:N \parsep
3729   \skip_set:Nn \__enumext_keyans_pic_above_skip
3730   {
3731     \box_dp:N \strutbox
3732     + \__enumext_topsep_v_skip
3733     - \parsep
3734   }
3735   \__enumext_item_std:w \scan_stop:
3736   % paranoia
3737   \RenewDocumentCommand \item {}
3738   {
3739     \msg_error:nn { enumext } { keyanspic-item-cmd }
3740   }
3741   }

```

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

```
\__enumext_keyans_pic_do:n
\__enumext_keyans_pic_do:e
```

The optional argument is split by comma and is handled directly by the function `\__enumext_keyans_pic_do:n` and passed to the function `\__enumext_keyans_pic_row:n`.

```
3742 \cs_new_protected:Nn \__enumext_keyans_pic_do:n
3743 {
3744   \clist_map_function:nN { #1 } \__enumext_keyans_pic_row:n
3745 }
3746 \cs_generate_variant:Nn \__enumext_keyans_pic_do:n { e }
```

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

```
\__enumext_keyans_pic_row:n
```

The function `\__enumext_keyans_pic_row:n` will set the widths for the `minipage` environments and place the content *⟨stored⟩* by `\anspic*` in the `\l__enumext_keyans_pic_body_seq` sequence inside them.

```
3747 \cs_new_protected:Nn \__enumext_keyans_pic_row:n
3748 {
3749   \dim_set:Nn \l__enumext_keyans_pic_width_dim { \linewidth / #1 }
3750   \int_set:Nn \l__enumext_keyans_pic_above_int { \l__enumext_keyans_pic_below_int }
3751   \int_set:Nn \l__enumext_keyans_pic_below_int { \l__enumext_keyans_pic_above_int + #1 }
3752   \int_step_inline:nnn
3753     { \l__enumext_keyans_pic_above_int + 1 }
3754     { \l__enumext_keyans_pic_below_int }
3755     {
3756       \__enumext_minipage:w [ b ] { \l__enumext_keyans_pic_width_dim }
3757       \centering
3758       \seq_item:Nn \l__enumext_keyans_pic_body_seq { ##1 }
3759       \__enumext_endminipage:
3760     }
3761   \par
3762 }
```

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

## 12.41 The horizontal environments

Generating horizontal list environments is NOT as simple as standard  $\text{\TeX}$  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` as in the non starred versions (at least I have not achieved it) and as we will make it behave differently, we have no other option than to define a cascade of functions.

## 12.42 Redefining `\footnote` command

```
\__enumext_footnotetext:nn
\__enumext_renew_footnote:
\__enumext_print_footnote:
```

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

```
3763 \cs_new_protected:Nn \__enumext_footnotetext:nn
3764 {
3765   \footnotetext[#1]{#2}
3766 }
3767 \cs_new_protected:Nn \__enumext_renew_footnote:
3768 {
3769   \seq_gclear:N \g__enumext_footnote_arg_seq
3770   \seq_gclear:N \g__enumext_footnote_int_seq
3771   \RenewDocumentCommand \footnote { o +m }
3772   {
3773     \tl_if_novalue:nTF {##1}
3774     {
3775       \stepcounter{footnote}
3776       \int_gset_eq:Nc \g__enumext_footnote_int { c@footnote }
3777     }
3778     {
3779       \int_gset:Nn \g__enumext_footnote_int { ##1 }
3780     }
3781     \footnotemark [ \g__enumext_footnote_int ]
3782     \seq_gput_right:Nn \g__enumext_footnote_arg_seq { ##2 }
3783     \seq_gput_right:NV \g__enumext_footnote_int_seq \g__enumext_footnote_int
3784   }
3785 }
3786 \cs_new_protected:Nn \__enumext_print_footnote:
3787 {
3788   \seq_if_empty:NF \g__enumext_footnote_int_seq
3789   {
```

```

3790     \seq_map_pairwise_function:NNN
3791     \g__enumext_footnote_int_seq
3792     \g__enumext_footnote_arg_seq
3793     \__enumext_footnotetext:nn
3794   }
3795 }

```

(End of definition for `\__enumext_footnotetext:nn`, `\__enumext_renew_footnote:`, and `\__enumext_print_footnote:`.)

### 12.42.1 Functions for item box width

To achieve the horizontal list environment we will capture the `\item` command and the content of this in an plain `lrbox` box using `\makebox` for the `label` and a `minipage` environment for the content 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 optional first argument (`\langle number \rangle`).

```

\__enumext_starred_columns_set_vii:
\__enumext_starred_columns_set_viii:

```

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

```

3796 \cs_new_protected:Nn \__enumext_starred_columns_set_vii:
3797 {
3798   \dim_compare:nNnT { \__enumext_columns_sep_vii_dim } = { \c_zero_dim }
3799   {
3800     \dim_set:Nn \__enumext_columns_sep_vii_dim
3801     {
3802       ( \__enumext_labelwidth_vii_dim + \__enumext_labelsep_vii_dim )
3803       / \__enumext_columns_vii_int
3804     }
3805   }
3806   \int_set:Nn \__enumext_tmpa_vii_int { \__enumext_columns_vii_int - 1 }
3807   \dim_set:Nn \__enumext_item_width_vii_dim
3808   {
3809     ( \linewidth - \__enumext_columns_sep_vii_dim * \__enumext_tmpa_vii_int )
3810     / \__enumext_columns_vii_int
3811     - \__enumext_labelwidth_vii_dim
3812     - \__enumext_labelsep_vii_dim
3813   }

```

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

```

3814   \dim_compare:nNnT { \__enumext_rightmargin_vii_dim } > { \c_zero_dim }
3815   {
3816     \dim_sub:Nn \__enumext_item_width_vii_dim
3817     {
3818       ( \__enumext_rightmargin_vii_dim * \__enumext_tmpa_vii_int )
3819       / \__enumext_columns_vii_int
3820     }
3821     \dim_add:Nn \__enumext_columns_sep_vii_dim
3822     {
3823       \__enumext_rightmargin_vii_dim
3824     }
3825   }
3826 }

```

Same implementation for the `keyans*` environment.

```

3827 \cs_new_protected:Nn \__enumext_starred_columns_set_viii:
3828 {
3829   \dim_compare:nNnT { \__enumext_columns_sep_viii_dim } = { \c_zero_dim }
3830   {
3831     \dim_set:Nn \__enumext_columns_sep_viii_dim
3832     {
3833       ( \__enumext_labelwidth_viii_dim + \__enumext_labelsep_viii_dim )
3834       / \__enumext_columns_viii_int
3835     }
3836   }
3837   \int_set:Nn \__enumext_tmpa_viii_int { \__enumext_columns_viii_int - 1 }
3838   \dim_set:Nn \__enumext_item_width_viii_dim
3839   {
3840     ( \linewidth - \__enumext_columns_sep_viii_dim * \__enumext_tmpa_viii_int )
3841     / \__enumext_columns_viii_int
3842     - \__enumext_labelwidth_viii_dim
3843     - \__enumext_labelsep_viii_dim
3844   }
3845   \dim_compare:nNnT { \__enumext_rightmargin_viii_dim } > { \c_zero_dim }
3846   {

```

```

3847     \dim_sub:Nn \l__enumext_item_width_viii_dim
3848     {
3849         ( \l__enumext_rightmargin_viii_dim * \l__enumext_tmpa_vii_int )
3850         / \l__enumext_columns_viii_int
3851     }
3852     \dim_add:Nn \l__enumext_columns_sep_viii_dim
3853     {
3854         \l__enumext_rightmargin_viii_dim
3855     }
3856 }
3857 }

```

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

### 12.42.2 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.

```

3858 \cs_new_protected:Npn \__enumext_starred_joined_item_vii:n #1
3859 {
3860     \int_set:Nn \l__enumext_joined_item_vii_int {#1}
3861     \int_compare:nNnT { \l__enumext_joined_item_vii_int } > { \l__enumext_columns_vii_int }
3862     {
3863         \msg_warning:nnee { enumext } { item-joined }
3864         { \int_use:N \l__enumext_joined_item_vii_int }
3865         { \int_use:N \l__enumext_columns_vii_int }
3866         \int_set:Nn \l__enumext_joined_item_vii_int
3867         {
3868             \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1
3869         }
3870     }
3871     \int_compare:nNnT
3872     { \l__enumext_joined_item_vii_int }
3873     >
3874     { \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1 }
3875     {
3876         \msg_warning:nnee { enumext } { item-joined-columns }
3877         { \int_use:N \l__enumext_joined_item_vii_int }
3878         {
3879             \int_eval:n
3880             { \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1 }
3881         }
3882         \int_set:Nn \l__enumext_joined_item_vii_int
3883         {
3884             \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1
3885         }
3886     }
3887     \int_compare:nNnTF { \l__enumext_joined_item_vii_int } > { 1 }
3888     {
3889         \int_set_eq:NN \l__enumext_joined_item_aux_vii_int \l__enumext_joined_item_vii_int
3890         \int_decr:N \l__enumext_joined_item_aux_vii_int
3891         \int_add:Nn \l__enumext_item_column_pos_vii_int { \l__enumext_joined_item_aux_vii_int }
3892         \int_gadd:Nn \g__enumext_item_count_all_vii_int { \l__enumext_joined_item_aux_vii_int }
3893         \dim_set:Nn \l__enumext_joined_width_vii_dim
3894         {
3895             \l__enumext_item_width_vii_dim * \l__enumext_joined_item_vii_int
3896             + ( \l__enumext_labelwidth_vii_dim + \l__enumext_labelsep_vii_dim
3897                 + \l__enumext_columns_sep_vii_dim
3898                 ) * \l__enumext_joined_item_aux_vii_int
3899         }
3900         \dim_set_eq:NN \itemwidth \l__enumext_joined_width_vii_dim
3901     }
3902     {
3903         \dim_set_eq:NN \l__enumext_joined_width_vii_dim \l__enumext_item_width_vii_dim
3904         \dim_set_eq:NN \itemwidth \l__enumext_item_width_vii_dim
3905     }
3906 }

```

Same implementation for the `keyans*` environment.

```

3907 \cs_new_protected:Npn \__enumext_starred_joined_item_viii:n #1
3908 {

```

```

3909 \int_set:Nn \l__enumext_joined_item_viii_int {#1}
3910 \int_compare:nNnT { \l__enumext_joined_item_viii_int } > { \l__enumext_columns_viii_int }
3911 {
3912   \msg_warning:nnee { enumext } { item-joined }
3913   { \int_use:N \l__enumext_joined_item_viii_int }
3914   { \int_use:N \l__enumext_columns_viii_int }
3915   \int_set:Nn \l__enumext_joined_item_viii_int
3916   {
3917     \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1
3918   }
3919 }
3920 \int_compare:nNnT
3921 { \l__enumext_joined_item_viii_int }
3922 >
3923 { \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1 }
3924 {
3925   \msg_warning:nnee { enumext } { item-joined-columns }
3926   { \int_use:N \l__enumext_joined_item_viii_int }
3927   {
3928     \int_eval:n
3929     { \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1 }
3930   }
3931   \int_set:Nn \l__enumext_joined_item_viii_int
3932   {
3933     \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1
3934   }
3935 }
3936 \int_compare:nNnTF { \l__enumext_joined_item_viii_int } > { 1 }
3937 {
3938   \int_set_eq:NN \l__enumext_joined_item_aux_viii_int \l__enumext_joined_item_viii_int
3939   \int_decr:N \l__enumext_joined_item_aux_viii_int
3940   \int_add:Nn \l__enumext_item_column_pos_viii_int { \l__enumext_joined_item_aux_viii_int }
3941   \int_gadd:Nn \g__enumext_item_count_all_viii_int { \l__enumext_joined_item_aux_viii_int }
3942   \dim_set:Nn \l__enumext_joined_width_viii_dim
3943   {
3944     \l__enumext_item_width_viii_dim * \l__enumext_joined_item_viii_int
3945     + ( \l__enumext_labelwidth_viii_dim + \l__enumext_labelsep_viii_dim
3946         + \l__enumext_columns_sep_viii_dim
3947     ) * \l__enumext_joined_item_aux_viii_int
3948   }
3949   \dim_set_eq:NN \itemwidth \l__enumext_joined_width_viii_dim
3950 }
3951 {
3952   \dim_set_eq:NN \l__enumext_joined_width_viii_dim \l__enumext_item_width_viii_dim
3953   \dim_set_eq:NN \itemwidth \l__enumext_item_width_viii_dim
3954 }
3955 }

```

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

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

`\__enumext_start_mini_vii:`  
`\__enumext_stop_mini_vii:`

The implementation of the `mini-env` key support is almost identical to the one used in the `enumext` and `keyans` environments, the difference is that the `\__enumext_mini_env*` environment on the “right side” is executed “after” closing the environment, so it is necessary to make a global copy of the variable `\l__enumext_minipage_right_vii_dim` in the variable `\g__enumext_minipage_right_vii_dim`.

```

3956 \cs_new_protected:Nn \__enumext_start_mini_vii:
3957 {
3958   \dim_compare:nNnT { \l__enumext_minipage_right_vii_dim } > { \c_zero_dim }
3959   {
3960     \dim_set:Nn \l__enumext_minipage_left_vii_dim
3961     {
3962       \linewidth
3963       - \l__enumext_minipage_right_vii_dim
3964       - \l__enumext_minipage_hsep_vii_dim
3965     }
3966     \bool_set_true:N \l__enumext_minipage_active_vii_bool
3967     \dim_gset_eq:NN
3968     \g__enumext_minipage_right_vii_dim
3969     \l__enumext_minipage_right_vii_dim
3970     \__enumext_mini_addvspace_vii:
3971     \nointerlineskip\noident

```



```

3972     \begin{__enumext_mini_env*}{ \l__enumext_minipage_left_vii_dim }
3973   }
3974 }

```

The function `\__enumext_stop_mini_vii`: closes the `__enumext_mini_env*` environment on the left side, applies `\hfill` and sets the value of the variable `\g__enumext_minipage_active_vii_bool` to true which will be used in the function `\__enumext_after_env:n` to execute the `__enumext_mini_env*` on the “right side”.

```

3975 \cs_new_protected:Nn \__enumext_stop_mini_vii:
3976 {
3977   \bool_if:NT \l__enumext_minipage_active_vii_bool
3978   {
3979     \end{__enumext_mini_env*}
3980     \hfill
3981     \bool_gset_true:N \g__enumext_minipage_active_vii_bool
3982   }
3983 }

```

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 `__enumext_mini_env*` 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.

```

3984 \__enumext_after_env:n {enumext*}
3985 {
3986   \bool_if:NT \g__enumext_minipage_active_vii_bool
3987   {
3988     \begin{__enumext_mini_env*}{ \g__enumext_minipage_right_vii_dim }
3989     \par\addvspace { \g__enumext_minipage_right_skip }
3990     \bool_if:NF \g__enumext_minipage_center_vii_bool
3991     {
3992       \tl_put_left:Nn \g__enumext_miniright_code_vii_tl
3993       {
3994         \centering
3995       }
3996     }
3997     \vbox_set_top:Nn \l__enumext_miniright_code_vii_box
3998     {
3999       \tl_use:N \g__enumext_miniright_code_vii_tl
4000     }
4001     \box_use_drop:N \l__enumext_miniright_code_vii_box
4002     \end{__enumext_mini_env*}
4003     \par\addvspace{ \g__enumext_minipage_after_skip }
4004   }
4005   \bool_gset_false:N \g__enumext_minipage_active_vii_bool
4006   \bool_gset_true:N \g__enumext_minipage_center_vii_bool
4007   \tl_gclear:N \g__enumext_miniright_code_vii_tl
4008   \dim_gzero:N \g__enumext_minipage_right_vii_dim
4009   \bool_gset_false:N \g__enumext_starred_bool
4010 }

```

(End of definition for `\__enumext_start_mini_vii`: and `\__enumext_stop_mini_vii`.)

`\__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.

```

4011 \cs_new_protected:Nn \__enumext_start_mini_viii:
4012 {
4013   \dim_compare:nNnT { \l__enumext_minipage_right_viii_dim } > { \c_zero_dim }
4014   {
4015     \dim_set:Nn \l__enumext_minipage_left_viii_dim
4016     {
4017       \linewidth
4018       - \l__enumext_minipage_right_viii_dim
4019       - \l__enumext_minipage_hsep_viii_dim
4020     }
4021     \bool_set_true:N \l__enumext_minipage_active_viii_bool
4022     \dim_gset_eq:NN
4023     \g__enumext_minipage_right_viii_dim
4024     \l__enumext_minipage_right_viii_dim
4025     \__enumext_mini_addvspace_viii:
4026     \nointerlineskip\noindent
4027     \begin{__enumext_mini_env*}{ \l__enumext_minipage_left_viii_dim }

```

```

4028     }
4029   }
4030   \cs_new_protected:Nn \__enumext_stop_mini_viii:
4031   {
4032     \bool_if:NT \l__enumext_minipage_active_viii_bool
4033     {
4034       \end{__enumext_mini_env*}
4035       \hfill
4036       \bool_gset_true:N \g__enumext_minipage_active_viii_bool
4037     }
4038   }
4039   \__enumext_after_env:nn {keyans*}
4040   {
4041     \bool_if:NT \g__enumext_minipage_active_viii_bool
4042     {
4043       \begin{__enumext_mini_env*}{ \g__enumext_minipage_right_viii_dim }
4044       \par\addvspace { \g__enumext_minipage_right_skip }
4045       \bool_if:NF \g__enumext_minipage_center_viii_bool
4046       {
4047         \tl_put_left:Nn \g__enumext_miniright_code_viii_tl
4048         {
4049           \centering
4050         }
4051       }
4052       \vbox_set_top:Nn \l__enumext_miniright_code_viii_box
4053       {
4054         \tl_use:N \g__enumext_miniright_code_viii_tl
4055       }
4056       \box_use_drop:N \l__enumext_miniright_code_viii_box
4057       \end{__enumext_mini_env*}
4058       \par\addvspace{ \g__enumext_minipage_after_skip }
4059     }
4060     \bool_gset_false:N \g__enumext_minipage_active_viii_bool
4061     \bool_gset_true:N \g__enumext_minipage_center_viii_bool
4062     \tl_gclear:N \g__enumext_miniright_code_viii_tl
4063     \dim_gzero:N \g__enumext_minipage_right_viii_dim
4064   }

```

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

## 12.43 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 \noindent and next to \item equal to \\_\_enumext\_start\_item\_tmp\_vii: which we will redefine later.

```

4065 \NewDocumentEnvironment{enumext*}{ o }
4066 {
4067   \__enumext_safe_exec_vii:
4068   \__enumext_parse_keys_vii:n {#1}
4069   \__enumext_before_list_vii:
4070   \__enumext_start_store_level_vii:
4071   \__enumext_start_list:nn { }
4072   {
4073     \__enumext_list_arg_two_vii:
4074     \__enumext_before_keys_exec_vii:
4075   }
4076   \__enumext_starred_columns_set_vii:
4077   \item[] \scan_stop:
4078   \cs_set_eq:NN \__enumext_stop_item_tmp_vii: \noindent
4079   \cs_set_eq:NN \item \__enumext_start_item_tmp_vii:
4080 }
4081 {
4082   \__enumext_stop_item_tmp_vii:
4083   \__enumext_remove_extra_parsep_vii:
4084   \__enumext_stop_list:
4085   \__enumext_stop_store_level_vii:
4086   \__enumext_after_list_vii:
4087 }

```

(End of definition for enumext\*. This function is documented on page 4.)

`\__enumext_safe_exec_vii:` We will first call the function `\__enumext_internal_mini_page:` to create the environment `\__enumext-mini-env*`, then the function `\__enumext_is_not_nested:` which sets `\g__enumext_starred_bool` to true if we are not nested within `enumext`, 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.

```

4088 \cs_new_protected:Nn \__enumext_safe_exec_vii:
4089 {
4090   \__enumext_internal_mini_page:
4091   \__enumext_is_not_nested:
4092   \int_incr:N \l__enumext_level_h_int
4093   \int_compare:nNnT { \l__enumext_level_h_int } > { 1 }
4094   {
4095     \msg_error:nn { enumext } { nested }
4096   }
4097   \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
4098   {
4099     \msg_error:nnn { enumext } { nested-horizontal } { keyans*}
4100   }
4101   \bool_set_true:N \l__enumext_starred_bool
4102   \bool_set_false:N \l__enumext_standar_bool
4103   \__enumext_is_on_first_level:
4104 }

```

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

`\__enumext_parse_keys_vii:n` First we will clear the variable `\l__enumext_series_str` used by the key `series`, process the environment `[⟨key = val⟩]` and execute the function `\__enumext_parse_series:n` and used by the key `series`, then we execute the function `\__enumext_store_active_keys_vii:n` and reprocess the `⟨keys⟩` to pass them to the storage `⟨sequence⟩` if the key `save-key` is not active and finally we call the function `\__enumext-nested_base_line_fix:` used by the key `base-fix`.

```

4105 \cs_new_protected:Npn \__enumext_parse_keys_vii:n #1
4106 {
4107   \tl_if_novalue:nF {#1}
4108   {
4109     \str_clear:N \l__enumext_series_str
4110     \keys_set:nn { enumext / enumext* } {#1}
4111     \__enumext_parse_series:n {#1}
4112     \__enumext_store_active_keys_vii:n {#1}
4113     \__enumext_nested_base_line_fix:
4114   }
4115 }

```

(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*`.

```

4116 \cs_new_protected:Nn \__enumext_before_list_vii:
4117 {
4118   \__enumext_vspace_above_vii:
4119   \__enumext_check_ans_active:
4120   \__enumext_before_args_exec_vii:
4121   \__enumext_start_mini_vii:
4122 }

```

(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:` used by the keys `mini-env`, `mini-right` and `mini-right*`, then to the functions `\__enumext_after_stop-list_vii:` used by the key `after`, `\__enumext_check_ans_key_hook:` used by the key `check-ans`, `\__enumext_vspace_below_vii:` used by the keys `below` and `below*`. Finally set `\l__enumext_starred_bool` to false and call the `\__enumext_resume_save_counter:` function used by the `series`, `resume` and `resume*` keys.

```

4123 \cs_new_protected:Nn \__enumext_after_list_vii:
4124 {
4125   \__enumext_stop_mini_vii:
4126   \__enumext_after_stop_list_vii:

```

```

4127     \__enumext_check_ans_key_hook:
4128     \__enumext_vspace_below_vii:
4129     \bool_set_false:N \__enumext_starred_bool
4130     \__enumext_resume_save_counter:
4131 }

```

(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 level saving mechanism for storage in *(sequence)* of the \anskey command and anskey\* environment if enumext\* are nested in enumext.

```

4132 \cs_new_protected:Nn \__enumext_start_store_level_vii:
4133 {
4134     \bool_if:NT \__enumext_store_active_bool
4135     {
4136         \int_compare:nNt { \__enumext_level_int } > { 0 }
4137         {
4138             \__enumext_store_level_open_vii:
4139         }
4140     }
4141 }
4142 \cs_new_protected:Nn \__enumext_stop_store_level_vii:
4143 {
4144     \bool_if:NT \__enumext_store_active_bool
4145     {
4146         \int_compare:nNt { \__enumext_level_int } > { 0 }
4147         {
4148             \__enumext_store_level_close_vii:
4149         }
4150     }
4151 }

```

(End of definition for \\_\_enumext\_start\_store\_level\_vii: and \\_\_enumext\_stop\_store\_level\_vii:.)

### 12.43.1 The command \item in enumext\*

```
\__enumext_start_item_tmp_vii:
```

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.

```

4152 \cs_new_protected_nopar:Nn \__enumext_start_item_tmp_vii:
4153 {
4154     \__enumext_stop_item_tmp_vii:
4155     \int_incr:N \__enumext_item_column_pos_vii_int
4156     \int_gincr:N \g__enumext_item_count_all_vii_int
4157     \__enumext_item_peek_args_vii:
4158 }

```

(End of definition for \\_\_enumext\_start\_item\_tmp\_vii:.)

```
\__enumext_item_peek_args_vii:
```

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).

```

4159 \cs_new_protected:Nn \__enumext_item_peek_args_vii:
4160 {
4161     \peek_meaning:NTF (
4162     { \__enumext_joined_item_vii:w }
4163     { \__enumext_joined_item_vii:w (1) }
4164 }

```

(End of definition for \\_\_enumext\_item\_peek\_args\_vii:.)

```
\__enumext_joined_item_vii:w
```

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\_standard\_item\_vii:w.

```

4165 \cs_new_protected:Npn \__enumext_joined_item_vii:w (#1)
4166 {
4167     \__enumext_starred_joined_item_vii:n {#1}
4168     \peek_meaning_remove:NTF *

```

```

4169     { \__enumext_starred_item_vii:w }
4170     { \__enumext_standar_item_vii:w }
4171 }

```

(End of definition for \\_\_enumext\_joined\_item\_vii:w.)

\\_\_enumext\_standar\_item\_vii:w

The function \\_\_enumext\_standar\_item\_vii:w will first look for the argument “[”, if present it will set the state of the variable \l\_\_enumext\_wrap\_label\_opt\_vii\_bool equal to the state of the variable \l\_\_enumext\_wrap\_label\_opt\_vii\_bool handled by the key `wrap-label*` and finally execute the *non-enumerated* version `\item[⟨custom⟩]` by means of the function \\_\_enumext\_start\_item\_vii:w, otherwise we will set the value of the variable \l\_\_enumext\_wrap\_label\_vii\_bool handled by the `wrap-label` key to true and set the switch `\if@noitemarg` to true to execute the enumerated version of `\item` by means of the function \\_\_enumext\_start\_item\_vii:w [ \l\_\_enumext\_label\_vii\_tl ].

```

4172 \cs_new_protected:Npn \__enumext_standar_item_vii:w
4173 {
4174   \bool_set_false:N \l__enumext_item_starred_vii_bool
4175   \peek_meaning:NTF [
4176     {
4177       \bool_set_eq:NN
4178       \l__enumext_wrap_label_vii_bool
4179       \l__enumext_wrap_label_opt_vii_bool
4180       \__enumext_start_item_vii:w
4181     }
4182     {
4183       \bool_set_true:N \l__enumext_wrap_label_vii_bool
4184       \legacy_if_set_true:n { @noitemarg }
4185       \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ]
4186     }
4187   }

```

(End of definition for \\_\_enumext\_standar\_item\_vii:w.)

\\_\_enumext\_starred\_item\_vii:w

The function \\_\_enumext\_starred\_item\_vii:w together with the specified auxiliary functions `aux_i:w`, `aux_ii:w`, and `aux_iii:w` execute `\item*`, `\item*[⟨symbol⟩]` and `\item*[⟨symbol⟩][⟨offset⟩]`.

\\_\_enumext\_starred\_item\_vii\_aux\_i:w

\\_\_enumext\_starred\_item\_vii\_aux\_ii:w

\\_\_enumext\_starred\_item\_vii\_aux\_iii:w

```

4188 \cs_new_protected:Npn \__enumext_starred_item_vii:w
4189 {
4190   \bool_set_true:N \l__enumext_item_starred_vii_bool
4191   \bool_set_true:N \l__enumext_wrap_label_vii_bool
4192   \peek_meaning:NTF [
4193     { \__enumext_starred_item_vii_aux_i:w }
4194     { \__enumext_starred_item_vii_aux_ii:w }
4195   }
4196   \cs_new_protected:Npn \__enumext_starred_item_vii_aux_i:w [#1]
4197   {
4198     \tl_gset:Nn \g__enumext_item_symbol_aux_vii_tl {#1}
4199     \__enumext_starred_item_vii_aux_ii:w
4200   }
4201   \cs_new_protected:Npn \__enumext_starred_item_vii_aux_ii:w
4202   {
4203     \peek_meaning:NTF [
4204       { \__enumext_starred_item_vii_aux_iii:w }
4205       {
4206         \dim_set_eq:NN
4207         \l__enumext_item_symbol_sep_vii_dim
4208         \l__enumext_labelsep_vii_dim
4209         \legacy_if_set_true:n { @noitemarg }
4210         \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ]
4211       }
4212     }
4213   \cs_new_protected:Npn \__enumext_starred_item_vii_aux_iii:w [#1]
4214   {
4215     \dim_set:Nn \l__enumext_item_symbol_sep_vii_dim {#1}
4216     \legacy_if_set_true:n { @noitemarg }
4217     \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ]
4218   }

```

(End of definition for \\_\_enumext\_starred\_item\_vii:w and others.)

### 12.43.2 Real definition of `\item` in `enumext*`

`\\_enumext_start_item_vii:w`

The functions `\\_enumext_start_item_vii:w` and `\\_enumext_stop_item_vii:` executing the true definition of `\item` inside the `enumext*` environment. 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 and add the `hyperref` compatible `enumXvii` counter, after that we will start capturing the item content in a box. Here need setting the `\if@hyper@item` switch to “true” for `hyperref` compatible. The explanation for this is given by the master Heiko Oberdiek on `\refstepcounter{enumi}` twice (or more) creates destination with the same identifier.

```

4219 \cs_new_protected_nopar:Npn \\_enumext_start_item_vii:w [#1]
4220 {
4221   \cs_set_eq:NN \\_enumext_stop_item_tmp_vii: \\_enumext_stop_item_vii:
4222   \legacy_if:nT { @noitemarg }
4223   {
4224     \legacy_if_set_false:n { @noitemarg }
4225     \legacy_if:nT { @nmbrrlist }
4226     {
4227       \bool_if:NT \\_enumext_hyperref_bool
4228       {
4229         \legacy_if_set_true:n { @hyper@item }
4230       }
4231       \refstepcounter{enumXvii}
4232       \bool_if:NT \\_enumext_check_answers_bool
4233       {
4234         \int_gincr:N \\_enumext_item_number_int
4235         \bool_set_true:N \\_enumext_item_number_bool
4236       }
4237     }
4238   }

```

Here we start capturing `\item` and its contents into a group using the plain form of the `lrbox` environment. If the state of the variable `\\_enumext_footnotes_key_bool` is false, we will redefine the command `\footnote`, followed by printing the  $\langle symbol \rangle$  defined for `\item*` if it is present and open a new group inside which we execute `font key` next to `\item` and the keys `wrap-label`, `wrap-label*`, `align`, close the group and execute the key `labelsep` and then the key `first`. Finally we open the `minipage` environment and execute the `listparindent` key which will be equal to `\parindent`, the `parsep` key which will be equal to `\parskip` and the `itemindent` key.

```

4239 \group_begin:
4240   \lrbox{ \\_enumext_item_text_vii_box }
4241   \bool_if:NF \\_enumext_footnotes_key_bool
4242   {
4243     \\_enumext_renew_footnote:
4244   }
4245   \bool_if:NT \\_enumext_item_starred_vii_bool
4246   {
4247     \tl_if_blank:VT \\_enumext_item_symbol_aux_vii_tl
4248     {
4249       \tl_gset_eq:NN
4250       \\_enumext_item_symbol_aux_vii_tl \\_enumext_item_symbol_vii_tl
4251     }
4252     \mode_leave_vertical:
4253     \skip_horizontal:n { -\\_enumext_item_symbol_sep_vii_dim }
4254     \makebox[ 0pt ][ r ]{ \\_enumext_item_symbol_aux_vii_tl }
4255     \skip_horizontal:N \\_enumext_item_symbol_sep_vii_dim
4256     \tl_gclear:N \\_enumext_item_symbol_aux_vii_tl
4257   }
4258   \group_begin:
4259     \tl_use:N \\_enumext_label_font_style_vii_tl
4260     \bool_if:NTF \\_enumext_wrap_label_vii_bool
4261     {
4262       \makebox[ \\_enumext_labelwidth_vii_dim ][ \\_enumext_align_label_vii_str ]
4263       { \\_enumext_wrapper_label_vii:n {#1} }
4264     }
4265     {
4266       \makebox[ \\_enumext_labelwidth_vii_dim ][ \\_enumext_align_label_vii_str ]{ #1 }
4267     }
4268   \group_end:
4269   \skip_horizontal:N \\_enumext_labelsep_vii_dim
4270   \tl_use:N \\_enumext_after_list_args_vii_tl
4271   \\_enumext_minipage:w [ t ]{ \\_enumext_joined_width_vii_dim }
4272   \skip_set_eq:NN \parindent \\_enumext_listparindent_vii_dim

```

```

4273         \skip_set_eq:Nn \parskip \l__enumext_parsep_vii_skip
4274         \tl_use:N \l__enumext_fake_item_indent_vii_tl
4275     }

```

(End of definition for `\__enumext_start_item_vii:w`.)

`\__enumext_stop_item_vii:` The function `\__enumext_stop_item_vii:` shall terminate with the capture of `\item` and its *contents*. Close the environments `minipage`, `lrbox` and the group. Then we only have to set the width of the box and print it next to `\footnote`, and add the horizontal and vertical separation between the boxes.

```

4276 \cs_new_protected_nopar:Nn \__enumext_stop_item_vii:
4277 {
4278     \__enumext_endminipage:
4279     \endlrbox
4280     \group_end:
4281     \box_set_wd:Nn \l__enumext_item_text_vii_box
4282     {
4283         \l__enumext_joined_width_vii_dim
4284         + \l__enumext_labelwidth_vii_dim
4285         + \l__enumext_labelsep_vii_dim
4286     }
4287     \int_set:Nn \hbadness { 10000 }
4288     \box_use_drop:N \l__enumext_item_text_vii_box
4289     \bool_if:NF \l__enumext_footnotes_key_bool
4290     {
4291         \__enumext_print_footnote:
4292     }
4293     \int_compare:nNnTF { \l__enumext_item_column_pos_vii_int } = { \l__enumext_columns_vii_int }
4294     {
4295         \par\noindent
4296         \int_zero:N \l__enumext_item_column_pos_vii_int
4297     }
4298     { \hspace{ \l__enumext_columns_sep_vii_dim } }
4299 }

```

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

`\__enumext_remove_extra_parsep_vii:` Finally we will remove the vertical space equal to `\parsep` when the total number of items is divisible by the number of items in the last row of the environment.

```

4300 \cs_new_protected:Nn \__enumext_remove_extra_parsep_vii:
4301 {
4302     \int_compare:nNnT
4303     {
4304         \int_mod:nn { \g__enumext_item_count_all_vii_int } { \l__enumext_columns_vii_int }
4305     }
4306     =
4307     { 0 }
4308     {
4309         \par
4310         \vspace{ -\l__enumext_itemsep_vii_skip }
4311         \int_gzero:N \g__enumext_item_count_all_vii_int
4312     }
4313 }

```

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`.

```

4314 \__enumext_after_env:nn {enumext*} { \__enumext_execute_after_env: }

```

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

## 12.44 The environment `keyans*`

`keyans*` First we will generate the environment and we will give a temporary definition to `\__enumext_stop_item_tmp_viii:` equal to `\noindent` and next to `\item` equal to `\__enumext_start_item_tmp_viii:` which we will redefine later.

```

4315 \NewDocumentEnvironment{keyans*}{ o }
4316 {
4317     \__enumext_safe_exec_viii:
4318     \__enumext_parse_keys_viii:n {#1}
4319     \__enumext_before_list_viii:
4320     \__enumext_start_list:nn { }
4321 }

```



```

4322     \__enumext_list_arg_two_viii:
4323     \__enumext_before_keys_exec_viii:
4324     }
4325     \__enumext_starred_columns_set_viii:
4326     \item[] \scan_stop:
4327     \cs_set_eq:NN \__enumext_stop_item_tmp_viii: \noindent
4328     \cs_set_eq:NN \item \__enumext_start_item_tmp_viii:
4329     }
4330     {
4331     \__enumext_stop_item_tmp_viii:
4332     \__enumext_remove_extra_parsep_viii:
4333     \__enumext_check_starred_cmd:n { item }
4334     \__enumext_stop_list:
4335     \__enumext_after_list_viii:
4336     }

```

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

`\__enumext_safe_exec_viii:` First check the maximum nesting level for the `keyans*` environment.

```

4337 \cs_new_protected:Nn \__enumext_safe_exec_viii:
4338 {
4339     \int_incr:N \__enumext_keyans_level_h_int
4340     \int_compare:nNnT { \__enumext_keyans_level_h_int } > { 1 }
4341     {
4342         \msg_error:nn { enumext } { nested }
4343     }
4344     \__enumext_keyans_name_and_start:
4345     \bool_if:NT \__enumext_starred_bool
4346     {
4347         \msg_error:nnn { enumext } { nested-horizontal } { enumext* }
4348     }
4349     \bool_set_true:N \__enumext_starred_bool
4350     % Set false for interfering with enumext nested in keyans* (yes, its possible and crayze)
4351     \bool_set_false:N \__enumext_store_active_bool
4352     \int_compare:nNnT { \__enumext_level_int } > { 1 }
4353     {
4354         \msg_error:nn { enumext } { keyans-wrong-level }
4355     }
4356 }

```

(End of definition for `\__enumext_safe_exec_viii:`)

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

```

4357 \cs_new_protected:Npn \__enumext_parse_keys_viii:n #1
4358 {
4359     \tl_if_novalue:nF {#1}
4360     {
4361         \keys_set:nn { enumext / keyans* } {#1}
4362     }
4363 }

```

(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`.

```

4364 \cs_new_protected:Nn \__enumext_before_list_viii:
4365 {
4366     \__enumext_vspace_above_viii:
4367     \__enumext_before_args_exec_viii:
4368     \__enumext_start_mini_viii:
4369 }

```

(End of definition for `\__enumext_before_list_viii:`)

`\__enumext_after_list_viii:` The function `\__enumext_after_list:` 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.

```

4370 \cs_new_protected:Nn \__enumext_after_list_viii:
4371 {
4372     \__enumext_stop_mini_viii:

```

```

4373     \__enumext_after_stop_list_viii:
4374     \__enumext_vspace_below_viii:
4375 }

```

(End of definition for \\_\_enumext\_after\_list\_viii:.)

#### 12.44.1 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\_start\_item\_tmp\_viii:

First we will call the function `\__enumext_stop_item_tmp_viii:` that we will redefine later, we will increment the value of `\l__enumext_item_column_pos_viii_int` that will count the item's by rows and the value of `\g__enumext_item_count_all_viii_int` that will count the total of item's in the environment. After that we will call the function `\__enumext_item_peek_args_viii:` that will handle the arguments passed to `\item`.

```

4376 \cs_new_protected_nopar:Nn \__enumext_start_item_tmp_viii:
4377 {
4378     \__enumext_stop_item_tmp_viii:
4379     \int_incr:N \l__enumext_item_column_pos_viii_int
4380     \int_gincr:N \g__enumext_item_count_all_viii_int
4381     \__enumext_item_peek_args_viii:
4382 }

```

(End of definition for \\_\_enumext\_start\_item\_tmp\_viii:.)

\\_\_enumext\_item\_peek\_args\_viii:

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).

```

4383 \cs_new_protected:Nn \__enumext_item_peek_args_viii:
4384 {
4385     \peek_meaning:NTF (
4386         { \__enumext_joined_item_viii:w }
4387         { \__enumext_joined_item_viii:w (1) }
4388     }

```

(End of definition for \\_\_enumext\_item\_peek\_args\_viii:.)

\\_\_enumext\_joined\_item\_viii:w

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`.

```

4389 \cs_new_protected:Npn \__enumext_joined_item_viii:w (#1)
4390 {
4391     \__enumext_starred_joined_item_viii:n {#1}
4392     \peek_meaning_remove:NTF *
4393     { \__enumext_starred_item_viii:w }
4394     { \__enumext_standar_item_viii:w }
4395 }

```

(End of definition for \\_\_enumext\_joined\_item\_viii:w.)

\\_\_enumext\_standar\_item\_viii:w

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 ]`.

```

4396 \cs_new_protected:Npn \__enumext_standar_item_viii:w
4397 {
4398     \bool_set_false:N \l__enumext_item_starred_viii_bool
4399     \peek_meaning:NTF [
4400     {
4401         \bool_set_eq:NN
4402         \l__enumext_wrap_label_viii_bool
4403         \l__enumext_wrap_label_opt_viii_bool

```

```

4404     \__enumext_start_item_viii:w
4405   }
4406   {
4407     \bool_set_true:N \__enumext_wrap_label_viii_bool
4408     \legacy_if_set_true:n { @noitemarg }
4409     \__enumext_start_item_viii:w [ \__enumext_label_viii_tl ]
4410   }
4411 }

```

(End of definition for \\_\_enumext\_standar\_item\_viii:w.)

```

\__enumext_starred_item_viii:w
\__enumext_starred_item_viii_aux_i:w
\__enumext_starred_item_viii_aux_ii:w

```

The function \\_\_enumext\_starred\_item\_viii:w together with the specified auxiliary functions aux\_i:w and aux\_ii:w execute \item\* and \item\*[\langle content \rangle].

```

4412 \cs_new_protected:Npn \__enumext_starred_item_viii:w
4413 {
4414   \bool_set_true:N \__enumext_item_starred_viii_bool
4415   \bool_set_true:N \__enumext_wrap_label_viii_bool
4416   \peek_meaning:NTF [
4417     { \__enumext_starred_item_viii_aux_i:w }
4418     { \__enumext_starred_item_viii_aux_ii:w }
4419   }

```

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.

```

4420 \cs_new_protected:Npn \__enumext_starred_item_viii_aux_i:w [#1]
4421 {
4422   \tl_clear:N \l__enumext_store_current_label_tl
4423   \tl_if_no_value:nF { #1 }
4424   {
4425     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_tl
4426     {
4427       \tl_put_right:Ne \l__enumext_store_current_label_tl { \l__enumext_store_keyans_item_opt_sep_tl }
4428       \tl_put_right:Ne \l__enumext_store_current_label_tl { #1 }
4429     }
4430     \tl_set:Ne \l__enumext_store_current_opt_arg_tl { #1 }
4431   }
4432   \__enumext_starred_item_viii_aux_ii:w
4433 }
4434 \cs_new_protected:Npn \__enumext_starred_item_viii_aux_ii:w
4435 {
4436   \legacy_if_set_true:n { @noitemarg }
4437   \__enumext_start_item_viii:w [ \l__enumext_label_viii_tl ]
4438 }

```

(End of definition for \\_\_enumext\_starred\_item\_viii:w, \\_\_enumext\_starred\_item\_viii\_aux\_i:w, and \\_\_enumext\_starred\_item\_viii\_aux\_ii:w.)

```
\__enumext_starred_item_exec:
```

The function \\_\_enumext\_starred\_item\_exec: will be in charge of storing the current \langle label \rangle for \item\* followed by the [\langle content \rangle] for \item\*[\langle content \rangle] if present in the \langle sequence \rangle and \langle prop list \rangle set by the save-ans key. In this same function the keys show-ans, show-pos and save-ref are implemented.

```

4439 \cs_new_protected:Nn \__enumext_starred_item_exec:
4440 {
4441   \tl_put_left:Ne \l__enumext_store_current_label_tl { \l__enumext_label_viii_tl }
4442   \__enumext_store_addto_prop:V \l__enumext_store_current_label_tl
4443   \__enumext_keyans_store_ref:
4444   \tl_put_left:Ne \l__enumext_store_current_label_tl { \item }
4445   \__enumext_keyans_addto_seq_link:
4446   \int_gincr:N \g__enumext_check_starred_cmd_int
4447   \bool_if:NT \l__enumext_show_answer_bool
4448   {
4449     \__enumext_print_keyans_box:NN \l__enumext_labelwidth_i_dim \l__enumext_labelsep_i_dim
4450   }
4451   \bool_if:NT \l__enumext_show_position_bool
4452   {
4453     \tl_set:Ne \l__enumext_mark_answer_sym_tl
4454     {
4455       \group_begin:
4456       \exp_not:N \normalfont
4457       \exp_not:N \footnotesize [ \int_eval:n

```

```

4458         {
4459             \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
4460         }
4461     ]
4462     \group_end:
4463 }
4464 \__enumext_print_keyans_box:NN \l__enumext_labelwidth_i_dim \l__enumext_labelsep_i_dim
4465 }
4466 }

```

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

#### 12.44.2 Real definition of `\item` in `keyans*`

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

```

4467 \cs_new_protected_nopar:Npn \__enumext_start_item_viii:w [#1]
4468 {
4469     \cs_set_eq:NN \__enumext_stop_item_tmp_viii: \__enumext_stop_item_viii:
4470     \legacy_if:nT { @noitemarg }
4471     {
4472         \legacy_if_set_false:n { @noitemarg }
4473         \legacy_if:nT { @nmbrrlist }
4474         {
4475             \bool_if:NT \l__enumext_hyperref_bool
4476             {
4477                 \legacy_if_set_true:n { @hyper@item }
4478             }
4479             \refstepcounter{enumXviii}
4480         }
4481     }

```

Here we start capturing `\item` and its contents into a group using the plain form of the `lrbox` environment.

```

4482     \group_begin:
4483     \lrbox{ \l__enumext_item_text_viii_box }
4484     \bool_if:NF \l__enumext_footnotes_key_bool
4485     {
4486         \__enumext_renew_footnote:
4487     }
4488     \bool_if:NT \l__enumext_item_starred_viii_bool
4489     {
4490         \__enumext_starred_item_exec:
4491     }
4492     \group_begin:
4493     \tl_use:N \l__enumext_label_font_style_viii_tl
4494     \bool_if:NTF \l__enumext_wrap_label_viii_bool
4495     {
4496         \makebox[ \l__enumext_labelwidth_viii_dim ][ \l__enumext_align_label_viii_str ]
4497         { \__enumext_wrapper_label_viii:n {#1} }
4498     }
4499     {
4500         \makebox[ \l__enumext_labelwidth_viii_dim ][ \l__enumext_align_label_viii_str ]{ #1
4501     }
4502     \group_end:
4503     \skip_horizontal:N \l__enumext_labelsep_viii_dim
4504     \tl_use:N \l__enumext_after_list_args_viii_tl
4505     \__enumext_minipage:w [ t ]{ \l__enumext_joined_width_viii_dim }
4506     \skip_set_eq:NN \parindent \l__enumext_listparindent_viii_dim
4507     \skip_set_eq:NN \parskip \l__enumext_parsep_viii_skip
4508     \bool_if:NT \l__enumext_item_starred_viii_bool
4509     {
4510         \tl_use:N \l__enumext_fake_item_indent_viii_tl
4511         \__enumext_keyans_show_item_opt:
4512         \skip_horizontal:n { -\l__enumext_fake_item_indent_viii_dim - \l__enumext_labelsep_viii_dim
4513     }
4514     {
4515         \tl_use:N \l__enumext_fake_item_indent_viii_tl
4516     }
4517 }

```

(End of definition for `\__enumext_start_item_viii:w`.)

`\__enumext_stop_item_viii:` The function `\__enumext_stop_item_viii:` shall terminate with the capture of `\item` and its *contents*. Close the environments `minipage`, `lrbox` and the group. Then we only have to set the width of the box and print it next to `\footnote`, and add the horizontal and vertical separation between the boxes.

```

4518 \cs_new_protected_nopar:Nn \__enumext_stop_item_viii:
4519 {
4520     \__enumext_endminipage:
4521     \endlrbox
4522     \group_end:
4523     \box_set_wd:Nn \l__enumext_item_text_viii_box
4524     {
4525         \l__enumext_joined_width_viii_dim
4526         + \l__enumext_labelwidth_viii_dim
4527         + \l__enumext_labelsep_viii_dim
4528     }
4529     \int_set:Nn \hbadness { 10000 }
4530     \box_use_drop:N \l__enumext_item_text_viii_box
4531     \bool_if:NF \l__enumext_footnotes_key_bool
4532     {
4533         \__enumext_print_footnote:
4534     }
4535     \int_compare:nNnTF
4536     { \l__enumext_item_column_pos_viii_int } = { \l__enumext_columns_viii_int }
4537     {
4538         \par\noindent
4539         \int_zero:N \l__enumext_item_column_pos_viii_int
4540     }
4541     { \hspace{ \l__enumext_columns_sep_viii_dim } }
4542 }

```

(End of definition for `\__enumext_stop_item_viii:`)

`\__enumext_remove_extra_parsep_viii:` Finally we will remove the vertical space equal to `\parsep` when the total number of items is divisible by the number of items in the last row of the environment.

```

4543 \cs_new_protected:Nn \__enumext_remove_extra_parsep_viii:
4544 {
4545     \int_compare:nNnT
4546     {
4547         \int_mod:nn
4548         { \g__enumext_item_count_all_viii_int }
4549         { \l__enumext_columns_viii_int }
4550     }
4551     =
4552     { 0 }
4553     {
4554         \par
4555         \vspace{ -\l__enumext_itemsep_viii_skip }
4556         \int_gzero:N \g__enumext_item_count_all_viii_int
4557     }
4558 }

```

(End of definition for `\__enumext_remove_extra_parsep_viii:`)

## 12.45 The command `\getkeyans`

`\getkeyans` The `\getkeyans` command takes a mandatory argument of the form  $\{\langle store\ name\rangle:\langle position\rangle\}$ . Retrieve a “single” content stored by `\anskey`, `\anspic*` and `\item*` from *prop list* defined by `save-ans` key.

```

4559 \NewDocumentCommand \getkeyans { m }
4560 {
4561     \exp_args:Ne \__enumext_getkeyans_aux:n
4562     { \tl_to_str:e { \text_expand:n {#1} } }
4563 }

```

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

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

```

4564 \cs_new_protected:Npn \__enumext_getkeyans_aux:n #1
4565 {
4566     \str_if_in:nnTF {#1} { : }
4567     {
4568         \use:e

```

```

4569         {
4570             \cs_set:Npn \exp_not:N \__enumext_tmp:w ##1 \c_colon_str ##2 \scan_stop:
4571             { {##1} {##2} }
4572         }
4573         \exp_after:wN \__enumext_getkeyans:nn \__enumext_tmp:w #1 \scan_stop:
4574     }
4575     { \msg_error:nnn { enumext } { missing-colon } {#1} }
4576 }

```

(End of definition for \\_\_enumext\_getkeyans\_aux:n.)

\\_\_enumext\_getkeyans:nn 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*.

```

4577 \cs_new_protected:Npn \__enumext_getkeyans:nn #1 #2
4578 {
4579     \prop_if_exist:cTF { g__enumext_#1_prop }
4580     {
4581         \prop_item:cn { g__enumext_#1_prop }{#2}
4582     }
4583     {
4584         \msg_error:nnn { enumext } { undefined-storage-anskey } {#1}
4585     }
4586 }

```

(End of definition for \\_\_enumext\_getkeyans:nn.)

## 12.46 The command \printkeyans

The `\printkeyans` command prints “all stored content” in the *sequence* defined by the `save-ans` key. The first thing we will do is define a set of *filtered keys* with which we will control the options of the different nesting levels for the environment `enumext` and `enumext*` by storing their values in the list of tokens `\l__enumext_print_keyans_X_tl`.

The variable `\l__enumext_print_keyans_starred_tl` will have the default *keys* for `\printkeyans*` and will be set by `\setenumext[⟨print*⟩]` and the variable `\l__enumext_print_keyans_vii_tl` will have the default keys for the environment `enumext*` nested within the *sequence* and will be set by `\setenumext[⟨print,*⟩]`, the rest of the variables will be for the environment `enumext` and will be set by `\setenumext[⟨print,level⟩]`.

```

4587 \keys_define:nn { enumext / print }
4588 {
4589     print* .code:n      = \keys_precompile:neN { enumext / enumext* }
4590                     { \__enumext_filter_save_key:n {#1} }
4591                     \l__enumext_print_keyans_starred_tl, % starred cmd
4592     print* .initial:n   = { nosep, label=\arabic*, columns=2, first=\small, font=\small },
4593     print-1 .code:n     = \keys_precompile:neN { enumext / level-1 }
4594                     { \__enumext_filter_save_key:n {#1} }
4595                     \l__enumext_print_keyans_i_tl,
4596     print-1 .initial:n  = { nosep, label=\arabic*, columns=2, first=\small, font=\small },
4597     print-2 .code:n     = \keys_precompile:neN { enumext / level-2 }
4598                     { \__enumext_filter_save_key:n {#1} }
4599                     \l__enumext_print_keyans_ii_tl,
4600     print-2 .initial:n  = { nosep, label=(\alph*), first=\small, font=\small },
4601     print-3 .code:n     = \keys_precompile:neN { enumext / level-3 }
4602                     { \__enumext_filter_save_key:n {#1} }
4603                     \l__enumext_print_keyans_iii_tl,
4604     print-3 .initial:n  = { nosep, label=\roman*, first=\small, font=\small },
4605     print-4 .code:n     = \keys_precompile:neN { enumext / level-4 }
4606                     { \__enumext_filter_save_key:n {#1} }
4607                     \l__enumext_print_keyans_iv_tl,
4608     print-4 .initial:n  = { nosep, label=\Alph*, first=\small, font=\small },
4609     print-* .code:n     = \keys_precompile:neN { enumext / enumext* }
4610                     { \__enumext_filter_save_key:n {#1} }
4611                     \l__enumext_print_keyans_vii_tl, % starred nested
4612     print-* .initial:n  = { nosep, label=\arabic*, first=\small, font=\small },
4613 }

```

- 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` 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`.

```

4614 \NewDocumentCommand \printkeyans { s O{} m }
4615 {
4616   \group_begin:
4617     \tl_use:N \__enumext_print_keyans_i_tl
4618     \tl_use:N \__enumext_print_keyans_ii_tl
4619     \tl_use:N \__enumext_print_keyans_iii_tl
4620     \tl_use:N \__enumext_print_keyans_iv_tl
4621     \tl_use:N \__enumext_print_keyans_vii_tl
4622     \__enumext_printkeyans:nnn { #1 } { #2 } { #3 }
4623   \group_end:
4624 }

```

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

`\__enumext_printkeyans:nnn` 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.

```

4625 \cs_new_protected:Npn \__enumext_printkeyans:nnn #1 #2 #3
4626 {
4627   \seq_if_exist:cTF { g__enumext_#3_seq }
4628   {
4629     \seq_if_empty:cF { g__enumext_#3_seq }
4630     {
4631       %%\seq_show:c { g__enumext_#3_seq }

```

If the starred argument is present we will check that the environment `enumext*` is not saved in the *⟨sequence⟩*, then execute the variable `\__enumext_print_keyans_starred_tl` that contains the default *⟨keys⟩* for the environment `enumext*`, it will open the environment `enumext*` passing the optional argument to the “first level”, set the key `base-fix` and then will map the *⟨sequence⟩*.

```

4632       \bool_if:nTF {#1}
4633       {
4634         \seq_if_in:cnTF { g__enumext_#3_seq } { \end{enumext*} }
4635         {
4636           \msg_error:nnnn { enumext } { print-starred } {#3} { enumext* }
4637         }
4638         {
4639           \tl_use:N \__enumext_print_keyans_starred_tl
4640           \begin{enumext*}[#2]
4641             \keys_set:nn { enumext / level-1 }{ base-fix }
4642             \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
4643             \end{enumext*}
4644           }
4645       }

```

Otherwise it will open the environment `enumext` passing the optional argument to the “first level”, set the key `base-fix` and then map the *⟨sequence⟩*.

```

4646       {
4647         \begin{enumext}[#2]
4648         \keys_set:nn { enumext / enumext* }{ base-fix }
4649         \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
4650         \end{enumext}
4651       }
4652     }
4653   }
4654   {
4655     \msg_error:nnn { enumext } { undefined-storage-anskey } {#3}
4656   }
4657 }

```

(End of definition for `\__enumext_printkeyans:nnn`.)

## 12.47 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.

`\__enumext_filter_first_level:n` 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`.

```

4658 \cs_new:Npn \__enumext_filter_first_level:n #1

```



```

4659 {
4660     \use:e
4661     {
4662         \keyval_parse:NNn
4663         \__enumext_filter_first_level_key:n
4664         \__enumext_filter_first_level_pair:nn {#1}
4665     }
4666 }

```

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*`.

```

4667 \cs_new:Npn \__enumext_filter_first_level_key:n #1
4668 {
4669     \str_case:nnF {#1}
4670     {
4671         { resume } {}
4672         { resume* } {}
4673     }
4674     { , { \exp_not:n {#1} } }
4675 }

```

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.

```

4676 \cs_new:Npn \__enumext_filter_first_level_pair:nn #1#2
4677 {
4678     \str_case:nnF {#1}
4679     {
4680         { series } {}
4681         { resume } {}
4682         { save-ans } {}
4683     }
4684     { , { \exp_not:n {#1} } = { \exp_not:n {#2} } }
4685 }

```

(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`.

```

4686 \keys_define:nn { enumext / meta-families }
4687 {
4688     enumext-1 .code:n =
4689     {
4690         \keys_set:ne { enumext / level-1 }
4691         {
4692             \__enumext_filter_first_level:n {#1}
4693         }
4694     } ,
4695     enumext-2 .code:n = { \keys_set:nn { enumext / level-2 } {#1} } ,
4696     enumext-3 .code:n = { \keys_set:nn { enumext / level-3 } {#1} } ,
4697     enumext-4 .code:n = { \keys_set:nn { enumext / level-4 } {#1} } ,
4698     keyans .code:n = { \keys_set:nn { enumext / keyans } {#1} } ,
4699     enumext* .code:n =
4700     {
4701         \keys_set:ne { enumext / enumext* }
4702         {
4703             \__enumext_filter_first_level:n {#1}
4704         }
4705     } ,
4706     keyans* .code:n = { \keys_set:nn { enumext / keyans* } {#1} } ,
4707     print* .code:n = { \keys_set:nn { enumext / print } { print* = {#1} } } ,
4708     print-1 .code:n = { \keys_set:nn { enumext / print } { print-1 = {#1} } } ,
4709     print-2 .code:n = { \keys_set:nn { enumext / print } { print-2 = {#1} } } ,
4710     print-3 .code:n = { \keys_set:nn { enumext / print } { print-3 = {#1} } } ,
4711     print-4 .code:n = { \keys_set:nn { enumext / print } { print-4 = {#1} } } ,
4712     print-* .code:n = { \keys_set:nn { enumext / print } { print-* = {#1} } } ,
4713     unknown .code:n = { \msg_error:nn { enumext } { unknown-key-family } } ,
4714 }

```

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

```

4715 \seq_const_from_clist:Nn \c__enumext_all_families_seq
4716 {
4717     enumext-1, enumext-2, enumext-3, enumext-4, keyans, enumext*,
4718     keyans*, print-1, print-2, print-3, print-4, print-*, print*,
4719 }

```

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

```

4720 \NewDocumentCommand \setenumext { 0{enumext,1} +m }
4721 {
4722   \seq_clear:N \l__enumext_setkey_tmpa_seq
4723   \seq_set_from_clist:Nn \l__enumext_setkey_tmpb_seq {#1}
4724   \int_set:Nn \l__enumext_setkey_tmpa_int
4725   {
4726     \seq_count:N \l__enumext_setkey_tmpb_seq
4727   }
4728   \int_compare:nNnTF { \l__enumext_setkey_tmpa_int } > { 1 }
4729   {
4730     \seq_pop_left:NN \l__enumext_setkey_tmpb_seq \l__enumext_setkey_tmpa_tl
4731     \seq_map_function:NN \l__enumext_setkey_tmpb_seq \__enumext_set_parse:n
4732     \seq_set_map_e:NNn \l__enumext_setkey_tmpa_seq \l__enumext_setkey_tmpa_seq
4733     {
4734       \tl_use:N \l__enumext_setkey_tmpa_tl - ##1
4735     }
4736   }
4737   {
4738     \seq_put_right:Ne \l__enumext_setkey_tmpa_seq { \tl_trim_spaces:n {#1} }
4739   }
4740   \seq_if_empty:NNTF \l__enumext_setkey_tmpa_seq
4741   { \seq_map_inline:Nn \c__enumext_all_families_seq }
4742   { \seq_map_inline:Nn \l__enumext_setkey_tmpa_seq }
4743   {
4744     \keys_set:nn { enumext / meta-families } { ##1 = {#2} }
4745   }
4746 }

```

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

`\__enumext_set_parse:n`  
`\__enumext_set_error:nn`

Internal functions used by the `\setenumext` command.

```

4747 \cs_new_protected:Npn \__enumext_set_parse:n #1
4748 {
4749   \tl_set:Ne \l__enumext_setkey_tmpb_tl { \tl_trim_spaces:n {#1} }
4750   \clist_map_inline:nn { 0, 1, 2, 3, 4, * } % <- max level
4751   { \tl_remove_all:Nn \l__enumext_setkey_tmpb_tl {##1} }
4752   \tl_if_empty:NNTF \l__enumext_setkey_tmpb_tl
4753   {
4754     \seq_put_right:Ne \l__enumext_setkey_tmpa_seq
4755     { \tl_trim_spaces:n {#1} }
4756   }
4757   { \__enumext_set_error:nn {#1} { } }
4758 }
4759 \cs_new_protected:Npn \__enumext_set_error:nn #1 #2
4760 { \msg_error:nnn { enumext } { invalid-key } {#1} {#2} }

```

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

## 12.48 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
4761 \prop_const_from_keyval:Nn \c__enumext_meta_paths_prop
4762 {
4763   {enumext,1} = level-1,
4764   {enumext,2} = level-2,
4765   {enumext,3} = level-3,
4766   {enumext,4} = level-4,
4767   {enumext*} = enumext*
4768 }

```

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

```

4769 \NewDocumentCommand \setenumextmeta { s 0{enumext,1} m +m }
4770 {
4771   \str_if_eq:eeTF { \tl_trim_spaces:n {#3} } { unknown }
4772   { \msg_error:nn { enumext } { prohibited-unknown } }
4773   {
4774     \bool_if:nTF {#1}

```

```

4775     {
4776         \int_step_inline:nn { 4 }
4777         { \__enumext_add_meta_key:nnn { enumext, ##1 } {#3} {#4} }
4778         \__enumext_add_meta_key:nnn { enumext* } {#3} {#4}
4779     }
4780     { \__enumext_add_meta_key:nnn {#2} {#3} {#4} }
4781 }
4782 }

```

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

```

4783 \cs_new_protected:Npn \__enumext_add_meta_key:nnn #1
4784 {
4785     \tl_set:Nn \l__enumext_meta_path_tl {#1}
4786     \tl_replace_all:Nnn \l__enumext_meta_path_tl { ~ } {}
4787     \prop_get:NVNTF
4788     \c__enumext_meta_paths_prop \l__enumext_meta_path_tl \l__enumext_meta_path_tl
4789     { \__enumext_def_meta_key:Vnn \l__enumext_meta_path_tl }
4790     {
4791         \msg_error:nnn { enumext } { unknown-set } {#1}
4792         \use_none:nn
4793     }
4794 }
4795 \cs_new_protected:Npn \__enumext_def_meta_key:nnn #1#2#3
4796 {
4797     \bool_lazy_or:nnTF
4798     { \keys_if_exist_p:nn { enumext / #1 } {#2} }
4799     { \keys_if_exist_p:nn { enumext / enumext* } {#2} }
4800     { \msg_error:nnn { enumext } { already-defined } {#2} }
4801     {
4802         \keys_define:nn { enumext / #1 }
4803         {
4804             #2 .meta:n = {#3},
4805             #2 .value_forbidden:n = true
4806         }
4807     }
4808 }
4809 \cs_generate_variant:Nn \__enumext_def_meta_key:nnn { V }

```

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

## 12.49 The command `\foreachkeyans`

The command `\foreachkeyans` will execute a *loop* over the *(prop list)* and return its contents. The implementation code is adapted from the answer provided by Enrico Gregorio (@egreg) in [Expand a .cs defined by key inside the function](#).

### `\foreachkeyans`

```

\__enumext_parse_foreach_keys:nn
\__enumext_parse_foreach_keys:n
\__enumext_foreach_keyans:nn
\__enumext_foreach_add_body:n

```

We define a set of *(keys)* for command and we will save the default values of these in `\g__enumext_foreach_default_keys_tl` to avoid the use of group.

```

4810 \keys_define:nn { enumext / foreach }
4811 {
4812     before .tl_set:N = \l__enumext_foreach_before_tl,
4813     before .value_required:n = true,
4814     after .tl_set:N = \l__enumext_foreach_after_tl,
4815     after .value_required:n = true,
4816     start .int_set:N = \l__enumext_foreach_start_int,
4817     start .value_required:n = true,
4818     stop .int_set:N = \l__enumext_foreach_stop_int,
4819     stop .value_required:n = true,
4820     step .int_set:N = \l__enumext_foreach_step_int,
4821     step .value_required:n = true,
4822     wrapper .cs_set_protected:Np = \__enumext_foreach_wrapper:n #1,
4823     wrapper .value_required:n = true,
4824     sep .tl_set:N = \l__enumext_foreach_sep_tl,
4825     sep .value_required:n = true,
4826     unknown .code:n = { \__enumext_parse_foreach_keys:n {#1} }
4827 }
4828 \keys_precompile:nnN { enumext / foreach }
4829 {
4830     before={},after={},start=1,step=1,stop=0,wrapper=#1,sep=
4831 }
4832 \g__enumext_foreach_default_keys_tl

```

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

```

4833 \cs_new_protected:Npn \__enumext_parse_foreach_keys:nn #1#2
4834 {
4835   \tl_if_blank:nTF {#2}
4836   {
4837     \msg_error:nnn { enumext } { for-key-unknown } {#1}
4838   }
4839   {
4840     \msg_error:nnnn { enumext } { for-key-value-unknown } {#1} {#2}
4841   }
4842 }
4843 \cs_new_protected:Npn \__enumext_parse_foreach_keys:n #1
4844 {
4845   \exp_args:NV \__enumext_parse_foreach_keys:nn \l_keys_key_str {#1}
4846 }

```

We create the command.

```

4847 \NewDocumentCommand \foreachkeyans { +0{ } m }
4848 {
4849   \__enumext_foreach_keyans:nn {#1} {#2}
4850 }

```

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

```

4851 \cs_new_protected:Npn \__enumext_foreach_keyans:nn #1 #2
4852 {
4853   \tl_use:N \g__enumext_foreach_default_keys_tl
4854   \keys_set:nn { enumext / foreach } {#1}
4855   \tl_set:Nn \l__enumext_foreach_name_prop_tl {#2}
4856   \prop_if_exist:cF { g__enumext_#2_prop }
4857   {
4858     \msg_error:nnn { enumext } { undefined-storage-anskey } {#2}
4859   }
4860   \int_compare:nNt { \l__enumext_foreach_stop_int } = { 0 }
4861   {
4862     \int_set:Nn \l__enumext_foreach_stop_int
4863     { \prop_count:c { g__enumext_#2_prop } }
4864   }
4865   \seq_clear:N \l__enumext_foreach_print_seq
4866   \int_step_function:nnnN
4867   { \l__enumext_foreach_start_int }
4868   { \l__enumext_foreach_step_int }
4869   { \l__enumext_foreach_stop_int }
4870   \__enumext_foreach_add_body:n
4871   \seq_use:NV \l__enumext_foreach_print_seq \l__enumext_foreach_sep_tl
4872 }
4873 \cs_new_protected:Npn \__enumext_foreach_add_body:n #1
4874 {
4875   \seq_put_right:Ne \l__enumext_foreach_print_seq
4876   {
4877     \exp_not:V \l__enumext_foreach_before_tl
4878     \__enumext_foreach_wrapper:n
4879     {
4880       \prop_item:cn { g__enumext_ \l__enumext_foreach_name_prop_tl _prop }{#1}
4881     }
4882     \exp_not:V \l__enumext_foreach_after_tl
4883   }
4884 }

```

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

## 12.50 Messages

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

```

4885 \msg_new:nnn { enumext } { package-load }
4886 {
4887   The ~ '#1' ~ package ~ is ~ already ~ loaded.
4888 }
4889 \msg_new:nnn { enumext } { package-not-load }
4890 {
4891   The ~ '#1' ~ package ~ will ~ be ~ loaded ~ as ~ a ~ dependency.
4892 }

```

```

4893 \msg_new:nnn { enumext } { package-load-foot }
4894 {
4895   The ~ '#1' ~ package ~ is ~ loaded ~ with ~ the ~ option ~ '#2'.
4896 }

```

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

```

4897 \msg_new:nnn { enumext } { counters }
4898 {
4899   The ~ counter ~ '#1' ~ is ~ already ~ defined ~ by ~ some ~ \\
4900   package ~ or ~ macro, ~ it ~ cannot ~ be ~ continued.
4901 }

```

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

```

4902 \msg_new:nnn { enumext } { unknown-choice }
4903 {
4904   The ~ value ~ '#3' ~ for ~ '#1' ~ key ~ is ~ invalid ~ use ~ ('#2').
4905 }

```

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

```

4906 \msg_new:nnnn { enumext } { anskey-env-error }
4907 {
4908   The ~ '#1' ~ environment ~is~ reserved ~ by ~\\
4909   'enumext' ~ package, ~ It~ is~ already~ defined.
4910 }
4911 {
4912   The ~ anskey* ~ environment ~ is ~ defined ~ internally ~
4913   for ~ the ~ 'save-ans' ~ key.\\
4914 }

```

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

```

4915 \msg_new:nnn { enumext } { store-prop }
4916 {
4917   * ~ Package ~ enumext: ~ Creating ~
4918   \c_backslash_str g__enumext_#1_prop ~ \msg_line_context:.
4919 }
4920 \msg_new:nnn { enumext } { store-seq }
4921 {
4922   * ~ Package ~ enumext: ~ Creating ~
4923   \c_backslash_str g__enumext_#1_seq ~ \msg_line_context:.
4924 }
4925 \msg_new:nnn { enumext } { store-int }
4926 {
4927   * ~ Package ~ enumext: ~ Creating ~
4928   \c_backslash_str g__enumext_resume_#1_int ~ \msg_line_context:.
4929 }
4930 \msg_new:nnn { enumext } { prop-seq-int-hook }
4931 {
4932   * ~ Package ~ enumext: ~ Elements ~ in ~
4933   \c_backslash_str g__enumext_#1_prop ~ = ~ #2.\\
4934   * ~ Package ~ enumext: ~ Elements ~ in ~
4935   \c_backslash_str g__enumext_#1_seq ~ = ~ #3.\\
4936   * ~ Package ~ enumext: ~ Value ~ off ~
4937   \c_backslash_str g__enumext_resume_#1_int ~ = ~ #4.
4938 }
4939 \msg_new:nnn { enumext } { item-answer-hook }
4940 {
4941   * ~ Package ~ enumext: ~ Value ~ off ~
4942   \c_backslash_str g__enumext_item_number_int ~ = ~ #1.\\
4943   * ~ Package ~ enumext: ~ Value ~ off ~
4944   \c_backslash_str g__enumext_item_anskey_int ~ = ~ #2.\\
4945   * ~ Package ~ enumext: ~ Difference ~ item_number_int ~ - ~ item_anskey_int ~ = ~ #3.
4946 }

```

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

```

4947 \msg_new:nnn { enumext } { invalid-key }
4948 {
4949   The ~ key ~ '#1' ~ is ~ not ~ know ~ the ~ level ~ #2.
4950 }
4951 \msg_new:nnn { enumext } { unknown-key-family }
4952 {
4953   Unknown~key~family~`\_keys_key_str'~for~enumext.
4954 }

```

Messages used in length calculation.

```

4955 \msg_new:nnn { enumext } { width-negative }
4956 {
4957   Ignoring ~ negative ~ value ~ '#1=#2' ~ \msg_line_context:.\
4958   The ~ key ~ '#1'~ accepts ~ values ~ >= ~ opt.
4959 }
4960 \msg_new:nnn { enumext } { width-zero }
4961 {
4962   Invalid ~ '#1=#2' ~ \msg_line_context:.\
4963   The ~ key ~ '#1'~ accepts ~ values ~ > ~ opt.
4964 }

```

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

```

4965 \msg_new:nnn { enumext } { list-lengths }
4966 {
4967   **** ~ Lengths ~ used ~ by ~ 'enumext' ~ level ~ '#2' ~ \msg_line_context:~\c_space_tl ****\
4968   \__enumext_show_length:nnn { dim } { labelsep } {#1}
4969   \__enumext_show_length:nnn { dim } { labelwidth } {#1}
4970   \__enumext_show_length:nnn { dim } { itemindent } {#1}
4971   \__enumext_show_length:nnn { dim } { leftmargin } {#1}
4972   \__enumext_show_length:nnn { dim } { rightmargin } {#1}
4973   \__enumext_show_length:nnn { dim } { listparindent } {#1}
4974   \__enumext_show_length:nnn { skip } { topsep } {#1}
4975   \__enumext_show_length:nnn { skip } { parsep } {#1}
4976   \__enumext_show_length:nnn { skip } { partopsep } {#1}
4977   \__enumext_show_length:nnn { skip } { itemsep } {#1}
4978   ****
4979 }

```

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

```

4980 \msg_new:nnn { enumext } { list-lengths-not-nested }
4981 {
4982   **** ~ Lengths ~ used ~ by ~ '#2' ~ environment ~ \msg_line_context:~\c_space_tl ****\
4983   \__enumext_show_length:nnn { dim } { labelsep } {#1}
4984   \__enumext_show_length:nnn { dim } { labelwidth } {#1}
4985   \__enumext_show_length:nnn { dim } { itemindent } {#1}
4986   \__enumext_show_length:nnn { dim } { leftmargin } {#1}
4987   \__enumext_show_length:nnn { dim } { rightmargin } {#1}
4988   \__enumext_show_length:nnn { dim } { listparindent } {#1}
4989   \__enumext_show_length:nnn { skip } { topsep } {#1}
4990   \__enumext_show_length:nnn { skip } { parsep } {#1}
4991   \__enumext_show_length:nnn { skip } { partopsep } {#1}
4992   \__enumext_show_length:nnn { skip } { itemsep } {#1}
4993   ****
4994 }

```

Messages used by `ref` key.

```

4995 \msg_new:nnn { enumext } { key-ref-empty }
4996 {
4997   Key ~ 'ref' ~ need ~ a ~ value ~ in ~ '#1'~ \msg_line_context:.
4998 }

```

Messages used by `save-ans` key.

```

4999 \msg_new:nnn { enumext } { save-ans-empty }
5000 {
5001   Key ~ 'save-ans' ~ need ~ a ~ value ~ in ~ '#1'~ \msg_line_context:.
5002 }
5003 \msg_new:nnn { enumext } { save-ans-log }
5004 {
5005   * ~ Package ~ enumext: ~ Start ~ #1\c_space_tl with ~ save-ans=#2 ~ \msg_line_context:.
5006 }
5007 \msg_new:nnn { enumext } { save-ans-log-hook }
5008 {
5009   * ~ Package ~ enumext: ~ Stop ~ #1\c_space_tl with ~ save-ans=#2 ~ \msg_line_context:.
5010 }
5011 \msg_new:nnn { enumext } { save-ans-hook }
5012 {
5013   Stop ~ storing ~ for ~ 'save-ans=#1' ~ \msg_line_context:.
5014 }

```

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

```

5015 \msg_new:nnn { enumext } { need-save-ans }
5016 {

```

```

5017     Key ~ '#1' ~ works ~ only ~ with ~ the ~ 'save-ans' ~ key ~ in ~ '#2' ~ \msg_line_context:.
5018 }
5019 \msg_new:nnn { enumext } { items-same-answer }
5020 {
5021     *****\
5022     * ~ Package ~ enumext: ~ Checking ~ answers ~ in ~ '#1' ~
5023     for ~ \c_left_brace_str #2 \c_right_brace_str\
5024     * ~ started ~ #3 ~ and ~ close ~ \msg_line_context: : ~
5025     'OK', ~ all ~ items ~ with ~ answer.\
5026     *****
5027 }
5028 \msg_new:nnn { enumext } { item-greater-answer }
5029 {
5030     Checking ~ answers ~ in ~ '#1' ~ for ~ \c_left_brace_str #2 \c_right_brace_str\
5031     started ~ #3 ~ and ~ close ~ \msg_line_context: : ~ 'NOT ~ OK'\
5032     Items ~ > ~ Answers.
5033 }
5034 \msg_new:nnn { enumext } { item-less-answer }
5035 {
5036     Checking ~ answers ~ in ~ '#1' ~ for ~ \c_left_brace_str #2 \c_right_brace_str\
5037     started ~ #3 ~ and ~ close ~ \msg_line_context: : ~ 'NOT ~ OK'\
5038     Items ~ < ~ Answers.
5039 }

```

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

```

5040 \msg_new:nnn { enumext } { missing-starred }
5041 {
5042     Missing ~ '\c_backslash_str #1*' ~ #2.
5043 }
5044 \msg_new:nnn { enumext } { many-starred }
5045 {
5046     Many ~ '\c_backslash_str #1*' ~ #2.
5047 }

```

Messages used by `\printkeyans*` command.

```

5048 \msg_new:nnn { enumext } { print-starred }
5049 {
5050     \c_backslash_str printkeyans*:~ The ~ sequence ~ '#1' ~ already ~ contains ~
5051     #2 ~ environment ~ \msg_line_context:.
5052 }

```

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

```

5053 \msg_new:nnn { enumext } { list-too-deep }
5054 {
5055     Too ~ deep ~ nesting ~ for ~ 'enumext' ~ \msg_line_context:~ \
5056     The ~ maximum ~ level ~ of ~ nesting ~ is ~ 4.
5057 }

```

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

```

5058 \msg_new:nnn { enumext } { anskey-unnumber-item }
5059 {
5060     Can't ~ store ~ with ~ a ~ unnumbered ~ \c_backslash_str item ~ \msg_line_context:.
5061 }
5062 \msg_new:nnn { enumext } { anskey-already-stored }
5063 {
5064     Content ~ already ~ stored ~ for ~ this ~ \c_backslash_str item ~ \msg_line_context:.
5065 }
5066 \msg_new:nnn { enumext } { anskey-empty-arg }
5067 {
5068     Can't ~ store ~ empty ~ content ~ \msg_line_context:.
5069 }
5070 \msg_new:nnn { enumext } { anskey-wrong-place }
5071 {
5072     Wrong ~ place ~ for ~ command ~ '\c_backslash_str #1' ~ \msg_line_context:~ \
5073     '\c_backslash_str #1' ~ works ~ in ~ the ~ environment ~ '#2'.
5074 }
5075 \msg_new:nnn { enumext } { anskey-nested }
5076 {
5077     The ~ command ~ \c_backslash_str anskey~ can't ~ be ~ nested ~ \msg_line_context:.
5078 }
5079 \msg_new:nnn { enumext } { anskey-math-mode }
5080 {
5081     #1 ~ can't ~ work ~ in ~ math ~ mode ~ \msg_line_context:.

```



```

5082     }
5083     \msg_new:nnn { enumext } { anskey-env-wrong }
5084     {
5085         The ~ environment ~ anskey* ~ cannot ~ use ~ in ~ '#1' ~ \msg_line_context:.
5086     }
5087     \msg_new:nnn { enumext } { ansPIC-wrong-place }
5088     {
5089         Wrong ~ place ~ for ~ command ~ '\c_backslash_str #1' ~ \msg_line_context:~ \\
5090         '\c_backslash_str #1' ~ works ~ in ~ the ~ environment ~ '#2'.
5091     }
5092     \msg_new:nnn { enumext } { command-wrong-place }
5093     {
5094         Wrong ~ place ~ for ~ command ~ '\c_backslash_str #1' ~ \msg_line_context:~ \\
5095         '\c_backslash_str #1' ~ works ~ outside ~ the ~ environment ~ '#2'.
5096     }
5097     \msg_new:nnnn { enumext } { anskey-env-key-unknown }
5098     {
5099         The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment~
5100         'anskey*' ~ and ~ is ~ being ~ ignored.
5101     }
5102     {
5103         The ~ environment ~ 'anskey*' ~ does ~ not ~ have ~ a ~ key ~ called ~'#1'.\\
5104         Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5105     }
5106     \msg_new:nnnn { enumext } { anskey-env-key-value-unknown }
5107     {
5108         The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~
5109         'anskey*' ~ and ~ is ~ being ~ ignored.
5110     }
5111     {
5112         The ~ environment ~ 'anskey*' ~ does ~ not ~ have ~ a ~ key ~ called ~'#1'.\\
5113         Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5114     }
5115     \msg_new:nnnn { enumext } { anskey-cmd-key-unknown }
5116     { The ~ key ~ '#1' ~ is ~ unknown ~ by ~ '\c_backslash_str anskey' ~ and ~ is ~ being ~ ignored.}
5117     {
5118         The ~ command ~ '\c_backslash_str anskey' ~ does ~ not ~ have ~ a ~ key ~ called ~'#1'.\\
5119         Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5120     }
5121     \msg_new:nnnn { enumext } { anskey-cmd-key-value-unknown }
5122     { The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ '\c_backslash_str anskey' ~ and ~ is ~ being ~ ignored.}
5123     {
5124         The ~ command ~ '\c_backslash_str anskey' ~ does ~ not ~ have ~ a ~ key ~ called ~'#1'.\\
5125         Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5126     }

```

Messages used by `keyans`, `keyans*` and `keyansPIC` environment.

```

5127     \msg_new:nnn { enumext } { keyans-nested }
5128     {
5129         The ~ environment ~ 'keyans' ~ can't ~ be ~ nested ~ \msg_line_context:.
5130     }
5131     \msg_new:nnn { enumext } { keyans-wrong-level }
5132     {
5133         Wrong ~ level ~ position ~ for ~ 'keyans' ~ \msg_line_context:~ \\
5134         The ~ environment ~ 'keyans' ~ can ~ only ~ be ~ in ~ the ~ first ~ level.
5135     }
5136     \msg_new:nnn { enumext } { wrong-place }
5137     {
5138         Wrong ~ place ~ for ~ '#1' ~ environment ~\msg_line_context:~ \\
5139         '#1' ~ is ~ only ~ found ~ with ~ '#2' ~ in ~ 'enumext.
5140     }
5141     \msg_new:nnn { enumext } { keyansPIC-nested }
5142     {
5143         The ~ environment ~ 'keyansPIC' ~ can't ~ be ~ nested~ \msg_line_context:~.
5144     }
5145     \msg_new:nnn { enumext } { keyansPIC-wrong-level }
5146     {
5147         Wrong ~ level ~ position ~ for ~ 'keyansPIC' ~ \msg_line_context:~ \\
5148         The ~ environment ~ 'keyans' ~ can ~ only ~ be ~ in ~ the ~ first ~ level.
5149     }
5150     \msg_new:nnn { enumext } { keyansPIC-item-cmd }
5151     {

```

```

5152     Can't ~ use ~ \c_backslash_str item ~ in ~ keyanspic ~ \msg_line_context:.
5153 }
5154 \msg_new:nnnn { enumext } { keyans-unknown-key }
5155 {
5156     The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment~
5157     '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
5158 }
5159 {
5160     The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5161     ~ have ~ a ~ key ~ called ~'#1'.\\
5162     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5163 }
5164 \msg_new:nnnn { enumext } { keyans-unknown-key-value }
5165 {
5166     The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~
5167     '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
5168 }
5169 {
5170     The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5171     ~ have ~ a ~ key ~ called ~'#1'.\\
5172     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5173 }

```

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

```

5174 \msg_new:nnnn { enumext } { starred-unknown-key }
5175 {
5176     The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment~
5177     '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
5178 }
5179 {
5180     The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5181     ~ have ~ a ~ key ~ called ~'#1'.\\
5182     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5183 }
5184 \msg_new:nnnn { enumext } { starred-unknown-key-value }
5185 {
5186     The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~
5187     '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
5188 }
5189 {
5190     The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5191     ~ have ~ a ~ key ~ called ~'#1'.\\
5192     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5193 }

```

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

```

5194 \msg_new:nnnn { enumext } { standar-unknown-key }
5195 {
5196     The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment ~ '\l__enumext_envir_name_tl' \c_space_tl
5197     ~ on ~ level ~ \int_use:N \l__enumext_level_int \c_space_tl and ~ is ~ being ~ ignored.
5198 }
5199 {
5200     The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5201     ~ have ~ a ~ key ~ called ~'#1' ~ on ~ level ~ \int_use:N \l__enumext_level_int.\\
5202     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5203 }
5204 \msg_new:nnnn { enumext } { standar-unknown-key-value }
5205 {
5206     The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~ '\l__enumext_envir_name_tl' \c_space_
5207     ~ on ~ level ~ \int_use:N \l__enumext_level_int \c_space_tl and ~ is ~ being ~ ignored.
5208 }
5209 {
5210     The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5211     ~ have ~ a ~ key ~ called ~'#1' ~ on ~ level ~ \int_use:N \l__enumext_level_int.\\
5212     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5213 }

```

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

```

5214 \msg_new:nnnn { enumext } { for-key-unknown }
5215 { The~key~'#1'~is~unknown~by~'\c_backslash_str foreachkeyans'~and~is~being~ignored.}
5216 {
5217     The~command~'\c_backslash_str foreachkeyans'~does~not~have~a~key~called~'#1'.\\

```

```

5218     Check~that~you~have~spelled~the~key~name~correctly.
5219 }
5220 \msg_new:nnnn { enumext } { for-key-value-unknown }
5221 { The~key~'#1=#2'~is~unknown~by~'\c_backslash_str foreachkeyans'~and~is~being~ignored. }
5222 {
5223     The~command~'\c_backslash_str foreachkeyans'~does~not~have~a~key~called~'#1'.\\
5224     Check~that~you~have~spelled~the~key~name~correctly.
5225 }

```

Messages used by `\getkeyans` command.

```

5226 \msg_new:nnn { enumext } { undefined-storage-anskey }
5227 {
5228     Storage ~ named ~ '#1' ~ is ~ not ~ defined ~ \msg_line_context:.
5229 }

```

Messages used by `\miniright` command.

```

5230 \msg_new:nnn { enumext } { missing-miniright }
5231 {
5232     Missing ~ '\c_backslash_str miniright' ~ in ~ \msg_line_context:.\\
5233     The ~ key ~ 'mini-env' ~ need ~ '\c_backslash_str miniright'.
5234 }
5235 \msg_new:nnn { enumext } { wrong-miniright-place }
5236 {
5237     Wrong ~ place ~ for ~ '\c_backslash_str miniright' ~ \msg_line_context:~ \\
5238     Works ~ in ~ 'enumext' ~ and ~ 'keyans' ~ with ~ key ~ 'mini-env'.
5239 }
5240 \msg_new:nnn { enumext } { wrong-miniright-use }
5241 {
5242     Wrong ~ use ~ for ~ '\c_backslash_str miniright' ~ \msg_line_context:~ \\
5243     '\c_backslash_str miniright' ~ need ~ a ~ key ~ 'mini-env'.
5244 }
5245 \msg_new:nnn { enumext } { wrong-miniright-starred }
5246 {
5247     Can't ~ use ~ \c_backslash_str miniright ~ in ~ starred ~ environments ~ \msg_line_context:.
5248 }
5249 \msg_new:nnn { enumext } { many-miniright-used }
5250 {
5251     Can't ~ use ~ \c_backslash_str miniright ~ more ~ than ~ once ~ \msg_line_context:.
5252 }

```

Messages used by `\setenumextmeta` command.

```

5253 \msg_new:nnn { enumext } { unknown-set }
5254 {
5255     Argument ~ [#1] ~ is ~ unknown ~ by ~ \c_backslash_str setenumextmeta ~ \msg_line_context:.
5256 }
5257 \msg_new:nnn { enumext } { already-defined }
5258 {
5259     The ~ key ~ '#1' ~ is ~ already ~ defined ~ \msg_line_context:.
5260 }
5261 \msg_new:nnn { enumext } { prohibited-unknown }
5262 {
5263     The ~ name ~ 'unknown' ~ can't ~ be ~ chosen~ for ~ a ~ meta ~ key ~ \msg_line_context:.
5264 }

```

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

```

5265 \msg_new:nnn { enumext } { nested }
5266 {
5267     The ~ environment ~ \l__enumext_envir_name_tl \c_space_tl can't ~ be ~ nested ~ \msg_line_context:.
5268 }
5269 \msg_new:nnn { enumext } { nested-horizontal }
5270 {
5271     The ~ environment ~ \l__enumext_envir_name_tl \c_space_tl can't ~ be ~ nested ~ in ~ '#1' ~ '
5272 }
5273 \msg_new:nnn { enumext } { item-joined }
5274 {
5275     Items ~ joined ~ (#1) ~ > ~ #2 ~ columns ~ \msg_line_context:.
5276 }
5277 \msg_new:nnn { enumext } { item-joined-columns }
5278 {
5279     Not ~ space ~ to ~ join ~ items ~ (#1) ~ > ~ #2 ~ \msg_line_context:.
5280 }

```

12.51 Finish package

Finish package implementation.

```
5281 \file_input_stop:
5282 </package>
```

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