

# enumext

ENUMERATE EXERCISE SHEETS

V1.0 2024-10-02<sup>\*</sup>

©2024 by Pablo González<sup>†</sup>

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

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

## Abstract

This package provides “enumerated list” environments compatible with  $\LaTeX$  tagging PDF 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.

## Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>	<b>6</b>	<b>The storage system</b>	<b>11</b>
1.1	Description and usage	2	6.1	Keys for storage system	11
1.2	The concept of left margin	3	6.1.1	Keys for label and ref	11
1.3	User interface	3	6.1.2	Keys for wrap and display	12
1.3.1	Internal counters	3	6.1.3	Keys for debug and checking	12
1.3.2	Public dimension	3	6.2	The command <code>\anskey</code>	12
1.3.3	Support for <code>multicol</code>	4	6.2.1	Keys for <code>\anskey</code>	12
1.3.4	Support for <code>minipage</code>	4	6.3	The environment <code>anskey*</code>	13
1.3.5	The <code>\label</code> and <code>\ref</code> system	4	6.3.1	Keys for <code>anskey*</code>	13
1.3.6	Support for <code>\footnote</code>	4	6.4	The environment <code>keyans</code>	14
<b>2</b>	<b>The environments provided</b>	<b>5</b>	6.4.1	The <code>\item*</code> in <code>keyans</code>	14
2.1	The environment <code>enumext</code>	5	6.5	The environment <code>keyanspic</code>	15
2.2	The environment <code>enumext*</code>	5	6.5.1	The command <code>\anspic</code>	15
2.3	The command <code>\item*</code>	5	6.6	Printing stored content	16
2.3.1	Keys for <code>\item*</code>	6	6.6.1	The command <code>\getkeyans</code>	16
2.4	The command <code>\item</code> in <code>enumext*</code>	6	6.6.2	The command <code>\foreachkeyans</code>	16
<b>3</b>	<b>The command <code>\setenumext</code></b>	<b>6</b>	6.6.3	The command <code>\printkeyans</code>	17
<b>4</b>	<b>The command <code>\setenumextmeta</code></b>	<b>6</b>	<b>7</b>	<b>Full examples</b>	<b>18</b>
<b>5</b>	<b>The keyval system</b>	<b>7</b>	<b>8</b>	<b>The way of non-enumerated lists</b>	<b>20</b>
5.1	Keys for label and ref	7	<b>9</b>	<b>References</b>	<b>22</b>
5.2	Keys for spaces	8	<b>10</b>	<b>Change history</b>	<b>23</b>
5.2.1	Vertical spaces	8	<b>11</b>	<b>Index of Documentation</b>	<b>24</b>
5.2.2	Horizontal spaces	9	<b>12</b>	<b>Implementation</b>	<b>26</b>
5.3	Keys for add code	9	<b>13</b>	<b>Index of Implementation</b>	<b>139</b>
5.4	Keys for start, series and resume	9			
5.5	Keys for <code>multicols</code>	10			
5.6	Keys for <code>minipage</code>	10			
5.6.1	The command <code>\miniright</code>	10			
5.6.2	The key <code>mini-right</code>	10			

## 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  $\LaTeX$  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

<sup>\*</sup>This file describes a documentation for v1.0, last revised 2024-10-02.

<sup>†</sup>E-mail: [pablgonz@educarchile.cl](mailto:pablgonz@educarchile.cl).

License and Requirements

Permission is granted to copy, distribute and/or modify this software under the terms of the LaTeX Project Public License (lpp), version 1.3 or later (<https://www.latex-project.org/lpp1.txt>). The software has the status “maintained”.  
The enumext package loads and requires multicol[3] and scontents[4] packages, need to have a modern T<sub>E</sub>X distribution such as T<sub>E</sub>X Live or MiK<sub>T</sub>E<sub>X</sub>. It has been tested with the standard classes provided by L<sup>A</sup>T<sub>E</sub>X: book, report, article and letter on 10pt, 11pt and 12pt.

1 Introduction

In the L<sup>A</sup>T<sub>E</sub>X world there are many useful packages and classes for creating “lists of exercises”, “worksheets” or “multiple choice questions”, classes like exam[1] and packages like xsim[2] do the job perfectly, but they don’t always fit the basic day to day needs.  
In my work (and in the work of many teachers) it is common to use “simple exercise sheets” also known as “informal lists of exercises”, as an example:

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

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

3. True False

(a)  $\alpha > \delta$

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

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

(b) Usually uses the package manager?

(c) Rate the following package and class

i. xsim-exam

ii. xsim

iii. exsheets

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

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

\* 

$(x - 1)^2$

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

\* 

$3(x + y + z)$

3. True False

(a)  $\alpha > \delta$ 

\* 

False

(b) L<sup>A</sup>T<sub>E</sub>Xze 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)  $\angle EDF = 45^\circ$

4. Question with image and label below:

A

A

B

A

D

E

©2024 by Pablo González L

2 / 154

5. Question with image on left side:

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



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

1. B)  $x = 5$

2. D)

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

\* 5. D) “other note”

\*

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  $\text{\TeX}$ , but “does not redefine” any internal commands associated with it such as `\list`, `\endlist` or `\item` outside of the “scope” in which they are defined.

- This package is NOT intend to replace the `enumerate` environment nor replace the powerful `enumitem`[6], the approach is intended to work without hindering either of them.
- This package can be used with `xelatex`, `lualatex`, `pdflatex` and the classical `latex»dvips»ps2pdf` and is present in  $\text{\TeX}$  Live and  $\text{MiK}\text{\TeX}$ , use the package manager to install. For manual installation, download `enumext.zip` and unzip it, run `lualatex enumext.dtx` and move all files to appropriate locations, then run `mktextlsr`. To produce the documentation run `lualatex enumext.dtx` two times.

```
enumext.sty  » TDS:tex/latex/enumext/
enumext.pdf  » TDS:doc/latex/enumext/
README.md   » TDS:doc/latex/enumext/
enumext.dtx  » 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.

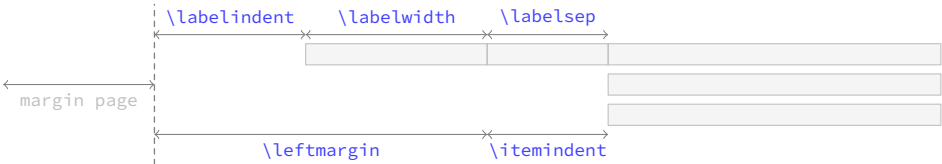


Figure 1: Representation of horizontal lengths in `enumitem`.

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.

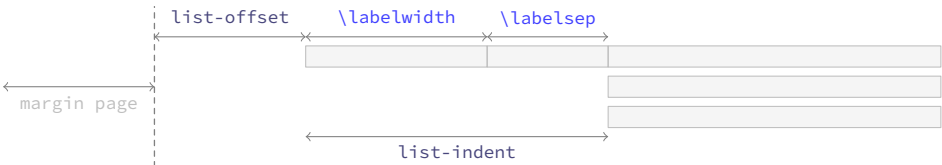


Figure 2: Representation of horizontal lengths concept in `enumext`.

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.

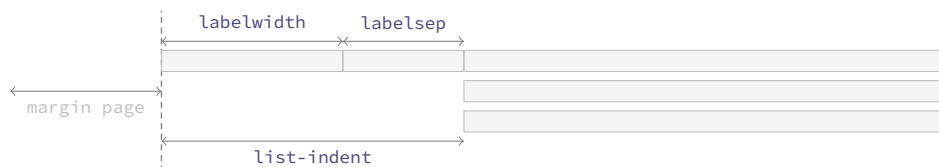


Figure 3: Default horizontal lengths `list-offset=0pt`, `list-indent=\labelwidth+\labelsep` in `enumext`.

### 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.

### 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*}
```

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

## 2 The environments provided

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

<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.
- You cannot have any standard list environments like `itemize`, `enumerate`, `description`, `quote`, `quotation`, `verse`, `center`, `flushleft`, `flushright`, `verbatim`, `tabbing`, `trivlist`, `list` and all environments created with `\newtheorem`.

**Example with `columns=2`**

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

### 2.3 The command `\item*`

<code>\item*</code>	<code>\item*</code>
	<code>\item* [\langle symbol \rangle]</code>
	<code>\item* [\langle symbol \rangle] [\langle offset \rangle]</code>

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

`item-pos*` = {<rigid length>} default: by levels  
Sets the *offset* between the box containing the current <label> defined by `labelwidth` key and the <symbol> set by `item-sym*` key. The default values are set by `labelsep` key at each level. If positive values are passed it will *offset to the left* and if negative values are passed it will *offset to the right*.

2.4 The command \item in enumext\*

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

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

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

3 The command \setenumext

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

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

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

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

4 The command \setenumextmeta

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

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

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



## 5 The keyval system

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

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

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

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

### 5.1 Keys for `label` and `ref`

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

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

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



## 5.2 Keys for spaces

`show-length` = { $\langle true \mid false \rangle$ } 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` = { $\langle rubber\ length \mid rigid\ length \rangle$ } 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` = { $\langle rubber\ length \mid rigid\ length \rangle$ } 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` = { $\langle rubber\ length \mid rigid\ length \rangle$ } 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  $\langle vertical\ mode \rangle$  and apply this value to the “top” and “bottom” the environment or nested level.

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

This is a “meta-key” that does not receive an argument. Set `itemsep` and `parsep` equal to `0pt` the entire level of environment.

`nosep`  $\langle value\ forbidden \rangle$  default: *not used*

This is a “meta-key” that does not receive an argument. Sets all keys for vertical spacing equal to `0pt` the entire level of environment.

`base-fix`  $\langle value\ forbidden \rangle$  default: *not used*

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

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

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

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

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

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

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

Set the *extra vertical space* space added, beyond `topsep`, to the bottom of the entire level of environment. This key is intended to give a “fine adjustment” of the vertical space on the “below” the environment without hindering the value of the `topsep` key. The space is added with `\vspace` so is “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\}\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  $\langle keys \rangle$  are “*only*” available for the `enumext*` environment and the “*first level*” of the `enumext` environment and are ignored if set when nested within each other.

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

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

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

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

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

Sets the *start value* and *options* for the “first level” continuing the numbering of the environment in which the `series={⟨series name⟩}` or `resume={⟨series name⟩}` keys are NOT present, if the `save-ans` key is active it will continue the numbering from the last environment in which it was executed. The *start value* can be overwritten using `start` or `start*` keys.

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

## 5.5 Keys for multicol

`columns = {⟨integer⟩}` default: **1**

Set the *number of columns* to be used by the `multicol` environment within the 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 `multicol` 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 `multicol` 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  $\TeX$  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={\store name}]
  \item Text \anskey{answer}
  \item Text
  \begin{keyans}
    ...
  \end{keyans}
\end{enumext}
```

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

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

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

### 6.1 Keys for storage system

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

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

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

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

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

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

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

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

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

#### 6.1.1 Keys for label and ref

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

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

`mark-ref = {\symbol}` 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:  $\$ \backslash star \$$   
 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*={ $\$ \backslash ast \$$ }` stores `\item*[\mathast] \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}
```

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

## 6.3 The environment `anskey*`

---

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

---

The environment `anskey*` takes a mandatory { $\langle body content \rangle$ } and “stores” it in the *sequence* and *prop list* { $\langle store name \rangle$ } set by `save-ans` key. If `save-ref` key are active and the `hyperref`[8] package is detected, `\hyperlink` and `\hypertarget` will be used, otherwise the usual “*label and ref*” system provided by L<sup>A</sup>T<sub>E</sub>X will be used.

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

The `anskey*` environment is implemented using the `scontents` package, for the correct operation `\begin{anskey*}` and `\end{anskey*}` must be in different lines, all {*keys*} 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 {*keys*} 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*}
  \item Text containing our instructions or questions.
  \begin{enumext}
    \item Question.
    \begin{anskey*}
      \second answer
    \end{anskey*}
  \end{enumext}
  \item Text containing our instructions or questions.
  \begin{anskey*}
    \third answer
  \end{anskey*}
  \item Text containing our instructions or questions.
  \begin{anskey*}
    \fourth answer
  \end{anskey*}
\end{enumext}
```

- |   |  |
|---|--|
| <p>★ 5. Text containing our instructions or questions.</p> <p>[5] <span style="border: 1px solid black; padding: 2px;">First answer with verbatim</span></p> <p>6. Text containing our instructions or questions.</p> <p>(a) Question.</p> <p>[6] <span style="border: 1px solid black; padding: 2px;">second answer</span></p> | <p>7. Text containing our instructions or questions.</p> <p>[7] <span style="border: 1px solid black; padding: 2px;">third answer</span></p> <p>8. Text containing our instructions or questions.</p> <p>[8] <span style="border: 1px solid black; padding: 2px;">fourth answer</span></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 `\langle keys \rangle` set in the *optional argument* of the environment are the same (almost) as those of the `enumext` and `enumext*` environments and have *higher precedence* than those set by `\setenumext[\langle keyans \rangle]{\langle key = val \rangle}` or `\setenumext[\langle keyans* \rangle]{\langle key = val \rangle}`. If the *optional argument* is not passed or the `\langle keys \rangle` are not set by `\setenumext`, the default values will be the same as the “*second level*” of the `enumext` environment with the difference in the `\langle label \rangle` which will be set to `label=\Alph*`.

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

---

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

---

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

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

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

1. Text containing a question.

A) Choice

\* B) Correct choice

C) Choice

D) Choice

E) Choice

2. Text containing a question and image.


A) Choice

B) Choice

C) Choice

D) Choice

\* E) [note] Correct choice



Some text

6.5 The environment keyanspic

keyanspic

```
\begin{keyanspic}*[\n° upper, n° lower]\anspic{<drawing>}\anspic*[\<content>]{<drawing or tabular>}
```

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

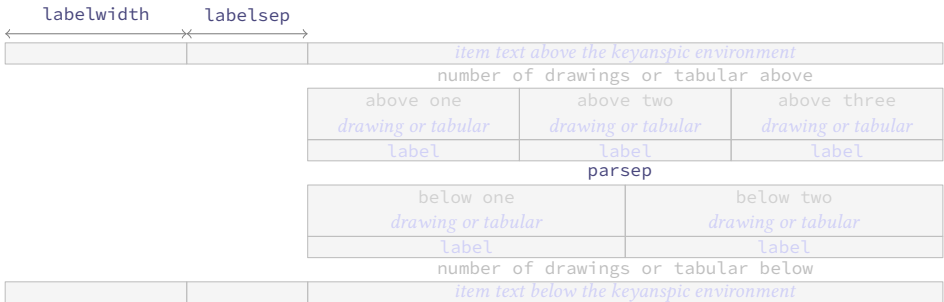


Figure 6: Representation of the `keyanspic` environment with optional argument [3,2] in `enumext`.

When the `keyanspic` environment is used *without arguments* the `<labels>` are centered *below* the drawings or tabular in a *single line* layout. The *starred argument* “\*” places `<labels>` centered *above* the drawings or tabular. The *optional argument* determines the number drawings or tabular placed at *upper and lower* in the environment. If the *optional argument* or the `<n° lower>` is omitted the drawings or tabular will be put on a *single line*. The vertical separation between “*upper*” and “*lower*” part is controlled by the values set by `parsep` key passed to `keyans` environment.

6.5.1 The command \anspic

\anspic

```
\anspic{<drawing or tabular>}
\anspic*[\<content>]{<drawing or tabular>}
```

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

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

## Example

```
\begin{enumext}[save-ans=test,show-ans,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*[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 \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 *step* (increment) applied to the value set by key `start` for each `{<content>}` stored in *prop list* `{<store name>}`. The value must be a *positive integer*.
- `start = {<integer>}` default: **1**  
 Sets the *position* of the *prop list* `{<store name>}` from which execution will start. The value must be a *positive integer*.
- `stop = {<integer>}` default: **0**  
 Sets the *position* of the *prop list* `{<store name>}` from which execution 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{<store name>}
\printkeyans[<keys>]{<store name>}
\printkeyans*[<keys>]{<store name>}
```

---

The command `\printkeyans` prints “all stored content” in *sequence* `{<store name>}` defined by `save-ans` key placing this inside the `enumext` environment by default 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* `{<store name>}` it will have the same default values plus the keys `nosep`, `first=\small`, `font=\small`.

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

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

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

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

#### Example

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

$3(x + y + z)$

2. True False

(a) 

TeX is cool?

[2] 

Very True!

3. Related to Linux

(a) You use linux?

[3] 

Yes

(b) Rate the following package and class

i. 

xsim

[4] 

very good

ii. 

exsheets

[5] 

obsolete

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

1.  $3(x + y + z)$

2. (a) Very True!

3. (a) Yes

(b) i. very good

ii. obsolete
- \*

\*

\*

\*

\*

7 Full examples

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

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

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

Example 1

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

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

A

 36 km/h.

B

 360 km/h.

C

 27,8 km/h.

D

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

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

A

 36 km/h.

B

 360 km/h.

C

 27,8 km/h.

D

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

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

A

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

B

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

C

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

D

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

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

A

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

B

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

C

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

D

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

1. B

2. A

3. B

4. A

Example 2

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

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

A

 36 km/h.

✓ B

 360 km/h.

C

 27,8 km/h.

D

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

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

✓ A

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

B

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

C

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

D

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

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

A

 36 km/h.

✓ B

 360 km/h.

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

- C

27,8 km/h.
- D

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

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

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

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

 $1 \text{ \AA} = 1 \times 10^3 \text{ fm}.$
1. B
2. A
3. B
4. A
- 
- \*
- \*
- \*
- \*

Example 3

A “simple multiple choice” test 📄.

1. First type of questions
- A

value
- B

correct
- C

value
- D

value
2. Second type of questions
- I.  $2\alpha + 2\delta = 90^\circ$
- II.  $\alpha = \delta$
- III.  $\angle EDF = 45^\circ$
- A

I only
- B

II only
- C

I and II only
- D

I and III only
- E

I, II, and III
3. Third type of questions
- (1)  $2\alpha + 2\delta = 90^\circ$
- (2)  $\angle EDF = 45^\circ$
- A

value
- B

value
- C

value
- D

value
- E

value
4. Question with image and label below:

A

A

D

B

B

A

C

E

B

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
- 
- \*
- \*
- \*
- 
- \*
- \*
- \*

Example 4

A “simple worksheet” using ducks :) 📄.

- ca. 1.

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

Factor  $3x + 3y + 3z$
- The following questions need to be cuaqtified :)
- ca. 3.

True False
- (a)  $\alpha > \delta$



(b)  $\text{\LaTeX}$  is cool?



Related to Linux

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

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

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

Example 5

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

<div>1</div> <p>Which choice best describes what happens in the passage?</p> <ul style="list-style-type: none"><li>A) One character argues with another character who intrudes on her home.</li><li>B) One character receives a surprising request from another character.</li><li>C) One character reminisces about choices she has made over the years.</li><li>D) One character criticizes another character for pursuing an unexpected course of action.</li></ul>	<div>3</div> <p>Which choice best describes what happens in the passage?</p> <ul style="list-style-type: none"><li>A) One character argues with another character who intrudes on her home.</li><li>B) One character receives a surprising request from another character.</li><li>C) One character reminisces about choices she has made over the years.</li><li>D) One character criticizes another character for pursuing an unexpected course of action.</li></ul>
<div>2</div> <p>Which choice best describes what happens in the passage?</p> <ul style="list-style-type: none"><li>A) One character argues with another character who intrudes on her home.</li><li>B) One character receives a surprising request from another character.</li><li>C) One character reminisces about choices she has made over the years.</li><li>D) One character criticizes another character for pursuing an unexpected course of action.</li></ul>	<div>4</div> <p>Which choice best describes what happens in the passage?</p> <ul style="list-style-type: none"><li>A) One character argues with another character who intrudes on her home.</li><li>B) One character receives a surprising request from another character.</li><li>C) One character reminisces about choices she has made over the years.</li><li>D) One character criticizes another character for pursuing an unexpected course of action.</li></ul>

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  $\text{\LaTeX}$  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

- |   |   |
|---|---|
| <ul style="list-style-type: none"><li>• First level item<ul style="list-style-type: none"><li>– Second level item<ul style="list-style-type: none"><li>* Third level item<ul style="list-style-type: none"><li>· Fourth level item</li></ul></li></ul></li></ul></li><li>• First level item</li></ul> | <ul style="list-style-type: none"><li>* First level item<ul style="list-style-type: none"><li>◊ Second level item<ul style="list-style-type: none"><li>◦ Third level item<ul style="list-style-type: none"><li>★ Fourth level item</li></ul></li></ul></li></ul></li><li>* First level item</li></ul> |
|---|---|

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={-\descitemwd - 4pt}`.

**Something** A short one-line description.  
This is an entry *without* a label.  
**Something** A short one-line description.  
**Something long** A much longer description. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris.  
If we add `align=right` it will look like this:

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

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

Description with multi-line labels

The `label` key does not accept *multiline material*, this is where the `wrap-label*` 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** 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**

## Final notes

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

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

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

### Why list environments?

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

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

### Why not random questions and other utilities

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

### Why has it taken so long?

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

## 9 References

- [1] HIRSCHHORN, PHILIP. “Using the exam document class”. Available from CTAN, <https://www.ctan.org/pkg/exam>, 2023.
- [2] NIEDERBERGER, CLEMENS. “xsim – eXercise Sheets IMproved”. Available from CTAN, <https://www.ctan.org/pkg/xsim>, 2023.
- [3] MITTELBACH, FRANK. “An environment for multicolumn output”. Available from CTAN, <https://www.ctan.org/pkg/multicol>, 2024.
- [4] GONZÁLEZ, PABLO. “scontents - Stores  $\text{\LaTeX}$  contents in memory or files”. Available from CTAN, <https://www.ctan.org/pkg/scontents>, 2022.
- [5] The  $\text{\LaTeX}$  Project. “enumerate – Enumerate with redefinable labels”. Available from CTAN, <https://www.ctan.org/pkg/enumerate>, 2024.
- [6] BEZOS, JAVIER. “Customizing lists with the enumitem package”. Available from CTAN, <https://www.ctan.org/pkg/enumitem>, 2019.
- [7] BERRY, KARL. “ $\text{\LaTeX} 2_{\epsilon}$ : An Unofficial Reference Manual”. Available from CTAN, <https://ctan.org/pkg/latex2e-help-texinfo>, 2024.

- [8] The L<sup>A</sup>T<sub>E</sub>X Project. “Extensive support for hypertext in L<sup>A</sup>T<sub>E</sub>X”. Available from CTAN, <https://www.ctan.org/pkg/hyperref>, 2024.
- [9] BURNOL, JEAN-FRANÇOIS. “The footnotehyper package”. Available from CTAN, <https://www.ctan.org/pkg/footnotehyper>, 2021.
- [10] The L<sup>A</sup>T<sub>E</sub>X Project. “The expl3 package”. Available from CTAN, <https://www.ctan.org/pkg/l3kernel>, 2024.
- [11] The L<sup>A</sup>T<sub>E</sub>X Project. “The L<sup>A</sup>T<sub>E</sub>X<sub>3</sub> Interfaces”. Available from CTAN, <https://www.ctan.org/pkg/l3kernel>, 2024.
- [12] The L<sup>A</sup>T<sub>E</sub>X Project. “The L<sup>A</sup>T<sub>E</sub>X<sub>2<sub>ε</sub></sub> sources”. Available from CTAN, <https://ctan.org/tex-archive/macros/latex/base>, 2024.
- [13] The L<sup>A</sup>T<sub>E</sub>X Project. “L<sup>A</sup>T<sub>E</sub>X for authors current version”. Available from CTAN, <https://ctan.org/pkg/latex-base>, 2024.
- [14] GUNDLACH, PATRICK. “The lua-visual-debug package”. Available from CTAN, <https://www.ctan.org/pkg/lua-visual-debug>, 2023.
- [15] LEMVIG, MOGENS. “The shortlst package”. Available from CTAN, <https://www.ctan.org/pkg/shortlst>, 1998.
- [16] NIEDERBERGER, CLEMENS. “tasks – Horizontally columned lists”. Available from CTAN, <https://www.ctan.org/pkg/tasks>, 2022.

## 10 Change history

**v1.0** 2024-10-02 – First public release.

11 Index of Documentation

The italic numbers denote the pages where the corresponding entry is described.

<b>C</b>		<b>I</b>	
Document class:		\itemsep .....	9
article .....	2	<b>K</b>	
book .....	2	Keys for \anskey provide by enumext:	
exam .....	2	break-col .....	13
letter .....	2	item-join .....	13
report .....	2	item-pos* .....	14
\columnbreak .....	4, 13	item-star .....	13, 14
\columnsep .....	11	item-sym* .....	14
Commands provide by enumext:		Keys for \foreachkeyans provide by enumext:	
\anskey .....	12-14	after .....	17
\anspic .....	12, 13, 16	before .....	17
\foreachkeyans .....	17	sep .....	17
\getkeyans .....	13, 17	start .....	17
\item* .....	6-8, 12, 13, 15, 16	step .....	17
\item .....	6-8, 10, 11, 13, 15	stop .....	17
\miniright .....	11	wrapper .....	17
\printkeyans .....	7, 12, 18	Keys for anskey* provide by enumext:	
\setenumextmeta .....	7	break-col .....	13
\setenumext .....	6-8, 12, 13, 15, 18	force-eol .....	14
Counters defined by enumext:		item-join .....	13
enumXiii .....	4	item-pos* .....	14
enumXii .....	4	item-star .....	13, 14
enumXiv .....	4	item-sym* .....	14
enumXi .....	4	overwrite .....	14
enumXviii .....	4	write-env .....	14
enumXvii .....	4	Keys for environments provide by enumext:	
enumXvi .....	4	above* .....	9
enumXv .....	4	above .....	9
<b>E</b>		after .....	10, 11
Environments provide by enumext:		align .....	8, 22
anskey* .....	12-14	base-fix .....	9
enumext* .....	4-15, 18	before* .....	10
enumext .....	4-10, 12-15, 18, 21	before .....	10
keyans* .....	4-15	below* .....	9
keyanspic .....	4, 8, 9, 12-14, 16, 21	below .....	9
keyans .....	4-10, 12-16, 21	check-ans .....	13
Environments:		columns-sep .....	4, 11
Verbatim .....	14	columns .....	4, 9, 11
center .....	6	first .....	10
description .....	6	font .....	8
enumerate .....	1, 3, 6, 23	item-pos* .....	6, 7
figure .....	6	item-sym* .....	6, 7
flushleft .....	6	itemindent .....	10
flushright .....	6	itemsep .....	9
itemize .....	6	labelsep .....	4, 6-8, 10, 11, 13, 22
list .....	3, 6, 10, 23	labelwidth .....	4, 7, 8, 10, 11, 13, 22
minipage .....	3-6, 11, 23	labelwith .....	6
multicols .....	3, 4, 11	label .....	8, 10, 15, 21, 22
quotation .....	6	list-indent .....	3, 4, 10
quote .....	6	list-offset .....	3, 4, 10, 22
tabbing .....	6	listparindent .....	10
table .....	6	mark-ans .....	13
task .....	6	mark-pos .....	13
trivlist .....	6	mark-ref .....	12
verbatim .....	6	mini-env .....	4, 5, 9, 11, 12
verse .....	6	mini-right* .....	8, 11, 12
<b>F</b>		mini-right .....	8, 11, 12
\footnote .....	6	mini-sep .....	4, 11, 12
		no-store .....	12-14

noitemsep .....	9	\alph* .....	8
nosep .....	9, 21	\arabic* .....	8
overwrite .....	14	\roman* .....	8
parsep .....	9, 16	\labelsep .....	3, 4, 8
partopsep .....	9	\labelwidth .....	3, 4, 8
ref .....	5, 8	\linewidth .....	11
resume* .....	8, 11, 12	\listparindent .....	10
resume .....	8, 11, 12		
rightmargin .....	10	<b>P</b>	
save-ans .....	5, 7, 11–18	Packages:	
save-key .....	11, 12, 18	enumerate .....	23
save-ref .....	5, 8, 12–14, 17	enumext .....	1–4, 6, 8, 16, 23
save-sep .....	12	enumitem .....	3, 5, 6, 10, 22, 23
series .....	8, 11, 12	fancyvrb .....	14
show-ans .....	12, 13	footnotehyper .....	6
show-length .....	9	hyperref .....	5, 6, 12–14, 23
show-pos .....	12, 13, 17	l3keys .....	8
start* .....	10, 11	l3prop .....	1, 23
start .....	10, 11	l3seq .....	1, 23
topsep .....	9, 10	multicol .....	1, 2, 4, 23
widest .....	8	scontents .....	1, 2, 14
wrap-ans .....	13	task .....	6, 7
wrap-label* .....	8, 22	xsim .....	2
wrap-label .....	8	\parsep .....	9
wrap-opt .....	13	\partopsep .....	9
write-env .....	14		
		<b>R</b>	
<b>L</b>		\raggedcolumns .....	4
\label .....	5	\ref .....	5
Labels provide by enumext:		\rightmargin .....	10
\Alph* .....	8, 15		
\Roman* .....	8	<b>T</b>	
		\topsep .....	9



## 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   {2024-10-02}
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 `\__enumext_current_widest_dim` and others.)

```
\__enumext_leftmargin_tmp_X_bool
\__enumext_leftmargin_tmp_X_dim
\__enumext_leftmargin_X_dim
\__enumext_itemindent_X_dim
```

The boolean variable `\__enumext_leftmargin_tmp_X_bool` and the dimensional variable `\__enumext_leftmargin_tmp_X_dim` are used by the `list-indent` key (§12.17). The variables `\__enumext_leftmargin_X_dim` and `\__enumext_itemindent_X_dim` are used and set by the function `\__enumext_calc_hspace`:NNNNNNNNNN (§12.37.1).

```
71 \cs_set_protected:Npn \__enumext_tmp:n #1
72 {
73   \bool_new:c { \__enumext_leftmargin_tmp_#1_bool }
74   \dim_new:c { \__enumext_leftmargin_tmp_#1_dim }
75   \dim_new:c { \__enumext_leftmargin_#1_dim }
76   \dim_new:c { \__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 `\__enumext_leftmargin_tmp_X_bool` and others.)

```
\__enumext_multicols_above_X_skip
\__enumext_multicols_below_X_skip
\g__enumext_multicols_right_X_skip
\__enumext_align_label_pos_X_str
```

Internal variables used by `columns` key (§12.21) and `align` key (§12.12).

```
79 \cs_set_protected:Npn \__enumext_tmp:n #1
80 {
81   \skip_new:c { \__enumext_multicols_above_#1_skip }
82   \skip_new:c { \__enumext_multicols_below_#1_skip }
83   \skip_new:c { \g__enumext_multicols_right_#1_skip }
84   \str_new:c { \__enumext_align_label_pos_#1_str }
85 }
86 \clist_map_inline:nn { i, ii, iii, iv, v } { \__enumext_tmp:n {#1} }
```

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

```
\g__enumext_minipage_stat_int
\__enumext_minipage_temp_skip
\__enumext_minipage_left_skip
\__enumext_minipage_right_skip
\__enumext_minipage_after_skip
\g__enumext_minipage_right_skip
\g__enumext_minipage_after_skip
\__enumext_minipage_left_X_dim
\__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).

```
87 \int_new:N \g__enumext_minipage_stat_int
88 \skip_new:N \__enumext_minipage_temp_skip
89 \skip_new:N \__enumext_minipage_left_skip
90 \skip_new:N \__enumext_minipage_right_skip
91 \skip_new:N \__enumext_minipage_after_skip
92 \skip_new:N \g__enumext_minipage_right_skip
93 \skip_new:N \g__enumext_minipage_after_skip
94 \cs_set_protected:Npn \__enumext_tmp:n #1
95 {
96   \dim_new:c { \__enumext_minipage_left_#1_dim }
97   \bool_new:c { \__enumext_minipage_active_#1_bool }
98 }
99 \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.)

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

The bool vars `\__enumext_wrap_label_X_bool` and `\__enumext_wrap_label_opt_X_bool` are used by `wrap-label` and `wrap-label*` keys (§12.12), the integer `\__enumext_start_X_int` are used by the `start` and `start*` keys (§12.14), the token list `\__enumext_fake_item_indent_X_tl` is used by `itemindent` key (§12.17.1), the variables `\__enumext_label_fill_left_X_tl` and `\__enumext_label_fill_right_X_tl` are used by the `align` key (§12.12). The boolean vars `\__enumext_vspace_a_star_X_bool`, `\__enumext_vspace_b_star_X_bool` are used by `above`, `above*`, `below` and `below*` keys (§12.19).

```
100 \cs_set_protected:Npn \__enumext_tmp:n #1
101 {
102   \bool_new:c { \__enumext_wrap_label_#1_bool }
103   \bool_new:c { \__enumext_wrap_label_opt_#1_bool }
104   \int_new:c { \__enumext_start_#1_int }
105   \tl_new:c { \__enumext_fake_item_indent_#1_tl }
106   \tl_new:c { \__enumext_label_fill_left_#1_tl }
107   \tl_new:c { \__enumext_label_fill_right_#1_tl }
108   \bool_new:c { \__enumext_vspace_a_star_#1_bool }
109   \bool_new:c { \__enumext_vspace_b_star_#1_bool }
110 }
111 \clist_map_inline:nn { i, ii, iii, iv, v, vii, viii } { \__enumext_tmp:n {#1} }
```

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

```

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

The variable `\l__enumext_store_anskey_arg_tl` save the *argument* of `\anskey` (§12.29) and the variables `\l__enumext_store_anskey_env_tl` and `\l__enumext_store_anskey_opt_tl` save the  $\langle body\rangle$  and the  $\langle keys\rangle$  of the environment `anskey*` (§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*` (§12.41.2) for the `keyans`, `keyans*` and `keyanspic` environments.

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

```

112 \bool_new:N \l__enumext_store_active_bool
113 \tl_new:N \l__enumext_store_name_tl
114 \tl_new:N \g__enumext_store_name_tl
115 \tl_new:N \l__enumext_store_anskey_arg_tl
116 \tl_new:N \l__enumext_store_anskey_env_tl
117 \tl_new:N \l__enumext_store_anskey_opt_tl
118 \tl_new:N \l__enumext_store_current_label_tl
119 \tl_new:N \l__enumext_store_current_opt_arg_tl
120 \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).

```

121 \tl_new:N \l__enumext_setkey_tmpa_tl
122 \tl_new:N \l__enumext_setkey_tmpb_tl
123 \int_new:N \l__enumext_setkey_tmpa_int
124 \seq_new:N \l__enumext_setkey_tmpa_seq
125 \seq_new:N \l__enumext_setkey_tmpb_seq

```

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

```

\l__enumext_meta_path_tl
\l__enumext_foreach_print_seq
\l__enumext_foreach_name_prop_tl
\g__enumext_foreach_default_keys_tl

```

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

```

126 \tl_new:N \l__enumext_meta_path_tl
127 \seq_new:N \l__enumext_foreach_print_seq
128 \tl_new:N \l__enumext_foreach_name_prop_tl
129 \tl_new:N \g__enumext_foreach_default_keys_tl

```

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

```

\l__enumext_print_keyans_starred_tl
\l__enumext_print_keyans_star_bool
\l__enumext_mark_position_str
\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 “*storing structure*”.

```

130 \tl_new:N \l__enumext_print_keyans_starred_tl
131 \bool_new:N \l__enumext_print_keyans_star_bool
132 \str_new:N \l__enumext_mark_position_str
133 \tl_new:N \g__enumext_item_symbol_aux_tl
134 \cs_set_protected:Npn \l__enumext_tmp:n #1
135 {
136   \tl_new:c { \l__enumext_print_keyans_#1_tl }
137   \tl_new:c { \l__enumext_store_save_key_#1_tl }
138   \bool_new:c { \l__enumext_store_save_key_#1_bool }
139   \bool_new:c { \l__enumext_store_upper_level_#1_bool }
140 }
141 \clist_map_inline:nn { i, ii, iii, iv, vii } { \l__enumext_tmp:n {#1} }

```

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

```

\l__enumext_anspic_args_seq
\l__enumext_anspic_mini_width_dim
\l__enumext_anspic_above_int
\l__enumext_anspic_below_int
\l__enumext_keyans_pic_star_bool
\l__enumext_anspic_mini_pos_str
\g__enumext_keyans_pic_parsep_skip
\l__enumext_anspic_label_box
\l__enumext_anspic_body_box
\l__enumext_anspic_label_htdp_dim
\l__enumext_anspic_body_htdp_dim

```

Internal variables used by `keyanspic` environment and `\anspic` command (§12.41.1).

```

142 \seq_new:N \l__enumext_anspic_args_seq
143 \dim_new:N \l__enumext_anspic_mini_width_dim
144 \int_new:N \l__enumext_anspic_above_int
145 \int_new:N \l__enumext_anspic_below_int
146 \bool_new:N \l__enumext_keyans_pic_star_bool
147 \str_new:N \l__enumext_anspic_mini_pos_str
148 \skip_new:N \g__enumext_keyans_pic_parsep_skip
149 \box_new:N \l__enumext_anspic_label_box
150 \box_new:N \l__enumext_anspic_body_box
151 \dim_new:N \l__enumext_anspic_label_htdp_dim
152 \dim_new:N \l__enumext_anspic_body_htdp_dim

```

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

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

```

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

```

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

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

```

161 \bool_new:N \l__enumext_hyperref_bool
162 \bool_new:N \l__enumext_footnotes_key_bool

```

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

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

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

```

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

```

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

Internal variables used for redefinition of `\footnote` (§12.42.4).

```

171 \int_new:N \g__enumext_footnote_int
172 \seq_new:N \g__enumext_footnote_arg_seq
173 \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`.)

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

```

174 \cs_set_protected:Npn \__enumext_tmp:n #1
175 {
176   \bool_new:c { l__enumext_item_starred_#1_bool }
177   \int_new:c { l__enumext_item_column_pos_#1_int }
178   \int_new:c { g__enumext_item_count_all_#1_int }
179   \int_new:c { l__enumext_joined_item_#1_int }
180   \int_new:c { l__enumext_joined_item_aux_#1_int }
181   \int_new:c { l__enumext_tmpa_#1_int }
182   \dim_new:c { l__enumext_tmpa_#1_dim }
183   \box_new:c { l__enumext_item_text_#1_box }
184   \dim_new:c { l__enumext_joined_width_#1_dim }
185   \dim_new:c { l__enumext_item_width_#1_dim }
186   \tl_new:c { g__enumext_item_symbol_aux_#1_tl }
187   \str_new:c { l__enumext_align_label_#1_str }
188   \bool_new:c { g__enumext_minipage_active_#1_bool }
189   \box_new:c { l__enumext_miniright_code_#1_box }
190   \bool_new:c { g__enumext_minipage_center_#1_bool }
191   \dim_new:c { g__enumext_minipage_right_#1_dim }
192   \skip_new:c { g__enumext_minipage_right_#1_skip }
193 }
194 \clist_map_inline:nn { vii, viii } { \__enumext_tmp:n {#1} }

```

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

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

```
195 \clist_const:Nn \c__enumext_all_envs_clist
196 {
197   {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv},
198   {keyans}{v}, {enumext*}{vii}, {keyans*}{viii}
199 }
```

(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`

```
200 \cs_generate_variant:Nn \keys_precompile:nnN { neN }
201 \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.

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

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

`\__enumext_after_env:nn` 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`

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

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

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

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

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

`\__enumext_if_is_int:nT` A conditional function to know if the variable we are passing is an integer used by `start` and `widest` keys.

`\__enumext_if_is_int:nF`

`\__enumext_if_is_int:nTF`

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?](#).

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

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

`\__enumext_regex_counter_style:`

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

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



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

`\__enumext_show_length:nnn`

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

```

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

```

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

`\__enumext_unskip_unkern:`

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

```

238 \cs_new_protected:Nn \__enumext_unskip_unkern:
239 {
240     \int_case:nnT { \lastnodetype }
241     {
242         { 11 }
243         {
244             % \typeout{SKIP} \typeout{\the\lastskip}
245             \unskip
246         }
247         { 12 }
248         {
249             % \typeout{KERN} \typeout{\the\lastkern}
250             \unkern
251         }
252     }
253 }

```

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

### 12.5.1 Utilities for environments and levels

`\__enumext_is_not_nested:`

The function `\__enumext_is_not_nested:` set the variables `\g__enumext_standar_bool` and `\g__enumext_starred_bool` to “true” only if the environments `enumext` and `enumext*` are nested in each other and save the environment name in `\l__enumext_envir_name_tl`.

`\__enumext_is_on_first_level:`

```

254 \cs_new_protected:Nn \__enumext_is_not_nested:
255 {
256     \str_case:en { \@currenvir }
257     {
258         {enumext}
259         {
260             \tl_set:Nn \l__enumext_envir_name_tl { enumext }
261             \bool_lazy_and:nnT
262             { \bool_not_p:n { \g__enumext_standar_bool } }
263             { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
264             {
265                 \bool_gset_true:N \g__enumext_standar_bool
266             }
267         }
268         {enumext*}
269         {
270             \tl_set:Nn \l__enumext_envir_name_tl { enumext* }
271             \bool_lazy_and:nnT
272             { \bool_not_p:n { \g__enumext_starred_bool } }
273             { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
274             {
275                 \bool_gset_true:N \g__enumext_starred_bool
276             }
277         }
278     }
279 }

```

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.

```

280 \cs_new_protected:Nn \__enumext_is_on_first_level:
281 {
282   \bool_lazy_all:nT
283   {
284     { \bool_if_p:N \g__enumext_standar_bool }
285     { \int_compare_p:nNn { \l__enumext_level_int } = { 1 } }
286     { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
287   }
288   {
289     \bool_set_true:N \l__enumext_standar_first_bool
290     \bool_set_true:N \l__enumext_anskey_env_bool
291     \tl_gset:Nn \g__enumext_envir_name_tl { enumext }
292     \tl_gset:Ne \g__enumext_start_line_tl
293     {
294       on ~ line ~ \exp_not:V \inputlineno
295     }
296   }
297   \bool_lazy_all:nT
298   {
299     { \bool_if_p:N \g__enumext_starred_bool }
300     { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
301     { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
302   }
303   {
304     \bool_set_true:N \l__enumext_starred_first_bool
305     \bool_set_true:N \l__enumext_anskey_env_bool
306     \tl_gset:Nn \g__enumext_envir_name_tl { enumext* }
307     \tl_gset:Ne \g__enumext_start_line_tl
308     {
309       on ~ line ~ \exp_not:V \inputlineno
310     }
311   }
312 }

```

(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.

```

313 \cs_new_protected:Nn \__enumext_keyans_name_and_start:
314 {
315   \str_case:en { \@currenvir }
316   {
317     {keyans}
318     {
319       \tl_set:Nn \l__enumext_envir_name_tl { keyans }
320       \tl_set:Ne \l__enumext_check_start_line_env_tl
321       {
322         in ~ 'keyans' ~ start ~ on ~ line ~ \exp_not:V \inputlineno
323       }
324     }
325     {keyans*}
326     {
327       \tl_set:Nn \l__enumext_envir_name_tl { keyans* }
328       \tl_set:Ne \l__enumext_check_start_line_env_tl
329       {
330         in ~ 'keyans*' ~ start ~ on ~ line ~ \exp_not:V \inputlineno
331       }
332     }
333     {keyanspic}
334     {
335       \tl_set:Nn \l__enumext_envir_name_tl { keyanspic }
336       \tl_set:Ne \l__enumext_check_start_line_env_tl
337       {
338         in ~ 'keyanspic' ~ start ~ on ~ line ~ \exp_not:V \inputlineno
339       }
340     }
341   }
342 }

```

(End of definition for \\_\_enumext\_keyans\_name\_and\_start:.)

### 12.5.2 Utilities for log and terminal

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

```

343 \cs_new_protected:Nn \__enumext_reset_global_vars:
344 {
345   \__enumext_reset_global_int:
346   \__enumext_reset_global_bool:
347   \__enumext_reset_global_tl:
348 }
349 \cs_new_protected:Nn \__enumext_reset_global_int:
350 {
351   \int_gzero:N \g__enumext_item_number_int
352   \int_gzero:N \g__enumext_item_anskey_int
353   \int_gzero:N \g__enumext_item_answer_diff_int
354 }
355 \cs_new_protected:Nn \__enumext_reset_global_bool:
356 {
357   \bool_gset_false:N \g__enumext_check_ans_key_bool
358   \bool_gset_false:N \g__enumext_standar_bool
359   \bool_gset_false:N \g__enumext_starred_bool
360 }
361 \cs_new_protected:Nn \__enumext_reset_global_tl:
362 {
363   \tl_gclear:N \g__enumext_store_name_tl
364   \tl_gclear:N \g__enumext_start_line_tl
365   \tl_gclear:N \g__enumext_envir_name_tl
366 }

```

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

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

```

367 \cs_new_protected:Nn \__enumext_log_global_vars:
368 {
369   \msg_log:nneeee { enumext } { prop-seq-int-hook }
370   { \g__enumext_store_name_tl }
371   { \prop_count:c { g__enumext_ \g__enumext_store_name_tl _prop } }
372   { \seq_count:c { g__enumext_ \g__enumext_store_name_tl _seq } }
373   { \int_use:c { g__enumext_resume_ \g__enumext_store_name_tl _int } }
374 }

```

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.

```

375 \cs_new_protected:Nn \__enumext_log_answer_vars:
376 {
377   \msg_log:nneee { enumext } { item-answer-hook }
378   { \int_use:N \g__enumext_item_number_int }
379   { \int_use:N \g__enumext_item_anskey_int }
380   { \int_eval:n { \g__enumext_item_number_int - \g__enumext_item_anskey_int } }
381 }

```

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

```

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

```

And `minipage` environment provided by  $\text{\LaTeX}$  has the following (simplified) plain form:

```

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

```

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

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

```

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

```

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

```

382 \__enumext_at_begin_document:n
383 {
384     \cs_new_eq:NN \__enumext_start_list:nn \list
385     \cs_new_eq:NN \__enumext_stop_list: \endlist
386     \NewCommandCopy \__enumext_item_std:w \item
387 }

```

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

```

388 \__enumext_at_begin_document:n
389 {
390     \cs_new_eq:NN \__enumext_minipage:w \minipage
391     \cs_new_eq:NN \__enumext_endminipage: \endminipage
392 }

```

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

## 12.7 The internal minipage environment

```

\__enumext_internal_mini_page:
__enumext_mini_env*

```

The function `\__enumext_internal_mini_page:` creates a internal `__enumext_mini_page` environment (*custom version* of `minipage`) setting the `\if@minipage` switch to “false” to allow spaces at the “above” of the environment, plus we will add `\skip_vertical:N \c_zero_skip` to maintain alignment on “top” in the first part and `\skip_vertical:N \c_zero_skip` in the second part to allow spaces “below”. This environment will be used internally by the `mini-env` key, it is not documented in the user interface and is for internal use only. 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)

```

393 \cs_new_protected:Nn \__enumext_internal_mini_page:
394 {
395     \int_compare:nNnT { \__enumext_level_int } = { 0 }
396     {
397         \DeclareDocumentEnvironment{__enumext_mini_page}{ m }
398         {
399             \__enumext_minipage:w [ t ] { ##1 }
400             \legacy_if_gset_false:n { @minipage }
401             \skip_vertical:N \c_zero_skip
402         }
403         {
404             \skip_vertical:N \c_zero_skip
405             \__enumext_endminipage:
406         }
407     }
408 }

```

(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.

```

409 \hook_gput_code:nnn { begindocument } { enumext } { \__enumext_after_hyperref: }
410 \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_hyperref_bool` to “true” if the package is loaded. At this point we will use the public macro `\IfHyperBoolean` to determine if the `hyperfootnotes=true` key is present, if so, we set the state of the boolean variable `\__enumext_footnotes_key_bool` to “true”.

```

411 \cs_new_protected:Nn \__enumext_after_hyperref:
412 {
413     \IfPackageLoadedTF { hyperref }
414     {
415         \msg_info:nnn { enumext } { package-load } { hyperref }
416         \bool_set_true:N \l__enumext_hyperref_bool
417         \IfHyperBoolean{hyperfootnotes}
418         {
419             % \typeout{hyperfootnotes=true}
420             \bool_set_true:N \l__enumext_footnotes_key_bool
421         }
422     }

```

```

423         % \typeout{hyperfootnotes=false}
424     }
425 }
426 { }

```

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`.

```

427 \bool_if:NT \l__enumext_footnotes_key_bool
428 {
429     \IfPackageLoadedTF { footnotehyper }
430     {
431         \msg_info:nnn { enumext } { package-load } { footnotehyper }
432     }
433     {
434         % \typeout{No ~ footnotehyper ~ load}
435         % \typeout{Load ~ and ~ use ~ \string\makesavenoteenv{enumext*}}
436         \bool_set_false:N \l__enumext_footnotes_key_bool
437     }
438 }

```

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

```

439 \bool_if:NTF \l__enumext_hyperref_bool
440 {
441     \cs_new_eq:NN \__enumext_hypertarget:nn \hypertarget
442     \cs_new_eq:NN \__enumext_phantomsection: \phantomsection
443 }
444 {
445     \cs_new_eq:NN \__enumext_hypertarget:nn \use_none:nn
446     \cs_new_eq:NN \__enumext_phantomsection: \prg_do_nothing:
447 }
448 }

```

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

`\__enumext_newlabel:nn`

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

#1: `\l__enumext_newlabel_arg_one_tl`  
 #2: `\l__enumext_newlabel_arg_two_tl`

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

```

449 \cs_new_protected:Npn \__enumext_newlabel:nn #1 #2
450 {
451     \protected@write \@auxout { }
452     {
453         \token_to_str:N \newlabel {#1}
454         {
455             {#2}
456             \bool_if:NT \l__enumext_hyperref_bool
457             { { \thepage } {#2} {#1} }
458             { }
459         }
460     }
461     \__enumext_hypertarget:nn {#1} { }
462     \__enumext_phantomsection:
463 }

```

(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.

```

464 \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.

```
465 \cs_new_protected:Npn \__enumext_define_counters:Nn #1 #2
466 {
467   \cs_if_exist:cTF { c@ #2 }
468   { \msg_fatal:nnn { enumext } { counters } { #2 } }
469   {
470     \tl_set:Nn #1 { #2 }
471     \newcounter { #2 }
472   }
473 }
```

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

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

```
enumXi 474 \__enumext_define_counters:Nn \__enumext_counter_i_tl { enumXi }
enumXii 475 \__enumext_define_counters:Nn \__enumext_counter_ii_tl { enumXii }
enumXiii 476 \__enumext_define_counters:Nn \__enumext_counter_iii_tl { enumXiii }
enumXiv 477 \__enumext_define_counters:Nn \__enumext_counter_iv_tl { enumXiv }
enumXv 478 \__enumext_define_counters:Nn \__enumext_counter_v_tl { enumXv }
enumXvi 479 \__enumext_define_counters:Nn \__enumext_counter_vi_tl { enumXvi }
enumXvii 480 \__enumext_define_counters:Nn \__enumext_counter_vii_tl { enumXvii }
enumXviii 481 \__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`, `enumext*`, `keyans` and `keyans*` environments, so it is necessary to get a default value for `labelwidth` from these `<labels>` at the same time.

```
482 \cs_new_protected:Npn \__enumext_register_counter_style:Nn #1 #2
483 {
484   \tl_const:cn { c__enumext_widest_ \cs_to_str:N #1 _tl } {#2}
485   \tl_gput_right:Nn \g__enumext_counter_styles_tl {#1}
486 }
487 \__enumext_register_counter_style:Nn \arabic { 0 }
488 \__enumext_register_counter_style:Nn \Alph { M }
489 \__enumext_register_counter_style:Nn \alph { m }
490 \__enumext_register_counter_style:Nn \Roman { VIII }
491 \__enumext_register_counter_style:Nn \roman { viii }
```

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

```
\__enumext_label_width_by_box:Nn
\__enumext_label_width_by_box:cv
```

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

```
492 \cs_new_protected:Npn \__enumext_label_width_by_box:Nn #1 #2
493 {
494   \hbox_set:Nn \l__enumext_label_width_by_box {#2}
495   \dim_set:Nn #1 { \box_wd:N \l__enumext_label_width_by_box }
496 }
497 \cs_generate_variant:Nn \__enumext_label_width_by_box:Nn { cv }
```

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

```
\__enumext_label_style:Nnn
\__enumext_label_style:cvn
```

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

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



```

499 {
500   \tl_clear_new:N #1
501   \tl_put_right:Ne #1 { \tl_trim_spaces:n {#3} }
502   \tl_gset_eq:NN \g__enumext_widest_label_tl #1
503   \tl_map_inline:Nn \g__enumext_counter_styles_tl
504     {
505       \tl_replace_all:Nne #1 { ##1* } { \exp_not:N ##1 {#2} }
506       \tl_greplace_all:Nne \g__enumext_widest_label_tl { ##1* }
507       { \tl_use:c { c__enumext_widest_ \cs_to_str:N ##1 _tl } }
508     }
509   \__enumext_label_width_by_box:Nn \__enumext_current_widest_dim
510   { \tl_use:N \g__enumext_widest_label_tl }
511   \tl_set_eq:cN { the #2 } #1
512 }
513 \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.

```

514 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
515 {
516   \keys_define:nn { enumext / #1 }
517   {
518     font .tl_set:c = { l__enumext_label_font_style_#2_tl },
519     font .value_required:n = true,
520     labelsep .dim_set:c = { l__enumext_labelsep_#2_dim },
521     labelsep .initial:n = {0.3333em},
522     labelsep .value_required:n = true,
523     labelwidth .dim_set:c = { l__enumext_labelwidth_#2_dim },
524     labelwidth .value_required:n = true,
525     wrap-label .cs_set_protected:cp = { __enumext_wrapper_label_#2:n } ##1,
526     wrap-label .initial:n = {##1},
527     wrap-label .value_required:n = true,
528     wrap-label* .code:n = {
529       \bool_set_true:c { l__enumext_wrap_label_opt_#2_bool }
530       \keys_set:nn { enumext / #1 } { wrap-label = {##1} }
531     },
532     wrap-label* .value_required:n = true,
533   }
534 }
535 \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.

```

536 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
537 {
538   \keys_define:nn { enumext / #1 }
539   {
540     align .choice:,
541     align / left .code:n =
542       {
543         \tl_clear:c { l__enumext_label_fill_left_#2_tl }
544         \tl_set:cn { l__enumext_label_fill_right_#2_tl } { \hfill }
545         \str_set:cn { l__enumext_align_label_pos_#2_str } { l }
546       },
547     align / right .code:n =
548       {
549         \tl_set:cn { l__enumext_label_fill_left_#2_tl } { \hfill }
550         \tl_clear:c { l__enumext_label_fill_right_#2_tl }
551         \str_set:cn { l__enumext_align_label_pos_#2_str } { r }
552       },
553     align / center .code:n =
554       {
555         \tl_set:cn { l__enumext_label_fill_left_#2_tl } { \hfill }

```

```

556         \tl_set:cn { l__enumext_label_fill_right_#2_tl } { \hfill }
557         \str_set:cn { l__enumext_align_label_pos_#2_str } { c }
558     },
559     align / unknown .code:n =
560         \msg_error:nneee { enumext } { unknown-choice }
561         { align } { left, ~ right, ~ center } { \exp_not:n {##1} },
562     align .initial:n = left,
563     align .value_required:n = true,
564 }
565 }
566 \clist_map_inline:nn
567 {
568     {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {keyans}{v}
569 }
570 { \__enumext_tmp:nn #1 }

```

For compatibility with  $\text{\LaTeX}$  tagged PDF we must set `\l__enumext_align_label_pos_X_str`. When tagged PDF is active `\make_label` is redefined and the only way to get the `align` key to work correctly is by using `\makebox`.

```

571 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
572 {
573     \keys_define:nn { enumext / #1 }
574     {
575         align .choice:,
576         align / left .code:n = \str_set:cn { l__enumext_align_label_#2_str } { l },
577         align / right .code:n = \str_set:cn { l__enumext_align_label_#2_str } { r },
578         align / center .code:n = \str_set:cn { l__enumext_align_label_#2_str } { c },
579         align / unknown .code:n =
580             \msg_error:nneee { enumext } { unknown-choice }
581             { align } { left, ~ right, ~ center } { \exp_not:n {##1} },
582         align .initial:n = left,
583         align .value_required:n = true,
584     }
585 }
586 \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.

```

\l__enumext_label_i_tl
\l__enumext_label_ii_tl
\l__enumext_label_iii_tl
\l__enumext_label_iv_tl
587 \cs_set_protected:Npn \__enumext_tmp:nnn #1 #2 #3
588 {
589     \keys_define:nn { enumext / #1 }
590     {
591         label .code:n = {
592             \__enumext_label_style:cvn { l__enumext_label_#2_tl }
593             { l__enumext_counter_#2_tl } {##1}
594             \dim_set_eq:cN { l__enumext_labelwidth_#2_dim }
595             \l__enumext_current_widest_dim
596         },
597         label .initial:n = #3,
598         label .value_required:n = true,
599         ref .code:n = \__enumext_standar_ref:n {##1},
600         ref .value_required:n = true,
601     }
602 }
603 \__enumext_tmp:nnn { level-1 } { i } { \arabic*. }
604 \__enumext_tmp:nnn { level-2 } { ii } { (\alph*. ) }
605 \__enumext_tmp:nnn { level-3 } { iii } { \roman*. }
606 \__enumext_tmp:nnn { level-4 } { iv } { \Alph*. }

```

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

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.

```

607 \cs_new_protected:Npn \__enumext_standar_ref:n #1
608 {
609   \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
610   \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
611   {
612     \msg_error:nnn { enumext } { key-ref-empty } { enumext }
613   }
614   {
615     \tl_set_eq:Nc
616     \l__enumext_ref_the_count_tl { \l__enumext_counter_ \__enumext_level: _tl }
617     \__enumext_regex_counter_style:
618     \tl_set_eq:Nc
619     \l__enumext_ref_the_count_tl { \l__enumext_the_counter_ \__enumext_level: _tl }
620     \tl_put_right:ce { \l__enumext_renew_the_count_ \__enumext_level: _tl }
621     {
622       \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl }
623       { \exp_not:V \l__enumext_ref_key_arg_tl }
624     }
625   }
626 }

```

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

```

627 \cs_new_protected:Npn \__enumext_standar_ref:
628 {
629   \tl_if_empty:cF { \l__enumext_renew_the_count_ \__enumext_level: _tl }
630   {
631     \tl_use:c { \l__enumext_renew_the_count_ \__enumext_level: _tl }
632   }
633 }

```

(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
634 \cs_set_protected:Npn \__enumext_tmp:nnn #1 #2 #3
635 {
636   \keys_define:nn { enumext / #1 }
637   {
638     label .code:n = {
639       \__enumext_label_style:cvn { \l__enumext_label_#2_tl }
640       { \l__enumext_counter_#2_tl } {##1}
641       \dim_set_eq:cN { \l__enumext_labelwidth_#2_dim }
642       \l__enumext_current_widest_dim
643     },
644     label .initial:n = #3,
645     label .value_required:n = true,
646     ref .code:n = \__enumext_starred_ref:n {##1},
647     ref .value_required:n = true,
648   }
649 }
650 \__enumext_tmp:nnn { enumext* } { vii } { \arabic*.}
651 \__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`.

```

652 \cs_new_protected:Npn \__enumext_starred_ref:n #1
653 {
654   \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
655   \int_compare:nNt { \l__enumext_level_h_int } = { 1 }
656   {
657     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
658     {
659       \msg_error:nnn { enumext } { key-ref-empty } { enumext* }
660     }
661     {

```

```

662         \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_counter_vii_tl
663         \__enumext_regex_counter_style:
664         \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_vii_tl
665         \tl_put_right:Ne \l__enumext_renew_the_count_vii_tl
666         {
667             \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl }
668             { \exp_not:V \l__enumext_ref_key_arg_tl }
669         }
670     }
671 }
672 \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
673 {
674     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
675     {
676         \msg_error:nnn { enumext } { key-ref-empty } { keyans* }
677     }
678     {
679         \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_counter_viii_tl
680         \__enumext_regex_counter_style:
681         \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_viii_tl
682         \tl_put_right:Ne \l__enumext_renew_the_count_viii_tl
683         {
684             \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl }
685             { \exp_not:V \l__enumext_ref_key_arg_tl }
686         }
687     }
688 }
689 }

```

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.

```

690 \cs_new_protected:Nn \__enumext_starred_ref:
691 {
692     \int_compare:nNnT { \l__enumext_level_h_int } = { 1 }
693     {
694         \tl_if_empty:NF \l__enumext_renew_the_count_vii_tl
695         {
696             \tl_use:N \l__enumext_renew_the_count_vii_tl
697         }
698     }
699     \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
700     {
701         \tl_if_empty:NF \l__enumext_renew_the_count_viii_tl
702         {
703             \tl_use:N \l__enumext_renew_the_count_viii_tl
704         }
705     }
706 }

```

(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.

```

\l__enumext_label_v_tl
\l__enumext_label_vi_tl
707 \keys_define:nn { enumext / keyans }
708 {
709     label .code:n = {
710         \__enumext_label_style:cvn { \l__enumext_label_v_tl }
711         { \l__enumext_counter_v_tl } {#1}
712         \dim_set_eq:cN { \l__enumext_labelwidth_v_dim }
713         \l__enumext_current_widest_dim
714         \__enumext_label_style:cvn { \l__enumext_label_vi_tl }
715         { \l__enumext_counter_vi_tl } {#1}
716         \dim_set_eq:cN { \l__enumext_labelwidth_v_dim }
717         \l__enumext_current_widest_dim
718     },
719     label .initial:n = \Alph*,
720     label .value_required:n = true,
721     ref .code:n = \__enumext_keyans_ref:n {#1},
722     ref .value_required:n = true,
723 }

```

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

`\__enumext_keyans_ref:n`  
`\__enumext_keyans_ref:`

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

```

724 \cs_new_protected:Npn \__enumext_keyans_ref:n #1
725 {
726   \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
727   \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
728   {
729     \msg_error:nnn { enumext } { key-ref-empty } { keyans }
730   }
731   {
732     \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_counter_v_tl
733     \__enumext_regex_counter_style:
734     \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_v_tl
735     \tl_put_right:Ne \l__enumext_renew_the_count_v_tl
736     {
737       \exp_not:N \renewcommand { \exp_not:N \l__enumext_ref_the_count_tl }
738       { \exp_not:N \l__enumext_ref_key_arg_tl }
739     }
740   }
741 }

```

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

```

742 \cs_new_protected:Nn \__enumext_keyans_ref:
743 {
744   \tl_if_empty:NF \l__enumext_renew_the_count_v_tl
745   {
746     \tl_use:N \l__enumext_renew_the_count_v_tl
747   }
748 }

```

(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: `\l__enumext_label_X_tl`  
 #2: `\l__enumext_start_X_int`  
 #3: *⟨integer or string⟩*

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

```

749 \cs_new_protected:Npn \__enumext_start_from:NNn #1 #2 #3
750 {
751   \__enumext_if_is_int:nTF { #3 }
752   {
753     \int_set:Nn #2 {#3}
754   }
755   {
756     \regex_match:nVT { \c{Alph} | \c{alph} } {#1}
757     { \int_set:Nn #2 { \int_from_alph:n {#3} } }
758     \regex_match:nVT { \c{Roman} | \c{roman} } {#1}
759     { \int_set:Nn #2 { \int_from_roman:n {#3} } }
760   }
761 }
762 \cs_generate_variant:Nn \__enumext_start_from:NNn { ccn, cce }

```

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

`\__enumext_widest_from:nNNn`  
`\__enumext_widest_from:nccn`

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

#1: The counter associated with the environment level  
 #2: `\l__enumext_label_X_tl`  
 #3: `\l__enumext_labelwidth_X_dim`  
 #4: *⟨integer or string⟩*

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

```

763 \cs_new_protected:Npn \__enumext_widest_from:nNNn #1 #2 #3 #4
764 {

```

```

765     \__enumext_if_is_int:nTF {#4}
766     {
767         \setcounter{enumX#1} { #4 }
768     }
769     {
770         \regex_match:nVT { \c{Alph} | \c{alph} } {#2}
771         { \setcounter{enumX#1} { \int_from_alph:n {#4} } }
772         \regex_match:nVT { \c{Roman} | \c{roman} } {#2}
773         { \setcounter{enumX#1} { \int_from_roman:n {#4} } }
774     }
775     \__enumext_label_width_by_box:cv
776     { l__enumext_labelwidth_#1_dim } { l__enumext_label_#1_tl }
777 }
778 \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.

```

779 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
780 {
781     \keys_define:nn { enumext / #1 }
782     {
783         start* .code:n = {
784             \__enumext_start_from:ccn
785             { l__enumext_label_#2_tl }
786             { l__enumext_start_#2_int } {##1}
787         },
788         start* .value_required:n = true,
789         start .code:n = {
790             \__enumext_start_from:cce
791             { l__enumext_label_#2_tl }
792             { l__enumext_start_#2_int } { \int_eval:n {##1} }
793         },
794         start .initial:n = 1,
795         start .value_required:n = true,
796         widest .code:n = {
797             \__enumext_widest_from:nccn {#2}
798             { l__enumext_label_#2_tl }
799             { l__enumext_labelwidth_#2_dim } {##1}
800         },
801         widest .value_required:n = true,
802     }
803 }
804 \clist_map_inline:Nn \__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.

```

805 \cs_set_protected:Npn \__enumext_tmp:nnnnnn #1 #2 #3 #4 #5 #6
806 {
807     \keys_define:nn { enumext / #1 }
808     {
809         topsep .skip_set:c = { l__enumext_topsep_#2_skip },
810         topsep .initial:n = {#3},
811         topsep .value_required:n = true,
812         partopsep .skip_set:c = { l__enumext_partopsep_#2_skip },
813         partopsep .initial:n = {#4},
814         partopsep .value_required:n = true,
815         parsep .skip_set:c = { l__enumext_parsep_#2_skip },
816         parsep .initial:n = {#5},
817         parsep .value_required:n = true,
818         itemsep .skip_set:c = { l__enumext_itemsep_#2_skip },
819         itemsep .initial:n = {#6},
820         itemsep .value_required:n = true,
821         noitemsep .meta:n = { itemsep = 0pt, parsep = 0pt },
822         noitemsep .value_forbidden:n = true,
823         nosepp .meta:n = {

```



```

824             itemsep = 0pt, parsep= 0pt,
825             topsep = 0pt, partopsep = 0pt,
826         },
827         noseprule .value_forbidden:n = true,
828     }
829 }

```

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

```

830 \__enumext_tmp:nnnnnn { level-1 } { i } { 8.0pt plus 2.0pt minus 4.0pt }
831 { 2.0pt plus 1.0pt minus 1.0pt } { 4.0pt plus 2.0pt minus 1.0pt }
832 { 4.0pt plus 2.0pt minus 1.0pt }
833 \__enumext_tmp:nnnnnn { level-2 } { ii } { 4.0pt plus 2.0pt minus 1.0pt }
834 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
835 { 2.0pt plus 1.0pt minus 1.0pt }
836 \__enumext_tmp:nnnnnn { level-3 } { iii } { 2.0pt plus 1.0pt minus 1.0pt }
837 { 1.0pt minus 1.0pt } { 0pt } { 2.0pt plus 1.0pt minus 1.0pt }
838 \__enumext_tmp:nnnnnn { level-4 } { iv } { 2.0pt plus 1.0pt minus 1.0pt }
839 { 1.0pt minus 1.0pt } { 0pt } { 2.0pt plus 1.0pt minus 1.0pt }
840 \__enumext_tmp:nnnnnn { keyans } { v } { 4.0pt plus 2.0pt minus 1.0pt }
841 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
842 { 2.0pt plus 1.0pt minus 1.0pt }
843 \__enumext_tmp:nnnnnn { enumext* } { vii } { 8.0pt plus 2.0pt minus 4.0pt }
844 { 2.0pt plus 1.0pt minus 1.0pt } { 4.0pt plus 2.0pt minus 1.0pt }
845 { 4.0pt plus 2.0pt minus 1.0pt }
846 \__enumext_tmp:nnnnnn { keyans* } { viii } { 4.0pt plus 2.0pt minus 1.0pt }
847 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
848 { 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` environment.

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

```

849 \keys_define:nn { enumext / level-1 }
850 {
851     base-fix .bool_set:N = \l__enumext_base_line_fix_bool,
852     base-fix .initial:n = false,
853     base-fix .value_forbidden:n = true,
854 }

```

(End of definition for `base-fix`.)

`\__enumext_nested_base_line_fix:`

The function `\__enumext_nested_base_line_fix:` will be responsible for applying the *baseline correction* and adjusting the `\keys` for the `enumext` environment and the `\printkeyans` with *starred argument* ‘\*’ (§12.46). This function is passed to the `\__enumext_parse_keys:n` function in the definition of the `enumext` environment (§12.38).

```

855 \cs_new_protected:Nn \__enumext_nested_base_line_fix:
856 {
857     \mode_leave_vertical:
858     \bool_lazy_all:nT
859     {
860         { \bool_if_p:N \l__enumext_starred_first_bool }
861         { \bool_if_p:N \l__enumext_base_line_fix_bool }
862         { \bool_not_p:n { \l__enumext_print_keyans_star_bool } }
863     }
864     {
865         \vspace { -\dim_eval:n { \baselineskip + \parsep } }
866     }
867     \bool_lazy_and:nnT
868     { \bool_if_p:N \l__enumext_starred_first_bool }
869     { \bool_if_p:N \l__enumext_print_keyans_star_bool }
870     {
871         \skip_vertical:n { -\baselineskip }
872         \skip_vertical:N \c_zero_skip
873     }
874     \keys_set:nn { enumext / level-1 }
875     {

```

```

876         topsep = 0pt, above = 0pt, above* = 0pt,
877     }
878     \bool_set_false:N \__enumext_base_line_fix_bool
879 }

```

(End of definition for `\__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.

```

880 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
881 {
882     \keys_define:nn { enumext / #1 }
883     {
884         itemindent .dim_set:c = { l__enumext_fake_item_indent_#2_dim },
885         itemindent .value_required:n = true,
886         rightmargin .dim_set:c = { l__enumext_rightmargin_#2_dim },
887         rightmargin .value_required:n = true,
888         listparindent .dim_set:c = { l__enumext_listparindent_#2_dim },
889         listparindent .value_required:n = true,
890         list-offset .dim_set:c = { l__enumext_listoffset_#2_dim },
891         list-offset .value_required:n = true,
892         list-indent .code:n =
893             \bool_set_true:c { l__enumext_leftmargin_tmp_#2_bool }
894             \dim_set:cn { l__enumext_leftmargin_tmp_#2_dim } {##1},
895         list-indent .value_required:n = true,
896     }
897 }
898 \clist_map_inline:nn
899 {
900     {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {keyans}{v}
901 }
902 { \__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.

```

903 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
904 {
905     \keys_define:nn { enumext / #1 }
906     {
907         itemindent .dim_set:c = { l__enumext_fake_item_indent_#2_dim },
908         itemindent .value_required:n = true,
909         rightmargin .dim_set:c = { l__enumext_rightmargin_#2_dim },
910         rightmargin .value_required:n = true,
911         listparindent .dim_set:c = { l__enumext_listparindent_#2_dim },
912         listparindent .value_required:n = true,
913         list-offset .dim_set:c = { l__enumext_listoffset_#2_dim },
914         list-offset .value_required:n = true,
915         list-indent .meta:n = { list-offset = ##1 },
916         list-indent .value_required:n = true,
917     }
918 }
919 \clist_map_inline:nn
920 {
921     {enumext*}{vii}, {keyans*}{viii}
922 }
923 { \__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 `0pt`. Here I will need to place `\mode_leave_vertical:` and the plain T<sub>E</sub>X macro `\ignorespaces` to avoid unwanted extra space when using the `itemindent` key.

```

924 \cs_set_protected:Nn \__enumext_fake_item_indent:
925 {
926     \dim_compare:nNt
927     { \dim_use:c { l__enumext_fake_item_indent_ \__enumext_level: _dim } }
928     >
929     { \c_zero_dim }

```

```

930     {
931         \tl_set:ce { l__enumext_fake_item_indent_ \__enumext_level: _tl }
932         {
933             \exp_not:N \mode_leave_vertical:
934             \exp_not:n { \skip_horizontal:n }
935             { \dim_use:c { l__enumext_fake_item_indent_ \__enumext_level: _dim } }
936             \ignorespaces
937         }
938     }
939 }
940 \cs_set_protected:Nn \__enumext_keyans_fake_item_indent:
941 {
942     \dim_compare:nNnT
943     { \l__enumext_fake_item_indent_v_dim } > { \c_zero_dim }
944     {
945         \tl_set:Ne \l__enumext_fake_item_indent_v_tl
946         {
947             \exp_not:N \mode_leave_vertical:
948             \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_v_dim
949             \ignorespaces
950         }
951     }
952 }
953 \cs_set_protected:Nn \__enumext_fake_item_vii:
954 {
955     \dim_compare:nNnT
956     { \l__enumext_fake_item_indent_vii_dim } > { \c_zero_dim }
957     {
958         \tl_set:Ne \l__enumext_fake_item_indent_vii_tl
959         {
960             \exp_not:N \mode_leave_vertical:
961             \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_vii_dim
962             \ignorespaces
963         }
964     }
965 }
966 \cs_set_protected:Nn \__enumext_fake_item_viii:
967 {
968     \dim_compare:nNnT
969     { \l__enumext_fake_item_indent_viii_dim } > { \c_zero_dim }
970     {
971         \tl_set:Ne \l__enumext_fake_item_indent_viii_tl
972         {
973             \exp_not:N \mode_leave_vertical:
974             \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_viii_dim
975             \ignorespaces
976         }
977     }
978 }

```

(End of definition for `\__enumext_fake_item_indent:` 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.

```

979 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
980 {
981     \keys_define:nn { enumext / #1 }
982     {
983         show-length .bool_set:c = { l__enumext_show_length_#2_bool },
984         show-length .initial:n = false,
985     }
986 }
987 \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

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

```

before 988 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
before* 989 {
after    990   \keys_define:nn { enumext / #1 }
first    991   {
          992     before .tl_set:c = { l__enumext_before_no_starred_key_#2_tl },
          993     before .value_required:n = true,
          994     before* .tl_set:c = { l__enumext_before_starred_key_#2_tl },
          995     before* .value_required:n = true,
          996     after .tl_set:c = { l__enumext_after_stop_list_#2_tl },
          997     after .value_required:n = true,
          998     first .tl_set:c = { l__enumext_after_list_args_#2_tl },
          999     first .value_required:n = true,
1000     }
1001   }
1002 \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⟩}`.

```

1003 \cs_new_protected:Nn \__enumext_before_args_exec:
1004 {
1005   \tl_use:c { l__enumext_before_starred_key_ \__enumext_level: _tl }
1006 }

```

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⟩}`

```

1007 \cs_new_protected:Nn \__enumext_before_keys_exec:
1008 {
1009   \tl_use:c { l__enumext_before_no_starred_key_ \__enumext_level: _tl }
1010 }

```

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

```

1011 \cs_new_protected:Nn \__enumext_after_stop_list:
1012 {
1013   \tl_use:c { l__enumext_after_stop_list_ \__enumext_level: _tl }
1014 }

```

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.`

```

1015 \cs_new_protected:Nn \__enumext_after_args_exec:
1016 {
1017   \tl_use:c { l__enumext_after_list_args_ \__enumext_level: _tl }
1018 }

```

(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:
1019 \cs_new_protected:Nn \__enumext_before_args_exec_v:
1020 {
1021   \tl_use:N \l__enumext_before_starred_key_v_tl
1022 }
1023 \cs_new_protected:Nn \__enumext_before_keys_exec_v:
1024 {
1025   \tl_use:N \l__enumext_before_no_starred_key_v_tl
1026 }
1027 \cs_new_protected:Nn \__enumext_after_stop_list_v:
1028 {
1029   \tl_use:N \l__enumext_after_stop_list_v_tl
1030 }
1031 \cs_new_protected:Nn \__enumext_after_args_exec_v:
1032 {

```

```

1033     \tl_use:N \l__enumext_after_list_args_v_tl
1034   }

```

(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*`

`\__enumext_before_args_exec_vii:` Same implementation as the one used in the `enumext` environment.

```

\__enumext_before_keys_exec_vii:
\__enumext_after_stop_list_vii:
\__enumext_after_args_exec_vii:
1035 \cs_new_protected:Nn \__enumext_before_args_exec_vii:
1036 {
1037   \tl_use:N \l__enumext_before_starred_key_vii_tl
1038 }
1039 \cs_new_protected:Nn \__enumext_before_args_exec_viii:
1040 {
1041   \tl_use:N \l__enumext_before_starred_key_viii_tl
1042 }
1043 \cs_new_protected:Nn \__enumext_before_keys_exec_vii:
1044 {
1045   \tl_use:N \l__enumext_before_no_starred_key_vii_tl
1046 }
1047 \cs_new_protected:Nn \__enumext_before_keys_exec_viii:
1048 {
1049   \tl_use:N \l__enumext_before_no_starred_key_viii_tl
1050 }
1051 \cs_new_protected:Nn \__enumext_after_stop_list_vii:
1052 {
1053   \tl_use:N \l__enumext_after_stop_list_vii_tl
1054 }
1055 \cs_new_protected:Nn \__enumext_after_stop_list_viii:
1056 {
1057   \tl_use:N \l__enumext_after_stop_list_viii_tl
1058 }
1059 \cs_new_protected:Nn \__enumext_after_args_exec_vii:
1060 {
1061   \tl_use:N \l__enumext_after_list_args_vii_tl
1062 }
1063 \cs_new_protected:Nn \__enumext_after_args_exec_viii:
1064 {
1065   \tl_use:N \l__enumext_after_list_args_viii_tl
1066 }

```

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

### 12.20 Setting keys for `multicols` and `minipage`

`mini-env` 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.

```

1067 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1068 {
1069   \keys_define:nn { enumext / #1 }
1070   {
1071     mini-env .dim_set:c = { \l__enumext_minipage_right_#2_dim },
1072     mini-env .value_required:n = true,
1073     mini-sep .dim_set:c = { \l__enumext_minipage_hsep_#2_dim },
1074     mini-sep .initial:n = 0.3333em,
1075     mini-sep .value_required:n = true,
1076     columns-sep .dim_set:c = { \l__enumext_columns_sep_#2_dim },
1077     columns-sep .value_required:n = true,
1078     columns .int_set:c = { \l__enumext_columns_#2_int },
1079     columns .initial:n = 1,
1080     columns .value_required:n = true,
1081   }
1082 }
1083 \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.

```

1084 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1085 {
1086   \keys_define:nn { enumext / #1 }

```

```

1087 {
1088   mini-right .tl_gset:c = { g__enumext_miniright_code_#2_tl },
1089   mini-right .value_required:n = true,
1090   mini-right* .code:n = {
1091     \bool_gset_true:c { g__enumext_minipage_center_#2_bool }
1092     \keys_set:nn { enumext / #1 } { mini-right = {##1} }
1093   },
1094   mini-right* .value_required:n = true,
1095 }
1096 }
1097 \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 multicol

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

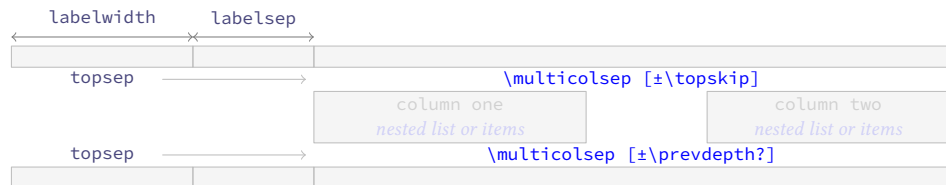


Figure 7: Representation of the vertical space in `multicol` for a nested level.

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

🌱 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 multicol in enumext

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

We will set the default values taking into account that T<sub>E</sub>X is in *horizontal mode*, then we will make the settings for the *vertical mode* in which `\partopsep` comes into play.

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

```

1098 \cs_new_protected:Nn \__enumext_multi_set_vskip:
1099 {
1100   \skip_set:cn { l__enumext_multicol_above_ \__enumext_level: _skip }
1101   {
1102     \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip }
1103   }
1104   \skip_set:cn { l__enumext_multicol_below_ \__enumext_level: _skip }
1105   {
1106     \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip }
1107   }
1108   \__enumext_add_pre_parsep:
1109 }

```

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

`\__enumext_add_pre_parsep:` The function `\__enumext_add_pre_parsep:` “adjusted” the value of `\l__enumext_multicol_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*.

```

1110 \cs_new_protected:Nn \__enumext_add_pre_parsep:
1111 {
1112   \int_case:nn { \l__enumext_level_int }
1113   {
1114     { 2 } {
1115       \skip_if_eq:nnF { \l__enumext_parsep_i_skip } { \c_zero_skip }
1116       {
1117         \skip_add:Nn \l__enumext_multicol_above_ii_skip
1118         {

```



```

1119         \l__enumext_parsep_i_skip
1120     }
1121 }
1122 }
1123 { 3 }{
1124     \skip_if_eq:nnF { \l__enumext_parsep_ii_skip } { \c_zero_skip }
1125     {
1126         \skip_add:Nn \l__enumext_multicols_above_iii_skip
1127         {
1128             \l__enumext_parsep_ii_skip
1129         }
1130     }
1131 }
1132 { 4 }{
1133     \skip_if_eq:nnF { \l__enumext_parsep_iii_skip } { \c_zero_skip }
1134     {
1135         \skip_add:Nn \l__enumext_multicols_above_iv_skip
1136         {
1137             \l__enumext_parsep_iii_skip
1138         }
1139     }
1140 }
1141 }
1142 }

```

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

```

1143 \cs_new_protected:Nn \__enumext_multi_addvspace:
1144 {
1145     \__enumext_multi_set_vskip:
1146     \mode_if_vertical:T
1147     {
1148         \skip_add:cn { \l__enumext_multicols_above_ \__enumext_level: _skip }
1149         {
1150             \skip_use:c { \l__enumext_partopsep_ \__enumext_level: _skip }
1151         }
1152         \skip_add:cn { \l__enumext_multicols_below_ \__enumext_level: _skip }
1153         {
1154             \skip_use:c { \l__enumext_partopsep_ \__enumext_level: _skip }
1155         }
1156     }
1157     %% \__enumext_unskip_unkern: % remove for pdflatex-dev
1158     \par\nopagebreak
1159     \addvspace{ \skip_use:c { \l__enumext_multicols_above_ \__enumext_level: _skip } }
1160 }

```

(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:`

```

1161 \cs_new_protected:Nn \__enumext_keyans_multi_set_vskip:
1162 {
1163     \skip_set:Nn \l__enumext_multicols_above_v_skip
1164     {
1165         \l__enumext_topsep_v_skip
1166     }
1167     \skip_set:Nn \l__enumext_multicols_below_v_skip
1168     {
1169         \l__enumext_topsep_v_skip
1170     }
1171 }
1172 \cs_new_protected:Nn \__enumext_keyans_multi_addvspace:
1173 {
1174     \__enumext_keyans_multi_set_vskip:
1175     \mode_if_vertical:T
1176     {

```

```

1177 \skip_add:Nn \l__enumext_multicols_above_v_skip
1178 {
1179   \skip_use:N \l__enumext_partopsep_v_skip
1180 }
1181 \skip_add:Nn \l__enumext_multicols_below_v_skip
1182 {
1183   \skip_use:N \l__enumext_partopsep_v_skip
1184 }
1185 }
1186 %% \l__enumext_unskip_unkern: % remove for pdflatex-dev
1187 \par\nopagebreak
1188 \addvspace{ \l__enumext_multicols_above_v_skip }
1189 }

```

(End of definition for `\l__enumext_keyans_multi_set_vskip:` and `\l__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  $\text{\TeX}$  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`[14] 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_minipage_set_skip:
\__enumext_minipage_add_space:

```

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

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

```

1190 \cs_new_protected:Nn \__enumext_minipage_set_skip:
1191 {
1192   \skip_set:Nn \l__enumext_minipage_right_skip
1193   {
1194     \skip_use:c { \l__enumext_topsep_ \__enumext_level: _skip }
1195   }
1196   \mode_if_vertical:T
1197   {
1198     \skip_add:Nn \l__enumext_minipage_right_skip
1199     {
1200       \skip_use:c { \l__enumext_partopsep_ \__enumext_level: _skip }
1201     }
1202   }
1203   \skip_set_eq:NN \l__enumext_minipage_after_skip \l__enumext_minipage_right_skip

```

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

```

1204 \skip_set_eq:cN
1205 { \l__enumext_multicols_above_ \__enumext_level: _skip } \l__enumext_minipage_right_skip
1206 \skip_set_eq:cN
1207 { \l__enumext_multicols_below_ \__enumext_level: _skip } \l__enumext_minipage_right_skip
1208 \__enumext_pre_itemsep_skip:

```

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

```

1209 \int_compare:nNt
1210 { \int_use:c { \l__enumext_columns_ \l__enumext_level: _int } } > { 1 }
1211 {
1212   \skip_zero:N \topskip
1213   \skip_set_eq:Nc \multicolsep { \l__enumext_multicols_above_ \l__enumext_level: _skip }
1214 }
1215 }

```

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

```

1216 \cs_new_protected:Nn \l__enumext_minipage_add_space:
1217 {
1218   \l__enumext_minipage_set_skip:
1219   \l__enumext_unskip_unkern:
1220   \mode_if_vertical:TF
1221   {
1222     \nopagebreak\nointerlineskip
1223   }
1224   {
1225     \par\nopagebreak\nointerlineskip
1226     \skip_zero:c { \l__enumext_partopsep_ \l__enumext_level: _skip }
1227   }
1228   \int_compare:nNtTF
1229   { \int_use:c { \l__enumext_columns_ \l__enumext_level: _int } } > { 1 }
1230   {
1231     \addvspace{ 0.445\box_ht:N \strutbox }
1232   }
1233   {
1234     \addvspace{ 0.250\box_ht:N \strutbox }
1235   }
1236 }

```

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

`\l__enumext_pre_itemsep_skip:`

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

```

1237 \cs_new_protected:Nn \l__enumext_pre_itemsep_skip:
1238 {
1239   \int_case:nn { \l__enumext_level_int }
1240   {
1241     { 2 }{
1242       \skip_if_eq:nnTF
1243       { \l__enumext_itemsep_i_skip } { \l__enumext_minipage_after_skip }
1244       {
1245         \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1246         \skip_set:Nn \l__enumext_multicols_below_ii_skip { 0.350\box_ht:N \strutbox }
1247       }
1248       {
1249         \dim_compare:nNt
1250         { \l__enumext_itemsep_i_skip } < { \l__enumext_minipage_after_skip }
1251         {
1252           \skip_sub:Nn
1253           \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1254           \skip_sub:Nn
1255           \l__enumext_multicols_below_ii_skip { \l__enumext_itemsep_i_skip }
1256           \skip_add:Nn
1257           \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1258           \skip_add:Nn
1259           \l__enumext_multicols_below_ii_skip { 0.350\box_ht:N \strutbox }
1260         }
1261         \dim_compare:nNt
1262         { \l__enumext_itemsep_i_skip } > { \l__enumext_minipage_after_skip }
1263         {
1264           \skip_set:Nn \l__enumext_minipage_temp_skip
1265           {

```

```

1266         \l__enumext_itemsep_i_skip - \l__enumext_minipage_after_skip
1267     }
1268     \skip_sub:Nn
1269     \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1270     \skip_sub:Nn
1271     \l__enumext_multicols_below_ii_skip { \l__enumext_itemsep_i_skip }
1272     \skip_add:Nn
1273     \l__enumext_minipage_after_skip
1274     { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1275     \skip_add:Nn
1276     \l__enumext_multicols_below_ii_skip
1277     { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1278 }
1279 }
1280 }
1281 { 3 }{
1282     \skip_if_eq:nnTF
1283     { \l__enumext_itemsep_ii_skip } { \c_zero_skip }
1284     {
1285         \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1286         \skip_set:Nn \l__enumext_multicols_below_iii_skip { 0.350\box_ht:N \strutbox }
1287     }
1288     {
1289         \dim_compare:nNnT
1290         { \l__enumext_itemsep_ii_skip } < { \l__enumext_minipage_after_skip }
1291         {
1292             \skip_sub:Nn
1293             \l__enumext_minipage_after_skip { \l__enumext_itemsep_ii_skip }
1294             \skip_sub:Nn
1295             \l__enumext_multicols_below_iii_skip { \l__enumext_itemsep_ii_skip }
1296             \skip_add:Nn
1297             \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1298             \skip_add:Nn
1299             \l__enumext_multicols_below_iii_skip { 0.350\box_ht:N \strutbox }
1300         }
1301         \dim_compare:nNnT
1302         { \l__enumext_itemsep_ii_skip } > { \l__enumext_minipage_after_skip }
1303         {
1304             \skip_set:Nn \l__enumext_minipage_temp_skip
1305             {
1306                 \l__enumext_itemsep_ii_skip - \l__enumext_minipage_after_skip
1307             }
1308             \skip_sub:Nn
1309             \l__enumext_minipage_after_skip { \l__enumext_itemsep_ii_skip }
1310             \skip_sub:Nn
1311             \l__enumext_multicols_below_iii_skip { \l__enumext_itemsep_ii_skip }
1312             \skip_add:Nn
1313             \l__enumext_minipage_after_skip
1314             { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1315             \skip_add:Nn
1316             \l__enumext_multicols_below_iii_skip
1317             { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1318         }
1319     }
1320 }
1321 { 4 }{
1322     \skip_if_eq:nnTF { \l__enumext_itemsep_iii_skip } { \c_zero_skip }
1323     {
1324         \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1325         \skip_set:Nn \l__enumext_multicols_below_iv_skip { 0.350\box_ht:N \strutbox }
1326     }
1327     {
1328         \dim_compare:nNnT
1329         { \l__enumext_itemsep_iii_skip } < { \l__enumext_minipage_after_skip }
1330         {
1331             \skip_sub:Nn
1332             \l__enumext_minipage_after_skip { \l__enumext_itemsep_iii_skip }
1333             \skip_sub:Nn
1334             \l__enumext_multicols_below_iv_skip { \l__enumext_itemsep_iii_skip }
1335             \skip_add:Nn
1336             \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }

```

```

1337         \skip_add:Nn
1338         \l__enumext_multicols_below_iv_skip { 0.350\box_ht:N \strutbox }
1339     }
1340     \dim_compare:nNt
1341     { \l__enumext_itemsep_iii_skip } > { \l__enumext_minipage_after_skip }
1342     {
1343         \skip_set:Nn \l__enumext_minipage_temp_skip
1344         {
1345             \l__enumext_itemsep_iii_skip - \l__enumext_minipage_after_skip
1346         }
1347         \skip_sub:Nn
1348         \l__enumext_minipage_after_skip { \l__enumext_itemsep_iii_skip }
1349         \skip_sub:Nn
1350         \l__enumext_multicols_below_iv_skip { \l__enumext_itemsep_iii_skip }
1351         \skip_add:Nn
1352         \l__enumext_minipage_after_skip
1353         { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1354         \skip_add:Nn
1355         \l__enumext_multicols_below_iv_skip
1356         { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1357     }
1358 }
1359 }
1360 }
1361 }

```

(End of definition for `\l__enumext_pre_itemsep_skip:`)

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

```

\__enumext_keyans_minipage_set_skip:
\__enumext_keyans_minipage_add_space:
\__enumext_keyans_pre_itemsep_skip:

```

The function `\__enumext_keyans_mini_set_vskip:` will take care of determining the “adjusted” spaces that we will apply “above” and “below” the `\__enumext_mini_page` environment in [keyans](#). The implementation of this function is the same as the one used in [enumext](#).

```

1362 \cs_new_protected:Nn \__enumext_keyans_minipage_set_skip:
1363 {
1364     \skip_zero:N \l__enumext_minipage_after_skip
1365     \skip_zero:N \l__enumext_minipage_left_skip
1366     \skip_zero:N \l__enumext_minipage_right_skip
1367     \skip_set:Nn \l__enumext_minipage_right_skip
1368     {
1369         \l__enumext_topsep_v_skip
1370     }
1371     \mode_if_vertical:T
1372     {
1373         \skip_add:Nn \l__enumext_minipage_right_skip
1374         {
1375             \l__enumext_partopsep_v_skip
1376         }
1377     }
1378     \skip_set_eq:NN \l__enumext_minipage_after_skip \l__enumext_minipage_right_skip
1379     \skip_set_eq:NN \l__enumext_multicols_above_v_skip \l__enumext_minipage_right_skip
1380     \skip_set_eq:NN \l__enumext_multicols_below_v_skip \l__enumext_minipage_right_skip
1381     \__enumext_keyans_pre_itemsep_skip:
1382     \int_compare:nNt { \l__enumext_columns_v_int } > { 1 }
1383     {
1384         \skip_zero:N \topskip
1385         \skip_set_eq:NN \multicolsep \l__enumext_minipage_right_skip
1386     }
1387 }
1388 \cs_new_protected:Nn \__enumext_keyans_minipage_add_space:
1389 {
1390     \__enumext_keyans_minipage_set_skip:
1391     \__enumext_unskip_unkern:
1392     \mode_if_vertical:TF
1393     {
1394         \nopagebreak\nointerlineskip
1395     }
1396     {
1397         \par\nopagebreak\nointerlineskip
1398         \skip_zero:N \l__enumext_partopsep_v_skip
1399     }
1400     \int_compare:nNt { \l__enumext_columns_v_int } > { 1 }

```

```

1401     {
1402         \addvspace{ 0.445\box_ht:N \strutbox }
1403     }
1404     {
1405         \addvspace{ 0.250\box_ht:N \strutbox }
1406     }
1407 }
1408 \cs_new_protected:Nn \__enumext_keyans_pre_itemsep_skip:
1409 {
1410     \skip_if_eq:nnTF
1411     { \l__enumext_itemsep_i_skip } { \l__enumext_minipage_after_skip }
1412     {
1413         \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1414         \skip_set:Nn \l__enumext_multicols_below_v_skip { 0.350\box_ht:N \strutbox }
1415     }
1416     {
1417         \dim_compare:nNnT
1418         { \l__enumext_itemsep_i_skip } < { \l__enumext_minipage_after_skip }
1419         {
1420             \skip_sub:Nn \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1421             \skip_sub:Nn \l__enumext_multicols_below_v_skip { \l__enumext_itemsep_i_skip }
1422             \skip_add:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1423             \skip_add:Nn \l__enumext_multicols_below_v_skip { 0.350\box_ht:N \strutbox }
1424         }
1425         \dim_compare:nNnT
1426         { \l__enumext_itemsep_i_skip } > { \l__enumext_minipage_after_skip }
1427         {
1428             \skip_set:Nn \l__enumext_minipage_temp_skip
1429             {
1430                 \l__enumext_itemsep_i_skip - \l__enumext_minipage_after_skip
1431             }
1432             \skip_sub:Nn \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1433             \skip_sub:Nn \l__enumext_multicols_below_v_skip { \l__enumext_itemsep_i_skip }
1434             \skip_add:Nn \l__enumext_minipage_after_skip
1435             { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1436             \skip_add:Nn \l__enumext_multicols_below_v_skip
1437             { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1438         }
1439     }
1440 }

```

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

### 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_page` environment in `enumext*` and `keyans*`.

```

1441 \cs_new_protected:Nn \__enumext_mini_set_vskip_vii:
1442 {
1443     \skip_zero_new:N \l__enumext_minipage_left_skip
1444     \skip_gzero_new:N \g__enumext_minipage_right_skip
1445     \skip_gzero_new:N \g__enumext_minipage_after_skip
1446     \skip_if_eq:nnTF { \l__enumext_topsep_vii_skip } { \c_zero_skip }
1447     {
1448         \skip_set:Nn \l__enumext_minipage_left_skip { 0.5\box_dp:N \strutbox }
1449         \skip_gset:Nn \g__enumext_minipage_right_skip { 0.325\box_dp:N \strutbox }
1450     }
1451     {
1452         \skip_set:Nn \l__enumext_minipage_left_skip { 0.5875\box_dp:N \strutbox }
1453         \skip_gset:Nn \g__enumext_minipage_right_skip
1454         {
1455             \l__enumext_topsep_vii_skip
1456         }
1457         \skip_gset:Nn \g__enumext_minipage_after_skip
1458         {
1459             0.325\box_dp:N \strutbox + \l__enumext_topsep_vii_skip
1460         }
1461     }
1462 }
1463 \cs_new_protected:Nn \__enumext_mini_set_vskip_viii:

```



```

1464 {
1465   \skip_zero_new:N \l__enumext_minipage_after_skip
1466   \skip_zero_new:N \l__enumext_minipage_left_skip
1467   \skip_zero_new:N \l__enumext_minipage_right_skip
1468   \skip_if_eq:nnTF { \l__enumext_topsep_viii_skip } { \c_zero_skip }
1469   {
1470     \skip_set:Nn \l__enumext_minipage_left_skip
1471     {
1472       0.5\box_dp:N \strutbox
1473     }
1474     \skip_set:Nn \l__enumext_minipage_right_skip
1475     {
1476       \l__enumext_partopsep_viii_skip
1477     }
1478     \skip_set:Nn \l__enumext_minipage_after_skip
1479     {
1480       1.6\box_dp:N \strutbox
1481     }
1482   }
1483   {
1484     \skip_set:Nn \l__enumext_minipage_left_skip
1485     {
1486       0.5875\box_dp:N \strutbox
1487     }
1488     \skip_set:Nn \l__enumext_minipage_right_skip
1489     {
1490       \l__enumext_topsep_viii_skip
1491     }
1492     \skip_set:Nn \l__enumext_minipage_after_skip
1493     {
1494       0.325\box_dp:N \strutbox + \l__enumext_topsep_viii_skip
1495     }
1496   }
1497 }

```

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

`\__enumext_mini_addvspace_vii:`  
`\__enumext_mini_addvspace_viii:`

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

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

```

1498 \cs_new_protected:Nn \__enumext_mini_addvspace_vii:
1499 {
1500   \__enumext_mini_set_vskip_vii:
1501   \par\nopagebreak
1502   \addvspace { \l__enumext_minipage_left_skip }
1503 }
1504 \cs_new_protected:Nn \__enumext_mini_addvspace_viii:
1505 {
1506   \__enumext_mini_set_vskip_viii:
1507   \par\nopagebreak
1508   \addvspace { \l__enumext_minipage_left_skip }
1509 }

```

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

`\miniright`

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

```

1510 \NewDocumentCommand \miniright { s }
1511 {
1512   \int_compare:nNt { \l__enumext_keyans_pic_level_int } = { 1 }

```

```

1513     {
1514       \msg_error:nnn { enumext } { wrong-miniright-place }
1515     }
1516   % outside
1517   \bool_lazy_and:nnT
1518   { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
1519   { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
1520   {
1521     \msg_error:nnn { enumext } { wrong-miniright-place }
1522   }
1523   % starred env
1524   \bool_if:NT \l__enumext_starred_bool
1525   {
1526     \msg_error:nnn { enumext } { wrong-miniright-starred }
1527   }
1528   \int_compare:nNnTF { \l__enumext_keyans_level_int } = { 1 }
1529   {
1530     \__enumext_keyans_mini_right_cmd:n {#1}
1531   }
1532   { \__enumext_mini_right_cmd:n {#1} }
1533 }

```

(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_page` environment on the “left side”, then we open the `\__enumext_mini_page` environment on the “right side”, apply our adjusted “vertical spaces”, followed by adding the `\centering` command when the *starred* argument ‘`*`’ is not present and set zero `\g__enumext_minipage_stat_int`, otherwise we return an error.

```

1534 \cs_new_protected:Npn \__enumext_mini_right_cmd:n #1
1535 {
1536   \dim_compare:nNnTF
1537   { \dim_use:c { \l__enumext_minipage_right_ \__enumext_level: _dim } } > { \c_zero_dim }
1538   {
1539     \__enumext_multicols_stop:
1540     \int_compare:nNnTF
1541     { \int_use:c { \l__enumext_columns_ \__enumext_level: _int } } = { 1 }
1542     {
1543       \par\addvspace{ \l__enumext_minipage_after_skip }
1544     }
1545     \end__enumext_mini_page
1546     \hfill
1547     \__enumext_mini_page{ \dim_use:c { \l__enumext_minipage_right_ \__enumext_level: _dim } }
1548     \par\nointerlineskip
1549     \addvspace { \l__enumext_minipage_right_skip }
1550     \bool_if:nF {#1}
1551     {
1552       \centering
1553     }
1554     \int_gzero:N \g__enumext_minipage_stat_int
1555   }
1556   { \msg_error:nnn { enumext } { wrong-miniright-use } }
1557   % paranoia
1558   \RenewDocumentCommand \miniright { s }
1559   {
1560     \msg_error:nn { enumext } { many-miniright-used }
1561   }
1562 }

```

(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.

```

1563 \cs_new_protected:Npn \__enumext_keyans_mini_right_cmd:n #1
1564 {
1565   \dim_compare:nNnTF { \l__enumext_minipage_right_v_dim } > { \c_zero_dim }
1566   {
1567     \__enumext_keyans_multicols_stop:
1568     \int_compare:nNnTF { \l__enumext_columns_v_int } = { 1 }

```

```

1569         {
1570             \par\addvspace{ \l__enumext_minipage_after_skip }
1571         }
1572     \end__enumext_mini_page
1573     \hfill
1574     \__enumext_mini_page{ \l__enumext_minipage_right_v_dim }
1575     \par\nointerlineskip
1576     \addvspace { \l__enumext_minipage_right_skip }
1577     \bool_if:nF {#1}
1578     {
1579         \centering
1580     }
1581     \int_gzero:N \g__enumext_minipage_stat_int
1582 }
1583 { \msg_error:nnn { enumext } { wrong-miniright-use } }
1584 % paranoia
1585 \RenewDocumentCommand \miniright { s }
1586 {
1587     \msg_error:nn { enumext } { many-miniright-used }
1588 }
1589 }

```

(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*
below
below*
1590 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1591 {
1592     \keys_define:nn { enumext / #1 }
1593     {
1594         above .skip_set:c = { \l__enumext_vspace_above_#2_skip },
1595         above .value_required:n = true,
1596         above* .code:n = \bool_set_true:c { \l__enumext_vspace_a_star_#2_bool }
1597             \keys_set:nn { enumext / #1 } { above = {##1} },
1598         above* .value_required:n = true,
1599         below .skip_set:c = { \l__enumext_vspace_below_#2_skip },
1600         below .value_required:n = true,
1601         below* .code:n = \bool_set_true:c { \l__enumext_vspace_b_star_#2_bool }
1602             \keys_set:nn { enumext / #1 } { below = {##1} },
1603         below* .value_required:n = true,
1604     }
1605 }
1606 \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.

```

1607 \cs_new_protected:Nn \__enumext_vspace_above:
1608 {
1609     \skip_if_eq:nnF
1610     { \skip_use:c { \l__enumext_vspace_above_ \__enumext_level: _skip } } { \c_zero_skip }
1611     {
1612         \bool_if:cTF { \l__enumext_vspace_a_star_ \__enumext_level: _bool }
1613         {
1614             \vspace*{ \skip_use:c { \l__enumext_vspace_above_ \__enumext_level: _skip } }
1615         }
1616         {
1617             \vspace { \skip_use:c { \l__enumext_vspace_above_ \__enumext_level: _skip } }
1618         }
1619     }
1620 }

```

(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.

```

1621 \cs_new_protected:Nn \__enumext_vspace_below:
1622 {
1623   \skip_if_eq:nnF
1624   { \skip_use:c { l__enumext_vspace_below_ \__enumext_level: _skip } } { \c_zero_skip }
1625   {
1626     \bool_if:cTF { l__enumext_vspace_b_star_ \__enumext_level: _bool }
1627     {
1628       \vspace*{ \skip_use:c { l__enumext_vspace_below_ \__enumext_level: _skip } }
1629     }
1630     {
1631       \vspace { \skip_use:c { l__enumext_vspace_below_ \__enumext_level: _skip } }
1632     }
1633   }
1634 }

```

(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.

```

1635 \cs_new_protected:Nn \__enumext_vspace_above_v:
1636 {
1637   \skip_if_eq:nnF { \l__enumext_vspace_above_v_skip } { \c_zero_skip }
1638   {
1639     \bool_if:NTF \l__enumext_vspace_a_star_v_bool
1640     {
1641       \vspace*{ \l__enumext_vspace_above_v_skip }
1642     }
1643     { \vspace { \l__enumext_vspace_above_v_skip } }
1644   }
1645 }

```

(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.

```

1646 \cs_new_protected:Nn \__enumext_vspace_below_v:
1647 {
1648   \skip_if_eq:nnF { \l__enumext_vspace_below_v_skip } { \c_zero_skip }
1649   {
1650     \bool_if:NTF \l__enumext_vspace_b_star_v_bool
1651     {
1652       \vspace*{ \l__enumext_vspace_below_v_skip }
1653     }
1654     { \vspace { \l__enumext_vspace_below_v_skip } }
1655   }
1656 }

```

(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.

`\__enumext_vspace_above_viii`:

```

1657 \cs_new_protected:Nn \__enumext_vspace_above_vii:
1658 {
1659   \skip_if_eq:nnF { \l__enumext_vspace_above_vii_skip } { \c_zero_skip }
1660   {
1661     \bool_if:NTF \l__enumext_vspace_a_star_vii_bool
1662     {
1663       \vspace*{ \l__enumext_vspace_above_vii_skip }
1664     }
1665     { \vspace { \l__enumext_vspace_above_vii_skip } }
1666   }
1667 }
1668 \cs_new_protected:Nn \__enumext_vspace_above_viii:
1669 {
1670   \skip_if_eq:nnF { \l__enumext_vspace_above_viii_skip } { \c_zero_skip }
1671   {

```

```

1672         \bool_if:NTF \l__enumext_vspace_a_star_viii_bool
1673         {
1674             \vspace*{ \l__enumext_vspace_above_viii_skip }
1675         }
1676         { \vspace { \l__enumext_vspace_above_viii_skip } }
1677     }
1678 }

```

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

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

`\__enumext_vspace_below_viii:`

```

1679 \cs_new_protected:Nn \__enumext_vspace_below_vii:
1680 {
1681     \skip_if_eq:nnF { \l__enumext_vspace_below_vii_skip } { \c_zero_skip }
1682     {
1683         \bool_if:NTF \l__enumext_vspace_b_star_vii_bool
1684         {
1685             \vspace*{ \l__enumext_vspace_below_vii_skip }
1686         }
1687         { \vspace { \l__enumext_vspace_below_vii_skip } }
1688     }
1689 }
1690 \cs_new_protected:Nn \__enumext_vspace_below_viii:
1691 {
1692     \skip_if_eq:nnF { \l__enumext_vspace_below_viii_skip } { \c_zero_skip }
1693     {
1694         \bool_if:NTF \l__enumext_vspace_b_star_viii_bool
1695         {
1696             \vspace*{ \l__enumext_vspace_below_viii_skip }
1697         }
1698         { \vspace { \l__enumext_vspace_below_viii_skip } }
1699     }
1700 }

```

(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  $\langle keys \rangle$  passed to the *optional argument* of the “first level” of the environments `enumext` and `enumext*`, but, discarding some specific  $\langle keys \rangle$ . This implementation is adapted directly from the code provided by Jonathan P. Spratte (@Skillmon) in `chat-Tex-SX`

`series`  
`resume`  
`resume*`

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

```

1701 \cs_set_protected:Npn \__enumext_tmp:n #1
1702 {
1703     \keys_define:nn { enumext / #1 }
1704     {
1705         series .str_set:N = \l__enumext_series_str,
1706         series .value_required:n = true,
1707         resume .code:n = \__enumext_resume_series:n {##1},
1708         resume* .code:n = \__enumext_resume_starred:,
1709         resume* .value_forbidden:n = true,
1710     }
1711 }
1712 \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

`\__enumext_filter_series:n`  
`\__enumext_filter_series_key:n`  
`\__enumext_filter_series_pair:nn`

The function `\__enumext_filter_series:n` will be in charge of filtering the  $\langle keys \rangle$  we want to store where  $\{#1\}$  represents the *optional argument* passed to the environment.

```

1713 \cs_new:Npn \__enumext_filter_series:n #1
1714 {
1715     \use:e
1716     {
1717         \keyval_parse:NNn
1718         \__enumext_filter_series_key:n
1719         \__enumext_filter_series_pair:nn {#1}
1720     }
1721 }

```

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.

```

1722 \cs_new:Npn \__enumext_filter_series_key:n #1
1723 {
1724   \str_case:nnF {#1}
1725   {
1726     { resume } {} { resume* } {} { base-fix } {}
1727   }
1728   { , { \exp_not:n {#1} } }
1729 }

```

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.

```

1730 \cs_new:Npn \__enumext_filter_series_pair:nn #1#2
1731 {
1732   \str_case:nnF {#1}
1733   {
1734     { series } {} { resume } {} { start } {}
1735     { start* } {} { save-ans } {} { save-key } {}
1736   }
1737   { , { \exp_not:n {#1} } = { \exp_not:n {#2} } }
1738 }

```

(End of definition for `\__enumext_filter_series:n`, `\__enumext_filter_series_key:n`, and `\__enumext_filter_series_pair:nn`.)

```

\__enumext_parse_series:n
\__enumext_resume_last:n

```

The function `\__enumext_parse_series:n` will be responsible for storing the filtered *(keys)* in the global variable `\g__enumext_series_<series name>_tl` along with the creation of the integer variable `\g__enumext_series_<series name>_int` when the key is passed as an argument; otherwise, it will check the state of the boolean variable `\l__enumext_resume_active_bool` set by the keys `resume` and `resume*` and will call the function `\__enumext_resume_last:n`.

- The value of boolean variable `\l__enumext_resume_active_bool` is set to true by the function `\__enumext_resume_counter:n` which is used by the keys `resume` and `resume*`, in this case we must Make sure it is set to false so that it does not overwrite the default filtered *(keys)*. This function is passed to the function `\__enumext_parse_keys:n` in the `enumext` environment definition (§12.38) and to the function `\__enumext_parse_keys_vii:n` in the `enumext*` environment definition (§12.43).

```

1739 \cs_new_protected:Npn \__enumext_parse_series:n #1
1740 {
1741   \str_if_empty:NTF \l__enumext_series_str
1742   {
1743     \bool_if:NF \l__enumext_resume_active_bool
1744     {
1745       \__enumext_resume_last:n {#1}
1746     }
1747   }
1748   {
1749     \tl_gclear_new:c { g__enumext_series_ \l__enumext_series_str _tl }
1750     \tl_gset:ce { g__enumext_series_ \l__enumext_series_str _tl }
1751     { \__enumext_filter_series:n {#1} }
1752     \int_if_exist:cF { g__enumext_series_ \l__enumext_series_str _int }
1753     {
1754       \int_new:c { g__enumext_series_ \l__enumext_series_str _int }
1755     }
1756   }
1757 }

```

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.

```

1758 \cs_new_protected:Npn \__enumext_resume_last:n #1
1759 {
1760   \bool_if:NT \l__enumext_standar_first_bool
1761   {
1762     \tl_gclear:N \g__enumext_standar_series_tl
1763     \tl_gset:Ne \g__enumext_standar_series_tl { \__enumext_filter_series:n {#1} }
1764   }
1765   \bool_if:NT \l__enumext_starred_first_bool
1766   {
1767     \tl_gclear:N \g__enumext_starred_series_tl

```

```

1768         \tl_gset:Nx \g__enumext_starred_series_tl { \__enumext_filter_series:n {#1} }
1769     }
1770 }

```

(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_⟨series name⟩_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).

```

1771 \cs_new_protected:Nn \__enumext_resume_save_counter:
1772 {
1773     \bool_if:NT \g__enumext_standar_bool
1774     {
1775         \tl_if_empty:NF \l__enumext_series_str
1776         {
1777             \int_gset_eq:cN
1778             { g__enumext_series_ \l__enumext_series_str_int } \value{enumXi}
1779         }
1780         \tl_if_empty:NTF \l__enumext_resume_name_tl
1781         {
1782             \str_if_empty:NT \l__enumext_series_str
1783             {
1784                 \int_gset_eq:NN \g__enumext_resume_int \value{enumXi}
1785             }
1786         }
1787         {
1788             \int_if_exist:cT { g__enumext_series_ \l__enumext_resume_name_tl_int }
1789             {
1790                 \int_gset_eq:cN
1791                 { g__enumext_series_ \l__enumext_resume_name_tl_int } \value{enumXi}
1792             }
1793         }
1794         \int_if_exist:cT { g__enumext_resume_ \l__enumext_store_name_tl_int }
1795         {
1796             \int_gset_eq:cN
1797             { g__enumext_resume_ \l__enumext_store_name_tl_int } \value{enumXi}
1798         }
1799     }
1800     \bool_if:NT \g__enumext_starred_bool
1801     {
1802         \tl_if_empty:NF \l__enumext_series_str
1803         {
1804             \int_gset_eq:cN
1805             { g__enumext_series_ \l__enumext_series_str_int } \value{enumXvii}
1806         }
1807         \tl_if_empty:NTF \l__enumext_resume_name_tl
1808         {
1809             \str_if_empty:NT \l__enumext_series_str
1810             {
1811                 \int_gset_eq:NN \g__enumext_resume_vii_int \value{enumXvii}
1812             }
1813         }
1814         {
1815             \int_if_exist:cT { g__enumext_series_ \l__enumext_resume_name_tl_int }
1816             {
1817                 \int_gset_eq:cN
1818                 { g__enumext_series_ \l__enumext_resume_name_tl_int } \value{enumXvii}
1819             }
1820         }
1821         \int_if_exist:cT { g__enumext_resume_ \l__enumext_store_name_tl_int }
1822         {
1823             \int_gset_eq:cN

```



```

1824         { g__enumext_resume_ \l__enumext_store_name_tl _int } \value{enumXvii}
1825     }
1826 }
1827 }

```

(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.

```

1828 \cs_new_protected:Npn \__enumext_resume_series:n #1
1829 {
1830     \tl_if_empty:NTF {#1}
1831     {
1832         \__enumext_resume_counter:n { }
1833     }
1834     {
1835         \tl_if_exist:cTF { g__enumext_series_ \tl_to_str:n {#1} _tl }
1836         {
1837             \__enumext_resume_counter:n {#1}
1838             \bool_if:NT \g__enumext_standar_bool
1839             {
1840                 \keys_set:nv { enumext / level-1 }
1841                 { g__enumext_series_ \tl_to_str:n {#1} _tl }
1842             }
1843             \bool_if:NT \g__enumext_starred_bool
1844             {
1845                 \keys_set:nv { enumext / enumext* }
1846                 { g__enumext_series_ \tl_to_str:n {#1} _tl }
1847             }
1848         }
1849         {
1850             \bool_if:NT \g__enumext_standar_bool
1851             {
1852                 \msg_error:nnn { enumext } { unknown-series } {#1}
1853             }
1854             \bool_if:NT \g__enumext_starred_bool
1855             {
1856                 \msg_error:nnn { enumext } { unknown-series } {#1}
1857             }
1858         }
1859     }
1860 }

```

(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`.

```

1861 \cs_new_protected:Npn \__enumext_resume_counter:n #1
1862 {
1863     \bool_set_true:N \l__enumext_resume_active_bool
1864     \tl_set:Nn \l__enumext_resume_name_tl {#1}
1865     \tl_if_empty:NTF \l__enumext_resume_name_tl
1866     {
1867         \__enumext_resume_counter:
1868     }
1869     {
1870         \__enumext_resume_counter_series:
1871     }
1872     \__enumext_resume_counter_save_ans:
1873 }

```

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.

```

1874 \cs_new_protected:Nn \__enumext_resume_counter:
1875 {
1876   \bool_if:NT \g__enumext_standar_bool
1877   {
1878     \int_gincr:N \g__enumext_resume_int
1879     \int_set_eq:NN \l__enumext_start_i_int \g__enumext_resume_int
1880   }
1881   \bool_if:NT \g__enumext_starred_bool
1882   {
1883     \int_gincr:N \g__enumext_resume_vii_int
1884     \int_set_eq:NN \l__enumext_start_vii_int \g__enumext_resume_vii_int
1885   }
1886 }

```

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.

```

1887 \cs_new_protected:Nn \__enumext_resume_counter_series:
1888 {
1889   \bool_if:NT \g__enumext_standar_bool
1890   {
1891     \int_set:Nn \l__enumext_start_i_int
1892     {
1893       \int_use:c { g__enumext_series_ \l__enumext_resume_name_tl _int } + 1
1894     }
1895   }
1896   \bool_if:NT \g__enumext_starred_bool
1897   {
1898     \int_set:Nn \l__enumext_start_vii_int
1899     {
1900       \int_use:c { g__enumext_series_ \l__enumext_resume_name_tl _int } + 1
1901     }
1902   }
1903 }

```

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.

```

1904 \cs_new_protected:Nn \__enumext_resume_counter_save_ans:
1905 {
1906   \bool_lazy_and:nnT
1907   { \bool_if_p:N \l__enumext_standar_first_bool }
1908   { \bool_if_p:N \l__enumext_store_active_bool }
1909   {
1910     \int_set:Nn \l__enumext_start_i_int
1911     {
1912       \int_use:c { g__enumext_resume_ \l__enumext_store_name_tl _int } + 1
1913     }
1914   }
1915   \bool_lazy_and:nnT
1916   { \bool_if_p:N \l__enumext_starred_first_bool }
1917   { \bool_if_p:N \l__enumext_store_active_bool }
1918   {
1919     \int_set:Nn \l__enumext_start_vii_int
1920     {
1921       \int_use:c { g__enumext_resume_ \l__enumext_store_name_tl _int } + 1
1922     }
1923   }
1924 }

```

(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.

```

1925 \cs_new_protected:Nn \__enumext_resume_starred:
1926 {

```

```

1927     \bool_if:NT \g__enumext_standar_bool
1928     {
1929         \tl_if_empty:NF \g__enumext_standar_series_tl
1930         {
1931             \__enumext_resume_counter:n { }
1932             \keys_set:nV { enumext / level-1 } \g__enumext_standar_series_tl
1933         }
1934     }
1935     \bool_if:NT \g__enumext_starred_bool
1936     {
1937         \tl_if_empty:NF \g__enumext_starred_series_tl
1938         {
1939             \__enumext_resume_counter:n { }
1940             \keys_set:nV { enumext / enumext* } \g__enumext_starred_series_tl
1941         }
1942     }
1943 }

```

(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*`.

```

1944 \cs_set_protected:Npn \__enumext_tmp:n #1
1945 {
1946     \keys_define:nn { enumext / #1 }
1947     {
1948         save-ans .code:n = \__enumext_storing_set:n {##1},
1949         save-ans .value_required:n = true,
1950     }
1951 }
1952 \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:  
\\_\_enumext\_stop\_save\_ans\_msg:

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

```

1953 \cs_new_protected:Nn \__enumext_start_save_ans_msg:
1954 {
1955     \msg_term:nnVV { enumext } { save-ans-log }
1956     \g__enumext_envir_name_tl \l__enumext_store_name_tl
1957 }
1958 \cs_new_protected:Nn \__enumext_stop_save_ans_msg:
1959 {
1960     \msg_term:nnVV { enumext } { save-ans-log-hook }
1961     \g__enumext_envir_name_tl \g__enumext_store_name_tl
1962 }

```

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

\\_\_enumext\_storing\_set:n  
\\_\_enumext\_storing\_exec:

The function `\__enumext_storing_set:n` first pass the value of the `save-ans` key to the variable `\l__enumext_store_name_tl` which will contain the  $\langle store\ name \rangle$  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.

```

1963 \cs_new_protected:Npn \__enumext_storing_set:n #1
1964 {
1965     \tl_set:Nx \l__enumext_store_name_tl {#1}
1966     \tl_if_empty:NTF \l__enumext_store_name_tl
1967     {
1968         \bool_lazy_or:nnT
1969         { \l__enumext_standar_first_bool } { \l__enumext_starred_first_bool }
1970         {

```

```

1971         \msg_error:nnV { enumext } { save-ans-empty } \g__enumext_envir_name_tl
1972     }
1973 }
1974 {
1975     \bool_lazy_or:nnT
1976     { \l__enumext_standar_first_bool } { \l__enumext_starred_first_bool }
1977     {
1978         \__enumext_start_save_ans_msg:
1979         \__enumext_storing_exec:
1980     }
1981 }
1982 }

```

The function `\__enumext_storing_exec:` will set to true the variable `\l__enumext_store_active_bool` which activates the use of the `\anskey` command and the `anskey*`, `keyans`, `keyans*` and `keyanspic` environments and will set to “true” the variable `\l__enumext_check_answers_bool` used for internal checking answers mechanism set by the `check-ans` and `no-store` keys, copy `{⟨store name⟩}` into the variable `\g__enumext_store_name_tl` and execute the function `\__enumext_anskey_env_make:V` creating the environment `anskey*` (§12.30).

```

1983 \cs_new_protected:Nn \__enumext_storing_exec:
1984 {
1985     \bool_set_true:N \l__enumext_store_active_bool
1986     \bool_set_true:N \l__enumext_check_answers_bool
1987     \tl_gset:NV \g__enumext_store_name_tl \l__enumext_store_name_tl
1988     \__enumext_anskey_env_make:V \l__enumext_store_name_tl

```

The *prop list* `\g__enumext_series_⟨store name⟩_prop` and the *sequence* `\g__enumext_series_⟨store name⟩_seq` will be created globally to “store content” in case they do not exist together with the integer variable `\g__enumext_series_⟨store name⟩_int` used by the keys `resume` and `resume*`.

```

1989     \prop_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _prop }
1990     {
1991         \msg_log:nnV { enumext } { store-prop } \l__enumext_store_name_tl
1992         \prop_new:c { g__enumext_ \l__enumext_store_name_tl _prop }
1993     }
1994     \seq_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _seq }
1995     {
1996         \msg_log:nnV { enumext } { store-seq } \l__enumext_store_name_tl
1997         \seq_new:c { g__enumext_ \l__enumext_store_name_tl _seq }
1998     }
1999     \int_if_exist:cF { g__enumext_resume_ \l__enumext_store_name_tl _int }
2000     {
2001         \msg_log:nnV { enumext } { store-int } \l__enumext_store_name_tl
2002         \int_new:c { g__enumext_resume_ \l__enumext_store_name_tl _int }
2003     }
2004 }

```

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

### 12.25.3 The check answer mechanism

The internal mechanism for “checking answers” follows this logic:

If the line begins with `\item` or `\item*` and does NOT *open a nested environment*, each `\item` or `\item*` must contain a *single* execution of the `\anskey` command, i.e. the counter of the executions of the `\anskey` command must be equal to the counter associated with the sum of executions of `\item` and `\item*`.

If the line begins with `\item` or `\item*` and *opens a nested environment* each `\item` or `\item*` in the nested environment must have a *single* execution of the `\anskey` command and the counter associated to the sum of `\item` and `\item*` executions must decrementing by “one” to maintain equality.

In order for the mechanism for the check-answer to work (not counting `keyans`, `keyans*` and `keyanspic`) we need:

1. We must keep track of the total number of `\item` and `\item*` (enumerated) that appear within the environment including the nested levels.
2. We must keep track of the total number of `\item` and `\item*` (enumerated) that appear per level of nesting.
3. Keeping track of the number of times the environment nests.

The integer variable associated to the sum of each `\item` and `\item*` in the environment `\g__enumext_item_number_int` must match the integer variable `\g__enumext_item_anskey_int` associated to the execution of the command `\anskey`. We analyze the cases:

- If the list only has one level the number of `\item` + `\item*` = `\anskey`
- 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

no-store

```

2005 \cs_set_protected:Npn \__enumext_tmp:n #1
2006 {
2007   \keys_define:nn { enumext / #1 }
2008   {
2009     check-ans .bool_set:N = \l__enumext_check_ans_key_bool,
2010     check-ans .initial:n = false,
2011     check-ans .value_required:n = true,
2012     no-store .code:n = {
2013       \bool_set_false:N \l__enumext_check_answers_bool
2014       \bool_set_false:N \l__enumext_check_ans_key_bool
2015     },
2016     no-store .value_forbidden:n = true,
2017   }
2018 }
2019 \clist_map_inline:nn
2020 {
2021   level-1, level-2, level-3, level-4, enumext*
2022 }
2023 { \__enumext_tmp:n {#1} }
```

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

#### 12.25.5 Set-up check answer mechanism

\\_\_enumext\_check\_ans\_active:

\\_\_enumext\_check\_ans\_level:

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

```

2024 \cs_new_protected:Nn \__enumext_check_ans_active:
2025 {
2026   \tl_if_empty:NF \l__enumext_store_name_tl
2027   {
2028     \bool_if:NT \l__enumext_check_answers_bool
2029     {
2030       \__enumext_check_ans_level:
2031     }
2032   }
2033 }
```

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

```

2034 \cs_new_protected:Nn \__enumext_check_ans_level:
2035 {
2036   \int_case:nn { \l__enumext_level_int }
2037   {
2038     { 1 }{
2039       \bool_lazy_all:nT
2040       {
2041         { \bool_if_p:N \g__enumext_starred_bool }
2042         { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
2043       }
2044       {
2045         \int_gdecr:N \g__enumext_item_number_int
2046         \bool_set_false:N \l__enumext_item_number_bool
2047       }
2048     }
2049     { 2 }{
2050       \int_gdecr:N \g__enumext_item_number_int
2051       \bool_set_false:N \l__enumext_item_number_bool
2052     }
2053   }
```

```

2053     { 3 }{
2054         \int_gdecr:N \g__enumext_item_number_int
2055         \bool_set_false:N \l__enumext_item_number_bool
2056     }
2057     { 4 }{
2058         \int_gdecr:N \g__enumext_item_number_int
2059         \bool_set_false:N \l__enumext_item_number_bool
2060     }
2061 }

```

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.

```

2062     \int_case:nn { \l__enumext_level_h_int }
2063     {
2064         { 1 }{
2065             \bool_lazy_all:nT
2066             {
2067                 { \bool_if_p:N \g__enumext_standar_bool }
2068                 { \int_compare_p:nNn { \l__enumext_level_int } = { 1 } }
2069             }
2070             {
2071                 \int_gdecr:N \g__enumext_item_number_int
2072                 \bool_set_false:N \l__enumext_item_number_bool
2073             }
2074         }
2075     }
2076 }

```

(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.

```

2077 \cs_new_protected:Nn \__enumext_check_ans_key_hook:
2078 {
2079     \bool_lazy_and:nnT
2080     { \bool_if_p:N \l__enumext_check_ans_key_bool }
2081     { \bool_if_p:N \g__enumext_standar_bool }
2082     {
2083         \bool_gset_true:N \g__enumext_check_ans_key_bool
2084     }
2085     \bool_lazy_and:nnT
2086     { \bool_if_p:N \l__enumext_check_ans_key_bool }
2087     { \bool_if_p:N \g__enumext_starred_bool }
2088     {
2089         \bool_gset_true:N \g__enumext_check_ans_key_bool
2090     }
2091 }

```

(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:`.

```

2092 \cs_new_protected:Nn \__enumext_item_answer_diff:
2093 {
2094     \int_gset:Nn \g__enumext_item_answer_diff_int
2095     {
2096         \int_sign:n { \g__enumext_item_number_int - \g__enumext_item_anskey_int }
2097     }
2098 }

```

(End of definition for `\__enumext_item_answer_diff:`)

`\__enumext_check_ans_show:`

`\__enumext_check_ans_msg_less:`  
`\__enumext_check_ans_msg_same_ok:`  
`\__enumext_check_ans_msg_greater:`

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

```

2099 \cs_new_protected:Nn \__enumext_check_ans_show:
2100 {

```

```

2101 \int_case:nn { \g__enumext_item_answer_diff_int }
2102 {
2103   { -1 }{ \__enumext_check_ans_msg_less: }
2104   { 0 }{ \__enumext_check_ans_msg_same_ok: }
2105   { 1 }{ \__enumext_check_ans_msg_greater: }
2106 }
2107 }
2108 \cs_new_protected:Nn \__enumext_check_ans_msg_less:
2109 {
2110   \msg_warning:nnee { enumext } { item-less-answer } { \g__enumext_store_name_tl }
2111   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2112 }
2113 \cs_new_protected:Nn \__enumext_check_ans_msg_same_ok:
2114 {
2115   \msg_term:nnee { enumext } { items-same-answer } { \g__enumext_store_name_tl }
2116   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2117 }
2118 \cs_new_protected:Nn \__enumext_check_ans_msg_greater:
2119 {
2120   \msg_warning:nnee { enumext } { item-greater-answer } { \g__enumext_store_name_tl }
2121   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2122 }

```

(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:`.

```

2123 \cs_new_protected:Nn \__enumext_check_ans_log:
2124 {
2125   \int_case:nn { \g__enumext_item_answer_diff_int }
2126   {
2127     { -1 }{ \__enumext_check_ans_log_msg_less: }
2128     { 0 }{ \__enumext_check_ans_log_msg_same_ok: }
2129     { 1 }{ \__enumext_check_ans_log_msg_greater: }
2130   }
2131 }
2132 \cs_new_protected:Nn \__enumext_check_ans_log_msg_less:
2133 {
2134   \msg_log:nnee { enumext } { item-less-answer } { \g__enumext_store_name_tl }
2135   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2136 }
2137 \cs_new_protected:Nn \__enumext_check_ans_log_msg_same_ok:
2138 {
2139   \msg_log:nnee { enumext } { items-same-answer } { \g__enumext_store_name_tl }
2140   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2141 }
2142 \cs_new_protected:Nn \__enumext_check_ans_log_msg_greater:
2143 {
2144   \msg_log:nnee { enumext } { item-greater-answer } { \g__enumext_store_name_tl }
2145   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2146 }

```

(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.

```

2147 \cs_new_protected:Npn \__enumext_check_starred_cmd:n #1
2148 {
2149   \int_compare:nNt
2150   { \g__enumext_check_starred_cmd_int } = { 0 }
2151   {
2152     \msg_warning:nnnV
2153     { enumext } { missing-starred }{ #1 } \l__enumext_check_start_line_env_tl
2154   }
2155   \int_compare:nNt
2156   { \g__enumext_check_starred_cmd_int } > { 1 }
2157   {

```



```

2158         \msg_warning:nnv
2159         { enumext } { many-starred }{ #1 } \__enumext_check_start_line_env_tl
2160     }
2161     \int_gzero:N \g__enumext_check_starred_cmd_int
2162     \tl_clear:N \l__enumext_check_start_line_env_tl
2163 }

```

(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*`.

```

2164 \cs_set_protected:Npn \__enumext_tmp:n #1
2165 {
2166     \keys_define:nn { enumext / #1 }
2167     {
2168         wrap-ans .cs_set_protected:Np = \__enumext_anskey_wrapper:n ##1,
2169         wrap-ans .initial:n =
2170             {
2171                 \fbox{\parbox[t]{\dimeval{\itemwidth -2\fboxsep -2\fboxrule}}{##1}}
2172             },
2173         wrap-ans .value_required:n = true,
2174         wrap-opt .cs_set_protected:Np = \__enumext_keyans_wrapper_opt:n ##1,
2175         wrap-opt .initial:n = [{##1}],
2176         wrap-opt .value_required:n = true,
2177         save-sep .tl_set:N = \l__enumext_store_keyans_item_opt_sep_tl,
2178         save-sep .initial:n = {, ~ },
2179         save-sep .value_required:n = true,
2180         mark-ans .tl_set:N = \l__enumext_mark_answer_sym_tl,
2181         mark-ans .initial:n = \textasteriskcentered,
2182         mark-ans .value_required:n = true,
2183         mark-pos .choice:,
2184         mark-pos / left .code:n = \str_set:Nn \l__enumext_mark_position_str { l },
2185         mark-pos / right .code:n = \str_set:Nn \l__enumext_mark_position_str { r },
2186         mark-pos / unknown .code:n =
2187             \msg_error:nnee { enumext } { unknown-choice }
2188             { mark-pos } { left, ~ right } { \exp_not:n {##1} },
2189         mark-pos .initial:n = right,
2190         mark-pos .value_required:n = true,
2191         show-ans .bool_set:N = \l__enumext_show_answer_bool,
2192         show-ans .initial:n = false,
2193         show-ans .value_required:n = true,
2194         show-pos .bool_set:N = \l__enumext_show_position_bool,
2195         show-pos .initial:n = false,
2196         show-pos .value_required:n = true,
2197         mark-ref .tl_set:N = \l__enumext_mark_ref_sym_tl,
2198         mark-ref .initial:n = \textasteriskcentered,
2199         mark-ref .value_required:n = true,
2200         save-ref .bool_set:N = \l__enumext_store_ref_key_bool,
2201         save-ref .initial:n = false,
2202         save-ref .value_required:n = true,
2203     }
2204 }
2205 \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`.

```

2206 \cs_set_protected:Npn \__enumext_tmp:n #1
2207 {
2208     \keys_define:nn { enumext / #1 }
2209     {
2210         mark-pos .choice:,
2211         mark-pos / left .code:n = \str_set:Nn \l__enumext_mark_position_str { l },
2212         mark-pos / right .code:n = \str_set:Nn \l__enumext_mark_position_str { r },
2213         mark-pos .initial:n = right,
2214         mark-pos .value_required:n = true,
2215         show-ans .bool_set:N = \l__enumext_show_answer_bool,
2216         show-ans .initial:n = false,
2217         show-ans .value_required:n = true,

```

```

2218         show-pos .bool_set:N = \l__enumext_show_position_bool,
2219         show-pos .initial:n = false,
2220         show-pos .value_required:n = true,
2221     }
2222 }
2223 \clist_map_inline:nn { keyans, keyans* } { \l__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 structure*” in the *sequence* is to have a copy of the *structure of the environment* in which the key `save-ans` is being executed so we must capture the *optional argument* passed to the levels of the environment in which it is executed and “*storing*” this in the *sequence*.

```

\__enumext_store_active_keys:n
\__enumext_store_active_keys_vii:n

```

The functions `\__enumext_store_active_keys:n` and `\__enumext_store_active_keys_vii:n` will be responsible for the “*storing keys*” filtered from the *optional argument* of the environment in which the key `save-ans` is executed and the levels within this for the `enumext` and `enumext*` environments. We will execute this function only if the variable `\l__enumext_store_save_key_X_bool` is false, that is, the key `store-key` is not active, establishing the variable `\l__enumext_store_save_key_X_tl` with the filtered *keys*.

```

2224 \cs_new_protected:Npn \__enumext_store_active_keys:n #1
2225 {
2226     \bool_if:cF { \l__enumext_store_save_key_ \__enumext_level: _bool }
2227     {
2228         \tl_clear:c { \l__enumext_save_key_ \__enumext_level: _tl }
2229         \tl_set:ce
2230             { \l__enumext_store_save_key_ \__enumext_level: _tl }
2231             { \__enumext_filter_save_key:n {#1} }
2232     }
2233 }
2234 \cs_new_protected:Npn \__enumext_store_active_keys_vii:n #1
2235 {
2236     \bool_if:NF \l__enumext_store_save_key_vii_bool
2237     {
2238         \tl_clear:N \l__enumext_store_save_key_vii_tl
2239         \tl_set:Ne \l__enumext_store_save_key_vii_tl { \__enumext_filter_save_key:n {#1} }
2240     }
2241 }

```

(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 “*storing structure*” in the *sequence* established by the `save-ans` key when executing `\anskey` or `anskey*`, we will not be able to modify it. The best thing here is to have a key that allows you to modify the *optional argument* of the “*storing structure*” in the *sequence*.

save-key

The values set by this key passed in the *optional argument* of the `enumext` and `enumext*` environments will override the values of the `\l__enumext_store_save_key_X_tl` variable set by the functions `\__enumext_store_active_keys:n` and `\__enumext_store_active_keys_vii:n`. Now define the key `save-key` for all levels of `enumext` and `enumext*` environments.

```

2242 \cs_set_protected:Npn \__enumext_tmp:n #1
2243 {
2244     \keys_define:nn { enumext / enumext* }
2245     {
2246         save-key .code:n = \__enumext_parse_save_key_vii:n {##1},
2247         save-key .value_required:n = true,
2248     }
2249     \keys_define:nn { enumext / #1 }
2250     {
2251         save-key .code:n = \__enumext_parse_save_key:n {##1},
2252         save-key .value_required:n = true,
2253     }
2254 }
2255 \clist_map_inline:nn { level-1, level-2, level-3, level-4 } { \__enumext_tmp:n {#1} }

```

(End of definition for save-key.)

```

__enumext_parse_save_key:n
  __enumext_parse_save_key_vii:n

```

The functions `__enumext_parse_save_key:n` and `__enumext_parse_save_key_vii:n` will be responsible for “*storing keys*” in the variable `l__enumext_store_save_key_X_tl` for `enumext` and `enumext*`.

```

2256 \cs_new_protected:Npn __enumext_parse_save_key:n #1
2257 {
2258   \bool_set_true:c { l__enumext_store_save_key_ __enumext_level: _bool }
2259   \tl_clear:c { l__enumext_save_key_ __enumext_level: _tl }
2260   \tl_set:ce
2261     { l__enumext_store_save_key_ __enumext_level: _tl }
2262     { __enumext_filter_save_key:n {#1} }
2263 }
2264 \cs_new_protected:Npn __enumext_parse_save_key_vii:n #1
2265 {
2266   \bool_set_true:N l__enumext_store_save_key_vii_bool
2267   \tl_clear:N l__enumext_store_save_key_vii_tl
2268   \tl_set:Ne l__enumext_store_save_key_vii_tl { __enumext_filter_save_key:n {#1} }
2269 }

```

(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

```

__enumext_filter_save_key:n
  __enumext_filter_save_key_key:n
  __enumext_filter_save_key_pair:nn

```

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

```

2270 \cs_new:Npn __enumext_filter_save_key:n #1
2271 {
2272   \use:e
2273     {
2274       \keyval_parse:NNn
2275         __enumext_filter_save_key_key:n
2276         __enumext_filter_save_key_pair:nn {#1}
2277     }
2278 }

```

The function `__enumext_filter_save_key_key:n` will be responsible for “*filtering keys*” that are passed “*without value*” by excluding the `resume`, `resume*`, `no-store` and `base-fix` keys.

```

2279 \cs_new:Npn __enumext_filter_save_key_key:n #1
2280 {
2281   \str_case:nnF {#1}
2282     {
2283       { resume } {} { resume* } {} { no-store } {} { base-fix } {}
2284     }
2285     { , { \exp_not:n {#1} } }
2286 }

```

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

```

2287 \cs_new:Npn __enumext_filter_save_key_pair:nn #1#2
2288 {
2289   \str_case:nnF {#1}
2290     {
2291       { series } {} { resume } {} { save-ans } {} { save-ref } {}
2292       { save-key } {} { check-ans } {} { show-ans } {} { show-pos } {}
2293       { wrap-ans } {} { mark-ans } {} { wrap-opt } {} { save-sep } {}
2294       { mark-ref } {} { mini-env } {} { mini-sep } {} { mini-right } {}
2295       { mini-right* } {}
2296     }
2297     { , { \exp_not:n {#1} } = { \exp_not:n {#2} } }
2298 }

```

(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 `\getkeyans` command.

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

```

2299 \cs_new_protected:Npn __enumext_store_addto_prop:n #1
2300 {

```

```

2301 \prop_gput_if_not_in:cen { g__enumext_ \l__enumext_store_name_tl _prop }
2302 {
2303   \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } + 1 }
2304 }
2305 { #1 }
2306 }
2307 \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  $\{\langle content \rangle\}$  in *sequence* defined by `save-ans` key. This function is used by \anskey in `enumext`, \item\* in `keyans` and \anspic in `keyanspic`.

The form in which the  $\{\langle content \rangle\}$  is stored in *sequence* is in 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.

```

2308 \cs_new_protected:Npn \__enumext_store_addto_seq:n #1
2309 {
2310   \seq_gput_right:cn { g__enumext_ \l__enumext_store_name_tl _seq } { #1 }
2311 }
2312 \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 “*storing structure*” is handled by the functions \\_\_enumext\_store\_level\_open: and \\_\_enumext\_store\_level\_close: which are executed per level within the `enumext` environment.

```

2313 \cs_new_protected:Npn \__enumext_store_level_open:
2314 {
2315   \bool_if:NT \l__enumext_check_answers_bool
2316   {
2317     \tl_if_empty:cTF { l__enumext_store_save_key_ \__enumext_level: _tl }
2318     {
2319       \__enumext_store_addto_seq:n
2320       {
2321         \item \begin{enumext}
2322       }
2323     }
2324     {
2325       \tl_put_left:cn { l__enumext_store_save_key_ \__enumext_level: _tl }
2326       {
2327         \item \begin{enumext} [
2328       }
2329       \tl_put_right:cn { l__enumext_store_save_key_ \__enumext_level: _tl }
2330       {
2331         ]
2332       }
2333       \__enumext_store_addto_seq:v { l__enumext_store_save_key_ \__enumext_level: _tl }
2334     }
2335   }
2336 }
2337 \cs_new_protected:Npn \__enumext_store_level_close:
2338 {
2339   \bool_if:NT \l__enumext_check_answers_bool
2340   {
2341     \__enumext_store_addto_seq:n { \end{enumext} }
2342   }
2343 }

```

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

The “*storing structure*” is handled by the functions \\_\_enumext\_store\_level\_open\_vii: and \\_\_enumext\_store\_level\_close\_vii: which are executed in the `enumext*` environment.

```

2344 \cs_new_protected:Npn \__enumext_store_level_open_vii:
2345 {
2346   \bool_if:NT \l__enumext_check_answers_bool
2347   {
2348     \tl_if_empty:NTF \l__enumext_store_save_key_vii_tl
2349     {
2350       \__enumext_store_addto_seq:n

```

```

2351         {
2352             \item \begin{enumext*}
2353         }
2354     }
2355     {
2356         \tl_put_left:Nn \l__enumext_store_save_key_vii_tl
2357         {
2358             \item \begin{enumext*}[
2359             ]
2360             \tl_put_right:Nn \l__enumext_store_save_key_vii_tl
2361             {
2362             ]
2363             }
2364             \__enumext_store_addto_seq:V \l__enumext_store_save_key_vii_tl
2365         }
2366     }
2367 }
2368 \cs_new_protected:Nn \__enumext_store_level_close_vii:
2369 {
2370     \bool_if:NT \l__enumext_check_answers_bool
2371     {
2372         \__enumext_store_addto_seq:n { \end{enumext*} }
2373     }
2374 }

```

(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`

```

2375 \cs_new_protected:Nn \__enumext_print_keyans_box:NN
2376 {
2377     \mode_leave_vertical:
2378     \skip_horizontal:n { -\dim_use:N #2 }
2379     \makebox[0pt][ r ]
2380     {
2381         \makebox[ \dim_use:N #1 ][ \l__enumext_mark_position_str ]
2382         {
2383             \tl_use:N \l__enumext_mark_answer_sym_tl
2384         }
2385     }
2386     \skip_horizontal:n { \dim_use:N #2 }
2387 }
2388 \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`.

```

2389 \cs_new_protected:Nn \__enumext_store_internal_ref:
2390 {
2391     \cs_set_protected:Npn \__enumext_tmp:n ##1
2392     {
2393         \tl_set_eq:cc { \l__enumext_label_copy_##1_tl } { \l__enumext_label_##1_tl }
2394         \tl_reverse:c { \l__enumext_label_copy_##1_tl }
2395         \tl_remove_once:cn { \l__enumext_label_copy_##1_tl } { . }
2396         \tl_reverse:c { \l__enumext_label_copy_##1_tl }
2397     }
2398     \clist_map_inline:nn { i, ii, iii, iv, vii } { \__enumext_tmp:n {##1} }
2399     \cs_set:Npn \__enumext_tmp:n ##1
2400     { . \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.

```

2401 \bool_lazy_all:nT
2402 {
2403   { \bool_if_p:N \g__enumext_starred_bool }
2404   { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
2405 }
2406 {
2407   \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2408   { \tl_use:N \l__enumext_label_copy_vii_tl }
2409 }
2410 \bool_lazy_all:nT
2411 {
2412   { \bool_not_p:n { \g__enumext_standar_bool } }
2413   { \bool_if_p:N \l__enumext_standar_bool }
2414   { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } }
2415 }
2416 {
2417   \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2418   {
2419     \tl_use:N \l__enumext_label_copy_vii_tl
2420     \int_step_function:nnN { 1 } { \l__enumext_level_int } \l__enumext_tmp:n
2421   }
2422 }

```

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.

```

2423 \bool_lazy_all:nT
2424 {
2425   { \bool_if_p:N \g__enumext_standar_bool }
2426   { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } }
2427   { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
2428 }
2429 {
2430   \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2431   {
2432     \tl_use:N \l__enumext_label_copy_i_tl
2433     \int_step_function:nnN { 2 } { \l__enumext_level_int } \l__enumext_tmp:n
2434   }
2435 }
2436 \cs_set:Npn \l__enumext_tmp:n ##1
2437 { \tl_use:c { \l__enumext_label_copy_ \int_to_roman:n {##1} _tl } . }
2438 \bool_lazy_all:nT
2439 {
2440   { \bool_if_p:N \g__enumext_standar_bool }
2441   { \bool_if_p:N \l__enumext_starred_bool }
2442   { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } }
2443 }
2444 {
2445   \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2446   {
2447     \int_step_function:nnN { 1 } { \l__enumext_level_int } \l__enumext_tmp:n
2448     \tl_use:N \l__enumext_label_copy_vii_tl
2449   }
2450 }

```

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

```

2451 \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
2452 {
2453   \l__enumext_store_name_tl \c_colon_str
2454   \int_eval:n { \prop_count:c { \g__enumext_ \l__enumext_store_name_tl _prop } }
2455 }

```

Now execute the function `\l__enumext_newlabel:nn` and save the result in the variable `\l__enumext_write_aux_file_tl` and finally we write in the `.aux` file.

```

2456 \tl_put_right:Ne \l__enumext_write_aux_file_tl
2457 {
2458   \l__enumext_newlabel:nn
2459   { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2460   { \l__enumext_newlabel_arg_two_tl }
2461 }
2462 \l__enumext_write_aux_file_tl

```

```
2463 }
```

(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  $\langle argument \rangle$  to the  $\langle prop list \rangle$ , 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*”  $\langle argument \rangle$ .

```
2464 \cs_new_protected:Npn \__enumext_store_anskey_code:n #1
2465 {
2466   \int_gincr:N \g__enumext_item_anskey_int
2467   \__enumext_store_addto_prop:n {#1}
2468   \bool_if:NT \l__enumext_store_ref_key_bool
2469   {
2470     \__enumext_store_internal_ref:
2471   }
2472   \__enumext_anskey_show_wrap_left:n { #1 }
```

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

```
2473   \tl_clear:N \l__enumext_store_anskey_arg_tl
2474   \bool_lazy_and:nnT
2475   { \bool_if_p:N \l__enumext_store_columns_break_bool }
2476   { \bool_not_p:n { \l__enumext_starred_bool } }
2477   {
2478     \tl_put_left:Nn \l__enumext_store_anskey_arg_tl { \columnbreak }
2479   }
2480   \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 `\l__enumext_store_anskey_arg_tl`.

```
2481   \bool_lazy_and:nnT
2482   { \bool_not_p:n { \l__enumext_starred_bool } }
2483   { \int_compare_p:nNn { \l__enumext_store_item_join_int } > { 1 } }
2484   {
2485     \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2486     {
2487       ( \exp_not:V \l__enumext_store_item_join_int )
2488     }
2489   }
```

And now we will review the keys `item-star`, `item-sym*` and `item-pos*` and pass them to `\l__enumext_store_anskey_arg_tl` along with the  $\langle argument \rangle$  for `\anskey` or  $\langle body \rangle$  for `anskey*`.

```
2490   \bool_if:NTF \l__enumext_store_item_star_bool
2491   {
2492     \tl_put_right:Nn \l__enumext_store_anskey_arg_tl { * }
2493     \tl_if_empty:NF \l__enumext_store_item_symbol_tl
2494     {
2495       \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2496       {
2497         [ \exp_not:V \l__enumext_store_item_symbol_tl ]
2498       }
2499     }
2500     \dim_compare:nT
2501     {
2502       \l__enumext_store_item_symbol_sep_dim != \c_zero_dim
2503     }
2504     {
2505       \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2506       {
2507         [ \exp_not:V \l__enumext_store_item_symbol_sep_dim ]
2508       }
2509     }
2510     \tl_put_right:Nn \l__enumext_store_anskey_arg_tl {#1}
2511   }
2512   {
2513     \tl_put_right:Nn \l__enumext_store_anskey_arg_tl {#1}
2514   }
```



Finally we check if the `save-ref` key are active along with the `hyperref` package load, if both conditions are met, it will create the `\hyperlink` with “*symbol*” set by `mark-ref` key and then store in *sequence*.

```

2515 \bool_lazy_and:nnT
2516 { \bool_if_p:N \l__enumext_store_ref_key_bool }
2517 { \bool_if_p:N \l__enumext_hyperref_bool }
2518 {
2519   \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2520   {
2521     \hfill \exp_not:N \hyperlink { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2522     { \exp_not:V \l__enumext_mark_ref_sym_tl }
2523   }
2524 }
2525 \__enumext_store_addto_seq:V \l__enumext_store_anskey_arg_tl
2526 }

```

(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.

```

2527 \cs_new_protected:Npn \__enumext_anskey_show_wrap_arg:n #1
2528 {
2529   \par
2530   \bool_if:NTF \l__enumext_starred_bool
2531   {
2532     \__enumext_print_keyans_box:NN
2533     \l__enumext_labelwidth_vii_dim \l__enumext_labelsep_vii_dim
2534   }
2535   {
2536     \__enumext_print_keyans_box:cc
2537     { \l__enumext_labelwidth_ \l__enumext_level: _dim }
2538     { \l__enumext_labelsep_ \l__enumext_level: _dim }
2539   }
2540   \__enumext_anskey_wrapper:n { #1 }
2541 }

```

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

`\__enumext_anskey_show_wrap_left:n`

The function `\__enumext_anskey_show_wrap_left:n` will show the “*mark*” defined by the `mark-ans` key or the “*position*” of the  $\langle content \rangle$  stored in the *prop* list when using the `show-pos` key on the left margin next to the “wraps”  $\langle argument \rangle$  passed to `\anskey` and the  $\langle body \rangle$  in `anskey*` on the right side when using the `show-ans` key.

```

2542 \cs_new_protected:Npn \__enumext_anskey_show_wrap_left:n #1
2543 {
2544   \bool_if:NT \l__enumext_show_answer_bool
2545   {
2546     \__enumext_anskey_show_wrap_arg:n { #1 }
2547   }
2548   \bool_if:NT \l__enumext_show_position_bool
2549   {
2550     \tl_set:Ne \l__enumext_mark_answer_sym_tl
2551     {
2552       \group_begin:
2553       \exp_not:N \normalfont
2554       \exp_not:N \footnotesize [ \int_eval:n
2555         {
2556           \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
2557         }
2558       ]
2559       \group_end:
2560     }
2561     \__enumext_anskey_show_wrap_arg:n { #1 }
2562   }
2563 }

```

(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 *sequences* and can (more or less) manage the options passed to each level, it is necessary that we have a little more control over `\item` when storing.

The `\anskey` command will cover this point and give it similar behaviour to that of `\item` in the `enumext` and `enumext*` environments executed as follows `\anskey[⟨key = val⟩]{⟨content⟩}`.

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

```
2564 \keys_define:nn { enumext / anskey }
2565 {
2566   break-col .bool_set:N = \l__enumext_store_columns_break_bool,
2567   break-col .default:n = true,
2568   break-col .value_forbidden:n = true,
2569   item-join .int_set:N = \l__enumext_store_item_join_int,
2570   item-join .value_required:n = true,
2571   item-star .bool_set:N = \l__enumext_store_item_star_bool,
2572   item-star .default:n = true,
2573   item-star .value_forbidden:n = true,
2574   item-sym* .tl_set:N = \l__enumext_store_item_symbol_tl,
2575   item-sym* .value_required:n = true,
2576   item-pos* .dim_set:N = \l__enumext_store_item_symbol_sep_dim,
2577   item-pos* .value_required:n = true,
2578   unknown .code:n = { \l__enumext_anskey_unknown:n {#1} },
2579 }
```

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`.

```
2580 \cs_new_protected:Npn \l__enumext_anskey_unknown:n #1
2581 {
2582   \exp_args:NV \l__enumext_anskey_unknown:nn \l_keys_key_str {#1}
2583 }
2584 \cs_new_protected:Npn \l__enumext_anskey_unknown:nn #1 #2
2585 {
2586   \tl_if_blank:nTF {#2}
2587   {
2588     \msg_error:nnn { enumext } { anskey-cmd-key-unknown } {#1}
2589   }
2590   {
2591     \msg_error:nnnn { enumext } { anskey-cmd-key-value-unknown } {#1} {#2}
2592   }
2593 }
```

(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`.

```
2594 \NewDocumentCommand \anskey { o +m }
2595 {
2596   \l__enumext_anskey_safe_outer:
2597   \group_begin:
2598     \bool_if:NT \l__enumext_check_answers_bool
2599     {
2600       \tl_if_novalue:nF {#1}
2601       {
2602         \keys_set:nn { enumext / anskey } {#1}
2603       }
2604       \tl_if_blank:nTF {#2}
2605       {
2606         \msg_error:nn { enumext } { anskey-empty-arg }
2607       }
2608       {
2609         \l__enumext_anskey_safe_inner:
2610         \l__enumext_store_anskey_code:n {#2}
2611       }
2612     }
2613 }
```

```

2613   \group_end:
2614 }

```

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

### 12.29.1 Internal functions for the command

```

\__enumext_anskey_safe_outer:
\__enumext_anskey_safe_inner:

```

The `\__enumext_store_anskey_safe_outer:` function will return the appropriate messages when the command is executed outside the environment in which the `save-ans` key was activated.

```

2615 \cs_new_protected:Nn \__enumext_anskey_safe_outer:
2616 {
2617   \bool_if:NF \l__enumext_store_active_bool
2618   {
2619     \msg_error:nnnn { enumext } { anskey-wrong-place } { anskey } { enumext }
2620   }
2621   \int_compare:nNt { \l__enumext_keyans_level_int } = { 1 }
2622   {
2623     \msg_error:nnnn { enumext } { command-wrong-place } { anskey } { keyans }
2624   }
2625   \int_compare:nNt { \l__enumext_keyans_level_h_int } = { 1 }
2626   {
2627     \msg_error:nnnn { enumext } { command-wrong-place } { anskey } { keyans* }
2628   }
2629   \int_compare:nNt { \l__enumext_keyans_pic_level_int } = { 1 }
2630   {
2631     \msg_error:nnnn { enumext } { command-wrong-place } { anskey } { keyanspic }
2632   }
2633 }

```

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.

```

2634 \cs_new_protected:Nn \__enumext_anskey_safe_inner:
2635 {
2636   \int_incr:N \l__enumext_anskey_level_int
2637   \int_compare:nNt { \l__enumext_anskey_level_int } > { 1 }
2638   {
2639     \msg_error:nn { enumext } { anskey-nested }
2640   }
2641   \bool_if:NF \l__enumext_item_number_bool
2642   {
2643     \msg_error:nn { enumext } { anskey-unnumber-item }
2644   }
2645   \mode_if_math:T
2646   {
2647     \msg_error:nne { enumext } { anskey-math-mode } { \c_backslash_str anskey }
2648   }
2649 }

```

(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.

```

2650 \cs_new_protected:Nn \__enumext_undefine_anskey_env:
2651 {
2652   \cs_undefine:c { anskey* }

```

```

2653 \cs_undefine:c { endanskey* }
2654 \cs_undefine:c { __scontents_anskey*_env_begin: }
2655 \cs_undefine:c { __scontents_anskey*_env_end: }
2656 }

```

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

```

2657 \__enumext_before_env:nn { enumext }
2658 {
2659   \bool_lazy_and:nnT
2660   { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
2661   { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
2662   {
2663     \cs_if_free:cF { __scontents_anskey*_env_begin: }
2664     {
2665       \msg_error:nnn { enumext } { anskey-env-error } { anskey* }
2666     }
2667   }
2668 }
2669 \__enumext_before_env:nn { enumext* }
2670 {
2671   \bool_lazy_and:nnT
2672   { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
2673   { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
2674   {
2675     \cs_if_free:cF { __scontents_anskey*_env_begin: }
2676     {
2677       \msg_error:nnn { enumext } { anskey-env-error } { anskey* }
2678     }
2679   }
2680 }

```

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.

```

2681 \__enumext_before_env:nn { anskey* }
2682 {
2683   \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
2684   {
2685     \msg_error:nnn { enumext } { anskey-env-wrong } { keyans }
2686   }
2687   \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
2688   {
2689     \msg_error:nnn { enumext } { anskey-env-wrong } { keyans* }
2690   }
2691   \int_compare:nNnT { \l__enumext_keyans_pic_level_int } = { 1 }
2692   {
2693     \msg_error:nnn { enumext } { anskey-env-wrong } { keyanspic }
2694   }
2695   \bool_if:NF \l__enumext_item_number_bool
2696   {
2697     \msg_error:nn { enumext } { anskey-unnumber-item }
2698   }
2699   \mode_if_math:T
2700   {
2701     \msg_error:nnn { enumext } { anskey-math-mode } { anskey* }
2702   }
2703 }

```

(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 `\l__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`.

```

2704 \cs_new_protected:Npn \__enumext_anskey_env_make:n #1
2705 {
2706   \bool_if:NT \l__enumext_anskey_env_bool
2707   {
2708     \newenvsv{anskey*}[store-env=#1,print-env=false]

```

```

2709     \__enumext_anskey_env_exec:
2710 }
2711 }
2712 \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`.

```

2713 \cs_new_protected:Nn \__enumext_anskey_env_define_keys:
2714 {
2715     \keys_define:nn { scontents / scontents }
2716     {
2717         break-col .bool_gset:N = \g__enumext_store_columns_break_bool,
2718         break-col .default:n   = true,
2719         break-col .value_forbidden:n = true,
2720         item-join .int_gset:N   = \g__enumext_store_item_join_int,
2721         item-join .value_required:n = true,
2722         item-star .bool_gset:N = \g__enumext_store_item_star_bool,
2723         item-star .default:n   = true,
2724         item-star .value_forbidden:n = true,
2725         item-sym* .tl_gset:N    = \g__enumext_store_item_symbol_tl,
2726         item-sym* .value_required:n = true,
2727         item-pos* .dim_gset:N   = \g__enumext_store_item_symbol_sep_dim,
2728         item-pos* .value_required:n = true,
2729         print-env .undefine:,
2730         store-env .undefine:,
2731         write-out .undefine:,
2732         unknown   .code:n      = { \__enumext_anskey_env_unknown:n {##1} },
2733     }
2734 }

```

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`.

```

2735 \cs_new_protected:Npn \__enumext_anskey_env_unknown:n #1
2736 {
2737     \exp_args:NV \__enumext_anskey_env_unknown:nn \l_keys_key_str {#1}
2738 }
2739 \cs_new_protected:Npn \__enumext_anskey_env_unknown:nn #1#2
2740 {
2741     \tl_if_blank:nTF {#2}
2742     {
2743         \msg_error:nnn { enumext } { anskey-env-key-unknown } {#1}
2744     }
2745     {
2746         \msg_error:nnnn { enumext } { anskey-env-key-value-unknown } {#1} {#2}
2747     }
2748 }

```

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`.

```

2749 \cs_new_protected:Nn \__enumext_anskey_env_reset_keys:
2750 {
2751     \keys_define:nn { scontents / scontents }
2752     {
2753         break-col .undefine:,
2754         item-join .undefine:,
2755         item-star .undefine:,
2756         item-sym* .undefine:,
2757         item-pos* .undefine:,
2758         write-out .code:n    = {
2759             \bool_set_false:N \l__scontents_storing_bool
2760             \bool_set_true:N  \l__scontents_writing_bool
2761             \tl_set:Nn \l__scontents_fname_out_tl {##1}
2762         },
2763         write-out .value_required:n = true,
2764         print-env .meta:nn         = { scontents } { print-env = ##1 },
2765         print-env .default:n       = true,
2766         store-env .meta:nn         = { scontents } { store-env = ##1 },
2767         unknown   .code:n          = { \__scontents_parse_environment_keys:n {##1} },
2768     }
2769 }

```

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*.

```

2770 \cs_new_protected:Npn \__enumext_rescan_anskey_env:n #1
2771 {
2772   \group_begin:
2773   \int_set:Nn \tex_newlinechar:D { `\\^J }
2774   \__scontents_rescan_tokens:x
2775   {
2776     \endgroup % This assumes \catcode`\\=0... Things might go off otherwise.
2777     #1
2778   }
2779 }

```

(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)*.

```

2780 \cs_new_protected:Nn \__enumext_anskey_env_exec:
2781 {
2782   \__enumext_before_env:nn { anskey* }
2783   {
2784     \__enumext_anskey_env_define_keys:
2785   }

```

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.

```

2786   \hook_if_empty:nF {env/anskey*/after}
2787   {
2788     \hook_gremove_code:nn {env/anskey*/after} { * }
2789   }
2790   \__enumext_after_env:nn { anskey* }
2791   {
2792     \__enumext_anskey_env_save_keys:
2793     \tl_clear:N \l__enumext_store_anskey_env_tl
2794     \tl_clear:N \l__enumext_store_anskey_opt_tl
2795     \bool_if:NT \l__enumext_check_answers_bool
2796     {
2797       \tl_gset:Ne \l__enumext_store_anskey_env_tl
2798       {
2799         \seq_item:ce { g__scontents_name_ \l__enumext_store_name_tl _seq } { -1 }
2800       }
2801       \regex_match:nVTF
2802       { ^\s* \z | ^\s* \u{c__scontents_hidden_space_str} \z }
2803       \l__enumext_store_anskey_env_tl
2804       {
2805         \msg_error:nn { enumext } { anskey-empty-arg }
2806       }
2807       {
2808         \__enumext_anskey_env_store:
2809       }
2810     }
2811     \__enumext_anskey_env_clean_vars:
2812     \__enumext_anskey_env_reset_keys:
2813   }
2814 }

```

🔗 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`.

```

2815 \cs_new_protected:Nn \__enumext_anskey_env_save_keys:
2816 {
2817   \bool_lazy_and:nnT
2818   { \bool_if_p:N \g__enumext_store_columns_break_bool }

```

```

2819     { \bool_not_p:n { \l__enumext_starred_bool } }
2820     {
2821       \tl_put_left:Ne \l__enumext_store_anskey_opt_tl { ,break-col, }
2822     }

```

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

```

2823     \bool_lazy_and:nnT
2824     { \bool_not_p:n { \l__enumext_starred_bool } }
2825     { \int_compare_p:nNn { \g__enumext_store_item_join_int } > { 1 } }
2826     {
2827       \tl_put_left:Ne \l__enumext_store_anskey_opt_tl
2828       {
2829         ,item-join = \exp_not:V \g__enumext_store_item_join_int,
2830       }
2831     }

```

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

```

2832     \bool_if:NT \g__enumext_store_item_star_bool
2833     {
2834       \tl_put_left:Ne \l__enumext_store_anskey_opt_tl
2835       {
2836         ,item-star,
2837       }
2838       \tl_if_empty:NF \g__enumext_store_item_symbol_tl
2839       {
2840         \tl_put_left:Ne \l__enumext_store_anskey_opt_tl
2841         {
2842           ,item-sym* = \exp_not:V \g__enumext_store_item_symbol_tl,
2843         }
2844       }
2845       \dim_compare:nT
2846       {
2847         \g__enumext_store_item_symbol_sep_dim != \c_zero_dim
2848       }
2849       {
2850         \tl_put_left:Ne \l__enumext_store_anskey_opt_tl
2851         {
2852           ,item-pos* = \exp_not:V \g__enumext_store_item_symbol_sep_dim,
2853         }
2854       }
2855     }
2856   }

```

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`.

```

2857 \cs_new_protected:Nn \__enumext_anskey_env_store:
2858 {
2859   \group_begin:
2860   \tl_if_empty:NTF \l__enumext_store_anskey_opt_tl
2861   {
2862     \exp_args:Ne
2863     \__enumext_store_anskey_code:n
2864     {
2865       \__enumext_rescan_anskey_env:n { \l__enumext_store_anskey_env_tl }
2866     }
2867   }
2868   {
2869     \keys_set_known:nV { enumext / anskey } \l__enumext_store_anskey_opt_tl
2870     \exp_args:Ne
2871     \__enumext_store_anskey_code:n
2872     {
2873       \__enumext_rescan_anskey_env:n { \l__enumext_store_anskey_env_tl }
2874     }
2875   }
2876   \group_end:
2877 }

```

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

```

2878 \cs_new_protected:Nn \__enumext_anskey_env_clean_vars:

```



```

2879 {
2880   \bool_gset_false:N \g__enumext_store_columns_break_bool
2881   \int_gzero:N       \g__enumext_store_item_join_int
2882   \bool_gset_false:N \g__enumext_store_item_star_bool
2883   \tl_gclear:N       \g__enumext_store_item_symbol_tl
2884   \dim_gzero:N       \g__enumext_store_item_symbol_sep_dim
2885 }

```

(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.

```

2886 \cs_new_protected:Nn \__enumext_execute_after_env:
2887 {
2888   \int_compare:nNtT { \l__enumext_level_int } = { 0 }
2889   {
2890     \tl_if_empty:NF \g__enumext_store_name_tl
2891     {
2892       \__enumext_stop_save_ans_msg:
2893       \__enumext_item_answer_diff:
2894       \__enumext_log_global_vars:
2895       \__enumext_log_answer_vars:
2896       \bool_if:NTF \g__enumext_check_ans_key_bool
2897       {
2898         \__enumext_check_ans_show:
2899       }
2900       { \__enumext_check_ans_log: }
2901       \__enumext_undefine_anskey_env:
2902     }
2903     \__enumext_reset_global_vars:
2904   }
2905 }

```

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

- This function is passed to the function `\__enumext_after_env:nn` 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 the current `<label>` for `\item*` in `keyans` environment and the current `<label>` for `\anspic*` in `keyanspic` environment followed by the `<contents>` of the *optional argument* of both commands to the `\l__enumext_store_current_label_tl` variable, which will be stored to the *prop list* defined by the `save-ans` key using the function `\__enumext_store_addto_prop:V`.

```

2906 \cs_new_protected:Npn \__enumext_keyans_addto_prop:n #1
2907 {
2908   \tl_clear:N \l__enumext_store_current_label_tl
2909   \int_compare:nNtTF { \l__enumext_keyans_pic_level_int } = { 1 }
2910   {
2911     \tl_put_right:Ne \l__enumext_store_current_label_tl { \l__enumext_label_vi_tl }
2912   }
2913   {
2914     \tl_put_right:Ne \l__enumext_store_current_label_tl { \l__enumext_label_v_tl }
2915   }

```

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

```

2916   \tl_if_novalue:nF { #1 }
2917   {
2918     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_tl
2919     {
2920       \tl_put_right:Ne \l__enumext_store_current_label_tl

```

```

2921         {
2922             \l__enumext_store_keyans_item_opt_sep_tl
2923         }
2924     }
2925     \tl_put_right:Ne \l__enumext_store_current_label_tl { #1 }
2926 }
2927 \__enumext_store_addto_prop:V \l__enumext_store_current_label_tl
2928 }

```

(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 `\anskey` basically because in this environments the interest is in the current `<label>` for `\item*` and `\anspic*` with the `<contents>` of the *optional argument*. The mechanism defined here will allow to execute `\ref{<store name: position>}` and will return `1`. (A).

```

\__enumext_keyans_store_ref:
  \__enumext_keyans_store_ref_aux_i:
  \__enumext_keyans_store_ref_aux_ii:

```

The function `\__enumext_keyans_store_ref:` handles the “*internal label and ref*” system used by the `save-ref` key for `\item*` and `\anspic*` commands. First we will create copies of the current `<labels>` and remove the dots “.” from them, we do not want to get double dots in references.

```

2929 \cs_new_protected:Nn \__enumext_keyans_store_ref:
2930 {
2931     \bool_if:NT \l__enumext_store_ref_key_bool
2932     {
2933         \cs_set_protected:Npn \__enumext_tmp:n ##1
2934         {
2935             \tl_set_eq:cc { \l__enumext_label_copy_##1_tl } { \l__enumext_label_##1_tl }
2936             \tl_reverse:c { \l__enumext_label_copy_##1_tl }
2937             \tl_remove_once:cn { \l__enumext_label_copy_##1_tl } { . }
2938             \tl_reverse:c { \l__enumext_label_copy_##1_tl }
2939         }
2940         \clist_map_inline:nn { i, v, vi, vii, viii } { \__enumext_tmp:n {##1} }
2941         \__enumext_keyans_store_ref_aux_i:
2942     }
2943 }

```

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

```

2944 \cs_new_protected:Nn \__enumext_keyans_store_ref_aux_i:
2945 {
2946     \bool_if:NT \g__enumext_starred_bool
2947     {
2948         \tl_set_eq:NN \l__enumext_label_copy_i_tl \l__enumext_label_copy_vii_tl
2949     }
2950     \int_compare:nNnT { \l__enumext_keyans_pic_level_int } = { 1 }
2951     {
2952         \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2953         { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_vii_tl }
2954     }
2955     \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
2956     {
2957         \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2958         { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_v_tl }
2959     }
2960     \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
2961     {
2962         \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2963         { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_viii_tl }
2964     }
2965     \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
2966     {
2967         \l__enumext_store_name_tl \c_colon_str
2968         \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } }
2969     }
2970     \__enumext_keyans_store_ref_aux_ii:
2971 }

```

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.

```

2972 \cs_new_protected:Nn \__enumext_keyans_store_ref_aux_ii:

```

```

2973 {
2974   \tl_put_right:Ne \l__enumext_write_aux_file_tl
2975   {
2976     \__enumext_newlabel:nn
2977     { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2978     { \l__enumext_newlabel_arg_two_tl }
2979   }
2980   \l__enumext_write_aux_file_tl
2981 }

```

(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 *⟨label⟩* `\l__enumext_label_v_tl` for the `keyans` environment and the `\l__enumext_label_vi_tl` for the `keyanspic` environment when using `\item*` and `\anspic*`, followed by the *⟨contents⟩* of the *optional argument* of both commands to the `\l__enumext_store_current_label_tl` variable to the sequence defined by the `save-ans` key.

```

2982 \cs_new_protected:Npn \__enumext_keyans_addto_seq:n #1
2983 {
2984   \tl_clear:N \l__enumext_store_current_label_tl
2985   \int_compare:nNnTF { \l__enumext_keyans_pic_level_int } = { 1 }
2986   {
2987     \tl_put_right:Ne \l__enumext_store_current_label_tl { \item \l__enumext_label_vi_tl }
2988   }
2989   {
2990     \tl_put_right:Ne \l__enumext_store_current_label_tl { \item \l__enumext_label_v_tl }
2991   }
2992   \tl_if_novalue:nF { #1 }
2993   {
2994     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_tl
2995     {
2996       \tl_put_right:Ne \l__enumext_store_current_label_tl
2997       {
2998         \l__enumext_store_keyans_item_opt_sep_tl
2999       }
3000     }
3001     \tl_put_right:Ne \l__enumext_store_current_label_tl { #1 }
3002   }
3003   \__enumext_keyans_addto_seq_link:
3004 }

```

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.

```

3005 \cs_new_protected:Nn \__enumext_keyans_addto_seq_link:
3006 {
3007   \bool_lazy_and:nnT
3008   { \bool_if_p:N \l__enumext_store_ref_key_bool }
3009   { \bool_if_p:N \l__enumext_hyperref_bool }
3010   {
3011     \tl_put_right:Ne \l__enumext_store_current_label_tl
3012     {
3013       \hfill \exp_not:N \hyperlink
3014       {
3015         \exp_not:V \l__enumext_newlabel_arg_one_tl
3016       }
3017       { \exp_not:V \l__enumext_mark_ref_sym_tl }
3018     }
3019   }
3020   \__enumext_store_addto_seq:V \l__enumext_store_current_label_tl
3021   \bool_if:NT \l__enumext_check_answers_bool
3022   {
3023     \int_gincr:N \g__enumext_item_anskey_int
3024   }
3025 }

```

(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.

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.

```

\__enumext_keyans_show_left:n
\__enumext_keyans_show_ans:
\__enumext_keyans_show_pos:
\__enumext_keyans_show_item_opt:
3026 \cs_new_protected:Npn \__enumext_keyans_show_left:n #1
3027 {
3028   \tl_if_novalue:nF { #1 }
3029   {
3030     \tl_set:Nx \l__enumext_store_current_opt_arg_tl { #1 }
3031   }
3032   \bool_if:NT \l__enumext_show_answer_bool
3033   {
3034     \__enumext_keyans_show_ans:
3035   }
3036   \bool_if:NT \l__enumext_show_position_bool
3037   {
3038     \__enumext_keyans_show_pos:
3039   }
3040 }
3041 \cs_new_protected:Nn \__enumext_keyans_show_item_opt:
3042 {
3043   \tl_if_empty:NF \l__enumext_store_current_opt_arg_tl
3044   {
3045     \bool_lazy_or:nnT
3046     { \bool_if_p:N \l__enumext_show_answer_bool }
3047     { \bool_if_p:N \l__enumext_show_position_bool }
3048     {
3049       \__enumext_keyans_wrapper_opt:n { \l__enumext_store_current_opt_arg_tl } \c_space_tl
3050     }
3051   }
3052 }
3053 \cs_new_protected:Nn \__enumext_keyans_show_ans:
3054 {
3055   \bool_if:NT \l__enumext_starred_bool
3056   {
3057     \dim_set_eq:NN \l__enumext_labelwidth_i_dim \l__enumext_labelwidth_vii_dim
3058     \dim_set_eq:NN \l__enumext_labelsep_i_dim \l__enumext_labelsep_vii_dim
3059   }
3060   \tl_put_left:Nn \l__enumext_label_v_tl
3061   {
3062     \__enumext_print_keyans_box:NN
3063     \l__enumext_labelwidth_i_dim \l__enumext_labelsep_i_dim
3064   }
3065 }
3066 \cs_new_protected:Nn \__enumext_keyans_show_pos:
3067 {
3068   \bool_if:NT \l__enumext_starred_bool
3069   {
3070     \dim_set_eq:NN \l__enumext_labelwidth_i_dim \l__enumext_labelwidth_vii_dim
3071     \dim_set_eq:NN \l__enumext_labelsep_i_dim \l__enumext_labelsep_vii_dim
3072   }
3073   \int_compare:nNnTF { \l__enumext_keyans_pic_level_int } = { 1 }
3074   {
3075     \tl_set:Nx \l__enumext_mark_answer_sym_tl
3076     {
3077       \group_begin:
3078       \exp_not:N \normalfont
3079       \exp_not:N \footnotesize [ \int_eval:n
3080       {
3081         \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
3082       }
3083       ]
3084       \group_end:
3085     }
3086   }
3087   {
3088     \tl_set:Nx \l__enumext_mark_answer_sym_tl
3089     {
3090       \group_begin:

```

```

3091         \exp_not:N \normalfont
3092         \exp_not:N \footnotesize [ \int_eval:n
3093         {
3094             \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } + 1
3095         }
3096     ]
3097     \group_end:
3098 }
3099 }
3100 \tl_put_left:Nn \l__enumext_label_v_tl
3101 {
3102     \__enumext_print_keyans_box:NN
3103     \l__enumext_labelwidth_i_dim \l__enumext_labelsep_i_dim
3104 }
3105 }

```

(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`.

```

3106 \cs_new_protected:Npn \__enumext_default_item:n #1
3107 {
3108     \tl_if_novalue:nTF {#1}
3109     {
3110         \bool_if:NT \l__enumext_check_answers_bool
3111         {
3112             \int_gincr:N \g__enumext_item_number_int
3113             \bool_set_true:N \l__enumext_item_number_bool
3114         }
3115         \bool_set_true:c { l__enumext_wrap_label_ \__enumext_level: _bool }
3116         \__enumext_item_std:w \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
3117     }
3118     {
3119         \bool_set_eq:cc
3120         { l__enumext_wrap_label_ \__enumext_level: _bool }
3121         { l__enumext_wrap_label_opt_ \__enumext_level: _bool }
3122         \__enumext_item_std:w [#1] \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
3123     }
3124 }

```

(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`.

```

3125 \cs_new_protected:Npn \__enumext_starred_item:nn #1 #2
3126 {
3127     \tl_if_novalue:nTF {#1}
3128     {
3129         \tl_gset_eq:Nc

```

```

3130         \g__enumext_item_symbol_aux_tl { l__enumext_item_symbol_ \__enumext_level: _tl }
3131     }
3132     {
3133         \tl_gset:Nn \g__enumext_item_symbol_aux_tl {#1}
3134     }
3135     \tl_if_novalue:nTF {#2}
3136     {
3137         \dim_set_eq:cc
3138         { l__enumext_item_symbol_sep_ \__enumext_level: _dim }
3139         { l__enumext_labelsep_ \__enumext_level: _dim }
3140     }
3141     {
3142         \dim_set:cn { l__enumext_item_symbol_sep_ \__enumext_level: _dim } {#2}
3143     }
3144     \bool_if:NT \l__enumext_check_answers_bool
3145     {
3146         \int_gincr:N \g__enumext_item_number_int
3147         \bool_set_true:N \l__enumext_item_number_bool
3148     }
3149     \bool_set_true:c { l__enumext_wrap_label_ \__enumext_level: _bool }
3150     \__enumext_item_std:w \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
3151 }

```

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

```

3152 \cs_new_protected:Nn \__enumext_item_star_exec:
3153 {
3154     \tl_if_empty:cF { l__enumext_item_symbol_ \__enumext_level: _tl }
3155     {
3156         \mode_leave_vertical:
3157         \skip_horizontal:n { -\dim_use:c { l__enumext_item_symbol_sep_ \__enumext_level: _dim } }
3158         \hbox_overlap_left:n { \g__enumext_item_symbol_aux_tl }
3159         \skip_horizontal:n { \dim_use:c { l__enumext_item_symbol_sep_ \__enumext_level: _dim } }
3160     }
3161 }

```

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

`\__enumext_redefine_item:`

The function `\__enumext_redefine_item:` will redefine the `\item` command in the `enumext` environment adding `\item*`. This function is passed to `\__enumext_list_arg_two_X:` used in the definition of the `enumext` environment (§12.38).

```

3162 \cs_new_protected:Nn \__enumext_redefine_item:
3163 {
3164     \RenewDocumentCommand \item { s o o }
3165     {
3166         \bool_if:nTF {##1}
3167         {
3168             \__enumext_starred_item:nn {##2} {##3}
3169         }
3170         { \__enumext_default_item:n {##2} }
3171     }
3172 }

```

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

🔑 When *tagged* PDF is active `\makelabel` is redefined as `\hss #1` and the only way to get the `align` key to work correctly is by using `\makebox`. The solution here is to redefine `\makelabel` conditionally using `\IfDocumentMetadataTF`.

`\__enumext_make_label:`  
`\__enumext_make_label_std:`  
`\__enumext_make_label_box:`

The function `\__enumext_make_label:` redefine `\makelabel` for the keys `align`, `font`, `wrap-label`, `wrap-label*` and `\item*` for `enumext` environment. This function is passed to `\__enumext_list_arg_two_X:` used in the definition of the `enumext` environment (§12.38).

```

3173 \cs_new_protected:Nn \__enumext_make_label:
3174 {
3175     \IfDocumentMetadataTF
3176     {
3177         \__enumext_make_label_box:
3178     }
3179     { \__enumext_make_label_std: }
3180 }

```

Standard definition when `\DocumentMetadata` is not active.

```

3181 \cs_new_protected:Nn \__enumext_make_label_std:
3182 {
3183   \RenewDocumentCommand \makeLabel { m }
3184   {
3185     \tl_use:c { l__enumext_label_fill_left_ \__enumext_level: _tl }
3186     \tl_use:c { l__enumext_label_font_style_ \__enumext_level: _tl }
3187     \bool_if:cTF { l__enumext_wrap_label_ \__enumext_level: _bool }
3188     {
3189       \__enumext_item_star_exec:
3190       \use:c { __enumext_wrapper_label_ \__enumext_level: :n } { ##1 }
3191     }
3192     { ##1 }
3193     \tl_use:c { l__enumext_label_fill_right_ \__enumext_level: _tl }
3194     \tl_gclear:N \g__enumext_item_symbol_aux_tl
3195   }
3196 }

```

Definition using `\makebox` when `\DocumentMetadata` is active.

```

3197 \cs_new_protected:Nn \__enumext_make_label_box:
3198 {
3199   \RenewDocumentCommand \makeLabel { m }
3200   {
3201     \makebox
3202     [ \dim_use:c { l__enumext_labelwidth_ \__enumext_level: _dim } ]
3203     [ \str_use:c { l__enumext_align_label_pos_ \__enumext_level: _str } ]
3204     {
3205       \tl_use:c { l__enumext_label_font_style_ \__enumext_level: _tl }
3206       \bool_if:cTF { l__enumext_wrap_label_ \__enumext_level: _bool }
3207       {
3208         \__enumext_item_star_exec:
3209         \use:c { __enumext_wrapper_label_ \__enumext_level: :n } { ##1 }
3210       }
3211       { ##1 }
3212       \tl_gclear:N \g__enumext_item_symbol_aux_tl
3213     }
3214   }
3215 }

```

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

## 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* 3216 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
3217 {
3218   \keys_define:nn { enumext / #1 }
3219   {
3220     item-sym* .tl_set:c = { l__enumext_item_symbol_#2_tl },
3221     item-sym* .value_required:n = true,
3222     item-sym* .initial:n = { $\star$ },
3223     item-pos* .dim_set:c = { l__enumext_item_symbol_sep_#2_dim },
3224     item-pos* .value_required:n = true,
3225   }
3226 }
3227 \clist_map_inline:nn
3228 {
3229   {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {enumext*}{vii}
3230 }
3231 { \__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\*

unknown

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

```
\__enumext_keyans_unknown_keys:n
\__enumext_keyans_unknown_keys:nn
```

```
3232 \cs_set_protected:Npn \__enumext_tmp:n #1
3233 {
3234   \keys_define:nn { enumext / #1 }
3235   {
3236     unknown .code:n = { \__enumext_keyans_unknown_keys:n {##1} }
3237   }
3238 }
3239 \clist_map_inline:nn { keyans, keyans* } { \__enumext_tmp:n {#1} }
```

Internal functions for handling `unknown` key.

```
3240 \cs_new_protected:Npn \__enumext_keyans_unknown_keys:n #1
3241 {
3242   \exp_args:NV \__enumext_keyans_unknown_keys:nn \l_keys_key_str {#1}
3243 }
3244 \cs_new_protected:Npn \__enumext_keyans_unknown_keys:nn #1#2
3245 {
3246   \tl_if_blank:nTF {#2}
3247   {
3248     \msg_error:nnn { enumext } { keyans-unknown-key } {#1}
3249   }
3250   {
3251     \msg_error:nnnn { enumext } { keyans-unknown-key-value } {#1} {#2}
3252   }
3253 }
```

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

### 12.35.2 Handling unknown keys for enumext\*

unknown

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

```
\__enumext_starred_unknown_keys:n
\__enumext_starred_unknown_keys:nn
```

```
3254 \keys_define:nn { enumext / enumext* }
3255 {
3256   unknown .code:n = { \__enumext_starred_unknown_keys:n {#1} }
3257 }
```

Internal functions for handling `unknown` key.

```
3258 \cs_new_protected:Npn \__enumext_starred_unknown_keys:n #1
3259 {
3260   \exp_args:NV \__enumext_starred_unknown_keys:nn \l_keys_key_str {#1}
3261 }
3262 \cs_new_protected:Npn \__enumext_starred_unknown_keys:nn #1#2
3263 {
3264   \tl_if_blank:nTF {#2}
3265   {
3266     \msg_error:nnn { enumext } { starred-unknown-key } {#1}
3267   }
3268   {
3269     \msg_error:nnnn { enumext } { starred-unknown-key-value } {#1} {#2}
3270   }
3271 }
```

(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.

```
\__enumext_standar_unknown_keys:n
\__enumext_standar_unknown_keys:nn
```

```
3272 \cs_set_protected:Npn \__enumext_tmp:n #1
3273 {
3274   \keys_define:nn { enumext / #1 }
3275   {
3276     unknown .code:n = { \__enumext_standar_unknown_keys:n {##1} }
3277   }
3278 }
3279 \clist_map_inline:nn { level-1,level-2,level-3,level-4 } { \__enumext_tmp:n {#1} }
```

Internal functions for handling `unknown` key.

```
3280 \cs_new_protected:Npn \__enumext_standar_unknown_keys:n #1
3281 {
3282   \exp_args:NV \__enumext_standar_unknown_keys:nn \l_keys_key_str {#1}
3283 }
3284 \cs_new_protected:Npn \__enumext_standar_unknown_keys:nn #1#2
```

```

3285 {
3286   \tl_if_blank:nTF {#2}
3287   {
3288     \msg_error:nnn { enumext } { standar-unknown-key } {#1}
3289   }
3290   {
3291     \msg_error:nnnn { enumext } { standar-unknown-key-value } {#1} {#2}
3292   }
3293 }

```

(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` along with the keys `wrap-label`, `wrap-label*` and `itemindent`.

```

3294 \cs_new_protected:Npn \__enumext_keyans_default_item:n #1
3295 {
3296   \tl_if_novalue:nTF { #1 }
3297   {
3298     \bool_set_true:N \__enumext_wrap_label_v_bool
3299     \__enumext_item_std:w \tl_use:N \__enumext_fake_item_indent_v_tl
3300   }
3301   {
3302     \bool_set_eq:NN \__enumext_wrap_label_v_bool \__enumext_wrap_label_opt_v_bool
3303     \__enumext_item_std:w [#1] \tl_use:N \__enumext_fake_item_indent_v_tl
3304   }
3305 }

```

(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⟩`, followed by this it will execute function `\__enumext_keyans_show_item_opt:` handled by `wrap-opt` key.

```

3306 \cs_new_protected:Npn \__enumext_keyans_starred_item:n #1
3307 {
3308   \tl_set_eq:NN \__enumext_store_current_label_tmp_tl \__enumext_label_v_tl
3309   \__enumext_keyans_show_left:n { #1 }
3310   \bool_set_true:N \__enumext_wrap_label_v_bool
3311   \__enumext_item_std:w \tl_use:N \__enumext_fake_item_indent_v_tl
3312   \__enumext_keyans_show_item_opt:

```

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, *store* it in the `⟨sequence⟩` and finally increments `\g__enumext_check_starred_cmd_int` for internal check system.

```

3313   \tl_set_eq:NN \__enumext_label_v_tl \__enumext_store_current_label_tmp_tl
3314   \__enumext_keyans_addto_prop:n { #1 }
3315   \__enumext_keyans_store_ref:
3316   \__enumext_keyans_addto_seq:n { #1 }
3317   \int_gincr:N \g__enumext_check_starred_cmd_int
3318 }

```

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

`\item*`

`\__enumext_keyans_redefine_item:`

The function `\__enumext_keyans_redefine_item:` is responsible for adding the *starred argument* and *optional argument* by the `\__enumext_list_arg_two_v:` function in the definition of the `keyans` environment. Here we need to use `\peek_remove_spaces:n` to prevent an unwanted space when using `\item*` in conjunction with the `itemindent` key. This function is passed to `\__enumext_list_arg_two_v:` used in the definition of the `keyans` environment (§12.37.2).

```

3319 \cs_new_protected:Nn \__enumext_keyans_redefine_item:
3320 {
3321   \RenewDocumentCommand \item { s o }
3322   {
3323     \bool_if:nTF {##1}
3324     {

```

```

3325         \peek_remove_spaces:n
3326         {
3327             \__enumext_keyans_starred_item:n {##2}
3328         }
3329     }
3330     {
3331         \__enumext_keyans_default_item:n {##2}
3332     }
3333 }
3334 }

```

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

```

\__enumext_keyans_make_label:
\__enumext_keyans_make_label_std:
\__enumext_keyans_make_label_box:

```

The function `\__enumext_keyans_make_label:` redefine `\makeLabel` for the keys `align`, `font`, `wrap-label`, `wrap-label*` and `\item*` for `keyans` environment. This function are passed to `\__enumext_list_arg_two_v:` used in the definition of the `keyans` environment (§12.37.2).

```

3335 \cs_new_protected:Nn \__enumext_keyans_make_label:
3336 {
3337     \IfDocumentMetadataTF
3338     {
3339         \__enumext_keyans_make_label_box:
3340     }
3341     { \__enumext_keyans_make_label_std: }
3342 }

```

Standard definition when `\DocumentMetadata` is not active.

```

3343 \cs_new_protected:Nn \__enumext_keyans_make_label_std:
3344 {
3345     \RenewDocumentCommand \makeLabel { m }
3346     {
3347         \tl_use:N \__enumext_label_fill_left_v_tl
3348         \tl_use:N \__enumext_label_font_style_v_tl
3349         \bool_if:NTF \__enumext_wrap_label_v_bool
3350         {
3351             \__enumext_wrapper_label_v:n { ##1 }
3352         }
3353         { ##1 }
3354         \tl_use:N \__enumext_label_fill_right_v_tl
3355     }
3356 }

```

Definition using `\makebox` when `\DocumentMetadata` is active.

```

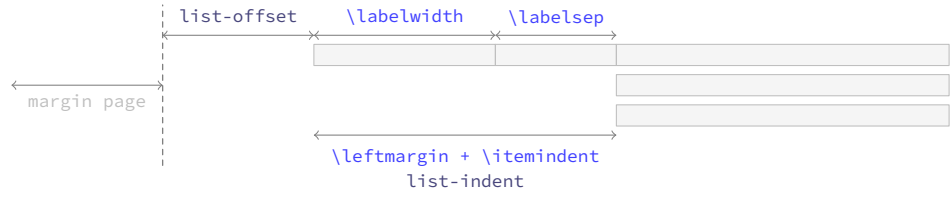
3357 \cs_new_protected:Nn \__enumext_keyans_make_label_box:
3358 {
3359     \RenewDocumentCommand \makeLabel { m }
3360     {
3361         \makebox[ \__enumext_labelwidth_v_dim ][ \__enumext_align_label_pos_v_str ]
3362         {
3363             \tl_use:N \__enumext_label_font_style_v_tl
3364             \bool_if:NTF \__enumext_wrap_label_v_bool
3365             {
3366                 \__enumext_wrapper_label_v:n { ##1 }
3367             }
3368             { ##1 }
3369         }
3370     }
3371 }

```

(End of definition for `\__enumext_keyans_make_label:`, `\__enumext_keyans_make_label_std:`, and `\__enumext_keyans_make_label_box:`.)

## 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`.

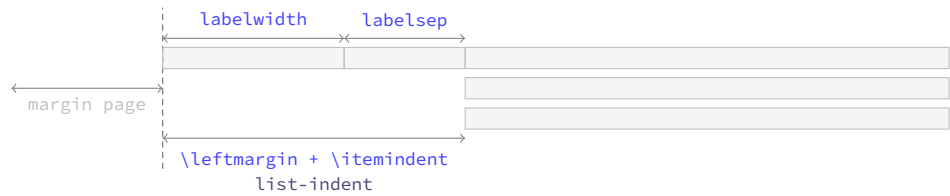
Figure 9: Representation of standard horizontal lengths in `list` environment.Figure 10: Representation of horizontal lengths concept in list in `enumext`.

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

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

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

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

Figure 11: Default horizontal lengths in `enumext`.

```
\__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:

```
#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).

```
3372 \cs_new_protected:Npn \__enumext_calc_hspace:NNNNNNN #1 #2 #3 #4 #5 #6 #7
3373 {
3374   \dim_compare:nNt { #1 } < { \c_zero_dim }
3375   {
3376     \msg_warning:nnnV { enumext } { width-non-positive } { labelwidth } { #1 }
3377     \dim_set:Nn #1 { \dim_abs:n { #1 } }
3378   }
3379   \dim_compare:nNt { #2 } < { \c_zero_dim }
3380   {
3381     \msg_warning:nnnV { enumext } { width-negative } { labelsep } { #2 }
3382     \dim_set:Nn #2 { \dim_abs:n { #2 } }
3383   }
3384 }
```

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

```
3384 \bool_if:nF #7 { \dim_set:Nn #4 { #1 + #2 } }
```

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

```
3385 \dim_compare:nNtF { #4 } < { \c_zero_dim }
3386 {
3387   \dim_set:Nn #6 { #1 + #2 - #4 }
3388   \dim_set:Nn #5 { #1 + #2 + #3 - #6 }
3389 }
```

```

3390 {
3391   \dim_compare:nNnT { #4 } = { #1 + #2 }
3392   { \dim_set:Nn #6 { \c_zero_dim } }
3393   \dim_compare:nNnT { #4 } < { #1 + #2 }
3394   { \dim_set:Nn #6 { #1 + #2 - #4 } }
3395   \dim_compare:nNnT { #4 } > { #1 + #2 }
3396   {
3397     \dim_set:Nn #6 { -#1 - #2 + #4 }
3398     \dim_set:Nn #6 { #6*-1 }
3399   }
3400   \dim_set:Nn #5 { #1 + #2 + #3 - #6 }
3401 }
3402 }
3403 \cs_generate_variant:Nn \__enumext_calc_hspace:NNNNNNN { cccccc }

```

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

### 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.

```

\__enumext_list_arg_two_i:
\__enumext_list_arg_two_ii:
\__enumext_list_arg_two_iii:
\__enumext_list_arg_two_iv:
\__enumext_list_arg_two_v:
3404 \cs_set_protected:Npn \__enumext_tmp:n #1
3405 {
3406   \cs_new_protected:cpn { __enumext_list_arg_two_#1: }
3407   {
3408     \__enumext_calc_hspace:ccccc
3409     { \__enumext_labelwidth_#1_dim } { \__enumext_labelsep_#1_dim }
3410     { \__enumext_listoffset_#1_dim } { \__enumext_leftmargin_tmp_#1_dim }
3411     { \__enumext_leftmargin_#1_dim } { \__enumext_itemindent_#1_dim }
3412     { \__enumext_leftmargin_tmp_#1_bool }
3413     \clist_map_inline:nn
3414     { labelsep, labelwidth, itemindent, leftmargin, rightmargin, listparindent }
3415     { \dim_set_eq:cc {###1} { \__enumext_###1_#1_dim } }
3416     \clist_map_inline:nn { topsep, parsep, partopsep, itemsep }
3417     { \skip_set_eq:cc {###1} { \__enumext_###1_#1_skip } }
3418     \usecounter { enumX#1 }
3419     \setcounter { enumX#1 } { \int_eval:n { \int_use:c { \__enumext_start_#1_int } - 1 } }
3420     \str_if_eq:nnTF {#1} { v }
3421     {
3422       \__enumext_keyans_redefine_item:
3423       \__enumext_keyans_make_label:
3424       \__enumext_keyans_ref:
3425       \__enumext_keyans_fake_item_indent:
3426       \bool_if:cT { \__enumext_show_length_#1_bool }
3427       {
3428         \msg_term:nnnn { enumext } { list-lengths-not-nested } { v } { keyans }
3429       }
3430     }
3431     {
3432       \__enumext_redefine_item:
3433       \__enumext_make_label:
3434       \__enumext_standar_ref:
3435       \__enumext_fake_item_indent:
3436       \bool_if:cT { \__enumext_show_length_#1_bool }
3437       {
3438         \msg_term:nnne { enumext } { list-lengths } {#1}
3439         { \int_use:N \__enumext_level_int }
3440       }
3441     }
3442   }
3443 }
3444 \clist_map_inline:nn { i, ii, iii, iv, v } { \__enumext_tmp:n {#1} }

```

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

For the horizontal environments `enumext*` and `keyans*` the implementation is similar, but, the value of `\partopsep` is always `0pt`. At this point we will modify the `parsep` key to make it take the value of the `itemsep` key and later, in the environment definition, we will modify `parindent` to make it set the value of `\lisparindent` and `parsep` to set the value of `\parskip` locally.

```

3445 \cs_set_protected:Npn \__enumext_tmp:n #1
3446 {
3447   \cs_new_protected:cpn { __enumext_list_arg_two_#1: }

```

```

3448 {
3449   \bool_set_true:c { l__enumext_leftmargin_tmp_#1_bool }
3450   \dim_zero:c { l__enumext_leftmargin_tmp_#1_dim }
3451   \__enumext_calc_hspace:ccccc
3452   { l__enumext_labelwidth_#1_dim } { l__enumext_labelsep_#1_dim }
3453   { l__enumext_listoffset_#1_dim } { l__enumext_leftmargin_tmp_#1_dim }
3454   { l__enumext_leftmargin_#1_dim } { l__enumext_itemindent_#1_dim }
3455   { l__enumext_leftmargin_tmp_#1_bool }
3456   \clist_map_inline:nn
3457     { labelsep, labelwidth, itemindent, leftmargin, rightmargin, listparindent }
3458     { \dim_set_eq:cc {###1} { l__enumext_###1_#1_dim } }
3459   \clist_map_inline:nn { topsep, parsep, partopsep, itemsep }
3460     { \skip_set_eq:cc {###1} { l__enumext_###1_#1_skip } }
3461   \skip_set_eq:Nc \parsep { l__enumext_itemsep_#1_skip }
3462   \skip_zero:N \partopsep
3463   \usecounter { enumX#1 }
3464   \setcounter { enumX#1 } { \int_eval:n { \int_use:c { l__enumext_start_#1_int } - 1 } }
3465   \__enumext_starred_ref:
3466   \str_if_eq:nnTF {#1} { vii }
3467     {
3468       \__enumext_fake_item_vii:
3469       \bool_if:cT { l__enumext_show_length_vii_bool }
3470         { \msg_term:nnnn { enumext } { list-lengths-not-nested } { vii } { enumext* } }
3471     }
3472     {
3473       \__enumext_fake_item_viii:
3474       \bool_if:cT { l__enumext_show_length_#1_bool }
3475         { \msg_term:nnnn { enumext } { list-lengths-not-nested } { #1 } { keyans* } }
3476     }
3477   }
3478 }
3479 \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\_safe\_exec:

The \\_\_enumext\_safe\_exec: function first call the function \\_\_enumext\_internal\_mini\_page: to create the environment `\__enumext_mini_page`, 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 \l\_\_enumext\_level\_int to restrict nesting of the environment, set \l\_\_enumext\_standar\_bool to “true” and finally call the function \\_\_enumext\_is\_on\_first\_level: which sets \l\_\_enumext\_standar\_first\_bool to “true” only if the environment is not nested and we are at the “first level”.

```

3480 \cs_new_protected:Nn \__enumext_safe_exec:
3481 {
3482   \__enumext_internal_mini_page:
3483   \__enumext_is_not_nested:
3484   \int_incr:N \l__enumext_level_int
3485   \int_compare:nNnT { \l__enumext_level_int } > { 4 }
3486     { \msg_fatal:nn { enumext } { list-too-deep } }
3487   \bool_set_true:N \l__enumext_standar_bool
3488   \bool_set_false:N \l__enumext_starred_bool
3489   \__enumext_is_on_first_level:
3490 }

```

(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.

```

3491 \cs_new_protected:Npn \__enumext_parse_keys:n #1
3492 {
3493   \tl_if_novalue:nF {#1}
3494   {
3495     \str_clear:N \l__enumext_series_str
3496     \int_compare:nNnTF { \l__enumext_level_int } = { 1 }
3497     {
3498       \keys_set:nn { enumext / level-1 } {#1}

```

```

3499         \__enumext_parse_series:n {#1}
3500         \__enumext_nested_base_line_fix:
3501     }
3502     {
3503         \exp_args:Ne \keys_set:nn
3504         { enumext / level- \int_use:N \l__enumext_level_int } {#1}
3505     }
3506     \__enumext_store_active_keys:n {#1}
3507 }
3508 }

```

(End of definition for \\_\_enumext\_parse\_keys:n.)

\\_\_enumext\_start\_store\_level: The \\_\_enumext\_start\_store\_level: function activate the level saving mechanism for *storage* in *sequence* for the command \anskey and the environment anskey\*.

```

3509 \cs_new_protected:Nn \__enumext_start_store_level:
3510 {
3511     \bool_lazy_all:nT
3512     {
3513         { \bool_if_p:N \l__enumext_store_active_bool }
3514         { \bool_not_p:n { \l__enumext_keyans_env_bool } }
3515         { \bool_if_p:N \g__enumext_standar_bool }
3516     }
3517     {
3518         \int_compare:nNnT { \l__enumext_level_int } > { 1 }
3519         {
3520             \bool_set_true:c { l__enumext_store_upper_level_ \__enumext_level: _bool }
3521             \__enumext_store_level_open:
3522         }
3523     }

```

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

```

3524     \bool_lazy_all:nT
3525     {
3526         { \bool_if_p:N \l__enumext_store_active_bool }
3527         { \bool_not_p:n { \l__enumext_keyans_env_bool } }
3528         { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
3529     }
3530     {
3531         \int_compare:nNnT { \l__enumext_level_int } > { 0 }
3532         {
3533             \bool_set_true:c { l__enumext_store_upper_level_ \__enumext_level: _bool }
3534             \__enumext_store_level_open:
3535         }
3536     }
3537 }

```

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

\\_\_enumext\_stop\_store\_level: The \\_\_enumext\_stop\_store\_level: function stop the level saving mechanism for *storage* in *sequence* for the command \anskey and the environment anskey\*.

```

3538 \cs_new_protected:Nn \__enumext_stop_store_level:
3539 {
3540     \bool_if:cT { l__enumext_store_upper_level_ \__enumext_level: _bool }
3541     {
3542         \__enumext_store_level_close:
3543     }
3544 }

```

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

\\_\_enumext\_multicols\_start: The function \\_\_enumext\_multicols\_start: will start the multicols environment according to the value passed by the columns key, then set the default value for \columnsep when columns-sep=opt and set the value of \multicolsep equal to zero and leave \columnseprule equal to zero for inner levels.

```

3545 \cs_new_protected:Nn \__enumext_multicols_start:
3546 {
3547     \int_compare:nNnT
3548     { \int_use:c { l__enumext_columns_ \__enumext_level: _int } } > { 1 }
3549     {
3550         \dim_compare:nNnT
3551         { \dim_use:c { l__enumext_columns_sep_ \__enumext_level: _dim } } = { \c_zero_dim }

```



```

3552     {
3553         \dim_set:cn { \__enumext_columns_sep_ \__enumext_level: _dim }
3554         {
3555             ( \dim_use:c { \__enumext_labelwidth_ \__enumext_level: _dim }
3556               + \dim_use:c { \__enumext_labelsep_ \__enumext_level: _dim }
3557             ) / \int_use:c { \__enumext_columns_ \__enumext_level: _int }
3558             - \dim_use:c { \__enumext_listoffset_ \__enumext_level: _dim }
3559         }
3560     }
3561     \dim_set_eq:Nc \columnsep { \__enumext_columns_sep_ \__enumext_level: _dim }
3562     \int_compare:nNnT { \__enumext_level_int } > { 1 }
3563     {
3564         \dim_zero:N \columnseprule
3565     }

```

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.

```

3566     \bool_if:cF { \__enumext_minipage_active_ \__enumext_level: _bool }
3567     {
3568         \skip_zero:N \multicolsep
3569         \__enumext_multi_addvspace:
3570     }
3571     \raggedcolumns
3572     \begin{multicols}{ \int_use:c { \__enumext_columns_ \__enumext_level: _int } }
3573 }
3574 }

```

(End of definition for `\__enumext_multicols_start:`)

`\__enumext_multicols_stop:`

The function `\__enumext_multicols_stop:` will stop the `multicols` environment and apply our “*vertical adjust*” spacing. For compatibility with *tagged* PDF, the closing of the `list` environment is executed here along with `\__enumext_stop_store_level:`.

```

3575 \cs_new_protected:Nn \__enumext_multicols_stop:
3576 {
3577     \int_compare:nNnTF
3578     { \int_use:c { \__enumext_columns_ \__enumext_level: _int } } > { 1 }
3579     {
3580         \__enumext_stop_list:
3581         \__enumext_stop_store_level:
3582         \end{multicols}
3583         \__enumext_unskip_unkern:
3584         \__enumext_unskip_unkern:
3585         \par\addvspace{ \skip_use:c { \__enumext_multicols_below_ \__enumext_level: _skip } }
3586     }
3587     {
3588         \__enumext_stop_list:
3589         \__enumext_stop_store_level:
3590     }
3591 }

```

(End of definition for `\__enumext_multicols_stop:`)

`\__enumext_before_list:`

The function `\__enumext_before_list:` first calls the function `\__enumext_vspace_above:` used by the keys `above` and `above*`, then calls the function `\__enumext_before_args_exec:` used by the key `before*` and finally execute the function `\__enumext_check_ans_active:` for the check answer mechanism.

```

3592 \cs_new_protected:Nn \__enumext_before_list:
3593 {
3594     \__enumext_vspace_above:
3595     \__enumext_before_args_exec:
3596     \__enumext_check_ans_active:

```

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

```

3597     \dim_compare:nNnT
3598     { \dim_use:c { \__enumext_minipage_right_ \__enumext_level: _dim } } > { \c_zero_dim }
3599     {
3600         \dim_set:cn { \__enumext_minipage_left_ \__enumext_level: _dim }
3601     }

```

```

3602         \linewidth
3603         - \dim_use:c { l__enumext_minipage_right_ \__enumext_level: _dim }
3604         - \dim_use:c { l__enumext_minipage_hsep_ \__enumext_level: _dim }
3605     }

```

The boolean variable `\l__enumext_minipage_active_X_bool` will be activated and the integer variable `\g__enumext_minipage_stat_int` used by the `\miniright` command will be incremented, then the function `\__enumext_minipage_add_space:` is called and the `\__enumext_mini_page` environment on the “left side” will be initialized followed by the “vertical spacing” applied to preserve the “baseline” between the *left* and *right* side environments. After these actions, the function `\__enumext_multicols_start:` is called to handle the `multicols` environment.

```

3606         \bool_set_true:c { l__enumext_minipage_active_ \__enumext_level: _bool }
3607         \int_gincr:N \g__enumext_minipage_stat_int
3608         \__enumext_minipage_add_space:
3609         \noindent
3610         \__enumext_mini_page{ \dim_use:c { l__enumext_minipage_left_ \__enumext_level: _dim } }
3611     }
3612     \__enumext_multicols_start:
3613 }

```

(End of definition for `\__enumext_before_list:`)

`\__enumext_second_part:` The function `\__enumext_second_part:` first check the state of the boolean variable `\l__enumext_minipage_active_X_bool`, if it is “true” a small test will be executed to check if we have omitted the use of `\miniright` (the `\__enumext_mini_page` environment has not been closed), then close `\__enumext_mini_page` and add the *adjusted vertical space* `\l__enumext_minipage_after_skip`, otherwise we will close the `multicols` environment.

```

3614 \cs_new_protected:Nn \__enumext_second_part:
3615 {
3616     \bool_if:cTF { l__enumext_minipage_active_ \__enumext_level: _bool }
3617     {
3618         \int_compare:nNt { \g__enumext_minipage_stat_int } = { 1 }
3619         {
3620             \msg_warning:nn { enumext } { missing-miniright }
3621             \miniright
3622         }
3623         \int_gzero:N \g__enumext_minipage_stat_int
3624         \__enumext_unskip_unkern: % remove topsep + [partopsep]
3625         \end__enumext_mini_page
3626     }
3627     {
3628         \__enumext_multicols_stop:
3629     }

```

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.

```

3630     \__enumext_after_stop_list:
3631     \__enumext_check_ans_key_hook:
3632     \__enumext_vspace_below:
3633     \bool_set_false:N \l__enumext_standar_bool
3634     \__enumext_resume_save_counter:
3635 }

```

(End of definition for `\__enumext_second_part:`)

`\__enumext_set_item_width:` The function `\__enumext_set_item_width:` will set the value of `\itemwidth` taking into account the value established by the `list-offset` key for each level of the environment.

```

3636 \cs_new_protected:Nn \__enumext_set_item_width:
3637 {
3638     \dim_set:Nn \itemwidth { \linewidth }
3639     \dim_compare:nT
3640     {
3641         \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim } != \c_zero_dim
3642     }
3643     {
3644         \dim_sub:Nn \itemwidth
3645         {
3646             \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim }
3647         }

```

```

3648     }
3649 }

```

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

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

```

3650 \NewDocumentEnvironment{enumext}{0}{ }
3651 {
3652   \__enumext_safe_exec:
3653   \__enumext_parse_keys:n {#1}
3654   \__enumext_before_list:
3655   \__enumext_start_store_level:
3656   \__enumext_start_list:nn
3657   { \tl_use:c { \__enumext_label_ \__enumext_level: _tl } }
3658   {
3659     \use:c { \__enumext_list_arg_two_ \__enumext_level: : }
3660     \__enumext_before_keys_exec:
3661   }
3662   \__enumext_set_item_width:
3663   \__enumext_after_args_exec:
3664 }
3665 {
3666   \__enumext_second_part:
3667 }

```

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`.

```

3668 \__enumext_after_env:nn {enumext}
3669 {
3670   \__enumext_execute_after_env:
3671 }

```

(End of definition for **enumext**. This function is documented on page 5.)

## 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”.

`\__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.

```

3672 \cs_new_protected:Nn \__enumext_keyans_safe_exec:
3673 {
3674   \bool_if:NF \l__enumext_store_active_bool
3675   {
3676     \msg_error:nnnn { enumext } { wrong-place } { keyans } { save-ans }
3677   }
3678   \int_incr:N \l__enumext_keyans_level_int
3679   \bool_set_true:N \l__enumext_keyans_env_bool
3680   \__enumext_keyans_name_and_start:
3681   % Set false for interfering with enumext nested in keyans (yes, its possible and crayze)
3682   \bool_set_false:N \l__enumext_store_active_bool
3683   \int_compare:nNnT { \l__enumext_keyans_level_int } > { 1 }
3684   {
3685     \msg_error:nn { enumext } { keyans-nested }
3686   }
3687   \int_compare:nNnT { \l__enumext_level_int } > { 1 }
3688   {
3689     \msg_error:nn { enumext } { keyans-wrong-level }
3690   }
3691 }

```

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

`\__enumext_keyans_parse_keys:n`

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

```

3692 \cs_new_protected:Npn \__enumext_keyans_parse_keys:n #1
3693 {
3694   \keys_set:nn { enumext / keyans } {#1}
3695 }

```

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

`\__enumext_before_list_v:`  
`\__enumext_keyans_multicols_start:`  
`\__enumext_keyans_multicols_stop:`  
`\__enumext_second_part_v:`

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

```

3696 \cs_new_protected:Nn \__enumext_before_list_v:
3697 {
3698   \__enumext_vspace_above_v:
3699   \__enumext_before_args_exec_v:
3700   \dim_compare:nNnT { \l__enumext_minipage_right_v_dim } > { \c_zero_dim }
3701   {
3702     \dim_set:Nn \l__enumext_minipage_left_v_dim
3703     {
3704       \linewidth - \l__enumext_minipage_right_v_dim - \l__enumext_minipage_hsep_v_dim
3705     }
3706     \bool_set_true:N \l__enumext_minipage_active_v_bool
3707     \int_gincr:N \g__enumext_minipage_stat_int
3708     \__enumext_keyans_minipage_add_space:
3709     \__enumext_mini_page{ \l__enumext_minipage_left_v_dim }
3710   }
3711   \__enumext_keyans_multicols_start:
3712 }
3713 \cs_new_protected:Nn \__enumext_keyans_multicols_start:
3714 {
3715   \int_compare:nNnT { \l__enumext_columns_v_int } > { 1 }
3716   {
3717     \dim_compare:nNnT { \l__enumext_columns_sep_v_dim } = { \c_zero_dim }
3718     {
3719       \dim_set:Nn \l__enumext_columns_sep_v_dim
3720       {
3721         (
3722           \l__enumext_labelwidth_v_dim + \l__enumext_labelsep_v_dim
3723         ) / \l__enumext_columns_v_int
3724         - \l__enumext_listoffset_v_dim
3725       }
3726     }
3727     \dim_set_eq:NN \columnsep \l__enumext_columns_sep_v_dim
3728     \dim_zero:N \columnseprule % no rule here
3729     \bool_if:NF \l__enumext_minipage_active_v_bool
3730     {
3731       \skip_zero:N \multicolsep
3732       \__enumext_keyans_multi_addvspace:
3733     }
3734     \raggedcolumns
3735     \begin{multicols}{\l__enumext_columns_v_int}
3736   }
3737 }
3738 \cs_new_protected:Nn \__enumext_keyans_multicols_stop:
3739 {
3740   \int_compare:nNnTF { \l__enumext_columns_v_int } > { 1 }
3741   {
3742     \__enumext_stop_list:
3743     \end{multicols}
3744     \__enumext_unskip_unkern:
3745     \__enumext_unskip_unkern:
3746     \par\addvspace{ \l__enumext_multicols_below_v_skip }
3747   }
3748   {
3749     \__enumext_stop_list:
3750   }
3751 }
3752 \cs_new_protected:Nn \__enumext_second_part_v:
3753 {
3754   \bool_if:NTF \l__enumext_minipage_active_v_bool
3755   {
3756     \int_compare:nNnT { \g__enumext_minipage_stat_int } = { 1 }
3757     {
3758       \msg_warning:nn { enumext } { missing-miniright }
3759       \miniright
3760     }
3761     \int_gzero:N \g__enumext_minipage_stat_int
3762     \__enumext_unskip_unkern: % remove \topsep + [\partopsep]
3763     \end__enumext_mini_page

```

```

3764     \par\addvspace{ \l__enumext_minipage_after_skip }
3765   }
3766   {
3767     \__enumext_keyans_multicols_stop:
3768   }
3769   \bool_set_false:N \l__enumext_keyans_env_bool
3770   \__enumext_after_stop_list_v:
3771   \__enumext_vspace_below_v:
3772 }

```

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

\\_\_enumext\_keyans\_set\_item\_width: The function \\_\_enumext\_keyans\_set\_item\_width: will set the value of \itemwidth taking into account the value established by the list-offset key.

```

3773 \cs_new_protected:Nn \__enumext_keyans_set_item_width:
3774 {
3775   \dim_set:Nn \itemwidth { \linewidth }
3776   \dim_compare:nT
3777   {
3778     \l__enumext_listoffset_v_dim != \c_zero_dim
3779   }
3780   {
3781     \dim_sub:Nn \itemwidth { \l__enumext_listoffset_v_dim }
3782   }
3783 }

```

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

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

```

3784 \NewDocumentEnvironment{keyans}{0}{}
3785 {
3786   \__enumext_keyans_safe_exec:
3787   \__enumext_keyans_parse_keys:n {#1}
3788   \__enumext_before_list_v:
3789   \__enumext_start_list:nn
3790   { \tl_use:N \l__enumext_label_v_tl }
3791   {
3792     \__enumext_list_arg_two_v:
3793     \__enumext_before_keys_exec_v:
3794   }
3795   \__enumext_keyans_set_item_width:
3796   \__enumext_after_args_exec_v:
3797 }
3798 {
3799   \__enumext_check_starred_cmd:n { item }
3800   \__enumext_second_part_v:
3801 }

```

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

## 12.40 Tagging PDF support for non-standart list environments

The ~~TeX~~TeX release 2022-06-01 brings automatic support for *tagged* PDF in several aspects, including the standard *list environments* and the **list** environment. Unfortunately non-standard *list environments* like **keyanspic** or the horizontal list environments **enumext\*** and **keyans\*** are not structured in a nice way, i.e. the expected result in the PDF file is the expected one, but the underlying structure is not correct. In simple terms, for *tagged* PDF a **list** environment is a **list** environment, no matter what it looks like in the PDF file.

To maintain a correct **list** structure when \DocumentMetadata is active, it is necessary to do some things manually. This implementation is an adaptation of my answer thanks to Ulrike Fischer's comments in [How can I modify my \item redefinition to be compatible with tagging-pdf.](#)

### 12.40.1 Socket for tagging support in enumext\* and keyans\*

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

```

start-list-tags
stop-start-tags
stop-list-tags
__enumext_start_list_tag:n
__enumext_stop_start_list_tag:
__enumext_stop_list_tag:n
3802 \socket_new:nn {taggsupport/enumext/starred}{ 1 }
3803 \socket_new_plugin:nnn {taggsupport/enumext/starred} {start-list-tags}
3804 {
3805   \tag_resume:n {#1}
3806   \tag_struct_begin:n {tag=LI}
3807   \tag_struct_begin:n {tag=Lbl}
3808   \tag_mc_begin:n {tag=Lbl}
3809 }

```

```

3810 \socket_new_plug:nnn {tagsupport/enumext/starred} {stop-start-tags}
3811 {
3812     \tag_mc_end:
3813     \tag_struct_end:n {tag=Lbl}
3814     \tag_struct_begin:n {tag=LBody}
3815     \tag_struct_begin:n {tag=text-unit}
3816     \tag_struct_begin:n {tag=text}
3817 }
3818 \socket_new_plug:nnn {tagsupport/enumext/starred} {stop-list-tags}
3819 {
3820     \tag_struct_end:n {tag=text}
3821     \tag_struct_end:n {tag=text-unit}
3822     \tag_struct_end:n {tag=LBody}
3823     \tag_struct_end:n {tag=LI}
3824     \tag_suspend:n {#1}
3825 }

```

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

```

3826 \cs_new_protected_nopar:Npn \__enumext_start_list_tag:n #1
3827 {
3828     \IfDocumentMetadataTF
3829     {
3830         \socket_assign_plug:nn {tagsupport/enumext/starred} {start-list-tags}
3831         \socket_use:n {tagsupport/enumext/starred} {#1}
3832     } {}
3833 }
3834 \cs_new_protected_nopar:Nn \__enumext_stop_start_list_tag:
3835 {
3836     \IfDocumentMetadataTF
3837     {
3838         \socket_assign_plug:nn {tagsupport/enumext/starred} {stop-start-tags}
3839         \socket_use:nn {tagsupport/enumext/starred} { }
3840     } {}
3841 }
3842 \cs_new_protected_nopar:Npn \__enumext_stop_list_tag:n #1
3843 {
3844     \IfDocumentMetadataTF
3845     {
3846         \socket_assign_plug:nn {tagsupport/enumext/starred} {stop-list-tags}
3847         \socket_use:nn {tagsupport/enumext/starred} {#1}
3848     } {}
3849 }

```

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

## 12.40.2 Socket for tagging support in keyanspic

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

```

start-list-tags
stop-start-tags
stop-list-tags
\__enumext_anspic_start_list_tag:
\__enumext_anspic_stop_start_list_tag:
\__enumext_anspic_stop_list_tag:

```

```

3850 \socket_new:nn {tagsupport/enumext/keyanspic}{ 0 }
3851 \socket_new_plug:nnn {tagsupport/enumext/keyanspic} {start-list-tags}
3852 {
3853     \tag_resume:n {keyanspic}
3854     \tag_struct_begin:n {tag=LI}
3855     \tag_struct_begin:n {tag=Lbl}
3856     \tag_mc_begin:n {tag=Lbl}
3857 }
3858 \socket_new_plug:nnn {tagsupport/enumext/keyanspic} {stop-start-tags}
3859 {
3860     \tag_mc_end:
3861     \tag_struct_end:n {tag=Lbl}
3862     \tag_struct_begin:n {tag=LBody}
3863     \tag_struct_begin:n {tag=text-unit}
3864     \tag_struct_begin:n {tag=text}
3865     \tag_mc_begin:n {tag=text}
3866 }
3867 \socket_new_plug:nnn {tagsupport/enumext/keyanspic} {stop-list-tags}
3868 {
3869     \tag_mc_end:
3870     \tag_struct_end:n {tag=text-unit}
3871     \tag_struct_end:n {tag=text}
3872     \tag_struct_end:n {tag=LBody}
3873     \tag_struct_end:n {tag=LI}
3874     \tag_suspend:n {keyanspic}

```

```
3875 }
```

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

```
3876 \cs_new_protected_nopar:Nn \__enumext_anspic_start_list_tag:
3877 {
3878   \IfDocumentMetadataTF
3879   {
3880     \socket_assign_plug:nn {tagsupport/enumext/keyanspic} {start-list-tags}
3881     \socket_use:n {tagsupport/enumext/keyanspic}
3882   } {}
3883 }
3884 \cs_new_protected_nopar:Nn \__enumext_anspic_stop_start_list_tag:
3885 {
3886   \IfDocumentMetadataTF
3887   {
3888     \socket_assign_plug:nn {tagsupport/enumext/keyanspic} {stop-start-tags}
3889     \socket_use:nn {tagsupport/enumext/keyanspic}
3890   } {}
3891 }
3892 \cs_new_protected_nopar:Nn \__enumext_anspic_stop_list_tag:
3893 {
3894   \IfDocumentMetadataTF
3895   {
3896     \socket_assign_plug:nn {tagsupport/enumext/keyanspic} {stop-list-tags}
3897     \socket_use:nn {tagsupport/enumext/keyanspic}
3898   } {}
3899 }
```

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

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

The `keyanspic` environment is a `list` based environment that uses the same configuration for “spacing” and `<label>` as the `keyans` environment, but it does not use `\item`. The `<contents>` are passed to the environment by means of the `\anspic` command as replacement for `\item` command and placed inside `minipage` environments, with the `<label>` centered “above” or “below”, adjusting *widths* and *position* according to the options passed to the environment.

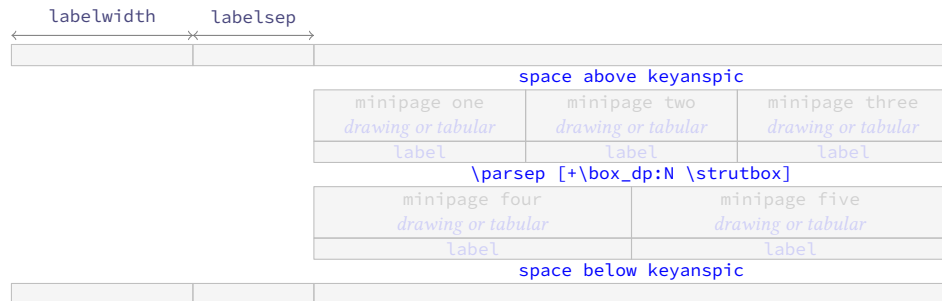


Figure 12: Representation of the `keyanspic` spacing in `enumext`.

The environment `keyanspic` will take two arguments, the first *starred argument* ‘`*`’ will set the position of the `<label>` processed by the command `\anspic` which will be “above” if present and “below” otherwise, the second *optional argument* will take two values separated by comma [`<n° upper, n° lower>`] and will determine the number of `minipage` environments in which all arguments of `\anspic` will be printed at the “upper” and “lower” within the environment, if not present these will be printed on a *single line*.

One of the complications here to make the `keyanspic` environment compatible with *tagged PDF* is the position of `<label>`, the `\anspic` command processes the arguments in order, where #1 and #2 correspond to `<label>` and #3 to the mandatory argument and puts all this inside a `minipage` environment. If #1 and #2, that is `<label>`, is above #3 there are no problems with *tagged PDF*, but if #3 comes first the list created with *tagged PDF* will not be correct.

### 12.41.1 The environment `keyanspic`

In order for the `keyanspic` environment and the `\anspic` command to work correctly, we need to set and export some variables in the first part of the environment definition and pass them to `\anspic` which is executed in the second part of the environment. This implementation is adapted from the answer given by Enrico Gregorio (@egreg) in [How to process the body of an environment and divide it by a \macro?](#).

```
\__enumext_keyans_pic_safe_exec:n
```

The function `\__enumext_keyans_pic_safe_exec:n` check the *starred argument* ‘`*`’ and nested level position inside the `enumext` environment. We will set the state of the variable `\l__enumext_keyans_pic_star_bool` along with the value of the variable `\l__enumext_anspic_mini_pos_str` using by `\anspic` according to the presence of the *starred argument* ‘`*`’.

```
3900 \cs_new_protected:Npn \__enumext_keyans_pic_safe_exec:n #1
```



```

3901 {
3902   \int_incr:N \l__enumext_keyans_pic_level_int
3903   \int_compare:nNtT { \l__enumext_keyans_pic_level_int } > { 1 }
3904   {
3905     \msg_error:nn { enumext } { keyanspic-nested }
3906   }
3907   \__enumext_keyans_name_and_start:
3908   \bool_if:nTF { #1 }
3909   {
3910     \bool_set_true:N \l__enumext_keyans_pic_star_bool
3911     \str_set:Nn \l__enumext_anspic_mini_pos_str { t }
3912   }
3913   {
3914     \str_set:Nn \l__enumext_anspic_mini_pos_str { b }
3915   }
3916 }

```

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

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

```

3917 \cs_new_protected:Npn \__enumext_keyans_pic_skip_abs:N #1
3918 {
3919   \dim_compare:nNtT { #1 } < { \c_zero_dim }
3920   {
3921     \skip_set:Nn #1 { -#1 }
3922   }
3923 }

```

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

`\__enumext_keyans_pic_arg_two:` The `\__enumext_keyans_pic_arg_two:` function will be used in the *second argument* of the `list` environment that defines the `keyanspic` environment, with this we will take the configuration of the “spaces” and the `<keys>` label and `wrap-label` from the `keyans` environment.

The first thing we need to do is set the boolean variable `\l__enumext_leftmargin_tmp_v_bool` handled by the `list-indent` key to “false”, then copy the definition of the second list argument from the `keyans` environment definition and make sure that `\parsep` does not have a negative value.

```

3924 \cs_new_protected:Nn \__enumext_keyans_pic_arg_two:
3925 {
3926   \bool_set_false:N \l__enumext_leftmargin_tmp_v_bool
3927   \__enumext_list_arg_two_v:
3928   \__enumext_keyans_pic_skip_abs:N \parsep

```

Now we increment the `enumXv` counter of the `keyans` environment and save the *total height* of the `<label>` in `\l__enumext_anspic_label_htdp_dim` used by `\anspic` and we will adjust the values of `\parsep` only if the *starred argument* ‘\*’ is NOT present.

```

3929   \bool_if:NF \l__enumext_keyans_pic_star_bool
3930   {
3931     \stepcounter { enumXv }
3932     \hbox_set:Nn \l__enumext_anspic_label_box { \l__enumext_label_v_tl }
3933     \dim_set:Nn \l__enumext_anspic_label_htdp_dim
3934     {
3935       \box_ht_plus_dp:N \l__enumext_anspic_label_box
3936     }
3937     \skip_add:Nn \parsep
3938     {
3939       \l__enumext_anspic_label_htdp_dim + \box_dp:N \strutbox
3940     }
3941     \skip_gset_eq:NN \g__enumext_keyans_pic_parsep_skip \parsep
3942   }

```

Finally we adjust the value of `\leftmargin` and `\topsep` then set `\labelwidth`, `\labelsep`, `\partopsep` and `\itemsep` to zero so that the *horizontal* and *vertical* space is not affected.

```

3943   \dim_add:Nn \leftmargin { -\labelwidth - \labelsep }
3944   \skip_add:Nn \topsep { 0.5\box_dp:N \strutbox }
3945   \dim_zero:N \labelwidth
3946   \dim_zero:N \listparindent
3947   \dim_zero:N \labelsep
3948   \skip_zero:N \partopsep
3949   \skip_zero:N \itemsep
3950 }

```

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

`keyanspic` Now we define the environment `keyanspic`. For compatibility with *tagged* PDF we must use the `\beginlist` form and a lot of conditional code using `\IfDocumentMetadataTF`.

```

3951 \NewDocumentEnvironment{keyanspic}{s o }
3952 {
3953   \__enumext_keyans_pic_safe_exec:n { #1 }
3954   \beginlist { } { \__enumext_keyans_pic_arg_two: }
3955   \IfDocumentMetadataTF
3956   {
3957     \tag_suspend:n {list}
3958   }{}
3959   \item[] \scan_stop:
3960   % paranoia
3961   \RenewDocumentCommand \item {}
3962   {
3963     \msg_error:nn { enumext } { keyanspic-item-cmd }
3964   }
3965   \IfDocumentMetadataTF
3966   {
3967     \tag_resume:n {keyanspic}
3968     \tag_tool:n {para/tagging=false}
3969     \tag_suspend:n {keyanspic}
3970   } { }
3971 }
3972 {
3973   \IfDocumentMetadataTF
3974   {
3975     \tag_resume:n {keyanspic}
3976     \tag_struct_begin:n {tag=L,attribute=enumerate}
3977   } { }

```

Now we process the command `\anspic`, if the *optional argument* is not present, the number of times the `\anspic` command appears will be counted from `\l__enumext_anspic_args_seq` and placed a single line.

```

3978 \tl_if_novalue:nTF { #2 }
3979 {
3980   \__enumext_anspic_print:e { \seq_count:N \l__enumext_anspic_args_seq }
3981 }
3982 { \__enumext_anspic_print:n { #2 } }
3983 \IfDocumentMetadataTF
3984 {
3985   \tag_suspend:n {keyanspic}
3986 } { }
3987 \endlist
3988 \IfDocumentMetadataTF
3989 {
3990   \tag_struct_end:
3991   \tag_struct_end:
3992 } { }

```

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

```

3993 \__enumext_check_starred_cmd:n { anspic }
3994 \setcounter { enumXvi } { 0 }
3995 \bool_if:NTF \l__enumext_keyans_pic_star_bool
3996 {
3997   \par\addvspace{ 0.5\box_dp:N \strutbox }
3998 }
3999 {
4000   \par\addvspace{ \g__enumext_keyans_pic_parsep_skip }
4001 }
4002 %\bool_set_false:N \l__enumext_store_active_bool
4003 }

```

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

### 12.41.2 The command `\anspic`

The `\anspic` command take three arguments, the *starred versions* `\anspic*[\langle content \rangle]` store the current `\label` next to the `[\langle content \rangle]` (if it is present) in the `\sequence` and `\prop list` defined by `save-ans` key. The third (mandatory) argument “drawing or tabular” is NOT stored in the `\sequence` or `\prop list`.

`\anspic` We check that the command is active in the `keyanspic` environment only if the `save-ans` key is present, otherwise we return an error. The three arguments are handled by the function `\__enumext_anspic_args:nnn` and stored in the sequence `\__enumext_anspic_args_seq` which is processed by the `keyanspic` environment.

```

4004 \NewDocumentCommand \anspic { s o +m }
4005 {
4006   \bool_if:NF \l__enumext_store_active_bool
4007   {
4008     \msg_error:nnnn { enumext } { wrong-place } { keyanspic } { save-ans }
4009   }
4010   \int_compare:nNnT { \l__enumext_level_int } > { 1 }
4011   {
4012     \msg_error:nn { enumext } { keyanspic-wrong-level }
4013   }
4014   \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
4015   {
4016     \msg_error:nnnn { enumext } { command-wrong-place } { anspic } { keyans }
4017   }
4018   \seq_put_right:Nn \l__enumext_anspic_args_seq
4019   {
4020     \__enumext_anspic_args:nnn { #1 } { #2 } { #3 }
4021   }
4022 }

```

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

`\__enumext_anspic_body_dim:n` The `\__enumext_anspic_body_dim:n` function will set the value of `\l__enumext_anspic_body_htdp_dim` equal to the height and depth of the mandatory argument if the `keyanspic*` environment is used with the *starred argument* ‘\*’.

```

4023 \cs_new_protected:Npn \__enumext_anspic_body_dim:n #1
4024 {
4025   \bool_if:NF \l__enumext_keyans_pic_star_bool
4026   {
4027     \IfDocumentMetadataTF
4028     {
4029       \tag_suspend:n {keyanspic}
4030     } { }
4031     \vbox_set:Nn \l__enumext_anspic_body_box { #1 }
4032     \dim_set:Nn \l__enumext_anspic_body_htdp_dim
4033     {
4034       \box_ht_plus_dp:N \l__enumext_anspic_body_box
4035     }
4036     \IfDocumentMetadataTF
4037     {
4038       \tag_resume:n {keyanspic}
4039     } { }
4040   }
4041 }

```

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

`\__enumext_anspic_label:nn` The `\__enumext_anspic_label:nn` function will process inside `\makebox` the *starred argument* ‘\*’ and *optional argument* passed to the command. Here we will store the `<label>` and *optional argument* in `<prop list>` and `<sequence>` and execute the `show-ans`, `show-pos`, `font`, `wrap-label` and `wrap-opt` keys.

```

4042 \cs_new_protected:Npn \__enumext_anspic_label:nn #1 #2
4043 {
4044   \makebox[ \l__enumext_anspic_mini_width_dim ][ c ]
4045   {
4046     \bool_if:nT { #1 }
4047     {
4048       \__enumext_keyans_addto_prop:n { #2 }
4049       \__enumext_keyans_store_ref:
4050       \__enumext_keyans_addto_seq:n { #2 }
4051       \int_gincr:N \g__enumext_check_starred_cmd_int
4052       \bool_lazy_or:nnT
4053       { \bool_if_p:N \l__enumext_show_answer_bool }
4054       { \bool_if_p:N \l__enumext_show_position_bool }
4055       {
4056         \tl_set_eq:NN \l__enumext_label_v_tl \l__enumext_label_vi_tl
4057         \__enumext_keyans_show_left:n { #2 }

```

```

4058         \tl_set_eq:NN \l__enumext_label_vi_tl \l__enumext_label_v_tl
4059     }
4060 }
4061 \tl_use:N \l__enumext_label_font_style_v_tl
4062 \__enumext_wrapper_label_v:n { \l__enumext_label_vi_tl }
4063 \__enumext_keyans_show_item_opt:
4064 }
4065 }

```

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

`\__enumext_anspic_label_pos:nnn`

The function `\__enumext_anspic_label_pos:nnn` will be in charge of handling the “counter” and the position of the `<label>`, which will have the same configuration as the `keyans` environment.

```

4066 \cs_new_protected:Npn \__enumext_anspic_label_pos:nnn #1 #2 #3
4067 {
4068     \stepcounter { enumXvi }
4069     \__enumext_anspic_body_dim:n { #3 }
4070     \bool_if:NTF \l__enumext_keyans_pic_star_bool
4071     {
4072         \__enumext_anspic_label:nn { #1 } { #2 }
4073     }
4074     {
4075         \raisebox
4076         {
4077             -\dim_eval:n
4078             {
4079                 \l__enumext_anspic_label_htdp_dim
4080                 + \l__enumext_anspic_body_htdp_dim
4081                 + \box_dp:N \strutbox
4082             }
4083         }
4084         [ opt ] [ opt ]
4085         {
4086             \__enumext_anspic_label:nn { #1 } { #2 }
4087         }
4088     }
4089 }
4090 %

```

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

`\__enumext_anspic_args:nnn`

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

```

4091 \cs_new_protected:Nn \__enumext_anspic_args:nnn
4092 {
4093     \__enumext_anspic_start_list_tag:
4094     \__enumext_anspic_label_pos:nnn { #1 } { #2 } { #3 }
4095     \__enumext_anspic_stop_start_list_tag:
4096     \l #3
4097     \__enumext_anspic_stop_list_tag:
4098 }

```

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

`\__enumext_anspic_print:n`  
`\__enumext_anspic_print:e`  
`\__enumext_anspic_row:n`

The *optional argument* `[<n°upper, n°lower>]` passed to the `keyanspic` environment is split by comma and is handled directly by the function `\__enumext_anspic_print:n` and passed to the function `\__enumext_anspic_row:n`.

```

4099 \cs_new_protected:Nn \__enumext_anspic_print:n
4100 {
4101     \clist_map_function:nN { #1 } \__enumext_anspic_row:n
4102 }
4103 \cs_generate_variant:Nn \__enumext_anspic_print:n { e }

```

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

```

4104 \cs_new_protected:Nn \__enumext_anspic_row:n
4105 {
4106     \dim_set:Nn \l__enumext_anspic_mini_width_dim { \linewidth / #1 }
4107     \int_set:Nn \l__enumext_anspic_above_int { \l__enumext_anspic_below_int }
4108     \int_set:Nn \l__enumext_anspic_below_int { \l__enumext_anspic_above_int + #1 }

```

```

4109 \int_step_inline:nnn
4110 { \l__enumext_anspic_above_int + 1 }
4111 { \l__enumext_anspic_below_int }
4112 {
4113   \IfDocumentMetadataTF
4114   {
4115     \tag_suspend:n {minipage}
4116   } { }
4117   \begin{minipage}[ \l__enumext_anspic_mini_pos_str ]{ \l__enumext_anspic_mini_width_dim }
4118     \centering
4119     \seq_item:Nn \l__enumext_anspic_args_seq { ##1 }
4120   \end{minipage}
4121   \IfDocumentMetadataTF
4122   {
4123     \tag_resume:n {minipage}
4124   } { }
4125 }
4126 \par
4127 }

```

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

## 12.42 The horizontal environments

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

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

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

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

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

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

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

### 12.42.1 Functions for item box width

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

```

\__enumext_starred_columns_set_vii:
\__enumext_starred_columns_set_viii:

```

```

4128 \cs_new_protected:Nn \__enumext_starred_columns_set_vii:
4129 {
4130   \dim_compare:nNnT { \l__enumext_columns_sep_vii_dim } = { \c_zero_dim }
4131   {
4132     \dim_set:Nn \l__enumext_columns_sep_vii_dim
4133     {
4134       ( \l__enumext_labelwidth_vii_dim + \l__enumext_labelsep_vii_dim )
4135       / \l__enumext_columns_vii_int
4136     }
4137   }
4138   \int_set:Nn \l__enumext_tmpa_vii_int { \l__enumext_columns_vii_int - 1 }
4139   \dim_set:Nn \l__enumext_item_width_vii_dim
4140   {
4141     ( \linewidth - \l__enumext_columns_sep_vii_dim * \l__enumext_tmpa_vii_int )
4142     / \l__enumext_columns_vii_int
4143     - \l__enumext_labelwidth_vii_dim
4144     - \l__enumext_labelsep_vii_dim
4145   }

```

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

```

4146   \dim_compare:nNnT { \l__enumext_rightmargin_vii_dim } > { \c_zero_dim }
4147   {
4148     \dim_sub:Nn \l__enumext_item_width_vii_dim

```

```

4149         {
4150             ( \l__enumext_rightmargin_vii_dim * \l__enumext_tmpa_vii_int )
4151             / \l__enumext_columns_vii_int
4152         }
4153     \dim_add:Nn \l__enumext_columns_sep_vii_dim
4154     {
4155         \l__enumext_rightmargin_vii_dim
4156     }
4157 }
4158 }

```

Same implementation for the `keyans*` environment.

```

4159 \cs_new_protected:Nn \__enumext_starred_columns_set_viii:
4160 {
4161     \dim_compare:nNnT { \l__enumext_columns_sep_viii_dim } = { \c_zero_dim }
4162     {
4163         \dim_set:Nn \l__enumext_columns_sep_viii_dim
4164         {
4165             ( \l__enumext_labelwidth_viii_dim + \l__enumext_labelsep_viii_dim )
4166             / \l__enumext_columns_viii_int
4167         }
4168     }
4169     \int_set:Nn \l__enumext_tmpa_viii_int { \l__enumext_columns_viii_int - 1 }
4170     \dim_set:Nn \l__enumext_item_width_viii_dim
4171     {
4172         ( \linewidth - \l__enumext_columns_sep_viii_dim * \l__enumext_tmpa_viii_int )
4173         / \l__enumext_columns_viii_int
4174         - \l__enumext_labelwidth_viii_dim
4175         - \l__enumext_labelsep_viii_dim
4176     }
4177     \dim_compare:nNnT { \l__enumext_rightmargin_viii_dim } > { \c_zero_dim }
4178     {
4179         \dim_sub:Nn \l__enumext_item_width_viii_dim
4180         {
4181             ( \l__enumext_rightmargin_viii_dim * \l__enumext_tmpa_vii_int )
4182             / \l__enumext_columns_viii_int
4183         }
4184         \dim_add:Nn \l__enumext_columns_sep_viii_dim
4185         {
4186             \l__enumext_rightmargin_viii_dim
4187         }
4188     }
4189 }

```

(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.

```

4190 \cs_new_protected:Npn \__enumext_starred_joined_item_vii:n #1
4191 {
4192     \int_set:Nn \l__enumext_joined_item_vii_int { #1 }
4193     \int_compare:nNnT { \l__enumext_joined_item_vii_int } > { \l__enumext_columns_vii_int }
4194     {
4195         \msg_warning:nnee { enumext } { item-joined }
4196         { \int_use:N \l__enumext_joined_item_vii_int }
4197         { \int_use:N \l__enumext_columns_vii_int }
4198         \int_set:Nn \l__enumext_joined_item_vii_int
4199         {
4200             \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1
4201         }
4202     }
4203     \int_compare:nNnT
4204     { \l__enumext_joined_item_vii_int }
4205     >
4206     { \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1 }
4207     {
4208         \msg_warning:nnee { enumext } { item-joined-columns }
4209         { \int_use:N \l__enumext_joined_item_vii_int }
4210         {

```

```

4211         \int_eval:n
4212         { \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1 }
4213     }
4214     \int_set:Nn \l__enumext_joined_item_vii_int
4215     {
4216         \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1
4217     }
4218 }
4219 \int_compare:nNnTF { \l__enumext_joined_item_vii_int } > { 1 }
4220 {
4221     \int_set_eq:NN \l__enumext_joined_item_aux_vii_int \l__enumext_joined_item_vii_int
4222     \int_decr:N \l__enumext_joined_item_aux_vii_int
4223     \int_add:Nn \l__enumext_item_column_pos_vii_int { \l__enumext_joined_item_aux_vii_int }
4224     \int_gadd:Nn \g__enumext_item_count_all_vii_int { \l__enumext_joined_item_aux_vii_int }
4225     \dim_set:Nn \l__enumext_joined_width_vii_dim
4226     {
4227         \l__enumext_item_width_vii_dim * \l__enumext_joined_item_vii_int
4228         + ( \l__enumext_labelwidth_vii_dim + \l__enumext_labelsep_vii_dim
4229             + \l__enumext_columns_sep_vii_dim
4230             )*\l__enumext_joined_item_aux_vii_int
4231     }
4232     \dim_set_eq:NN \itemwidth \l__enumext_joined_width_vii_dim
4233 }
4234 {
4235     \dim_set_eq:NN \l__enumext_joined_width_vii_dim \l__enumext_item_width_vii_dim
4236     \dim_set_eq:NN \itemwidth \l__enumext_item_width_vii_dim
4237 }
4238 }

```

Same implementation for the **keyans\*** environment.

```

4239 \cs_new_protected:Npn \__enumext_starred_joined_item_viii:n #1
4240 {
4241     \int_set:Nn \l__enumext_joined_item_viii_int {#1}
4242     \int_compare:nNnT { \l__enumext_joined_item_viii_int } > { \l__enumext_columns_viii_int }
4243     {
4244         \msg_warning:nnee { enumext } { item-joined }
4245         { \int_use:N \l__enumext_joined_item_viii_int }
4246         { \int_use:N \l__enumext_columns_viii_int }
4247         \int_set:Nn \l__enumext_joined_item_viii_int
4248         {
4249             \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1
4250         }
4251     }
4252     \int_compare:nNnT
4253     { \l__enumext_joined_item_viii_int }
4254     >
4255     { \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1 }
4256     {
4257         \msg_warning:nnee { enumext } { item-joined-columns }
4258         { \int_use:N \l__enumext_joined_item_viii_int }
4259         {
4260             \int_eval:n
4261             { \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1 }
4262         }
4263         \int_set:Nn \l__enumext_joined_item_viii_int
4264         {
4265             \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1
4266         }
4267     }
4268     \int_compare:nNnTF { \l__enumext_joined_item_viii_int } > { 1 }
4269     {
4270         \int_set_eq:NN \l__enumext_joined_item_aux_viii_int \l__enumext_joined_item_viii_int
4271         \int_decr:N \l__enumext_joined_item_aux_viii_int
4272         \int_add:Nn \l__enumext_item_column_pos_viii_int { \l__enumext_joined_item_aux_viii_int }
4273         \int_gadd:Nn \g__enumext_item_count_all_viii_int { \l__enumext_joined_item_aux_viii_int }
4274         \dim_set:Nn \l__enumext_joined_width_viii_dim
4275         {
4276             \l__enumext_item_width_viii_dim * \l__enumext_joined_item_viii_int
4277             + ( \l__enumext_labelwidth_viii_dim + \l__enumext_labelsep_viii_dim
4278                 + \l__enumext_columns_sep_viii_dim
4279                 )*\l__enumext_joined_item_aux_viii_int
4280         }

```



```

4281     \dim_set_eq:NN \itemwidth \l__enumext_joined_width_viii_dim
4282   }
4283   {
4284     \dim_set_eq:NN \l__enumext_joined_width_viii_dim \l__enumext_item_width_viii_dim
4285     \dim_set_eq:NN \itemwidth \l__enumext_item_width_viii_dim
4286   }
4287 }

```

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

```

4288 \cs_new_protected:Nn \__enumext_start_mini_vii:
4289 {
4290   \dim_compare:nNnT { \l__enumext_minipage_right_vii_dim } > { \c_zero_dim }
4291   {
4292     \dim_set:Nn \l__enumext_minipage_left_vii_dim
4293     {
4294       \linewidth
4295       - \l__enumext_minipage_right_vii_dim
4296       - \l__enumext_minipage_hsep_vii_dim
4297     }
4298     \bool_set_true:N \l__enumext_minipage_active_vii_bool
4299     \dim_gset_eq:NN
4300     \g__enumext_minipage_right_vii_dim
4301     \l__enumext_minipage_right_vii_dim
4302     \__enumext_mini_addvspace_vii:
4303     \nointerlineskip\noindent
4304     \__enumext_mini_page{ \l__enumext_minipage_left_vii_dim }
4305   }
4306 }

```

The function `\__enumext_stop_mini_vii:` closes the `\__enumext_mini_page` environment on the “left side”, applies `\hfill` and set the variable `\g__enumext_minipage_active_vii_bool` to “true” which will be used in the function `\__enumext_after_env:n` to execute the `minipage` on the “right side”. At this point we will execute the `\__enumext_stop_list:` and `\__enumext_stop_store_level_vii:` functions stopping the `list` environment and the level saving mechanism for storage in *(sequence)* of the `\anskey` command and `anskey*` environment. This function is passed to the `\__enumext_after_list_vii:` function in the second part of the `enumext*` environment definition (§12.43).

```

4307 \cs_new_protected:Nn \__enumext_stop_mini_vii:
4308 {
4309   \bool_if:NTF \l__enumext_minipage_active_vii_bool
4310   {
4311     \__enumext_stop_list:
4312     \__enumext_stop_store_level_vii:
4313     \IfDocumentMetadataTF { \tag_resume:n {enumext*} } { }
4314     \end__enumext_mini_page
4315     \hfill
4316     \bool_gset_true:N \g__enumext_minipage_active_vii_bool
4317   }
4318   {
4319     \__enumext_stop_list:
4320     \__enumext_stop_store_level_vii:
4321   }
4322 }

```

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

Finally we execute the `{\code}` passed to the `mini-right` or `mini-right*` keys stored in the variable `\g__enumext_miniright_code_vii_tl` in the `minipage` environment on the “right side”. For compatibility with the `caption` package and possibly other `{\code}` passed to this key, we will pass it to a box and then print it.

```

4323 \__enumext_after_env:n {enumext*}
4324 {
4325   \bool_if:NT \g__enumext_minipage_active_vii_bool
4326   {
4327     \__enumext_minipage:w [ t ] { \g__enumext_minipage_right_vii_dim }
4328     \legacy_if_gset_false:n { @minipage }

```

```

4329     \skip_vertical:N \c_zero_skip
4330     \par\addvspace { \g__enumext_minipage_right_skip }
4331     \bool_if:NF \g__enumext_minipage_center_vii_bool
4332     {
4333         \tl_put_left:Nn \g__enumext_miniright_code_vii_tl
4334         {
4335             \centering
4336         }
4337     }
4338     \vbox_set_top:Nn \l__enumext_miniright_code_vii_box
4339     {
4340         \tl_use:N \g__enumext_miniright_code_vii_tl
4341     }
4342     \box_use_drop:N \l__enumext_miniright_code_vii_box
4343     \skip_vertical:N \c_zero_skip
4344     \__enumext_endminipage:
4345     \par\addvspace{ \g__enumext_minipage_after_skip }
4346 }
4347 \bool_gset_false:N \g__enumext_minipage_active_vii_bool
4348 \bool_gset_true:N \g__enumext_minipage_center_vii_bool
4349 \tl_gclear:N \g__enumext_miniright_code_vii_tl
4350 \dim_gzero:N \g__enumext_minipage_right_vii_dim
4351 \bool_gset_false:N \g__enumext_starred_bool
4352 }

```

`\__enumext_start_mini_viii:`  
`\__enumext_stop_mini_viii:`

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

```

4353 \cs_new_protected:Nn \__enumext_start_mini_viii:
4354 {
4355     \dim_compare:nNt { \l__enumext_minipage_right_viii_dim } > { \c_zero_dim }
4356     {
4357         \dim_set:Nn \l__enumext_minipage_left_viii_dim
4358         {
4359             \linewidth
4360             - \l__enumext_minipage_right_viii_dim
4361             - \l__enumext_minipage_hsep_viii_dim
4362         }
4363         \bool_set_true:N \l__enumext_minipage_active_viii_bool
4364         \dim_gset_eq:NN
4365             \g__enumext_minipage_right_viii_dim
4366             \l__enumext_minipage_right_viii_dim
4367         \__enumext_mini_addvspace_viii:
4368         \nointerlineskip\noindent
4369         \__enumext_mini_page{ \l__enumext_minipage_left_viii_dim }
4370     }
4371 }
4372 \cs_new_protected:Nn \__enumext_stop_mini_viii:
4373 {
4374     \bool_if:NTF \l__enumext_minipage_active_viii_bool
4375     {
4376         \__enumext_stop_list:
4377         \IfDocumentMetadataTF { \tag_resume:n {keyans*} } { }
4378         \end__enumext_mini_page
4379         \hfill
4380         \bool_gset_true:N \g__enumext_minipage_active_viii_bool
4381     }
4382     {
4383         \__enumext_stop_list:
4384     }
4385 }
4386 \__enumext_after_env:nn {keyans*}
4387 {
4388     \bool_if:NT \g__enumext_minipage_active_viii_bool
4389     {
4390         \__enumext_mini_page{ \g__enumext_minipage_right_viii_dim }
4391         \par\addvspace { \g__enumext_minipage_right_skip }
4392         \bool_if:NF \g__enumext_minipage_center_viii_bool
4393         {
4394             \tl_put_left:Nn \g__enumext_miniright_code_viii_tl
4395             {
4396                 \centering

```

```

4397         }
4398     }
4399     \vbox_set_top:Nn \l__enumext_miniright_code_viii_box
4400     {
4401         \tl_use:N \g__enumext_miniright_code_viii_tl
4402     }
4403     \box_use_drop:N \l__enumext_miniright_code_viii_box
4404     \end__enumext_mini_page
4405     \par\addvspace{ \g__enumext_minipage_after_skip }
4406 }
4407 \bool_gset_false:N \g__enumext_minipage_active_viii_bool
4408 \bool_gset_true:N \g__enumext_minipage_center_viii_bool
4409 \tl_gclear:N \g__enumext_miniright_code_viii_tl
4410 \dim_gzero:N \g__enumext_minipage_right_viii_dim
4411 }

```

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

#### 12.42.4 Redefining \footnote command

\\_\_enumext\_footnotetext:nn 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.

```

4412 \cs_new_protected:Nn \__enumext_footnotetext:nn
4413 {
4414     \footnotetext[#1]{#2}
4415 }
4416 \cs_new_protected:Nn \__enumext_renew_footnote:
4417 {
4418     \seq_gclear:N \g__enumext_footnote_arg_seq
4419     \seq_gclear:N \g__enumext_footnote_int_seq
4420     \RenewDocumentCommand \footnote { o +m }
4421     {
4422         \tl_if_novalue:nTF {##1}
4423         {
4424             \stepcounter{footnote}
4425             \int_gset_eq:Nc \g__enumext_footnote_int { c@footnote }
4426         }
4427         {
4428             \int_gset:Nn \g__enumext_footnote_int { ##1 }
4429         }
4430         \footnotemark [ \g__enumext_footnote_int ]
4431         \seq_gput_right:Nn \g__enumext_footnote_arg_seq { ##2 }
4432         \seq_gput_right:NV \g__enumext_footnote_int_seq \g__enumext_footnote_int
4433     }
4434 }
4435 \cs_new_protected:Nn \__enumext_print_footnote:
4436 {
4437     \seq_if_empty:NF \g__enumext_footnote_int_seq
4438     {
4439         \seq_map_pairwise_function:NNN
4440         \g__enumext_footnote_int_seq
4441         \g__enumext_footnote_arg_seq
4442         \__enumext_footnotetext:nn
4443     }
4444 }

```

(End of definition for \\_\_enumext\_footnotetext:nn, \\_\_enumext\_renew\_footnote:, and \\_\_enumext\_print\_footnote:.)

#### 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 \\_\_enumext\_first\_item\_tmp\_vii: and next to \item equal to \\_\_enumext\_start\_item\_tmp\_vii: which we will redefine later. Unlike the implementation used by the shortlst package, we will not set the values of \rightskip and \@rightskip equal to \@flushglue whose value is 0.0pt plus 1.0 fil, in the tests I have performed this fails in some circumstances and different results are obtained when using pdfTeX and LuaTeX.

```

4445 \NewDocumentEnvironment{enumext*}{o }
4446 {
4447     \__enumext_safe_exec_vii:
4448     \__enumext_parse_keys_vii:n {#1}
4449     \__enumext_before_list_vii:

```

```

4450     \__enumext_start_store_level_vii:
4451     \__enumext_start_list:nn { }
4452     {
4453         \__enumext_list_arg_two_vii:
4454         \__enumext_before_keys_exec_vii:
4455     }
4456     \IfDocumentMetadataTF { \tag_suspend:n {enumext*} } { }
4457     \__enumext_starred_columns_set_vii:
4458     \item[] \scan_stop:
4459     \cs_set_eq:NN \__enumext_stop_item_tmp_vii: \__enumext_first_item_tmp_vii:
4460     \cs_set_eq:NN \item \__enumext_start_item_tmp_vii:
4461     \ignorespaces
4462 }
4463 {
4464     \IfDocumentMetadataTF { \tag_struct_end:n {tag=text-unit} } { }
4465     \__enumext_stop_item_tmp_vii:
4466     \__enumext_remove_extra_parsep_vii:
4467     \__enumext_after_list_vii:
4468 }

```

(End of definition for `enumext*`. This function is documented on page 5.)

`\__enumext_safe_exec_vii:` We will first call the function `\__enumext_internal_mini_page:` to create the environment `__enumext-mini_page`, 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.

```

4469 \cs_new_protected:Nn \__enumext_safe_exec_vii:
4470 {
4471     \__enumext_internal_mini_page:
4472     \__enumext_is_not_nested:
4473     \int_incr:N \l__enumext_level_h_int
4474     \int_compare:nNnT { \l__enumext_level_h_int } > { 1 }
4475     {
4476         \msg_error:nn { enumext } { nested }
4477     }
4478     \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
4479     {
4480         \msg_error:nnn { enumext } { nested-horizontal } { keyans*}
4481     }
4482     \bool_set_true:N \l__enumext_starred_bool
4483     \bool_set_false:N \l__enumext_standar_bool
4484     \__enumext_is_on_first_level:
4485 }

```

(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.

```

4486 \cs_new_protected:Npn \__enumext_parse_keys_vii:n #1
4487 {
4488     \tl_if_novalue:nF {#1}
4489     {
4490         \str_clear:N \l__enumext_series_str
4491         \keys_set:nn { enumext / enumext* } {#1}
4492         \__enumext_parse_series:n {#1}
4493         \__enumext_store_active_keys_vii:n {#1}
4494     }
4495 }

```

(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*`.

```

4496 \cs_new_protected:Nn \__enumext_before_list_vii:

```

```

4497 {
4498   \__enumext_vspace_above_vii:
4499   \__enumext_check_ans_active:
4500   \__enumext_before_args_exec_vii:
4501   \__enumext_start_mini_vii:
4502 }

```

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

\\_\_enumext\_after\_list\_vii: The function \\_\_enumext\_after\_list\_vii: first calls the function \\_\_enumext\_stop\_mini\_vii: which internally calls \\_\_enumext\_stop\_list: and \\_\_enumext\_stop\_store\_level\_vii: (§12.42.3) used by the keys `mini-env`, `mini-right` and `mini-right*`, then to the functions \\_\_enumext\_after\_stop\_list\_vii: used by the key `after`, \\_\_enumext\_check\_ans\_key\_hook: used by the key `check-ans`, \\_\_enumext\_vspace\_below\_vii: used by the keys `below` and `below*`. Finally set \l\_\_enumext\_starred\_bool to false and call the \\_\_enumext\_resume\_save\_counter: function used by the `series`, `resume` and `resume*` keys.

```

4503 \cs_new_protected:Nn \__enumext_after_list_vii:
4504 {
4505   \__enumext_stop_mini_vii:
4506   \__enumext_after_stop_list_vii:
4507   \__enumext_check_ans_key_hook:
4508   \__enumext_vspace_below_vii:
4509   \bool_set_false:N \l__enumext_starred_bool
4510   \__enumext_resume_save_counter:
4511 }

```

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

\\_\_enumext\_start\_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`.

```

4512 \cs_new_protected:Nn \__enumext_start_store_level_vii:
4513 {
4514   \bool_if:NT \l__enumext_store_active_bool
4515   {
4516     \int_compare:nNnT { \l__enumext_level_int } > { 0 }
4517     {
4518       \__enumext_store_level_open_vii:
4519     }
4520   }
4521 }
4522 \cs_new_protected:Nn \__enumext_stop_store_level_vii:
4523 {
4524   \bool_if:NT \l__enumext_store_active_bool
4525   {
4526     \int_compare:nNnT { \l__enumext_level_int } > { 0 }
4527     {
4528       \__enumext_store_level_close_vii:
4529     }
4530   }
4531 }

```

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

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

\\_\_enumext\_first\_item\_tmp\_vii: The \\_\_enumext\_first\_item\_tmp\_vii: function will remove horizontal space equal to `\labelwidth` plus `\labelsep` to the left of the first `\item` in the environment at the point of execution of this function, where it is equal to the \\_\_enumext\_stop\_item\_tmp\_vii: function inside the environment body definition.

```

4532 \cs_new_protected_nopar:Nn \__enumext_first_item_tmp_vii:
4533 {
4534   \skip_horizontal:n { -\l__enumext_labelwidth_vii_dim - \l__enumext_labelsep_vii_dim }
4535 }

```

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

\\_\_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 `\l__enumext_item_column_pos_vii_int` that will count the item's by rows and the value of `\g__enumext_item_count_all_vii_int` that will count the total of item's in the environment. After that we will call the function \\_\_enumext\_item\_peek\_args\_vii: that will handle the arguments passed to `\item`.

```

4536 \cs_new_protected_nopar:Nn \__enumext_start_item_tmp_vii:
4537 {
4538   \__enumext_stop_item_tmp_vii:
4539   \int_incr:N \l__enumext_item_column_pos_vii_int
4540   \int_gincr:N \g__enumext_item_count_all_vii_int
4541   \__enumext_item_peek_args_vii:
4542 }

```

(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).

```

4543 \cs_new_protected:Nn \__enumext_item_peek_args_vii:
4544 {
4545   \peek_meaning:NTF (
4546     { \__enumext_joined_item_vii:w }
4547     { \__enumext_joined_item_vii:w (1) }
4548   }

```

(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\_standar\_item\_vii:w.

```

4549 \cs_new_protected:Npn \__enumext_joined_item_vii:w (#1)
4550 {
4551   \__enumext_starred_joined_item_vii:n {#1}
4552   \peek_meaning_remove:NTF *
4553     { \__enumext_starred_item_vii:w }
4554     { \__enumext_standar_item_vii:w }
4555 }

```

(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 ].

```

4556 \cs_new_protected:Npn \__enumext_standar_item_vii:w
4557 {
4558   \bool_set_false:N \l__enumext_item_starred_vii_bool
4559   \peek_meaning:NTF [
4560     {
4561       \bool_set_eq:NN \l__enumext_wrap_label_vii_bool \l__enumext_wrap_label_opt_vii_bool
4562       \__enumext_start_item_vii:w
4563     }
4564     {
4565       \bool_set_true:N \l__enumext_wrap_label_vii_bool
4566       \legacy_if_set_true:n { @noitemarg }
4567       \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ]
4568     }
4569   }

```

(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

```

4570 \cs_new_protected:Npn \__enumext_starred_item_vii:w
4571 {
4572   \bool_set_true:N \l__enumext_item_starred_vii_bool
4573   \bool_set_true:N \l__enumext_wrap_label_vii_bool
4574   \peek_meaning:NTF [
4575     { \__enumext_starred_item_vii_aux_i:w }
4576     { \__enumext_starred_item_vii_aux_ii:w }
4577   }

```

```

4578 \cs_new_protected:Npn \__enumext_starred_item_vii_aux_i:w [#1]
4579 {
4580   \tl_gset:Nn \g__enumext_item_symbol_aux_vii_tl {#1}
4581   \__enumext_starred_item_vii_aux_ii:w
4582 }
4583 \cs_new_protected:Npn \__enumext_starred_item_vii_aux_ii:w
4584 {
4585   \peek_meaning:NTF [
4586     { \__enumext_starred_item_vii_aux_iii:w }
4587     {
4588       \dim_set_eq:NN \l__enumext_item_symbol_sep_vii_dim \l__enumext_labelsep_vii_dim
4589       \legacy_if_set_true:n { @noitemarg }
4590       \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ]
4591     }
4592   }
4593 \cs_new_protected:Npn \__enumext_starred_item_vii_aux_iii:w [#1]
4594 {
4595   \dim_set:Nn \l__enumext_item_symbol_sep_vii_dim {#1}
4596   \legacy_if_set_true:n { @noitemarg }
4597   \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ]
4598 }

```

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

`\__enumext_fake_make_label_vii:n`

The `\__enumext_fake_make_label_vii:n` function will be in charge of handling our definition of `\item`. First we increment the counter `enumXvii` for the enumerated items and activate support for the *check answers* mechanism, followed by support for `\item*[\langle symbol \rangle][\langle offset \rangle]` if present, then the `wrap-label` and `wrap-label*` keys which we execute using `\makebox` whose width will be given by the `labelwidth` key and position by the `align` key, inside the argument of this we will execute the `font` key together with the function defined by the `wrap-label` or `wrap-label*` keys. Finally we execute the `labelsep` key applying a `\skip_horizontal:N` and `\ignorespaces`.

- For compatibility with *tagged* PDF and `hyperref` when an environment `enumext` is nested in `enumext*` need setting the `\if@hyper@item` switch to “true”. The explanation for this is given by the master Heiko Oberdiek on `\refstepcounter{enumi}` twice (or more) creates destination with the same identifier.

```

4599 \cs_new_protected_nopar:Npn \__enumext_fake_make_label_vii:n #1
4600 {
4601   \legacy_if:nT { @noitemarg }
4602   {
4603     \legacy_if_set_false:n { @noitemarg }
4604     \legacy_if:nT { @nmbrrlist }
4605     {
4606       \IfDocumentMetadataTF
4607       {
4608         \bool_if:NT \l__enumext_hyperref_bool
4609         {
4610           \legacy_if_set_true:n { @hyper@item }
4611         }
4612       } { }
4613       \refstepcounter{enumXvii}
4614       \bool_if:NT \l__enumext_check_answers_bool
4615       {
4616         \int_gincr:N \g__enumext_item_number_int
4617         \bool_set_true:N \l__enumext_item_number_bool
4618       }
4619     }
4620   }
4621   \bool_if:NT \l__enumext_item_starred_vii_bool
4622   {
4623     \tl_if_blank:VT \g__enumext_item_symbol_aux_vii_tl
4624     {
4625       \tl_gset_eq:NN
4626       \g__enumext_item_symbol_aux_vii_tl \l__enumext_item_symbol_vii_tl
4627     }
4628     \mode_leave_vertical:
4629     \skip_horizontal:n { -\l__enumext_item_symbol_sep_vii_dim }
4630     \hbox_overlap_left:n { \g__enumext_item_symbol_aux_vii_tl }
4631     \skip_horizontal:N \l__enumext_item_symbol_sep_vii_dim
4632     \tl_gclear:N \g__enumext_item_symbol_aux_vii_tl
4633   }
4634   \makebox[ \l__enumext_labelwidth_vii_dim ][ \l__enumext_align_label_vii_str ]

```



```

4635     {
4636         \tl_use:N \l__enumext_label_font_style_vii_tl
4637         \bool_if:NTF \l__enumext_wrap_label_vii_bool
4638         {
4639             \__enumext_wrapper_label_vii:n {#1}
4640         }
4641         { #1 }
4642     }
4643     \skip_horizontal:N \l__enumext_labelsep_vii_dim \ignorespaces
4644 }

```

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

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

The functions `\__enumext_start_item_vii:w` and `\__enumext_stop_item_vii:` executing the true definition of `\item` inside the `enumext*` environment, unlike the implementation in `shortlst` we will NOT use an extra group and the plain form of the `lrbox` environment.

`\__enumext_start_item_vii:w`

The first thing we will do is set the value of `\__enumext_stop_item_tmp_vii:` equal to `\__enumext_stop_item_vii:` which we will define later, after that we will start capturing `\item` and its *contents* in a *horizontal box* where the width will be `\itemwidth` plus `\labelwidth` plus `\labelsep`.

```

4645 \cs_new_protected_nopar:Npn \__enumext_start_item_vii:w [#1]
4646 {
4647     \cs_set_eq:NN \__enumext_stop_item_tmp_vii: \__enumext_stop_item_vii:
4648     \hbox_set_to_wd:Nnw \l__enumext_item_text_vii_box
4649     {
4650         \l__enumext_joined_width_vii_dim
4651         + \l__enumext_labelwidth_vii_dim
4652         + \l__enumext_labelsep_vii_dim
4653     }

```

If `\DocumentMetadata` is not active and the state of the variable `\l__enumext_footnotes_key_bool` is false, we will redefine the `\footnote` command.

```

4654     \IfDocumentMetadataTF { }
4655     {
4656         \bool_if:NF \l__enumext_footnotes_key_bool
4657         {
4658             \__enumext_renew_footnote:
4659         }
4660     }

```

Now we insert our *sockets* for *tagging* PDF support and print `\item`.

```

4661     \__enumext_start_list_tag:n {enumext*}
4662     \__enumext_fake_make_label_vii:n {#1}
4663     \__enumext_stop_start_list_tag:

```

Finally we open the `minipage` environment capture the *item content* and execute `first` and `itemindent` keys, then `listparindent` key which will be equal to `\parindent`, then `parsep` key which will be equal to `\parskip`.

```

4664     \__enumext_minipage:w [ t ]{ \l__enumext_joined_width_vii_dim }
4665     \tl_use:N \l__enumext_after_list_args_vii_tl
4666     \tl_use:N \l__enumext_fake_item_indent_vii_tl
4667     \dim_set_eq:NN \parindent \l__enumext_listparindent_vii_dim
4668     \skip_set_eq:NN \parskip \l__enumext_parsep_vii_skip
4669 }

```

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

`\__enumext_stop_item_vii:`

The `\__enumext_stop_item_vii:` function will finish the fetching `\item` and its *content* by closing the `minipage` environment, the *sockets* for *tagging* PDF and the *horizontal box*.

```

4670 \cs_new_protected_nopar:Nn \__enumext_stop_item_vii:
4671 {
4672     \__enumext_endminipage:
4673     \__enumext_stop_list_tag:n {enumext*}
4674     \hbox_set_end:

```

Here we will reduce the *warnings* a bit by setting the value of `\hbadness` to `10000`, print the *contents* of the *box* along with `\footnote`.

```

4675     \int_set:Nn \hbadness { 10000 }
4676     \box_use_drop:N \l__enumext_item_text_vii_box
4677     \IfDocumentMetadataTF { }
4678     {

```

```

4679         \bool_if:NF \__enumext_footnotes_key_bool
4680         {
4681             \__enumext_print_footnote:
4682         }
4683     }

```

Finally set the *vertical* and *horizontal* spaces between rows and columns.

```

4684     \int_compare:nNnTF
4685     { \__enumext_item_column_pos_vii_int } = { \__enumext_columns_vii_int }
4686     {
4687         \par\noindent
4688         \int_zero:N \__enumext_item_column_pos_vii_int
4689     }
4690     {
4691         \skip_horizontal:N \__enumext_columns_sep_vii_dim
4692     }
4693 }

```

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

`\__enumext_remove_extra_parsep_vii:`

Remove the *vertical space* equal to `\parsep=itemsep` when the total number of items is divisible by the number of items in the last row of the environment. Here the use of `\unskip` or `\removeatlastskip` fails and does not obtain the expected result, using `\vspace` is the option and in this case, we can use a simplified version since we are always in *(vertical mode)*.

```

4694 \cs_new_protected:Nn \__enumext_remove_extra_parsep_vii:
4695 {
4696     \int_compare:nNnT
4697     {
4698         \int_mod:nn
4699         { \g__enumext_item_count_all_vii_int } { \__enumext_columns_vii_int }
4700     }
4701     =
4702     { 0 }
4703     {
4704         \para_end:
4705         \skip_vertical:n { -\__enumext_itemsep_vii_skip }
4706         \skip_vertical:N \c_zero_skip
4707         \int_gzero:N \g__enumext_item_count_all_vii_int
4708     }
4709 }

```

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

As we don't want our check to be executed `check-ans` by levels but on the complete list, we will take it out of the `enumext*` environment using the “hook” function `\__enumext_after_env:nn`.

```

4710 \__enumext_after_env:nn {enumext*}
4711 {
4712     \__enumext_execute_after_env:
4713 }

```

## 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 `\__enumext_first_item_tmp_viii:` and next to `\item` equal to `\__enumext_start_item_tmp_viii:` which we will redefine later. The implementation of this environment is the same as that used by the `enumext*` environment except for the `\__enumext_check_starred_cmd:n` function added in the second part.

```

4714 \NewDocumentEnvironment{keyans*}{ o }
4715 {
4716     \__enumext_safe_exec_viii:
4717     \__enumext_parse_keys_viii:n {#1}
4718     \__enumext_before_list_viii:
4719     \__enumext_start_list:nn { }
4720     {
4721         \__enumext_list_arg_two_viii:
4722         \__enumext_before_keys_exec_viii:
4723     }
4724     \IfDocumentMetadataTF { \tag_suspend:n {keyans*} } { } { }
4725     \__enumext_starred_columns_set_viii:
4726     \item[] \scan_stop:
4727     \cs_set_eq:NN \__enumext_stop_item_tmp_viii: \__enumext_first_item_tmp_viii:
4728     \cs_set_eq:NN \item \__enumext_start_item_tmp_viii:

```

```

4729     \ignorespaces
4730   }
4731   {
4732     \IfDocumentMetadataTF { \tag_struct_end:n {tag=text-unit} } { }
4733     \__enumext_stop_item_tmp_viii:
4734     \__enumext_remove_extra_parsep_viii:
4735     \__enumext_check_starred_cmd:n { item }
4736     \__enumext_after_list_viii:
4737   }

```

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

`\__enumext_safe_exec_viii:` The `\__enumext_safe_exec_viii:` function will first check if the `save-ans` key is active and only when this is true the environment will be available, it will increment the value of `\l__enumext_keyans_level_h_int` and return an error message when we are nesting the environment, then it will call the `\__enumext_keyans_name_and_start:` function in charge of saving the name of the environment and the line it is running on, then it will check if we are trying to nest `keyans*` in `enumext*` returning an error and we will set `\l__enumext_starred_bool` to true, finally we will check if we are within the appropriate level within the `enumext` environment.

```

4738 \cs_new_protected:Nn \__enumext_safe_exec_viii:
4739 {
4740   \bool_if:NF \l__enumext_store_active_bool
4741   {
4742     \msg_error:nnnn { enumext } { wrong-place } { keyans* } { save-ans }
4743   }
4744   \int_incr:N \l__enumext_keyans_level_h_int
4745   \int_compare:nNnT { \l__enumext_keyans_level_h_int } > { 1 }
4746   {
4747     \msg_error:nn { enumext } { nested }
4748   }
4749   \__enumext_keyans_name_and_start:
4750   \bool_if:NT \l__enumext_starred_bool
4751   {
4752     \msg_error:nnn { enumext } { nested-horizontal } { enumext* }
4753   }
4754   \bool_set_true:N \l__enumext_starred_bool
4755   % Set false for interfering with enumext nested in keyans* (yes, its possible and crayze)
4756   \bool_set_false:N \l__enumext_store_active_bool
4757   \int_compare:nNnT { \l__enumext_level_int } > { 1 }
4758   {
4759     \msg_error:nn { enumext } { keyans-wrong-level }
4760   }
4761 }

```

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

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

```

4762 \cs_new_protected:Npn \__enumext_parse_keys_viii:n #1
4763 {
4764   \tl_if_novalue:nF {#1}
4765   {
4766     \keys_set:nn { enumext / keyans* } {#1}
4767   }
4768 }

```

(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`.

```

4769 \cs_new_protected:Nn \__enumext_before_list_viii:
4770 {
4771   \__enumext_vspace_above_viii:
4772   \__enumext_before_args_exec_viii:
4773   \__enumext_start_mini_viii:
4774 }

```

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

`\__enumext_after_list_viii:` The function `\__enumext_after_list_viii:` first call the function `\__enumext_stop_mini_viii:`, then apply the `{\code}` handled by the `after` key together with the *vertical space* handled by the `below` key if they are present.

```

4775 \cs_new_protected:Nn \__enumext_after_list_viii:
4776 {
4777   \__enumext_stop_mini_viii:
4778   \__enumext_after_stop_list_viii:
4779   \__enumext_vspace_below_viii:
4780 }

```

(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_first_item_tmp_viii:` The `\__enumext_first_item_tmp_viii:` function will remove horizontal space equal to `\labelwidth` plus `\labelsep` to the left of the first `\item` in the environment at the point of execution of this function, where it is equal to the `\__enumext_stop_item_tmp_viii:` function inside the environment body definition.

```

4781 \cs_new_protected_nopar:Nn \__enumext_first_item_tmp_viii:
4782 {
4783   \skip_horizontal:n { -\labelwidth_viii_dim - \labelsep_viii_dim }
4784 }

```

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

`\__enumext_start_item_tmp_viii:` First we will call the function `\__enumext_stop_item_tmp_viii:` that we will redefine later, we will increment the value of `\l__enumext_item_column_pos_viii_int` that will count the item's by rows and 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`.

```

4785 \cs_new_protected_nopar:Nn \__enumext_start_item_tmp_viii:
4786 {
4787   \__enumext_stop_item_tmp_viii:
4788   \int_incr:N \l__enumext_item_column_pos_viii_int
4789   \int_gincr:N \g__enumext_item_count_all_viii_int
4790   \__enumext_item_peek_args_viii:
4791 }

```

(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).

```

4792 \cs_new_protected:Nn \__enumext_item_peek_args_viii:
4793 {
4794   \peek_meaning:NTF (
4795     { \__enumext_joined_item_viii:w }
4796     { \__enumext_joined_item_viii:w (1) }
4797 }

```

(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`.

```

4798 \cs_new_protected:Npn \__enumext_joined_item_viii:w (#1)
4799 {
4800   \__enumext_starred_joined_item_viii:n {#1}
4801   \peek_meaning_remove:NTF *
4802     { \__enumext_starred_item_viii:w }
4803     { \__enumext_standar_item_viii:w }
4804 }

```

(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 ].

```

4805 \cs_new_protected:Npn \__enumext_standar_item_viii:w
4806 {
4807   \bool_set_false:N \l__enumext_item_starred_viii_bool
4808   \peek_meaning:NTF [
4809     {
4810       \bool_set_eq:NN \l__enumext_wrap_label_viii_bool \l__enumext_wrap_label_opt_viii_bool
4811       \__enumext_start_item_viii:w
4812     }
4813     {
4814       \bool_set_true:N \l__enumext_wrap_label_viii_bool
4815       \legacy_if_set_true:n { @noitemarg }
4816       \__enumext_start_item_viii:w [ \l__enumext_label_viii_tl ]
4817     }
4818   }

```

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

\\_\_enumext\_starred\_item\_viii: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*[⟨content⟩]`.

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

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

```

4819 \cs_new_protected:Npn \__enumext_starred_item_viii:w
4820 {
4821   \bool_set_true:N \l__enumext_item_starred_viii_bool
4822   \bool_set_true:N \l__enumext_wrap_label_viii_bool
4823   \peek_meaning:NTF [
4824     { \__enumext_starred_item_viii_aux_i:w }
4825     { \__enumext_starred_item_viii_aux_ii:w }
4826   }

```

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.

```

4827 \cs_new_protected:Npn \__enumext_starred_item_viii_aux_i:w [#1]
4828 {
4829   \tl_clear:N \l__enumext_store_current_label_tl
4830   \tl_if_no_value:nF { #1 }
4831   {
4832     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_tl
4833     {
4834       \tl_put_right:Ne \l__enumext_store_current_label_tl
4835       {
4836         \l__enumext_store_keyans_item_opt_sep_tl
4837       }
4838       \tl_put_right:Ne \l__enumext_store_current_label_tl { #1 }
4839     }
4840     \tl_set:Ne \l__enumext_store_current_opt_arg_tl { #1 }
4841   }
4842   \__enumext_starred_item_viii_aux_ii:w
4843 }
4844 \cs_new_protected:Npn \__enumext_starred_item_viii_aux_ii:w
4845 {
4846   \legacy_if_set_true:n { @noitemarg }
4847   \__enumext_start_item_viii:w [ \l__enumext_label_viii_tl ]
4848 }

```

(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 *⟨label⟩* for `\item*` followed by the [⟨content⟩] for `\item*[⟨content⟩]` if present in the *⟨sequence⟩* and *⟨prop list⟩* set by the `save-ans` key. In this same function the keys `show-ans`, `show-pos` and `save-ref` are implemented.

```

4849 \cs_new_protected:Nn \__enumext_starred_item_exec:
4850 {

```

```

4851 \tl_put_left:Ne \l__enumext_store_current_label_tl { \l__enumext_label_viii_tl }
4852 \__enumext_store_addto_prop:V \l__enumext_store_current_label_tl
4853 \__enumext_keyans_store_ref:
4854 \tl_put_left:Ne \l__enumext_store_current_label_tl { \item }
4855 \__enumext_keyans_addto_seq_link:
4856 \int_gincr:N \g__enumext_check_starred_cmd_int
4857 \bool_if:NT \l__enumext_show_answer_bool
4858 {
4859   \__enumext_print_keyans_box:NN \l__enumext_labelwidth_i_dim \l__enumext_labelsep_i_dim
4860 }
4861 \bool_if:NT \l__enumext_show_position_bool
4862 {
4863   \tl_set:Ne \l__enumext_mark_answer_sym_tl
4864   {
4865     \group_begin:
4866     \exp_not:N \normalfont
4867     \exp_not:N \footnotesize [ \int_eval:n
4868       {
4869         \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
4870       }
4871     ]
4872     \group_end:
4873   }
4874   \__enumext_print_keyans_box:NN \l__enumext_labelwidth_i_dim \l__enumext_labelsep_i_dim
4875 }
4876 }

```

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

\\_\_enumext\_fake\_make\_label\_viii:n

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

```

4877 \cs_new_protected_nopar:Npn \__enumext_fake_make_label_viii:n #1
4878 {
4879   \legacy_if:nT { @noitemarg }
4880   {
4881     \legacy_if_set_false:n { @noitemarg }
4882     \legacy_if:nT { @nmbrrlist }
4883     {
4884       \refstepcounter{enumXviii}
4885     }
4886   }
4887   \bool_if:NT \l__enumext_item_starred_viii_bool
4888   {
4889     \__enumext_starred_item_exec:
4890   }
4891   \makebox[ \l__enumext_labelwidth_viii_dim ][ \l__enumext_align_label_viii_str ]
4892   {
4893     \tl_use:N \l__enumext_label_font_style_viii_tl
4894     \bool_if:NTF \l__enumext_wrap_label_viii_bool
4895     {
4896       \__enumext_wrapper_label_viii:n {#1}
4897     }
4898     { #1 }
4899   }
4900   \skip_horizontal:N \l__enumext_labelsep_viii_dim \ignorespaces
4901 }

```

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

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

\\_\_enumext\_start\_item\_viii:w

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

```

4902 \cs_new_protected_nopar:Npn \__enumext_start_item_viii:w [#1]
4903 {
4904   \cs_set_eq:NN \__enumext_stop_item_tmp_viii: \__enumext_stop_item_viii:
4905   \hbox_set_to_wd:Nnw \l__enumext_item_text_viii_box
4906   {
4907     \l__enumext_joined_width_viii_dim
4908     + \l__enumext_labelwidth_viii_dim
4909     + \l__enumext_labelsep_viii_dim
4910   }
4911   \IfDocumentMetadataTF { }
4912   {

```

```

4913         \bool_if:NF \l__enumext_footnotes_key_bool
4914         {
4915             \__enumext_renew_footnote:
4916         }
4917     }
4918     \__enumext_start_list_tag:n {keyans*}
4919     \__enumext_fake_make_label_viii:n {#1}
4920     \__enumext_stop_start_list_tag:
4921     \__enumext_minipage:w [ t ]{ \l__enumext_joined_width_viii_dim }
4922     \tl_use:N \l__enumext_after_list_args_viii_tl
4923     \bool_if:NT \l__enumext_item_starred_viii_bool
4924     {
4925         \tl_use:N \l__enumext_fake_item_indent_viii_tl
4926         \__enumext_keyans_show_item_opt:
4927         \skip_horizontal:n { -\l__enumext_fake_item_indent_viii_dim - \l__enumext_labelsep_viii_dim }
4928     }
4929     {
4930         \tl_use:N \l__enumext_fake_item_indent_viii_tl
4931     }
4932     \dim_set_eq:NN \parindent \l__enumext_listparindent_viii_dim
4933     \skip_set_eq:NN \parskip \l__enumext_parsep_viii_skip
4934 }

```

(End of definition for \\_\_enumext\_start\_item\_viii:w.)

\\_\_enumext\_stop\_item\_viii: The \\_\_enumext\_stop\_item\_viii: function will finish the fetching \item and its *content* by closing the minipage environment and the horizontal box. Here we will reduce the warnings a bit by setting the value of \hbadness to 10000, print the *contents* of the box along with \footnote and finally set the vertical and horizontal spaces between rows and columns.

```

4935 \cs_new_protected_nopar:Nn \__enumext_stop_item_viii:
4936 {
4937     \__enumext_endminipage:
4938     \__enumext_stop_list_tag:n {keyans*}
4939     \hbox_set_end:
4940     \int_set:Nn \hbadness { 10000 }
4941     \box_use_drop:N \l__enumext_item_text_viii_box
4942     \IfDocumentMetadataTF { }
4943     {
4944         \bool_if:NF \l__enumext_footnotes_key_bool
4945         {
4946             \__enumext_print_footnote:
4947         }
4948     }
4949     \int_compare:nNnTF
4950     { \l__enumext_item_column_pos_viii_int } = { \l__enumext_columns_viii_int }
4951     {
4952         \par\noindent
4953         \int_zero:N \l__enumext_item_column_pos_viii_int
4954     }
4955     {
4956         \skip_horizontal:N \l__enumext_columns_sep_viii_dim
4957     }
4958 }

```

(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.

```

4959 \cs_new_protected:Nn \__enumext_remove_extra_parsep_viii:
4960 {
4961     \int_compare:nNnT
4962     {
4963         \int_mod:nn
4964         { \g__enumext_item_count_all_viii_int }
4965         { \l__enumext_columns_viii_int }
4966     }
4967     =
4968     { 0 }
4969     {
4970         \para_end:
4971         \skip_vertical:n { -\l__enumext_itemsep_viii_skip }

```



```

4972         \skip_vertical:N \c_zero_skip
4973         \int_gzero:N \g__enumext_item_count_all_viii_int
4974     }
4975 }

```

(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  $\langle store\ name : position \rangle$ . Retrieve a “single” content stored by `\anskey`, `\anspic*` and `\item*` from  $\langle prop\ list \rangle$  defined by `save-ans` key.

```

4976 \NewDocumentCommand \getkeyans { m }
4977 {
4978     \exp_args:Ne \__enumext_getkeyans_aux:n
4979     { \tl_to_str:e { \text_expand:n {#1} } }
4980 }

```

(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  $\langle argument \rangle$  using “.”. If “.” is omitted it will return an error.

```

4981 \cs_new_protected:Npn \__enumext_getkeyans_aux:n #1
4982 {
4983     \str_if_in:nnTF {#1} { : }
4984     {
4985         \use:e
4986         {
4987             \cs_set:Npn \exp_not:N \__enumext_tmp:w ##1 \c_colon_str ##2 \scan_stop:
4988             { {##1} {##2} }
4989         }
4990         \exp_after:wN \__enumext_getkeyans:nn \__enumext_tmp:w #1 \scan_stop:
4991     }
4992     { \msg_error:nnn { enumext } { missing-colon } {#1} }
4993 }

```

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

`\__enumext_getkeyans:nn`

The internal function `\__enumext_getkeyans:nn` will check for the existence of the  $\langle prop\ list \rangle$ , if it does not exist it will return an error message, then it will fetch the content specified by the second  $\langle argument \rangle$  from  $\langle prop\ list \rangle$ .

```

4994 \cs_new_protected:Npn \__enumext_getkeyans:nn #1 #2
4995 {
4996     \prop_if_exist:cTF { g__enumext_#1_prop }
4997     {
4998         \prop_item:cn { g__enumext_#1_prop }{#2}
4999     }
5000     {
5001         \msg_error:nnn { enumext } { undefined-storage-anskey } {#1}
5002     }
5003 }

```

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

## 12.46 The command `\printkeyans`

The `\printkeyans` command prints “all stored content” in the  $\langle sequence \rangle$  defined by the `save-ans` key. The first thing we will do is define a set of  $\langle filtered\ keys \rangle$  with which we will control the options of the different nesting levels for the environment `enumext` and `enumext*` by storing their values in the list of tokens `\l__enumext_print_keyans_X_tl`.

The variable `\l__enumext_print_keyans_starred_tl` will have the default  $\langle keys \rangle$  for `\printkeyans*` and will be set by `\setenumext[ $\langle print^* \rangle$ ]` and the variable `\l__enumext_print_keyans_vii_tl` will have the default keys for the environment `enumext*` nested within the  $\langle sequence \rangle$  and will be set by `\setenumext[ $\langle print ,^* \rangle$ ]`, the rest of the variables will be for the environment `enumext` and will be set by `\setenumext[ $\langle print , level \rangle$ ]`.

```

5004 \keys_define:nn { enumext / print }
5005 {
5006     print* .code:n      = \keys_precompile:neN { enumext / enumext* }
5007                     { \__enumext_filter_save_key:n {#1} }
5008                     \l__enumext_print_keyans_starred_tl, % starred cmd
5009     print* .initial:n   = { nosep, label=\arabic*., columns=2, first=\small, font=\small },
5010     print-1 .code:n     = \keys_precompile:neN { enumext / level-1 }

```

```

5011         { \__enumext_filter_save_key:n {#1} }
5012         \__enumext_print_keyans_i_tl,
5013     print-1 .initial:n = { nosep, label=\arabic*., columns=2, first=\small, font=\small },
5014     print-2 .code:n    = \keys_precompile:neN { enumext / level-2 }
5015         { \__enumext_filter_save_key:n {#1} }
5016         \__enumext_print_keyans_ii_tl,
5017     print-2 .initial:n = { nosep, label=(\alph*), first=\small, font=\small },
5018     print-3 .code:n    = \keys_precompile:neN { enumext / level-3 }
5019         { \__enumext_filter_save_key:n {#1} }
5020         \__enumext_print_keyans_iii_tl,
5021     print-3 .initial:n = { nosep, label=\roman*., first=\small, font=\small },
5022     print-4 .code:n    = \keys_precompile:neN { enumext / level-4 }
5023         { \__enumext_filter_save_key:n {#1} }
5024         \__enumext_print_keyans_iv_tl,
5025     print-4 .initial:n = { nosep, label=\Alph*., first=\small, font=\small },
5026     print-* .code:n    = \keys_precompile:neN { enumext / enumext* }
5027         { \__enumext_filter_save_key:n {#1} }
5028         \__enumext_print_keyans_vii_tl, % starred nested
5029     print-* .initial:n = { nosep, label=\arabic*., first=\small, font=\small },
5030 }

```

🔗 The reason for storing  $\langle keys \rangle$  in token lists using `\keys_precompile:neN` is because the keys are set via `\setenumext` but are later executed by running the command `\printkeyans` and they are not handled directly by its *optional argument*, except those related to the *first* opening level.

`\printkeyans` Create a user command to print “all stored content” in  $\langle sequence \rangle$  for `\anskey`, `anskey*`, `\item*` and `\anspic*`. Within a group we will run our “precompiled keys” and then call the internal function `\__enumext_printkeyans:nnn`.

```

5031 \NewDocumentCommand \printkeyans { s O{} m }
5032 {
5033     \group_begin:
5034         \tl_use:N \__enumext_print_keyans_i_tl
5035         \tl_use:N \__enumext_print_keyans_ii_tl
5036         \tl_use:N \__enumext_print_keyans_iii_tl
5037         \tl_use:N \__enumext_print_keyans_iv_tl
5038         \tl_use:N \__enumext_print_keyans_vii_tl
5039         \__enumext_printkeyans:nnn { #1 } { #2 } { #3 }
5040     \group_end:
5041 }

```

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

`\__enumext_printkeyans:nnn` The internal function `\__enumext_printkeyans:nnn` will check for the existence of the  $\langle sequence \rangle$ , if it does not exist it will return an error message, then it will check if not empty.

```

5042 \cs_new_protected:Npn \__enumext_printkeyans:nnn #1 #2 #3
5043 {
5044     \seq_if_exist:cTF { g__enumext_#3_seq }
5045     {
5046         \seq_if_empty:cF { g__enumext_#3_seq }
5047     }

```

If the *starred argument* ‘`*`’ is present we will check that the environment `enumext*` is not saved in the  $\langle sequence \rangle$ , then execute the variable `\__enumext_print_keyans_starred_tl` that contains the default  $\langle keys \rangle$  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*.

```

5048         \bool_if:nTF {#1}
5049         {
5050             \seq_if_in:cnTF { g__enumext_#3_seq } { \end{enumext*} }
5051             {
5052                 \msg_error:nnnn { enumext } { print-starred } {#3} { enumext* }
5053             }
5054             {
5055                 \tl_use:N \__enumext_print_keyans_starred_tl
5056                 \bool_set_true:N \__enumext_base_line_fix_bool
5057                 \bool_set_true:N \__enumext_print_keyans_star_bool
5058                 \begin{enumext*}[#2]
5059                     \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
5060                 \end{enumext*}
5061             }
5062         }

```

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

```

5063         {
5064             \begin{enumext} [#2]
5065             \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
5066             \end{enumext}
5067         }
5068     }
5069 }
5070 {
5071     \msg_error:nnn { enumext } { undefined-storage-anskey } { #3 }
5072 }
5073 }

```

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

## 12.47 The command `\setenumext`

The command `\setenumext` will be in charge of managing the  $\langle keys \rangle$  passed to all environments and to the `\printkeyans` command. We must take precautions with the `enumext*` environment and “first level” of the `enumext` environment so as not to capture  $\langle keys \rangle$  that complicate us.

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

```

5074 \cs_new:Npn \__enumext_filter_first_level:n #1
5075 {
5076     \use:e
5077     {
5078         \keyval_parse:NNn
5079         \__enumext_filter_first_level_key:n
5080         \__enumext_filter_first_level_pair:nn { #1 }
5081     }
5082 }

```

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

```

5083 \cs_new:Npn \__enumext_filter_first_level_key:n #1
5084 {
5085     \str_case:nnF { #1 }
5086     {
5087         { resume } {}
5088         { resume* } {}
5089     }
5090     { , { \exp_not:n { #1 } } }
5091 }

```

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

```

5092 \cs_new:Npn \__enumext_filter_first_level_pair:nn #1#2
5093 {
5094     \str_case:nnF { #1 }
5095     {
5096         { series } {}
5097         { resume } {}
5098         { save-ans } {}
5099     }
5100     { , { \exp_not:n { #1 } } = { \exp_not:n { #2 } } }
5101 }

```

(End of definition for `\__enumext_filter_first_level:n`, `\__enumext_filter_first_level_key:n`, and `\__enumext_filter_first_level_pair:nn`.)

Now define a “meta families” of  $\langle keys \rangle$  to access from `\setenumext`.

```

5102 \keys_define:nn { enumext / meta-families }
5103 {
5104     enumext-1 .code:n =
5105     {
5106         \keys_set:ne { enumext / level-1 }
5107         {
5108             \__enumext_filter_first_level:n { #1 }
5109         }
5110     } ,
5111     enumext-2 .code:n = { \keys_set:nn { enumext / level-2 } { #1 } } ,

```

```

5112 enumext-3 .code:n = { \keys_set:nn { enumext / level-3 } {#1} } ,
5113 enumext-4 .code:n = { \keys_set:nn { enumext / level-4 } {#1} } ,
5114 keyans .code:n = { \keys_set:nn { enumext / keyans } {#1} } ,
5115 enumext* .code:n =
5116 {
5117     \keys_set:ne { enumext / enumext* }
5118     {
5119         \__enumext_filter_first_level:n {#1}
5120     }
5121 } ,
5122 keyans* .code:n = { \keys_set:nn { enumext / keyans* } {#1} } ,
5123 print* .code:n = { \keys_set:nn { enumext / print } { print* = {#1} } } ,
5124 print-1 .code:n = { \keys_set:nn { enumext / print } { print-1 = {#1} } } ,
5125 print-2 .code:n = { \keys_set:nn { enumext / print } { print-2 = {#1} } } ,
5126 print-3 .code:n = { \keys_set:nn { enumext / print } { print-3 = {#1} } } ,
5127 print-4 .code:n = { \keys_set:nn { enumext / print } { print-4 = {#1} } } ,
5128 print-* .code:n = { \keys_set:nn { enumext / print } { print-* = {#1} } } ,
5129 unknown .code:n = { \msg_error:nn { enumext } { unknown-key-family } } ,
5130 }

```

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

```

5131 \seq_const_from_clist:Nn \c__enumext_all_families_seq
5132 {
5133     enumext-1, enumext-2, enumext-3, enumext-4, keyans, enumext*,
5134     keyans*, print-1, print-2, print-3, print-4, print-*, print*,
5135 }

```

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

```

5136 \NewDocumentCommand \setenumext { 0{enumext,1} +m }
5137 {
5138     \seq_clear:N \l__enumext_setkey_tmpa_seq
5139     \seq_set_from_clist:Nn \l__enumext_setkey_tmpb_seq {#1}
5140     \int_set:Nn \l__enumext_setkey_tmpa_int
5141     {
5142         \seq_count:N \l__enumext_setkey_tmpb_seq
5143     }
5144     \int_compare:nNnTF { \l__enumext_setkey_tmpa_int } > { 1 }
5145     {
5146         \seq_pop_left:NN \l__enumext_setkey_tmpb_seq \l__enumext_setkey_tmpa_tl
5147         \seq_map_function:NN \l__enumext_setkey_tmpb_seq \__enumext_set_parse:n
5148         \seq_set_map_e:NNn \l__enumext_setkey_tmpa_seq \l__enumext_setkey_tmpa_seq
5149         {
5150             \tl_use:N \l__enumext_setkey_tmpa_tl - ##1
5151         }
5152     }
5153     {
5154         \seq_put_right:Ne \l__enumext_setkey_tmpa_seq { \tl_trim_spaces:n {#1} }
5155     }
5156     \seq_if_empty:NTF \l__enumext_setkey_tmpa_seq
5157     { \seq_map_inline:Nn \c__enumext_all_families_seq }
5158     { \seq_map_inline:Nn \l__enumext_setkey_tmpa_seq }
5159     {
5160         \keys_set:nn { enumext / meta-families } { ##1 = {#2} }
5161     }
5162 }

```

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

`\__enumext_set_parse:n`  
`\__enumext_set_error:n`

Internal functions used by the `\setenumext` command.

```

5163 \cs_new_protected:Npn \__enumext_set_parse:n #1
5164 {
5165     \tl_set:Ne \l__enumext_setkey_tmpb_tl { \tl_trim_spaces:n {#1} }
5166     \clist_map_inline:nn { 0, 1, 2, 3, 4, * } % <- max level
5167     { \tl_remove_all:Nn \l__enumext_setkey_tmpb_tl {##1} }
5168     \tl_if_empty:NTF \l__enumext_setkey_tmpb_tl
5169     {
5170         \seq_put_right:Ne \l__enumext_setkey_tmpa_seq
5171         { \tl_trim_spaces:n {#1} }
5172     }
5173     { \__enumext_set_error:nn {#1} { } }
5174 }

```

```

5175 \cs_new_protected:Npn \__enumext_set_error:nn #1 #2
5176 { \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

```

```

5177 \prop_const_from_keyval:Nn \c__enumext_meta_paths_prop
5178 {
5179   {enumext,1} = level-1,
5180   {enumext,2} = level-2,
5181   {enumext,3} = level-3,
5182   {enumext,4} = level-4,
5183   {enumext*} = enumext*
5184 }

```

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

```

5185 \NewDocumentCommand \setenumextmeta { s O{enumext,1} m +m }
5186 {
5187   \str_if_eq:eeTF { \tl_trim_spaces:n {#3} } { unknown }
5188   { \msg_error:nn { enumext } { prohibited-unknown } }
5189   {
5190     \bool_if:nTF {#1}
5191     {
5192       \int_step_inline:nn { 4 }
5193       { \__enumext_add_meta_key:nnn { enumext, ##1 } {#3} {#4} }
5194       \__enumext_add_meta_key:nnn { enumext* } {#3} {#4}
5195     }
5196     { \__enumext_add_meta_key:nnn {#2} {#3} {#4} }
5197   }
5198 }

```

The internal functions \\_\_enumext\_add\_meta\_key:nnn and \\_\_enumext\_def\_meta\_key:nnn will check the *optional argument* and create the “meta-key”.

```

5199 \cs_new_protected:Npn \__enumext_add_meta_key:nnn #1
5200 {
5201   \tl_set:Nn \l__enumext_meta_path_tl {#1}
5202   \tl_replace_all:Nnn \l__enumext_meta_path_tl { ~ } {}
5203   \prop_get:NVNTF
5204   \c__enumext_meta_paths_prop \l__enumext_meta_path_tl \l__enumext_meta_path_tl
5205   { \__enumext_def_meta_key:Vnn \l__enumext_meta_path_tl }
5206   {
5207     \msg_error:nnn { enumext } { unknown-set } {#1}
5208     \use_none:nn
5209   }
5210 }
5211 \cs_new_protected:Npn \__enumext_def_meta_key:nnn #1#2#3
5212 {
5213   \bool_lazy_or:nnTF
5214   { \keys_if_exist_p:nn { enumext / #1 } {#2} }
5215   { \keys_if_exist_p:nn { enumext / enumext* } {#2} }
5216   { \msg_error:nnn { enumext } { already-defined } {#2} }
5217   {
5218     \keys_define:nn { enumext / #1 }
5219     {
5220       #2 .meta:n = {#3},
5221       #2 .value_forbidden:n = true
5222     }
5223   }
5224 }
5225 \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.

```

5226 \keys_define:nn { enumext / foreach }
5227 {
5228   before .tl_set:N = \l__enumext_foreach_before_tl,
5229   before .value_required:n = true,
5230   after .tl_set:N = \l__enumext_foreach_after_tl,
5231   after .value_required:n = true,
5232   start .int_set:N = \l__enumext_foreach_start_int,
5233   start .value_required:n = true,
5234   stop .int_set:N = \l__enumext_foreach_stop_int,
5235   stop .value_required:n = true,
5236   step .int_set:N = \l__enumext_foreach_step_int,
5237   step .value_required:n = true,
5238   wrapper .cs_set_protected:Np = \__enumext_foreach_wrapper:n #1,
5239   wrapper .value_required:n = true,
5240   sep .tl_set:N = \l__enumext_foreach_sep_tl,
5241   sep .value_required:n = true,
5242   unknown .code:n = { \__enumext_parse_foreach_keys:n {#1} }
5243 }
5244 \keys_precompile:nnN { enumext / foreach }
5245 {
5246   before={},after={},start=1,step=1,stop=0,wrapper=#1,sep=
5247 }
5248 \g__enumext_foreach_default_keys_tl

```

Functions for handling unknown *keys*.

```

5249 \cs_new_protected:Npn \__enumext_parse_foreach_keys:nn #1#2
5250 {
5251   \tl_if_blank:nTF {#2}
5252   {
5253     \msg_error:nnn { enumext } { for-key-unknown } {#1}
5254   }
5255   {
5256     \msg_error:nnnn { enumext } { for-key-value-unknown } {#1} {#2}
5257   }
5258 }
5259 \cs_new_protected:Npn \__enumext_parse_foreach_keys:n #1
5260 {
5261   \exp_args:NV \__enumext_parse_foreach_keys:nn \l_keys_key_str {#1}
5262 }

```

We create the command.

```

5263 \NewDocumentCommand \foreachkeyans { +0{} m }
5264 {
5265   \__enumext_foreach_keyans:nn {#1} {#2}
5266 }

```

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

```

5267 \cs_new_protected:Npn \__enumext_foreach_keyans:nn #1 #2
5268 {
5269   \tl_use:N \g__enumext_foreach_default_keys_tl
5270   \keys_set:nn { enumext / foreach } {#1}
5271   \tl_set:Nn \l__enumext_foreach_name_prop_tl {#2}
5272   \prop_if_exist:cF { g__enumext_#2_prop }
5273   {
5274     \msg_error:nnn { enumext } { undefined-storage-anskey } {#2}
5275   }
5276   \int_compare:nNnT { \l__enumext_foreach_stop_int } = { 0 }
5277   {
5278     \int_set:Nn \l__enumext_foreach_stop_int
5279     { \prop_count:c { g__enumext_#2_prop } }
5280   }
5281   \seq_clear:N \l__enumext_foreach_print_seq
5282   \int_step_function:nnnN

```

```

5283     { \l__enumext_foreach_start_int }
5284     { \l__enumext_foreach_step_int }
5285     { \l__enumext_foreach_stop_int }
5286     \__enumext_foreach_add_body:n
5287     \seq_use:NV \l__enumext_foreach_print_seq \l__enumext_foreach_sep_tl
5288   }
5289   \cs_new_protected:Npn \__enumext_foreach_add_body:n #1
5290   {
5291     \seq_put_right:Ne \l__enumext_foreach_print_seq
5292     {
5293       \exp_not:V \l__enumext_foreach_before_tl
5294       \__enumext_foreach_wrapper:n
5295       {
5296         \prop_item:cn { g__enumext_ \l__enumext_foreach_name_prop_tl _prop }{#1}
5297       }
5298       \exp_not:V \l__enumext_foreach_after_tl
5299     }
5300   }

```

(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.

```

5301 \msg_new:nnn { enumext } { package-load }
5302 {
5303   The ~ '#1' ~ package ~ is ~ already ~ loaded.
5304 }
5305 \msg_new:nnn { enumext } { package-not-load }
5306 {
5307   The ~ '#1' ~ package ~ will ~ be ~ loaded ~ as ~ a ~ dependency.
5308 }
5309 \msg_new:nnn { enumext } { package-load-foot }
5310 {
5311   The ~ '#1' ~ package ~ is ~ loaded ~ with ~ the ~ option ~ '#2'.
5312 }

```

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

```

5313 \msg_new:nnn { enumext } { counters }
5314 {
5315   The ~ counter ~ '#1' ~ is ~ already ~ defined ~ by ~ some ~ \\
5316   package ~ or ~ macro, ~ it ~ cannot ~ be ~ continued.
5317 }

```

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

```

5318 \msg_new:nnn { enumext } { unknown-choice }
5319 {
5320   The ~ value ~ '#3' ~ for ~ '#1' ~ key ~ is ~ invalid ~ use ~ ('#2').
5321 }

```

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

```

5322 \msg_new:nnnn { enumext } { anskey-env-error }
5323 {
5324   The ~ '#1' ~ environment ~is~ reserved ~ by ~\\
5325   'enumext' ~ package, ~ It~ is~ already~ defined.
5326 }
5327 {
5328   The ~ anskey* ~ environment ~ is ~ defined ~ internally ~
5329   for ~ the ~ 'save-ans' ~ key.\\
5330 }

```

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

```

5331 \msg_new:nnn { enumext } { store-prop }
5332 {
5333   * ~ Package ~ enumext: ~ Creating ~
5334   \c_backslash_str g__enumext_#1_prop ~ \msg_line_context:.
5335 }
5336 \msg_new:nnn { enumext } { store-seq }
5337 {
5338   * ~ Package ~ enumext: ~ Creating ~
5339   \c_backslash_str g__enumext_#1_seq ~ \msg_line_context:.
5340 }
5341 \msg_new:nnn { enumext } { store-int }

```



```

5342 {
5343     * ~ Package ~ enumext: ~ Creating ~
5344     \c_backslash_str g__enumext_resume_#1_int ~ \msg_line_context:.
5345 }
5346 \msg_new:nnn { enumext } { prop-seq-int-hook }
5347 {
5348     * ~ Package ~ enumext: ~ Elements ~ in ~
5349     \c_backslash_str g__enumext_#1_prop ~ = ~ #2.\\
5350     * ~ Package ~ enumext: ~ Elements ~ in ~
5351     \c_backslash_str g__enumext_#1_seq ~ = ~ #3.\\
5352     * ~ Package ~ enumext: ~ Value ~ off ~
5353     \c_backslash_str g__enumext_resume_#1_int ~ = ~ #4.
5354 }
5355 \msg_new:nnn { enumext } { item-answer-hook }
5356 {
5357     * ~ Package ~ enumext: ~ Value ~ off ~
5358     \c_backslash_str g__enumext_item_number_int ~ = ~ #1.\\
5359     * ~ Package ~ enumext: ~ Value ~ off ~
5360     \c_backslash_str g__enumext_item_anskey_int ~ = ~ #2.\\
5361     * ~ Package ~ enumext: ~ Difference ~ item_number_int ~ - ~ item_anskey_int ~ = ~ #3.
5362 }

```

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

```

5363 \msg_new:nnn { enumext } { invalid-key }
5364 {
5365     The ~ key ~ '#1' ~ is ~ not ~ know ~ the ~ level ~ #2.
5366 }
5367 \msg_new:nnn { enumext } { unknown-key-family }
5368 {
5369     Unknown~key~family~`\l_keys_key_str'~for~enumext.
5370 }

```

Messages used in length calculation.

```

5371 \msg_new:nnn { enumext } { width-negative }
5372 {
5373     Ignoring ~ negative ~ value ~ '#1=#2' ~ \msg_line_context:.\\
5374     The ~ key ~ '#1'~ accepts ~ values ~ >= ~ 0pt.
5375 }
5376 \msg_new:nnn { enumext } { width-zero }
5377 {
5378     Invalid ~ '#1=#2' ~ \msg_line_context:.\\
5379     The ~ key ~ '#1'~ accepts ~ values ~ > ~ 0pt.
5380 }

```

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

```

5381 \msg_new:nnn { enumext } { list-lengths }
5382 {
5383     **** ~ Lengths ~ used ~ by ~ 'enumext' ~ level ~ '#2' ~ \msg_line_context:~\c_space_tl ****\\
5384     \__enumext_show_length:nnn { dim } { labelsep } {#1}
5385     \__enumext_show_length:nnn { dim } { labelwidth } {#1}
5386     \__enumext_show_length:nnn { dim } { itemindent } {#1}
5387     \__enumext_show_length:nnn { dim } { leftmargin } {#1}
5388     \__enumext_show_length:nnn { dim } { rightmargin } {#1}
5389     \__enumext_show_length:nnn { dim } { listparindent } {#1}
5390     \__enumext_show_length:nnn { skip } { topsep } {#1}
5391     \__enumext_show_length:nnn { skip } { parsep } {#1}
5392     \__enumext_show_length:nnn { skip } { partopsep } {#1}
5393     \__enumext_show_length:nnn { skip } { itemsep } {#1}
5394     ****
5395 }

```

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

```

5396 \msg_new:nnn { enumext } { list-lengths-not-nested }
5397 {
5398     **** ~ Lengths ~ used ~ by ~ '#2' ~ environment ~ \msg_line_context:~\c_space_tl ****\\
5399     \__enumext_show_length:nnn { dim } { labelsep } {#1}
5400     \__enumext_show_length:nnn { dim } { labelwidth } {#1}
5401     \__enumext_show_length:nnn { dim } { itemindent } {#1}
5402     \__enumext_show_length:nnn { dim } { leftmargin } {#1}
5403     \__enumext_show_length:nnn { dim } { rightmargin } {#1}
5404     \__enumext_show_length:nnn { dim } { listparindent } {#1}
5405     \__enumext_show_length:nnn { skip } { topsep } {#1}
5406     \__enumext_show_length:nnn { skip } { parsep } {#1}

```

```

5407     \__enumext_show_length:nnn { skip } { partopsep } {#1}
5408     \__enumext_show_length:nnn { skip } { itemsep } {#1}
5409     *****
5410 }

```

Messages used by `ref` key.

```

5411 \msg_new:nnn { enumext } { key-ref-empty }
5412 {
5413     Key ~ 'ref' ~ need ~ a ~ value ~ in ~ '#1'~ \msg_line_context:.
5414 }

```

Messages used by `save-ans` key.

```

5415 \msg_new:nnn { enumext } { save-ans-empty }
5416 {
5417     Key ~ 'save-ans' ~ need ~ a ~ value ~ in ~ '#1'~ \msg_line_context:.
5418 }
5419 \msg_new:nnn { enumext } { save-ans-log }
5420 {
5421     * ~ Package ~ enumext: ~ Start ~ #1\c_space_tl with ~ save-ans=#2 ~ \msg_line_context:.
5422 }
5423 \msg_new:nnn { enumext } { save-ans-log-hook }
5424 {
5425     * ~ Package ~ enumext: ~ Stop ~ #1\c_space_tl with ~ save-ans=#2 ~ \msg_line_context:.
5426 }
5427 \msg_new:nnn { enumext } { save-ans-hook }
5428 {
5429     Stop ~ storing ~ for ~ 'save-ans=#1' ~ \msg_line_context:.
5430 }

```

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

```

5431 \msg_new:nnn { enumext } { need-save-ans }
5432 {
5433     Key ~ '#1'~ works ~ only ~ with ~ the ~ 'save-ans' ~ key ~ in ~ '#2'~ \msg_line_context:.
5434 }
5435 \msg_new:nnn { enumext } { items-same-answer }
5436 {
5437     *****\
5438     * ~ Package ~ enumext: ~ Checking ~ answers ~ in ~ '#1' ~
5439     for ~ \c_left_brace_str #2 \c_right_brace_str\
5440     * ~ started ~ #3 ~ and ~ close ~ \msg_line_context: : ~
5441     'OK', ~ all ~ items ~ with ~ answer.\
5442     *****
5443 }
5444 \msg_new:nnn { enumext } { item-greater-answer }
5445 {
5446     Checking ~ answers ~ in ~ '#1' ~ for ~ \c_left_brace_str #2 \c_right_brace_str\
5447     started ~ #3 ~ and ~ close ~ \msg_line_context: : ~'NOT ~ OK'\
5448     Items ~ > ~ Answers.
5449 }
5450 \msg_new:nnn { enumext } { item-less-answer }
5451 {
5452     Checking ~ answers ~ in ~ '#1' ~ for ~ \c_left_brace_str #2 \c_right_brace_str\
5453     started ~ #3 ~ and ~ close ~ \msg_line_context: : ~'NOT ~ OK'\
5454     Items ~ < ~ Answers.
5455 }

```

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

```

5456 \msg_new:nnn { enumext } { missing-starred }
5457 {
5458     Missing ~ '\c_backslash_str #1*' ~ #2.
5459 }
5460 \msg_new:nnn { enumext } { many-starred }
5461 {
5462     Many ~ '\c_backslash_str #1*' ~ #2.
5463 }

```

Messages used by `\printkeyans*` command.

```

5464 \msg_new:nnn { enumext } { print-starred }
5465 {
5466     \c_backslash_str printkeyans*:~ The ~ sequence ~ '#1' ~ already ~ contains ~
5467     #2 ~ environment ~ \msg_line_context:.
5468 }

```

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

```
5469 \msg_new:nnn { enumext } { list-too-deep }
5470 {
5471     Too ~ deep ~ nesting ~ for ~ 'enumext' ~ \msg_line_context:~ \\
5472     The ~ maximum ~ level ~ of ~ nesting ~ is ~ 4.
5473 }
```

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

```
5474 \msg_new:nnn { enumext } { anskey-unnumber-item }
5475 {
5476     Can't ~ store ~ with ~ a ~ unnumbered ~ \c_backslash_str item ~ \msg_line_context:.
5477 }
5478 \msg_new:nnn { enumext } { anskey-already-stored }
5479 {
5480     Content ~ already ~ stored ~ for ~ this ~ \c_backslash_str item ~ \msg_line_context:.
5481 }
5482 \msg_new:nnn { enumext } { anskey-empty-arg }
5483 {
5484     Can't ~ store ~ empty ~ content ~ \msg_line_context:.
5485 }
5486 \msg_new:nnn { enumext } { anskey-wrong-place }
5487 {
5488     Wrong ~ place ~ for ~ command ~ '\c_backslash_str #1' ~ \msg_line_context:~ \\
5489     '\c_backslash_str #1' ~ works ~ in ~ the ~ environment ~ '#2'.
5490 }
5491 \msg_new:nnn { enumext } { anskey-nested }
5492 {
5493     The ~ command ~ \c_backslash_str anskey~ can't ~ be ~ nested ~ \msg_line_context:.
5494 }
5495 \msg_new:nnn { enumext } { anskey-math-mode }
5496 {
5497     #1 ~ can't ~ work ~ in ~ math ~ mode ~ \msg_line_context:.
5498 }
5499 \msg_new:nnn { enumext } { anskey-env-wrong }
5500 {
5501     The ~ environment ~ anskey* ~ cannot ~ use ~ in ~ '#1' ~ \msg_line_context:.
5502 }
5503 \msg_new:nnn { enumext } { ansPIC-wrong-place }
5504 {
5505     Wrong ~ place ~ for ~ command ~ '\c_backslash_str #1' ~ \msg_line_context:~ \\
5506     '\c_backslash_str #1' ~ works ~ in ~ the ~ environment ~ '#2'.
5507 }
5508 \msg_new:nnn { enumext } { command-wrong-place }
5509 {
5510     Wrong ~ place ~ for ~ command ~ '\c_backslash_str #1' ~ \msg_line_context:~ \\
5511     '\c_backslash_str #1' ~ works ~ outside ~ the ~ environment ~ '#2'.
5512 }
5513 \msg_new:nnnn { enumext } { anskey-env-key-unknown }
5514 {
5515     The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment~
5516     'anskey*' ~ and ~ is ~ being ~ ignored.
5517 }
5518 {
5519     The ~ environment ~ 'anskey*' ~ does ~ not ~ have ~ a ~ key ~ called ~ '#1'.\\
5520     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5521 }
5522 \msg_new:nnnn { enumext } { anskey-env-key-value-unknown }
5523 {
5524     The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~
5525     'anskey*' ~ and ~ is ~ being ~ ignored.
5526 }
5527 {
5528     The ~ environment ~ 'anskey*' ~ does ~ not ~ have ~ a ~ key ~ called ~ '#1'.\\
5529     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5530 }
5531 \msg_new:nnnn { enumext } { anskey-cmd-key-unknown }
5532 { The ~ key ~ '#1' ~ is ~ unknown ~ by ~ '\c_backslash_str anskey' ~ and ~ is ~ being ~ ignored.}
5533 {
5534     The ~ command ~ '\c_backslash_str anskey' ~ does ~ not ~ have ~ a ~ key ~ called ~ '#1'.\\
5535     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5536 }
```

```

5537 \msg_new:nnnn { enumext } { anskey-cmd-key-value-unknown }
5538 { The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ '\c_backslash_str anskey' ~ and ~ is ~ being ~ ignored.
5539 {
5540   The ~ command ~ '\c_backslash_str anskey' ~ does ~ not ~ have ~ a ~ key ~ called ~ '#1'.\\
5541   Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5542 }

```

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

```

5543 \msg_new:nnn { enumext } { keyans-nested }
5544 {
5545   The ~ environment ~ 'keyans' ~ can't ~ be ~ nested ~ \msg_line_context:.
5546 }
5547 \msg_new:nnn { enumext } { keyans-wrong-level }
5548 {
5549   Wrong ~ level ~ position ~ for ~ 'keyans' ~ \msg_line_context:~ \\
5550   The ~ environment ~ 'keyans' ~ can ~ only ~ be ~ in ~ the ~ first ~ level.
5551 }
5552 \msg_new:nnn { enumext } { wrong-place }
5553 {
5554   Wrong ~ place ~ for ~ '#1' ~ environment ~ \msg_line_context:~ \\
5555   '#1' ~ is ~ only ~ found ~ with ~ '#2' ~ in ~ 'enumext'.
5556 }
5557 \msg_new:nnn { enumext } { keyanspic-nested }
5558 {
5559   The ~ environment ~ 'keyanspic' ~ can't ~ be ~ nested ~ \msg_line_context:~.
5560 }
5561 \msg_new:nnn { enumext } { keyanspic-wrong-level }
5562 {
5563   Wrong ~ level ~ position ~ for ~ 'keyanspic' ~ \msg_line_context:~ \\
5564   The ~ environment ~ 'keyans' ~ can ~ only ~ be ~ in ~ the ~ first ~ level.
5565 }
5566 \msg_new:nnn { enumext } { keyanspic-item-cmd }
5567 {
5568   Can't ~ use ~ \c_backslash_str item ~ in ~ keyanspic ~ \msg_line_context:.
5569 }
5570 \msg_new:nnnn { enumext } { keyans-unknown-key }
5571 {
5572   The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment~
5573   '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
5574 }
5575 {
5576   The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5577   ~ have ~ a ~ key ~ called ~ '#1'.\\
5578   Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5579 }
5580 \msg_new:nnnn { enumext } { keyans-unknown-key-value }
5581 {
5582   The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~
5583   '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
5584 }
5585 {
5586   The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5587   ~ have ~ a ~ key ~ called ~ '#1'.\\
5588   Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5589 }

```

Message used by unknown `<keys>` in `enumext*` environment.

```

5590 \msg_new:nnnn { enumext } { starred-unknown-key }
5591 {
5592   The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment~
5593   '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
5594 }
5595 {
5596   The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5597   ~ have ~ a ~ key ~ called ~ '#1'.\\
5598   Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5599 }
5600 \msg_new:nnnn { enumext } { starred-unknown-key-value }
5601 {
5602   The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~
5603   '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
5604 }

```

```

5605 {
5606     The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5607     ~ have ~ a ~ key ~ called ~ '#1'.\\
5608     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5609 }

```

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

```

5610 \msg_new:nnnn { enumext } { standar-unknown-key }
5611 {
5612     The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment ~ '\l__enumext_envir_name_tl' \c_space_tl
5613     ~ on ~ level ~ \int_use:N \l__enumext_level_int \c_space_tl and ~ is ~ being ~ ignored.
5614 }
5615 {
5616     The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5617     ~ have ~ a ~ key ~ called ~ '#1' ~ on ~ level ~ \int_use:N \l__enumext_level_int.\\
5618     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5619 }
5620 \msg_new:nnnn { enumext } { standar-unknown-key-value }
5621 {
5622     The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~ '\l__enumext_envir_name_tl' \c_space_
5623     ~ on ~ level ~ \int_use:N \l__enumext_level_int \c_space_tl and ~ is ~ being ~ ignored.
5624 }
5625 {
5626     The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5627     ~ have ~ a ~ key ~ called ~ '#1' ~ on ~ level ~ \int_use:N \l__enumext_level_int.\\
5628     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5629 }

```

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

```

5630 \msg_new:nnnn { enumext } { for-key-unknown }
5631 { The~key~'#1'~is~unknown~by~'\c_backslash_str foreachkeyans'~and~is~being~ignored.}
5632 {
5633     The~command~'\c_backslash_str foreachkeyans'~does~not~have~a~key~called~'#1'.\\
5634     Check~that~you~have~spelled~the~key~name~correctly.
5635 }
5636 \msg_new:nnnn { enumext } { for-key-value-unknown }
5637 { The~key~'#1=#2'~is~unknown~by~'\c_backslash_str foreachkeyans'~and~is~being~ignored. }
5638 {
5639     The~command~'\c_backslash_str foreachkeyans'~does~not~have~a~key~called~'#1'.\\
5640     Check~that~you~have~spelled~the~key~name~correctly.
5641 }

```

Messages used by \getkeyans command.

```

5642 \msg_new:nnn { enumext } { undefined-storage-anskey }
5643 {
5644     Storage ~ named ~ '#1' ~ is ~ not ~ defined ~ \msg_line_context:.
5645 }

```

Messages used by \miniright command.

```

5646 \msg_new:nnn { enumext } { missing-miniright }
5647 {
5648     Missing ~ '\c_backslash_str miniright' ~ in ~ \msg_line_context:.\\
5649     The ~ key ~ 'mini-env' ~ need ~ '\c_backslash_str miniright'.
5650 }
5651 \msg_new:nnn { enumext } { wrong-miniright-place }
5652 {
5653     Wrong ~ place ~ for ~ '\c_backslash_str miniright' ~ \msg_line_context:~ \\
5654     Works ~ in ~ 'enumext' ~ and ~ 'keyans' ~ with ~ key ~ 'mini-env'.
5655 }
5656 \msg_new:nnn { enumext } { wrong-miniright-use }
5657 {
5658     Wrong ~ use ~ for ~ '\c_backslash_str miniright' ~ \msg_line_context:~ \\
5659     '\c_backslash_str miniright' ~ need ~ a ~ key ~ 'mini-env'.
5660 }
5661 \msg_new:nnn { enumext } { wrong-miniright-starred }
5662 {
5663     Can't ~ use ~ \c_backslash_str miniright ~ in ~ starred ~ environments ~ \msg_line_context:.
5664 }
5665 \msg_new:nnn { enumext } { many-miniright-used }
5666 {
5667     Can't ~ use ~ \c_backslash_str miniright ~ more ~ than ~ once ~ \msg_line_context:.
5668 }

```

Messages used by `\setenumextmeta` command.

```

5669 \msg_new:nnn { enumext } { unknown-set }
5670 {
5671   Argument ~ [#1] ~ is ~ unknown ~ by ~ \c_backslash_str setenumextmeta ~ \msg_line_context:.
5672 }
5673 \msg_new:nnn { enumext } { already-defined }
5674 {
5675   The ~ key ~ '#1' ~ is ~ already ~ defined ~ \msg_line_context:.
5676 }
5677 \msg_new:nnn { enumext } { prohibited-unknown }
5678 {
5679   The ~ name ~ 'unknown' ~ can't ~ be ~ chosen~ for ~ a ~ meta ~ key ~ \msg_line_context:.
5680 }

```

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

```

5681 \msg_new:nnn { enumext } { nested }
5682 {
5683   The ~ environment ~ \l__enumext_envir_name_tl \c_space_tl can't ~ be ~ nested ~ \msg_line_context:.
5684 }
5685 \msg_new:nnn { enumext } { nested-horizontal }
5686 {
5687   The ~ environment ~ \l__enumext_envir_name_tl \c_space_tl can't ~ be ~ nested ~ in ~ '#1' ~ '
5688 }
5689 \msg_new:nnn { enumext } { item-joined }
5690 {
5691   Items ~ joined ~ (#1) ~ > ~ #2 ~ columns ~ \msg_line_context:.
5692 }
5693 \msg_new:nnn { enumext } { item-joined-columns }
5694 {
5695   Not ~ space ~ to ~ join ~ items ~ (#1) ~ > ~ #2 ~ \msg_line_context:.
5696 }

```

## 12.51 Finish package

Finish package implementation.

```

5697 \file_input_stop:
5698 </package>

```

### 13 Index of Implementation

The *italic* numbers denote the pages where the corresponding entry is described, the numbers underlined and all others indicate the line on which they are implemented in the package code.

Symbols	
<code>\*</code>	228
<code>\+</code>	220
<code>\-</code>	220
<code>\\</code>	236, 2776, 4096, 5315, 5324, 5329, 5349, 5351, 5358, 5360, 5373, 5378, 5383, 5398, 5437, 5439, 5441, 5446, 5447, 5452, 5453, 5471, 5488, 5505, 5510, 5519, 5528, 5534, 5540, 5549, 5554, 5563, 5577, 5587, 5597, 5607, 5617, 5627, 5633, 5639, 5648, 5653, 5658
A	
above	<u>1590</u>
above*	<u>1590</u>
<code>\addvspace</code>	1159, 1188, 1231, 1234, 1402, 1405, 1502, 1508, 1543, 1549, 1570, 1576, 3585, 3746, 3764, 3997, 4000, 4330, 4345, 4391, 4405
after	<u>988</u>
align	<u>536</u>
<code>\Alph</code>	38, 43
<code>\Alph</code>	488, 606, 651, 719, 5025
<code>\alph</code>	38, 43
<code>\alph</code>	489, 604, 5017
<code>\anskey</code>	13, 77, 79, <u>2594</u>
anskey*	14, <u>2704</u>
<code>\anspic</code>	16, 105, 107, <u>4004</u>
<code>\anspic*</code>	70
<code>\arabic</code>	32, 38
<code>\arabic</code>	487, 603, 650, 5009, 5013, 5029
B	
base-fix	<u>849</u>
<code>\baselineskip</code>	<u>52</u>
<code>\baselineskip</code>	865, 871
before	<u>988</u>
before*	<u>988</u>
below	<u>1590</u>
below*	<u>1590</u>
bool commands:	
<code>\bool_gset_false:N</code>	357, 358, 359, 2880, 2882, 4347, 4351, 4407
<code>\bool_gset_true:N</code>	265, 275, 1091, 2083, 2089, 4316, 4348, 4380, 4408
<code>\bool_if:NTF</code>	427, 439, 456, 1524, 1612, 1626, 1639, 1650, 1661, 1672, 1683, 1694, 1743, 1760, 1765, 1773, 1800, 1838, 1843, 1850, 1854, 1876, 1881, 1889, 1896, 1927, 1935, 2028, 2226, 2236, 2315, 2339, 2346, 2370, 2468, 2490, 2530, 2544, 2548, 2598, 2617, 2641, 2695, 2706, 2795, 2832, 2896, 2931, 2946, 3021, 3032, 3036, 3055, 3068, 3110, 3144, 3187, 3206, 3349, 3364, 3426, 3436, 3469, 3474, 3540, 3566, 3616, 3674, 3729, 3754, 3929, 3995, 4006, 4025, 4070, 4309, 4325, 4331, 4374, 4388, 4392, 4514, 4524, 4608, 4614, 4621, 4637, 4656, 4679, 4740, 4750, 4857, 4861, 4887, 4894, 4913, 4923, 4944
<code>\bool_if:nTF</code>	1550, 1577, 3166, 3323, 3384, 3908, 4046, 5048, 5190
<code>\bool_if_p:N</code>	284, 299, 860, 861, 868, 869, 1907, 1908, 1916, 1917, 2041, 2067, 2080, 2081, 2086, 2087, 2403, 2413, 2425, 2440, 2441, 2475, 2516, 2517, 2818, 3008, 3009, 3046, 3047, 3513, 3515, 3526, 4053, 4054
<code>\bool_lazy_all:nTF</code>	282, 297, 858, 2039, 2065, 2401, 2410, 2423, 2438, 3511, 3524
<code>\bool_lazy_and:nnTF</code>	261, 271, 867, 1517, 1906, 1915, 2079, 2085, 2474, 2481, 2515, 2659, 2671, 2817, 2823, 3007
<code>\bool_lazy_or:nnTF</code>	1968, 1975, 3045, 4052, 5213
<code>\bool_new:N</code>	34, 35, 36, 37, 38, 39, 40, 41, 64, 73, 97, 102, 103, 108, 109, 112, 131, 138, 139, 146, 153, 154, 159, 161, 162, 176, 188, 190
<code>\bool_not_p:n</code>	262, 272, 862, 2412, 2476, 2482, 2819, 2824, 3514, 3527
<code>\bool_set_eq:NN</code>	3119, 3302, 4561, 4810
<code>\bool_set_false:N</code>	436, 878, 2013, 2014, 2046, 2051, 2055, 2059, 2072, 2759, 3488, 3633, 3682, 3769, 3926, 4002, 4483, 4509, 4558, 4756, 4807
<code>\bool_set_true:N</code>	289, 290, 304, 305, 416, 420, 529, 893, 1596, 1601, 1863, 1985, 1986, 2258, 2266, 2760, 3113, 3115, 3147, 3149, 3298, 3310, 3449, 3487, 3520, 3533, 3606, 3679, 3706, 3910, 4298, 4363, 4482, 4565, 4572, 4573, 4617, 4754, 4814, 4821, 4822, 5056, 5057
box commands:	
<code>\box_dp:N</code>	1448, 1449, 1452, 1459, 1472, 1480, 1486, 1494, 3939, 3944, 3997, 4081
<code>\box_ht:N</code>	1231, 1234, 1245, 1246, 1257, 1259, 1274, 1277, 1285, 1286, 1297, 1299, 1314, 1317, 1324, 1325, 1336, 1338, 1353, 1356, 1402, 1405, 1413, 1414, 1422, 1423, 1435, 1437
<code>\box_ht_plus_dp:N</code>	3935, 4034
<code>\box_new:N</code>	70, 149, 150, 183, 189
<code>\box_use_drop:N</code>	4342, 4403, 4676, 4941
<code>\box_wd:N</code>	495
C	
<code>\c</code>	228, 229, 756, 758, 770, 772
<code>\catcode</code>	2776
<code>\cB</code>	229
<code>\cE</code>	229
<code>\centering</code>	1552, 1579, 4118, 4335, 4396
check-ans	<u>2005</u>
Document class:	
article	45
clist commands:	
<code>\clist_const:Nn</code>	195
<code>\clist_map_function:nN</code>	4101
<code>\clist_map_inline:Nn</code>	535, 804, 987, 1002, 1083, 1606
<code>\clist_map_inline:nn</code>	49, 60, 78, 86, 99, 111, 141, 170, 194, 566, 586, 898, 919, 1097, 1712, 1952, 2019, 2205, 2223, 2255, 2398, 2940, 3227, 3239, 3279, 3413, 3416, 3444, 3456, 3459, 3479, 5166
<code>\columnbreak</code>	77
<code>\columnbreak</code>	2478
columns	<u>1067</u>
columns-sep	<u>1067</u>
<code>\columnsep</code>	98
<code>\columnsep</code>	3561, 3727
<code>\columnseprule</code>	98
<code>\columnseprule</code>	3564, 3728
Commands provide by enumext:	
<code>\anskey</code>	30, 67, 68, 72–76, 78, 79, 86, 88, 98, 117, 127, 128,



136

\anspic\* . . . . . 30, 31, 70, 73, 86, 87, 107, 127, 128

\anspic . . . . . 30, 74, 105, 107, 136

\foreachkeyans . . . . . 132, 138

\getkeyans . . . . . 73, 127, 138

\item\* 30, 31, 70, 73, 74, 86, 87, 89, 93, 118, 119, 124, 127, 128

\item . . . . . 89, 93, 111, 117, 118, 120, 123, 124

\miniright . . . . . 29, 49, 57, 58, 100, 138

\printkeyans\* . . . . . 127

\printkeyans . . . . . 30, 74, 127, 128

\setenumextmeta . . . . . 131, 139

\setenumext . . . . . 30, 128–130, 134

Counters defined by [enumext](#):

enumXiii . . . . . 28, 38

enumXii . . . . . 28, 38

enumXiv . . . . . 28, 38

enumXi . . . . . 28, 38

enumXviii . . . . . 28, 38

enumXvii . . . . . 28, 38, 119

enumXvi . . . . . 28, 38

enumXv . . . . . 28, 38

cs commands:

\cs\_generate\_variant:Nn . 200, 201, 497, 513, 762, 778, 2307, 2312, 2388, 2712, 3403, 4103, 5225

\cs\_if\_exist:NTF . . . . . 467

\cs\_if\_free:NTF . . . . . 2663, 2675

\cs\_new:Nn . . . . . 214

\cs\_new:Npn . 232, 1713, 1722, 1730, 2270, 2279, 2287, 5074, 5083, 5092

\cs\_new\_eq:NN . 384, 385, 390, 391, 441, 442, 445, 446

\cs\_new\_protected:Nn . 224, 238, 254, 280, 313, 343, 349, 355, 361, 367, 375, 393, 411, 627, 690, 742, 855, 1003, 1007, 1011, 1015, 1019, 1023, 1027, 1031, 1035, 1039, 1043, 1047, 1051, 1055, 1059, 1063, 1098, 1110, 1143, 1161, 1172, 1190, 1216, 1237, 1362, 1388, 1408, 1441, 1463, 1498, 1504, 1607, 1621, 1635, 1646, 1657, 1668, 1679, 1690, 1771, 1874, 1887, 1904, 1925, 1953, 1958, 1983, 2024, 2034, 2077, 2092, 2099, 2108, 2113, 2118, 2123, 2132, 2137, 2142, 2313, 2337, 2344, 2368, 2375, 2389, 2615, 2634, 2650, 2713, 2749, 2780, 2815, 2857, 2878, 2886, 2929, 2944, 2972, 3005, 3041, 3053, 3066, 3152, 3162, 3173, 3181, 3197, 3319, 3335, 3343, 3357, 3480, 3509, 3538, 3545, 3575, 3592, 3614, 3636, 3672, 3696, 3713, 3738, 3752, 3773, 3924, 4091, 4099, 4104, 4128, 4159, 4288, 4307, 4353, 4372, 4412, 4416, 4435, 4469, 4496, 4503, 4512, 4522, 4543, 4694, 4738, 4769, 4775, 4792, 4849, 4959

\cs\_new\_protected:Npn 202, 206, 210, 449, 465, 482, 492, 498, 607, 652, 724, 749, 763, 1534, 1563, 1739, 1758, 1828, 1861, 1963, 2147, 2224, 2234, 2256, 2264, 2299, 2308, 2464, 2527, 2542, 2580, 2584, 2704, 2735, 2739, 2770, 2906, 2982, 3026, 3106, 3125, 3240, 3244, 3258, 3262, 3280, 3284, 3294, 3306, 3372, 3406, 3447, 3491, 3692, 3900, 3917, 4023, 4042, 4066, 4190, 4239, 4486, 4549, 4556, 4570, 4578, 4583, 4593, 4762, 4798, 4805, 4819, 4827, 4844, 4981, 4994, 5042, 5163, 5175, 5199, 5211, 5249, 5259, 5267, 5289

\cs\_new\_protected\_nopar:Nn . . . 3834, 3876, 3884, 3892, 4532, 4536, 4670, 4781, 4785, 4935

\cs\_new\_protected\_nopar:Npn . . 3826, 3842, 4599, 4645, 4877, 4902

\cs\_set:Npn . . . . . 2399, 2436, 4987

\cs\_set\_eq:NN . . 4459, 4460, 4647, 4727, 4728, 4904

\cs\_set\_protected:Nn . . . . . 924, 940, 953, 966

\cs\_set\_protected:Npn 45, 54, 71, 79, 94, 100, 134, 166, 174, 514, 536, 571, 587, 634, 779, 805, 880, 903, 979, 988, 1067, 1084, 1590, 1701, 1944, 2005, 2164, 2206, 2242, 2391, 2933, 3216, 3232, 3272, 3404, 3445

\cs\_to\_str:N . . . . . 484, 507

\cs\_undefine:N . . . . . 2652, 2653, 2654, 2655

## D

\d . . . . . 220

\DeclareDocumentEnvironment . . . . . 397

dim commands:

\dim\_abs:n . . . . . 3377, 3382

\dim\_add:Nn . . . . . 3943, 4153, 4184

\dim\_compare:nNnTF . 926, 942, 955, 968, 1249, 1261, 1289, 1301, 1328, 1340, 1417, 1425, 1536, 1565, 3374, 3379, 3385, 3391, 3393, 3395, 3550, 3597, 3700, 3717, 3919, 4130, 4146, 4161, 4177, 4290, 4355

\dim\_compare:nTF . . . . . 2500, 2845, 3639, 3776

\dim\_eval:n . . . . . 865, 4077

\dim\_gset\_eq:NN . . . . . 4299, 4364

\dim\_gzero:N . . . . . 2884, 4350, 4410

\dim\_new:N . 67, 74, 75, 76, 96, 143, 151, 152, 182, 184, 185, 191

\dim\_set:Nn . . 495, 894, 3142, 3377, 3382, 3384, 3387, 3388, 3392, 3394, 3397, 3398, 3400, 3553, 3600, 3638, 3702, 3719, 3775, 3933, 4032, 4106, 4132, 4139, 4163, 4170, 4225, 4274, 4292, 4357, 4595

\dim\_set\_eq:NN 594, 641, 712, 716, 3057, 3058, 3070, 3071, 3137, 3415, 3458, 3561, 3727, 4232, 4235, 4236, 4281, 4284, 4285, 4588, 4667, 4932

\dim\_sub:Nn . . . . . 3644, 3781, 4148, 4179

\dim\_use:N 927, 935, 1537, 1547, 2378, 2381, 2386, 3157, 3159, 3202, 3551, 3555, 3556, 3558, 3598, 3603, 3604, 3610, 3641, 3646

\dim\_zero:N . . . . 3450, 3564, 3728, 3945, 3946, 3947

\dim\_zero\_new:N . . . . . 464

\c\_zero\_dim 929, 943, 956, 969, 1537, 1565, 2502, 2847, 3374, 3379, 3385, 3392, 3551, 3598, 3641, 3700, 3717, 3778, 3919, 4130, 4146, 4161, 4177, 4290, 4355

\dimeval . . . . . 2171

## E

\end . . . 2341, 2372, 3582, 3743, 3987, 4120, 5050, 5060, 5066

end internal commands:

\end\_\_enumext\_mini\_page . 1545, 1572, 3625, 3763, 4314, 4378, 4404

\endgroup . . . . . 2776

\endlist . . . . . 385

\endminipage . . . . . 391

enumext . . . . . 6, 3650

enumext internal commands:

\l\_\_enumext\_\_ref\_the\_count\_tl . . . . . 40

\l\_\_enumext\_\_resume\_name\_tl . . . . . 63

\\_\_enumext\_add\_meta\_key:nnn . . . 131, 5177, 5193, 5194, 5196, 5199

\\_\_enumext\_add\_pre\_parsep: . 50, 1108, 1110, 1110

\\_\_enumext\_after\_args\_exec: 48, 1003, 1015, 3663

\\_\_enumext\_after\_args\_exec\_v: 1019, 1031, 3796

\\_\_enumext\_after\_args\_exec\_vii: . . 1035, 1059

\\_\_enumext\_after\_args\_exec\_viii: . . . . 1063

\\_\_enumext\_after\_env:nn 82, 83, 85, 101, 113, 121, 206, 206, 2790, 3668, 4323, 4386, 4710

\\_\_enumext\_after\_hyperref: . . 36, 409, 411, 411

\l\_\_enumext\_after\_list\_args\_v\_tl . . . . 1033

\l\_\_enumext\_after\_list\_args\_vii\_tl 1061, 4665

```

\l__enumext_after_list_args_viii_tl .. 1065,
    4922
\__enumext_after_list_vii: 113, 117, 4467, 4503,
    4503
\__enumext_after_list_viii: ... 123, 4736, 4775,
    4775
\__enumext_after_stop_list: 48, 100, 1003, 1011,
    3630
\__enumext_after_stop_list_v: 1019, 1027, 3770
\l__enumext_after_stop_list_v_tl ..... 1029
\__enumext_after_stop_list_vii: .. 117, 1035,
    1051, 4506
\l__enumext_after_stop_list_vii_tl ... 1053
\__enumext_after_stop_list_viii: . 1055, 4778
\l__enumext_after_stop_list_viii_tl ... 1057
\l__enumext_align_label_pos_v_str .... 3361
\l__enumext_align_label_pos_X_str ..... 79
\l__enumext_align_label_vii_str ..... 4634
\l__enumext_align_label_viii_str ..... 4891
\l__enumext_align_label_X_str ..... 174
\c__enumext_all_envs_clist .. 195, 535, 804, 987,
    1002, 1083, 1606
\c__enumext_all_families_seq .. 130, 5131, 5157
\l__enumext_anskey_env_bool 33, 81, 34, 290, 305,
    2706
\__enumext_anskey_env_clean_vars: . 84, 2811,
    2815, 2878
\__enumext_anskey_env_define_keys: 82, 2704,
    2713, 2784
\__enumext_anskey_env_exec: 83, 2709, 2780, 2780
\__enumext_anskey_env_make:n 67, 81, 1988, 2704,
    2704, 2712
\__enumext_anskey_env_reset_keys: 82, 83, 2749,
    2812
\__enumext_anskey_env_reset_keys:\__-
    enumext_rescan_anskey_env:n ..... 2704
\__enumext_anskey_env_save_keys: .. 83, 2792,
    2815, 2815
\__enumext_anskey_env_store: .. 84, 2808, 2815,
    2857
\__enumext_anskey_env_unknown:n 82, 2732, 2735
\__enumext_anskey_env_unknown:nn . 2737, 2739
\l__enumext_anskey_level_int .. 28, 2636, 2637
\__enumext_anskey_safe_inner:.. 80, 2609, 2615,
    2634
\__enumext_anskey_safe_inner:n ..... 79
\__enumext_anskey_safe_outer: . 79, 2596, 2615,
    2615
\__enumext_anskey_show_wrap_arg:n . 78, 2527,
    2527, 2546, 2561
\__enumext_anskey_show_wrap_left:n 78, 2472,
    2542, 2542
\__enumext_anskey_unknown:n 79, 2564, 2578, 2580
\__enumext_anskey_unknown:nn . 2564, 2582, 2584
\__enumext_anskey_wrapper:n ..... 2168, 2540
\l__enumext_anspic_above_int . 142, 4107, 4108,
    4110
\__enumext_anspic_args:nnn 108, 109, 4020, 4091,
    4091
\l__enumext_anspic_args_seq 107-109, 142, 3980,
    4018, 4119
\l__enumext_anspic_below_int . 142, 4107, 4108,
    4111
\l__enumext_anspic_body_box ... 142, 4031, 4034
\__enumext_anspic_body_dim:n .. 108, 4023, 4023,
    4069
\l__enumext_anspic_body_htdp_dim .. 108, 142,
    4032, 4080
\__enumext_anspic_label:nn 108, 4042, 4042, 4072,
    4086
\l__enumext_anspic_label_box .. 142, 3932, 3935
\l__enumext_anspic_label_htdp_dim . 106, 142,
    3933, 3939, 4079
\__enumext_anspic_label_pos:nnn .. 109, 4066,
    4066, 4094
\l__enumext_anspic_mini_pos_str 105, 142, 3911,
    3914, 4117
\l__enumext_anspic_mini_width_dim 142, 4044,
    4106, 4117
\__enumext_anspic_print:n 109, 3980, 3982, 4099,
    4099, 4103
\__enumext_anspic_row:n .. 109, 4099, 4101, 4104
\__enumext_anspic_start_list_tag: 3850, 3876,
    4093
\__enumext_anspic_stop_list_tag: . 3850, 3892,
    4097
\__enumext_anspic_stop_start_list_tag: 3850,
    3884, 4095
\__enumext_at_begin_document:n .. 35, 202, 202,
    382, 388
\l__enumext_base_line_fix_bool . 851, 861, 878,
    5056
\__enumext_before_args_exec: . 48, 99, 116, 1003,
    1003, 3595
\__enumext_before_args_exec_v: 1019, 1019, 3699
\__enumext_before_args_exec_vii: . 1035, 1035,
    4500
\__enumext_before_args_exec_viii: 1039, 4772
\__enumext_before_env:nn 82, 206, 210, 2657, 2669,
    2681, 2782
\__enumext_before_keys_exec: .. 48, 1003, 1007,
    3660
\__enumext_before_keys_exec_v: 1019, 1023, 3793
\__enumext_before_keys_exec_vii ..... 1035
\__enumext_before_keys_exec_vii: . 1043, 4454
\__enumext_before_keys_exec_viii: 1047, 4722
\__enumext_before_list: ... 99, 3592, 3592, 3654
\__enumext_before_list_v: ... 3696, 3696, 3788
\__enumext_before_list_vii: ... 116, 4449, 4496,
    4496
\__enumext_before_list_viii: .. 122, 4718, 4769,
    4769
\l__enumext_before_no_starred_key_v_tl 1025
\l__enumext_before_no_starred_key_vii_-
    tl ..... 1045
\l__enumext_before_no_starred_key_viii_-
    tl ..... 1049
\l__enumext_before_starred_key_v_tl ... 1021
\l__enumext_before_starred_key_vii_tl . 1037
\l__enumext_before_starred_key_viii_tl 1041
\__enumext_calc_hspace:NNNNNNN 95, 3372, 3372,
    3403, 3408, 3451
\__enumext_check_ans_active: . 68, 99, 116, 2024,
    2024, 3596, 4499
\g__enumext_check_ans_item_tl ..... 87
\g__enumext_check_ans_key_bool 69, 70, 153, 357,
    2083, 2089, 2896
\l__enumext_check_ans_key_bool 69, 2009, 2014,
    2080, 2086

```

\\_\_enumext\_check\_ans\_key\_hook: . . 69, 100, 117, 2077, 2077, 3631, 4507  
 \\_\_enumext\_check\_ans\_level: 68, 2024, 2030, 2034  
 \\_\_enumext\_check\_ans\_log: 69, 70, 85, 2123, 2123, 2900  
 \\_\_enumext\_check\_ans\_log\_msg\_greater: 2123, 2129, 2142  
 \\_\_enumext\_check\_ans\_log\_msg\_less: 2123, 2127, 2132  
 \\_\_enumext\_check\_ans\_log\_msg\_same\_ok: 2123, 2128, 2137  
 \\_\_enumext\_check\_ans\_msg\_greater: 2099, 2105, 2118  
 \\_\_enumext\_check\_ans\_msg\_less: 2099, 2103, 2108  
 \\_\_enumext\_check\_ans\_msg\_same\_ok: 2099, 2104, 2113  
 \\_\_enumext\_check\_ans\_show: . . 69, 85, 2099, 2099, 2898  
 \l\_\_enumext\_check\_answers\_bool . 67, 68, 79, 89, 153, 1986, 2013, 2028, 2315, 2339, 2346, 2370, 2598, 2795, 3021, 3110, 3144, 4614  
 \\_\_enumext\_check\_starred\_cmd:n 34, 70, 87, 121, 2147, 2147, 3799, 3993, 4735  
 \g\_\_enumext\_check\_starred\_cmd\_int . . 93, 153, 2150, 2156, 2161, 3317, 4051, 4856  
 \l\_\_enumext\_check\_start\_line\_env\_tl . 34, 153, 320, 328, 336, 2153, 2159, 2162  
 \l\_\_enumext\_columns\_sep\_v\_dim 3717, 3719, 3727  
 \l\_\_enumext\_columns\_sep\_vii\_dim . . 4130, 4132, 4141, 4153, 4229, 4691  
 \l\_\_enumext\_columns\_sep\_viii\_dim . 4161, 4163, 4172, 4184, 4278, 4956  
 \l\_\_enumext\_columns\_v\_int 1382, 1400, 1568, 3715, 3723, 3735, 3740  
 \l\_\_enumext\_columns\_vii\_int . . 4135, 4138, 4142, 4151, 4193, 4197, 4200, 4206, 4212, 4216, 4685, 4699  
 \l\_\_enumext\_columns\_viii\_int . 4166, 4169, 4173, 4182, 4242, 4246, 4249, 4255, 4261, 4265, 4950, 4965  
 \l\_\_enumext\_counter\_i\_tl . . . . . 45, 474  
 \l\_\_enumext\_counter\_ii\_tl . . . . . 45, 475  
 \l\_\_enumext\_counter\_iii\_tl . . . . . 45, 476  
 \l\_\_enumext\_counter\_iv\_tl . . . . . 45, 477  
 \c\_\_enumext\_counter\_style\_tl . . . . 32, 50, 226  
 \g\_\_enumext\_counter\_styles\_tl. 28, 38, 67, 485, 503  
 \l\_\_enumext\_counter\_v\_tl . . . . . 45, 478, 732  
 \l\_\_enumext\_counter\_vi\_tl . . . . . 45, 479  
 \l\_\_enumext\_counter\_vii\_tl . . . . . 45, 480, 662  
 \l\_\_enumext\_counter\_viii\_tl . . . . 45, 481, 679  
 \l\_\_enumext\_current\_widest\_dim 28, 67, 509, 595, 642, 713, 717  
 \\_\_enumext\_def\_meta\_key:nnn . . . 131, 5177, 5205, 5211, 5225  
 \\_\_enumext\_default\_item:n . . . 3106, 3106, 3170  
 \\_\_enumext\_define\_counters:Nn 28, 465, 465, 474, 475, 476, 477, 478, 479, 480, 481  
 \\_\_enumext\_endminipage: . 36, 382, 391, 405, 4344, 4672, 4937  
 \g\_\_enumext\_envir\_name\_tl 33, 34, 291, 306, 365, 1956, 1961, 1971, 2111, 2116, 2121, 2135, 2140, 2145  
 \l\_\_enumext\_envir\_name\_tl . 33, 34, 34, 260, 270, 319, 327, 335, 5573, 5576, 5583, 5586, 5593, 5596, 5603, 5606, 5612, 5616, 5622, 5626, 5683, 5687  
 \\_\_enumext\_execute\_after\_env: 35, 66, 69, 70, 80, 85, 2886, 2886, 3670, 4712  
 \\_\_enumext\_fake\_item\_indent: . . 924, 924, 3435  
 \l\_\_enumext\_fake\_item\_indent\_v\_dim 943, 948  
 \l\_\_enumext\_fake\_item\_indent\_v\_tl 945, 3299, 3303, 3311  
 \l\_\_enumext\_fake\_item\_indent\_vii\_dim 956, 961  
 \l\_\_enumext\_fake\_item\_indent\_vii\_tl 958, 4666  
 \l\_\_enumext\_fake\_item\_indent\_viii\_dim . 969, 974, 4927  
 \l\_\_enumext\_fake\_item\_indent\_viii\_tl . . 971, 4925, 4930  
 \l\_\_enumext\_fake\_item\_indent\_X\_tl . . . . 100  
 \\_\_enumext\_fake\_item\_vii: . . . . 924, 953, 3468  
 \\_\_enumext\_fake\_item\_viii: . . . . 924, 966, 3473  
 \\_\_enumext\_fake\_make\_label\_vii:n . 119, 4599, 4599, 4662  
 \\_\_enumext\_fake\_make\_label\_viii:n 4877, 4877, 4919  
 \\_\_enumext\_filter\_first\_level:n . . 129, 5074, 5074, 5108, 5119  
 \\_\_enumext\_filter\_first\_level\_key:n 129, 5074, 5079, 5083  
 \\_\_enumext\_filter\_first\_level\_pair:nn . 129, 5074, 5080, 5092  
 \\_\_enumext\_filter\_save\_key:n . . 73, 2231, 2239, 2262, 2268, 2270, 2270, 5007, 5011, 5015, 5019, 5023, 5027  
 \\_\_enumext\_filter\_save\_key\_key:n . . 73, 2270, 2275, 2279  
 \\_\_enumext\_filter\_save\_key\_pair:nn 73, 2270, 2276, 2287  
 \\_\_enumext\_filter\_series:n 61, 1713, 1713, 1751, 1763, 1768  
 \\_\_enumext\_filter\_series\_key:n 62, 1713, 1718, 1722  
 \\_\_enumext\_filter\_series\_pair:nn . . 62, 1713, 1719, 1730  
 \\_\_enumext\_first\_item\_tmp\_vii: 115, 117, 4459, 4532, 4532  
 \\_\_enumext\_first\_item\_tmp\_viii: 121, 123, 4727, 4781, 4781  
 \g\_\_enumext\_footnote\_arg\_seq . 171, 4418, 4431, 4441  
 \g\_\_enumext\_footnote\_int . 171, 4425, 4428, 4430, 4432  
 \g\_\_enumext\_footnote\_int\_seq . 171, 4419, 4432, 4437, 4440  
 \\_\_enumext\_footnotes\_key\_bool . . . . . 36  
 \l\_\_enumext\_footnotes\_key\_bool 31, 37, 120, 161, 420, 427, 436, 4656, 4679, 4913, 4944  
 \\_\_enumext\_footnotetext:nn . . . 4412, 4412, 4442  
 \\_\_enumext\_foreach\_add\_body:n . 132, 5226, 5286, 5289  
 \l\_\_enumext\_foreach\_after\_tl . . . . 5230, 5298  
 \l\_\_enumext\_foreach\_before\_tl . . . . 5228, 5293  
 \g\_\_enumext\_foreach\_default\_keys\_tl 132, 126, 5248, 5269  
 \\_\_enumext\_foreach\_keyans:nn . . 132, 5226, 5265, 5267  
 \l\_\_enumext\_foreach\_name\_prop\_tl . 126, 5271, 5296  
 \l\_\_enumext\_foreach\_print\_seq 126, 5281, 5287, 5291  
 \l\_\_enumext\_foreach\_sep\_tl . . . . . 5240, 5287  
 \l\_\_enumext\_foreach\_start\_int . . . . 5232, 5283

```

\l__enumext_foreach_step_int . . . . . 5236, 5284
\l__enumext_foreach_stop_int . 5234, 5276, 5278,
    5285
\__enumext_foreach_wrapper:n . . . . . 5238, 5294
\__enumext_getkeyans:nn . . 127, 4990, 4994, 4994
\__enumext_getkeyans_aux:n 127, 4978, 4981, 4981
\l__enumext_hyperref_bool . . 31, 36, 37, 161, 416,
    439, 456, 2517, 3009, 4608
\__enumext_hypertarget:nn 37, 411, 441, 445, 461
\__enumext_if_is_int:n . . . . . 218
\__enumext_if_is_int:nTF . . . . . 218, 751, 765
\__enumext_internal_mini_page: 36, 97, 116, 393,
    393, 3482, 4471
\__enumext_is_not_nested: 28, 33, 97, 116, 254, 254,
    3483, 4472
\__enumext_is_on_first_level: . 28, 33, 97, 116,
    254, 280, 3489, 4484
\g__enumext_item_anskey_int 79, 87, 153, 352, 379,
    380, 2096, 2466, 3023
\__enumext_item_answer_diff: . . 69, 70, 85, 2092,
    2092, 2893
\g__enumext_item_answer_diff_int . 69, 70, 153,
    353, 2094, 2101, 2125
\l__enumext_item_column_pos_vii_int 117, 4200,
    4206, 4212, 4216, 4223, 4539, 4685, 4688
\l__enumext_item_column_pos_viii_int . . 123,
    4249, 4255, 4261, 4265, 4272, 4788, 4950, 4953
\l__enumext_item_column_pos_X_int . . . . . 174
\g__enumext_item_count_all_vii_int 117, 4224,
    4540, 4699, 4707
\g__enumext_item_count_all_viii_int 123, 4273,
    4789, 4964, 4973
\g__enumext_item_count_all_X_int . . . . . 174
\g__enumext_item_number_bool . . . . . 153
\l__enumext_item_number_bool 68, 159, 2046, 2051,
    2055, 2059, 2072, 2641, 2695, 3113, 3147, 4617
\g__enumext_item_number_int 68, 69, 153, 351, 378,
    380, 2045, 2050, 2054, 2058, 2071, 2096, 3112, 3146,
    4616
\__enumext_item_peek_args_vii: 117, 118, 4541,
    4543, 4543
\__enumext_item_peek_args_viii: . . 123, 4790,
    4792, 4792
\__enumext_item_star_exec: 90, 3125, 3152, 3189,
    3208
\l__enumext_item_starred_vii_bool 4558, 4572,
    4621
\l__enumext_item_starred_viii_bool 4807, 4821,
    4887, 4923
\l__enumext_item_starred_X_bool . . . . . 174
\__enumext_item_std:w . 36, 89, 93, 382, 386, 3116,
    3122, 3150, 3299, 3303, 3311
\g__enumext_item_symbol_aux_tl . 89, 130, 3130,
    3133, 3158, 3194, 3212
\g__enumext_item_symbol_aux_vii_tl 4580, 4623,
    4626, 4630, 4632
\g__enumext_item_symbol_aux_X_tl . . . . . 174
\l__enumext_item_symbol_sep_vii_dim . . 4588,
    4595, 4629, 4631
\l__enumext_item_symbol_vii_tl . . . . . 4626
\l__enumext_item_text_vii_box . . . 4648, 4676
\l__enumext_item_text_viii_box . . . 4905, 4941
\l__enumext_item_text_X_box . . . . . 174
\l__enumext_item_width_vii_dim . . . 4139, 4148,
    4227, 4235, 4236
\l__enumext_item_width_viii_dim . . 4170, 4179,
    4276, 4284, 4285
\l__enumext_item_width_X_dim . . . . . 174
\l__enumext_itemindent_X_dim . . . . . 71
\l__enumext_itemsep_i_skip . . . 1243, 1250, 1253,
    1255, 1262, 1266, 1269, 1271, 1411, 1418, 1420, 1421,
    1426, 1430, 1432, 1433
\l__enumext_itemsep_ii_skip . . 1283, 1290, 1293,
    1295, 1302, 1306, 1309, 1311
\l__enumext_itemsep_iii_skip . 1322, 1329, 1332,
    1334, 1341, 1345, 1348, 1350
\l__enumext_itemsep_vii_skip . . . . . 4705
\l__enumext_itemsep_viii_skip . . . . . 4971
\l__enumext_joined_item_aux_vii_int . . 4221,
    4222, 4223, 4224, 4230
\l__enumext_joined_item_aux_viii_int . 4270,
    4271, 4272, 4273, 4279
\l__enumext_joined_item_aux_X_int . . . . 174
\__enumext_joined_item_vii:w . . 118, 4546, 4547,
    4549, 4549
\l__enumext_joined_item_vii_int . . 4192, 4193,
    4196, 4198, 4204, 4209, 4214, 4219, 4221, 4227
\__enumext_joined_item_viii:w . 123, 4795, 4796,
    4798, 4798
\l__enumext_joined_item_viii_int . 4241, 4242,
    4245, 4247, 4253, 4258, 4263, 4268, 4270, 4276
\l__enumext_joined_item_X_int . . . . . 174
\l__enumext_joined_width_vii_dim . 4225, 4232,
    4235, 4650, 4664
\l__enumext_joined_width_viii_dim 4274, 4281,
    4284, 4907, 4921
\l__enumext_joined_width_X_dim . . . . . 174
\__enumext_keyans_addto_prop:n 85, 2906, 2906,
    3314, 4048
\__enumext_keyans_addto_seq:n . 87, 2982, 2982,
    3316, 4050
\__enumext_keyans_addto_seq_link: 2982, 3003,
    3005, 4855
\__enumext_keyans_default_item:n . . 93, 3294,
    3294, 3331
\l__enumext_keyans_env_bool 34, 3514, 3527, 3679,
    3769
\__enumext_keyans_fake_item_indent: 924, 940,
    3425
\l__enumext_keyans_level_h_int . . 122, 28, 672,
    699, 2625, 2687, 2960, 4478, 4744, 4745
\l__enumext_keyans_level_int . . 28, 1528, 2621,
    2683, 2955, 3678, 3683, 4014
\__enumext_keyans_make_label: 39, 94, 3335, 3335,
    3423
\__enumext_keyans_make_label_box: 3335, 3339,
    3357
\__enumext_keyans_make_label_std: 3335, 3341,
    3343
\__enumext_keyans_mini_right_cmd:n 58, 1530,
    1563, 1563
\__enumext_keyans_mini_set_vskip: . . . . . 55
\__enumext_keyans_minipage_add_space: 1362,
    1388, 3708
\__enumext_keyans_minipage_set_skip: . 1362,
    1362, 1390
\__enumext_keyans_multi_addvspace: 1161, 1172,
    3732

```



```

\__enumext_keyans_multi_set_vskip: 51, 1161,
    1161, 1174
\__enumext_keyans_multicols_start: 3696, 3711,
    3713
\__enumext_keyans_multicols_stop: 1567, 3696,
    3738, 3767
\__enumext_keyans_name_and_start: 28, 34, 122,
    313, 313, 3680, 3907, 4749
\__enumext_keyans_parse_keys:n 3692, 3692, 3787
\__enumext_keyans_pic_arg_two: 106, 3924, 3924,
    3954
\l__enumext_keyans_pic_level_int .. 28, 1512,
    2629, 2691, 2909, 2950, 2985, 3073, 3902, 3903
\g__enumext_keyans_pic_parse_skip 142, 3941,
    4000
\__enumext_keyans_pic_safe_exec:n 105, 3900,
    3900, 3953
\__enumext_keyans_pic_skip_abs:N . 106, 3917,
    3917, 3928
\l__enumext_keyans_pic_star_bool .. 105, 142,
    3910, 3929, 3995, 4025, 4070
\__enumext_keyans_pre_itemsep_skip: .. 1362,
    1381, 1408
\__enumext_keyans_redefine_item: .. 93, 3319,
    3319, 3422
\__enumext_keyans_ref: ..... 43, 724, 742, 3424
\__enumext_keyans_ref:n ..... 43, 721, 724, 724
\__enumext_keyans_safe_exec: . 3672, 3672, 3786
\__enumext_keyans_set_item_width: 103, 3773,
    3773, 3795
\__enumext_keyans_show_ans: .. 3026, 3034, 3053
\__enumext_keyans_show_item_opt: .. 93, 3026,
    3041, 3312, 4063, 4926
\__enumext_keyans_show_left:n . 93, 3026, 3026,
    3309, 4057
\__enumext_keyans_show_pos: .. 3026, 3038, 3066
\__enumext_keyans_starred_item:n .. 93, 3306,
    3306, 3327
\__enumext_keyans_store_ref: .. 86, 2929, 2929,
    3315, 4049, 4853
\__enumext_keyans_store_ref_aux_i: 86, 2929,
    2941, 2944
\__enumext_keyans_store_ref_aux_ii: 86, 2929,
    2970, 2972
\__enumext_keyans_unknown_keys:n . 3232, 3236,
    3240
\__enumext_keyans_unknown_keys:nn 3232, 3242,
    3244
\__enumext_keyans_wrapper_opt:n .. 2174, 3049
\l__enumext_label_copy_i_tl .. 2432, 2948, 2953,
    2958, 2963
\l__enumext_label_copy_v_tl ..... 2958
\l__enumext_label_copy_vi_tl ..... 2953
\l__enumext_label_copy_vii_tl 2408, 2419, 2448,
    2948
\l__enumext_label_copy_viii_tl ..... 2963
\l__enumext_label_copy_X_tl ..... 163
\l__enumext_label_fill_left_v_tl ..... 3347
\l__enumext_label_fill_left_X_tl ..... 100
\l__enumext_label_fill_right_v_tl .... 3354
\l__enumext_label_fill_right_X_tl .... 100
\l__enumext_label_font_style_v_tl 3348, 3363,
    4061
\l__enumext_label_font_style_vii_tl ... 4636
\l__enumext_label_font_style_viii_tl .. 4893
\l__enumext_label_i_tl ..... 587
\l__enumext_label_ii_tl ..... 587
\l__enumext_label_iii_tl ..... 587
\l__enumext_label_iv_tl ..... 587
\__enumext_label_style:Nnn 28, 38, 498, 498, 513,
    592, 639, 710, 714
\l__enumext_label_v_tl 87, 707, 2914, 2990, 3060,
    3100, 3308, 3313, 3790, 3932, 4056, 4058
\l__enumext_label_vi_tl 87, 707, 2911, 2987, 4056,
    4058, 4062
\l__enumext_label_vii_tl . 634, 4567, 4590, 4597
\l__enumext_label_viii_tl 634, 4816, 4847, 4851
\l__enumext_label_width_by_box .. 67, 494, 495
\__enumext_label_width_by_box:Nn 38, 492, 492,
    497, 509, 775
\l__enumext_labelsep_i_dim ... 3058, 3063, 3071,
    3103, 4859, 4874
\l__enumext_labelsep_v_dim ..... 3722
\l__enumext_labelsep_vii_dim . 2533, 3058, 3071,
    4134, 4144, 4228, 4534, 4588, 4643, 4652
\l__enumext_labelsep_viii_dim 4165, 4175, 4277,
    4783, 4900, 4909, 4927
\l__enumext_labelwidth_i_dim . 3057, 3063, 3070,
    3103, 4859, 4874
\l__enumext_labelwidth_v_dim ..... 3361, 3722
\l__enumext_labelwidth_vii_dim ... 2533, 3057,
    3070, 4134, 4143, 4228, 4534, 4634, 4651
\l__enumext_labelwidth_viii_dim .. 4165, 4174,
    4277, 4783, 4891, 4908
\l__enumext_leftmargin_tmp_v_bool . 106, 3926
\l__enumext_leftmargin_tmp_X_bool ..... 71
\l__enumext_leftmargin_tmp_X_dim ..... 71
\l__enumext_leftmargin_X_dim ..... 71
\__enumext_level: 214, 214, 616, 619, 620, 629, 631,
    927, 931, 935, 1005, 1009, 1013, 1017, 1100, 1102,
    1104, 1106, 1148, 1150, 1152, 1154, 1159, 1194, 1200,
    1205, 1207, 1210, 1213, 1226, 1229, 1537, 1541, 1547,
    1610, 1612, 1614, 1617, 1624, 1626, 1628, 1631, 2226,
    2228, 2230, 2258, 2259, 2261, 2317, 2325, 2329, 2333,
    2537, 2538, 3115, 3116, 3120, 3121, 3122, 3130, 3138,
    3139, 3142, 3149, 3150, 3154, 3157, 3159, 3185, 3186,
    3187, 3190, 3193, 3202, 3203, 3205, 3206, 3209, 3520,
    3533, 3540, 3548, 3551, 3553, 3555, 3556, 3557, 3558,
    3561, 3566, 3572, 3578, 3585, 3598, 3600, 3603, 3604,
    3606, 3610, 3616, 3641, 3646, 3657, 3659
\l__enumext_level_h_int 116, 28, 263, 286, 300, 655,
    692, 1519, 2042, 2062, 2427, 2661, 2673, 3528, 4473,
    4474
\l__enumext_level_int . 97, 28, 216, 273, 285, 301,
    395, 1112, 1239, 1518, 2036, 2068, 2404, 2414, 2420,
    2426, 2433, 2442, 2447, 2660, 2672, 2888, 3439, 3484,
    3485, 3496, 3504, 3518, 3531, 3562, 3687, 4010, 4516,
    4526, 4757, 5613, 5617, 5623, 5627
\__enumext_list_arg_two_i: ..... 3404
\__enumext_list_arg_two_ii: ..... 3404
\__enumext_list_arg_two_iii: ..... 3404
\__enumext_list_arg_two_iv: ..... 3404
\__enumext_list_arg_two_v: . 93, 3404, 3792, 3927
\__enumext_list_arg_two_vii: ..... 3445, 4453
\__enumext_list_arg_two_viii: .... 3445, 4721
\l__enumext_listoffset_v_dim . 3724, 3778, 3781
\l__enumext_listparindent_vii_dim .... 4667
\l__enumext_listparindent_viii_dim ... 4932
\__enumext_log_answer_vars: . 35, 367, 375, 2895

```

```

\__enumext_log_global_vars: . 35, 367, 367, 2894
\__enumext_make_label: . 39, 90, 3173, 3173, 3433
\__enumext_make_label_box: . . . 3173, 3177, 3197
\__enumext_make_label_std: . . . 3173, 3179, 3181
\l__enumext_mark_answer_sym_tl 75, 2180, 2383,
    2550, 3075, 3088, 4863
\l__enumext_mark_position_str 130, 2184, 2185,
    2211, 2212, 2381
\l__enumext_mark_ref_sym_tl . . 2197, 2522, 3017
\l__enumext_meta_path_tl . 126, 5201, 5202, 5204,
    5205
\c__enumext_meta_paths_prop . . . . . 131, 5177
\__enumext_mini_addvspace_vii: 57, 1498, 1498,
    4302
\__enumext_mini_addvspace_viii: 57, 1498, 1504,
    4367
__enumext_mini_env* . . . . . 393
\__enumext_mini_page 1547, 1574, 3610, 3709, 4304,
    4369, 4390
\__enumext_mini_right_cmd:n 58, 1532, 1534, 1534
\__enumext_mini_set_vskip_vii: 56, 1441, 1441,
    1500
\__enumext_mini_set_vskip_viii: 56, 1441, 1463,
    1506
\__enumext_minipage:w 36, 382, 390, 399, 4327, 4664,
    4921
\l__enumext_minipage_active_v_bool 3706, 3729,
    3754
\g__enumext_minipage_active_vii_bool . . 113,
    4316, 4325, 4347
\l__enumext_minipage_active_vii_bool . 4298,
    4309
\g__enumext_minipage_active_viii_bool 4380,
    4388, 4407
\l__enumext_minipage_active_viii_bool 4363,
    4374
\g__enumext_minipage_active_X_bool . . . 174
\l__enumext_minipage_active_X_bool . . . . 87
\__enumext_minipage_add_space: . 53, 100, 1190,
    1216, 3608
\g__enumext_minipage_after_skip 87, 1445, 1457,
    4345, 4405
\l__enumext_minipage_after_skip . . 52, 100, 87,
    1203, 1243, 1245, 1250, 1253, 1257, 1262, 1266, 1269,
    1273, 1285, 1290, 1293, 1297, 1302, 1306, 1309, 1313,
    1324, 1329, 1332, 1336, 1341, 1345, 1348, 1352, 1364,
    1378, 1411, 1413, 1418, 1420, 1422, 1426, 1430, 1432,
    1434, 1465, 1478, 1492, 1543, 1570, 3764
\g__enumext_minipage_center_vii_bool . 4331,
    4348
\g__enumext_minipage_center_viii_bool 4392,
    4408
\g__enumext_minipage_center_X_bool . . . 174
\l__enumext_minipage_hsep_v_dim . . . . . 3704
\l__enumext_minipage_hsep_vii_dim . . . . 4296
\l__enumext_minipage_hsep_viii_dim . . . 4361
\l__enumext_minipage_left_skip 87, 1365, 1443,
    1448, 1452, 1466, 1470, 1484, 1502, 1508
\l__enumext_minipage_left_v_dim . . 3702, 3709
\l__enumext_minipage_left_vii_dim 4292, 4304
\l__enumext_minipage_left_viii_dim 4357, 4369
\l__enumext_minipage_left_X_dim . . . . . 87
\g__enumext_minipage_right_skip 87, 1444, 1449,
    1453, 4330, 4391
\l__enumext_minipage_right_skip . 52, 87, 1192,
    1198, 1203, 1205, 1207, 1366, 1367, 1373, 1378, 1379,
    1380, 1385, 1467, 1474, 1488, 1549, 1576
\l__enumext_minipage_right_v_dim . 1565, 1574,
    3700, 3704
\g__enumext_minipage_right_vii_dim 113, 4300,
    4327, 4350
\l__enumext_minipage_right_vii_dim 113, 4290,
    4295, 4301
\g__enumext_minipage_right_viii_dim . . 4365,
    4390, 4410
\l__enumext_minipage_right_viii_dim . . 4355,
    4360, 4366
\g__enumext_minipage_right_X_dim . . . . . 174
\g__enumext_minipage_right_X_skip . . . . 174
\__enumext_minipage_set_skip: . 52, 1190, 1190,
    1218
\g__enumext_minipage_stat_int . . 100, 87, 1554,
    1581, 3607, 3618, 3623, 3707, 3756, 3761
\l__enumext_minipage_temp_skip 87, 1264, 1274,
    1277, 1304, 1314, 1317, 1343, 1353, 1356, 1428, 1435,
    1437
\l__enumext_miniright_code_vii_box 4338, 4342
\g__enumext_miniright_code_vii_tl 113, 4333,
    4340, 4349
\l__enumext_miniright_code_viii_box . . 4399,
    4403
\g__enumext_miniright_code_viii_tl 4394, 4401,
    4409
\l__enumext_miniright_code_X_box . . . . . 174
\__enumext_multi_addvspace: . 51, 99, 1143, 1143,
    3569
\__enumext_multi_set_vskip: 50, 1098, 1098, 1145
\l__enumext_multicols_above_ii_skip . . 1117
\l__enumext_multicols_above_iii_skip . . 1126
\l__enumext_multicols_above_iv_skip . . 1135
\l__enumext_multicols_above_v_skip 1163, 1177,
    1188, 1379
\l__enumext_multicols_above_X_skip . . . . . 79
\l__enumext_multicols_below_ii_skip . . 1246,
    1255, 1259, 1271, 1276
\l__enumext_multicols_below_iii_skip . 1286,
    1295, 1299, 1311, 1316
\l__enumext_multicols_below_iv_skip . . 1325,
    1334, 1338, 1350, 1355
\l__enumext_multicols_below_v_skip 1167, 1181,
    1380, 1414, 1421, 1423, 1433, 1436, 3746
\l__enumext_multicols_below_X_skip . . . . . 79
\g__enumext_multicols_right_X_skip . . . . 79
\__enumext_multicols_start: 98, 100, 3545, 3545,
    3612
\__enumext_multicols_stop: 99, 1539, 3575, 3575,
    3628
\__enumext_nested_base_line_fix: . 45, 97, 855,
    855, 3500
\__enumext_newlabel:nn 31, 37, 76, 449, 449, 2458,
    2976
\l__enumext_newlabel_arg_one_tl 31, 37, 76, 86,
    163, 2451, 2459, 2521, 2965, 2977, 3015
\l__enumext_newlabel_arg_two_tl 31, 37, 75, 163,
    2407, 2417, 2430, 2445, 2460, 2952, 2957, 2962, 2978
\__enumext_parse_foreach_keys:n . . 5226, 5242,
    5259
\__enumext_parse_foreach_keys:nn . 5226, 5249,
    5261

```

```

\__enumext_parse_keys:n 45, 62, 3491, 3491, 3653
\__enumext_parse_keys_vii:n 62, 4448, 4486, 4486
\__enumext_parse_keys_viii:n . 4717, 4762, 4762
\__enumext_parse_save_key:n 73, 2251, 2256, 2256
\__enumext_parse_save_key_vii:n 73, 2246, 2256,
2264
\__enumext_parse_series:n 62, 97, 116, 1739, 1739,
3499, 4492
\__enumext_parse_store_keys:n . . . . . 97
\l__enumext_parsep_i_skip . . . . . 1115, 1119
\l__enumext_parsep_ii_skip . . . . . 1124, 1128
\l__enumext_parsep_iii_skip . . . . . 1133, 1137
\l__enumext_parsep_vii_skip . . . . . 4668
\l__enumext_parsep_viii_skip . . . . . 4933
\l__enumext_partopsep_v_skip . 1179, 1183, 1375,
1398
\l__enumext_partopsep_viii_skip . . . . . 1476
\__enumext_phantomsection: 37, 411, 442, 446, 462
\__enumext_pre_itemsep_skip: 52, 53, 1208, 1237,
1237
\__enumext_print_footnote: . . . 4412, 4435, 4681,
4946
\__enumext_print_keyans_box:NN 75, 2375, 2375,
2388, 2532, 2536, 3062, 3102, 4859, 4874
\l__enumext_print_keyans_i_tl . . . . 5012, 5034
\l__enumext_print_keyans_ii_tl . . . 5016, 5035
\l__enumext_print_keyans_iii_tl . . 5020, 5036
\l__enumext_print_keyans_iv_tl . . . 5024, 5037
\l__enumext_print_keyans_star_bool 130, 862,
869, 5057
\l__enumext_print_keyans_starred_tl 127, 128,
130, 5008, 5055
\l__enumext_print_keyans_vii_tl 127, 5028, 5038
\l__enumext_print_keyans_X_tl . . . . . 130
\__enumext_printkeyans:nnn 128, 5039, 5042, 5042
\__enumext_redefine_item: . 90, 3162, 3162, 3432
\l__enumext_ref_key_arg_tl . 40, 41, 50, 229, 609,
610, 623, 654, 657, 668, 674, 685, 726, 727, 738
\l__enumext_ref_the_count_tl . 41, 50, 616, 619,
622, 662, 664, 667, 679, 681, 684, 732, 734, 737
\__enumext_regex_counter_style: . . 32, 40, 224,
224, 617, 663, 680, 733
\__enumext_register_counter_style:Nn . . 482,
482, 487, 488, 489, 490, 491
\__enumext_remove_extra_parsep_vii: . . 4466,
4694, 4694
\__enumext_remove_extra_parsep_viii: . 4734,
4959, 4959
\__enumext_renew_footnote: . . . 4412, 4416, 4658,
4915
\l__enumext_renew_the_count_v_tl 735, 744, 746
\l__enumext_renew_the_count_vii_tl 665, 694,
696
\l__enumext_renew_the_count_viii_tl 682, 701,
703
\l__enumext_renew_the_count_X_tl . . . . . 50
\__enumext_rescan_anskey_env:n . . 83, 84, 2770,
2865, 2873
\__enumext_reset_global_bool: . . 343, 346, 355
\__enumext_reset_global_int: . . . 343, 345, 349
\__enumext_reset_global_tl: . . . . 343, 347, 361
\__enumext_reset_global_vars: . 35, 85, 343, 343,
2903
\l__enumext_resume_active_bool 62, 64, 61, 1743,
1863
\__enumext_resume_counter: . . 64, 65, 1861, 1867,
1874
\__enumext_resume_counter:n . 62, 64, 1832, 1837,
1861, 1861, 1931, 1939
\__enumext_resume_counter_save_ans: . . 64, 65,
1861, 1872, 1904
\__enumext_resume_counter_series: 64, 65, 1861,
1870, 1887
\g__enumext_resume_int . . . 61, 1784, 1878, 1879
\__enumext_resume_last:n . . 62, 1739, 1745, 1758
\l__enumext_resume_name_tl 61, 1780, 1788, 1791,
1807, 1815, 1818, 1864, 1865, 1893, 1900
\__enumext_resume_save_counter: . 63, 100, 117,
1771, 1771, 3634, 4510
\__enumext_resume_series:n . 64, 1707, 1828, 1828
\__enumext_resume_starred: . 65, 1708, 1925, 1925
\g__enumext_resume_vii_int 61, 1811, 1883, 1884
\l__enumext_rightmargin_vii_dim . . 4146, 4150,
4155
\l__enumext_rightmargin_viii_dim . 4177, 4181,
4186
\__enumext_safe_exec: . . 36, 97, 3480, 3480, 3652
\__enumext_safe_exec_vii: . 36, 4447, 4469, 4469
\__enumext_safe_exec_viii: 122, 4716, 4738, 4738
\__enumext_second_part: . . 100, 3614, 3614, 3666
\__enumext_second_part_v: . . . 3696, 3752, 3800
\l__enumext_series_name_tl . . . . . 64
\l__enumext_series_str . . 63, 97, 116, 1705, 1741,
1749, 1750, 1752, 1754, 1775, 1778, 1782, 1802, 1805,
1809, 3495, 4490
\__enumext_set_error:nn . . . . . 5163, 5173, 5175
\__enumext_set_item_width: 100, 3636, 3636, 3662
\__enumext_set_parse:n . . . . . 5147, 5163, 5163
\l__enumext_setkey_tmpa_int . . . 121, 5140, 5144
\l__enumext_setkey_tmpa_seq . . 121, 5138, 5148,
5154, 5156, 5158, 5170
\l__enumext_setkey_tmpa_tl . . . . 121, 5146, 5150
\l__enumext_setkey_tmpb_seq . . 121, 5139, 5142,
5146, 5147
\l__enumext_setkey_tmpb_tl 121, 5165, 5167, 5168
\l__enumext_show_answer_bool . 2191, 2215, 2544,
3032, 3046, 4053, 4857
\__enumext_show_length:nnn . . 47, 232, 232, 5384,
5385, 5386, 5387, 5388, 5389, 5390, 5391, 5392, 5393,
5399, 5400, 5401, 5402, 5403, 5404, 5405, 5406, 5407,
5408
\l__enumext_show_position_bool . . 2194, 2218,
2548, 3036, 3047, 4054, 4861
\g__enumext_standar_bool 33, 97, 34, 262, 265, 284,
358, 1773, 1838, 1850, 1876, 1889, 1927, 2067, 2081,
2412, 2425, 2440, 3515
\l__enumext_standar_bool 97, 100, 34, 2413, 3487,
3633, 4483
\l__enumext_standar_first_bool 33, 97, 34, 289,
1760, 1907, 1969, 1976
\__enumext_standar_item_vii:w . 118, 4554, 4556,
4556
\__enumext_standar_item_viii:w 123, 124, 4803,
4805, 4805
\__enumext_standar_ref: . . . . 41, 607, 627, 3434
\__enumext_standar_ref:n . . . . 40, 599, 607, 607
\g__enumext_standar_series_tl . 61, 1762, 1763,
1929, 1932

```

```

\__enumext_standar_unknown_keys:n 3272, 3276,
    3280
\__enumext_standar_unknown_keys:nn 3272, 3282,
    3284
\g__enumext_starred_bool 33, 116, 34, 272, 275, 299,
    359, 1800, 1843, 1854, 1881, 1896, 1935, 2041, 2087,
    2403, 2946, 4351
\l__enumext_starred_bool 116, 117, 122, 34, 1524,
    2441, 2476, 2482, 2530, 2819, 2824, 3055, 3068, 3488,
    4482, 4509, 4750, 4754
\__enumext_starred_columns_set_vii: .. 4128,
    4128, 4457
\__enumext_starred_columns_set_viii: . 4128,
    4159, 4725
\l__enumext_starred_first_bool 33, 116, 34, 304,
    860, 868, 1765, 1916, 1969, 1976
\__enumext_starred_item:nn ... 3125, 3125, 3168
\__enumext_starred_item_exec: 124, 4849, 4849,
    4889
\__enumext_starred_item_vii:w . 118, 4553, 4570,
    4570
\__enumext_starred_item_vii_aux_i:w .. 4570,
    4575, 4578
\__enumext_starred_item_vii_aux_ii:w . 4570,
    4576, 4581, 4583
\__enumext_starred_item_vii_aux_iii:w 4570,
    4586, 4593
\__enumext_starred_item_viii:w 123, 124, 4802,
    4819, 4819
\__enumext_starred_item_viii_aux_i:w .. 124,
    4819, 4824, 4827
\__enumext_starred_item_viii_aux_ii:w . 124,
    4819, 4825, 4842, 4844
\__enumext_starred_joined_item_vii:n 111, 118,
    4190, 4190, 4551
\__enumext_starred_joined_item_viii:n . 111,
    123, 4190, 4239, 4800
\__enumext_starred_ref: .... 42, 652, 690, 3465
\__enumext_starred_ref:n .... 41, 646, 652, 652
\g__enumext_starred_series_tl . 61, 1767, 1768,
    1937, 1940
\__enumext_starred_unknown_keys:n 3254, 3256,
    3258
\__enumext_starred_unknown_keys:nn 3254, 3260,
    3262
\__enumext_start_from:NNn 43, 749, 749, 762, 784,
    790
\l__enumext_start_i_int .... 1879, 1891, 1910
\__enumext_start_item_tmp_vii: 115, 4460, 4536,
    4536
\__enumext_start_item_tmp_viii: .. 121, 4728,
    4785, 4785
\__enumext_start_item_vii:w 118, 120, 4562, 4567,
    4590, 4597, 4645, 4645
\__enumext_start_item_viii:w . 124, 4811, 4816,
    4847, 4902, 4902
\g__enumext_start_line_tl 33, 34, 292, 307, 364,
    2111, 2116, 2121, 2135, 2140, 2145
\__enumext_start_list:nn . 36, 94, 382, 384, 3656,
    3789, 4451, 4719
\__enumext_start_list_tag:n .. 3802, 3826, 4661,
    4918
\__enumext_start_mini_vii: 116, 4288, 4288, 4501
\__enumext_start_mini_viii: ... 122, 4353, 4353,
    4773
\__enumext_start_save_ans_msg: 66, 1953, 1953,
    1978
\__enumext_start_store_level: . 98, 3509, 3509,
    3655
\__enumext_start_store_level_vii: 117, 4450,
    4512, 4512
\l__enumext_start_vii_int ... 1884, 1898, 1919
\l__enumext_start_X_int ..... 100
\__enumext_stop_item_tmp_vii: .. 115, 117, 120,
    4459, 4465, 4538, 4647
\__enumext_stop_item_tmp_viii: 121, 123, 4727,
    4733, 4787, 4904
\__enumext_stop_item_vii: 120, 4647, 4670, 4670
\__enumext_stop_item_viii: 126, 4904, 4935, 4935
\__enumext_stop_list: 36, 113, 117, 382, 385, 3580,
    3588, 3742, 3749, 4311, 4319, 4376, 4383
\__enumext_stop_list_tag:n ... 3802, 3842, 4673,
    4938
\__enumext_stop_mini_vii: 113, 117, 4288, 4307,
    4505
\__enumext_stop_mini_viii: 123, 4353, 4372, 4777
\__enumext_stop_save_ans_msg: . 66, 1953, 1958,
    2892
\__enumext_stop_start_list_tag: .. 3802, 3834,
    4663, 4920
\__enumext_stop_store_level: 98, 99, 3538, 3538,
    3581, 3589
\__enumext_stop_store_level_vii: .. 113, 117,
    4312, 4320, 4512, 4522
\l__enumext_store_active_bool 30, 67, 112, 1908,
    1917, 1985, 2617, 3513, 3526, 3674, 3682, 4002, 4006,
    4514, 4524, 4740, 4756
\__enumext_store_active_keys:n .. 72, 97, 2224,
    2224, 3506
\__enumext_store_active_keys_vii:n . 72, 116,
    2224, 2234, 4493
\__enumext_store_addto_prop:n 73, 85, 2299, 2299,
    2307, 2467, 2927, 4852
\__enumext_store_addto_seq:n 74, 87, 2308, 2308,
    2312, 2319, 2333, 2341, 2350, 2364, 2372, 2525, 3020
\l__enumext_store_anskey_arg_tl .. 30, 77, 112,
    2473, 2478, 2480, 2485, 2492, 2495, 2505, 2510, 2513,
    2519, 2525
\__enumext_store_anskey_code:n 77, 79, 84, 2464,
    2464, 2610, 2863, 2871
\l__enumext_store_anskey_env_tl .. 30, 83, 112,
    2793, 2797, 2803, 2865, 2873
\l__enumext_store_anskey_opt_tl 30, 83, 84, 112,
    2794, 2821, 2827, 2834, 2840, 2850, 2860, 2869
\__enumext_store_anskey_safe_outer: .... 80
\g__enumext_store_columns_break_bool . 2717,
    2818, 2880
\l__enumext_store_columns_break_bool . 2475,
    2566
\l__enumext_store_current_label_tl 30, 85, 87,
    124, 112, 2908, 2911, 2914, 2920, 2925, 2927, 2984,
    2987, 2990, 2996, 3001, 3011, 3020, 4829, 4834, 4838,
    4851, 4852, 4854
\l__enumext_store_current_label_tmp_tl . 30,
    112, 3308, 3313
\l__enumext_store_current_opt_arg_tl 30, 124,
    112, 3030, 3043, 3049, 4840
\__enumext_store_internal_ref: .. 75, 77, 2389,
    2389, 2470

```



```

\g__enumext_store_item_join_int .. 2720, 2825,
    2829, 2881
\l__enumext_store_item_join_int .. 2483, 2487,
    2569
\g__enumext_store_item_star_bool .. 2722, 2832,
    2882
\l__enumext_store_item_star_bool .. 2490, 2571
\g__enumext_store_item_symbol_sep_dim .. 2727,
    2847, 2852, 2884
\l__enumext_store_item_symbol_sep_dim .. 2502,
    2507, 2576
\g__enumext_store_item_symbol_tl .. 2725, 2838,
    2842, 2883
\l__enumext_store_item_symbol_tl .. 2493, 2497,
    2574
\l__enumext_store_keyans_item_opt_sep_
    tl .. 2177, 2918, 2922, 2994, 2998, 4832, 4836
\__enumext_store_level_close: .. 74, 2313, 2337,
    3542
\__enumext_store_level_close_vii: .. 74, 2344,
    2368, 4528
\__enumext_store_level_open: .. 74, 98, 2313, 2313,
    3521, 3534
\__enumext_store_level_open_vii: .. 74, 2344,
    2344, 4518
\g__enumext_store_name_tl .. 30, 67, 112, 363, 370,
    371, 372, 373, 1961, 1987, 2110, 2115, 2120, 2134,
    2139, 2144, 2890
\l__enumext_store_name_tl .. 30, 66, 68, 112, 1794,
    1797, 1821, 1824, 1912, 1921, 1956, 1965, 1966, 1987,
    1988, 1989, 1991, 1992, 1994, 1996, 1997, 1999, 2001,
    2002, 2026, 2301, 2303, 2310, 2453, 2454, 2556, 2799,
    2967, 2968, 3081, 3094, 4869
\l__enumext_store_ref_key_bool .. 77, 2200, 2468,
    2516, 2931, 3008
\l__enumext_store_save_key_vii_bool .. 2236,
    2266
\l__enumext_store_save_key_vii_tl .. 2238, 2239,
    2267, 2268, 2348, 2356, 2360, 2364
\l__enumext_store_save_key_X_bool .. 72, 130
\l__enumext_store_save_key_X_tl .. 72, 130
\l__enumext_store_upper_level_X_bool .. 130
\__enumext_storing_exec: .. 66, 67, 81, 1963, 1979,
    1983
\__enumext_storing_set:n .. 66, 1948, 1963, 1963
\l__enumext_the_counter_v_tl .. 734
\l__enumext_the_counter_vii_tl .. 664
\l__enumext_the_counter_viii_tl .. 681
\l__enumext_the_counter_X_tl .. 50
\__enumext_tmp:n .. 45, 49, 54, 60, 71, 78, 79, 86, 94, 99,
    100, 111, 134, 141, 166, 170, 174, 194, 1701, 1712,
    1944, 1952, 2005, 2023, 2164, 2205, 2206, 2223, 2242,
    2255, 2391, 2398, 2399, 2420, 2433, 2436, 2447, 2933,
    2940, 3232, 3239, 3272, 3279, 3404, 3444, 3445, 3479
\__enumext_tmp:nn .. 514, 535, 536, 570, 571, 586, 779,
    804, 880, 902, 903, 923, 979, 987, 988, 1002, 1067,
    1083, 1084, 1097, 1590, 1606, 3216, 3231
\__enumext_tmp:nnn .. 587, 603, 604, 605, 606, 634, 650,
    651
\__enumext_tmp:nnnnnn .. 805, 830, 833, 836, 838, 840,
    843, 846
\__enumext_tmp:w .. 4987, 4990
\l__enumext_tmpa_vii_int .. 4138, 4141, 4150, 4181
\l__enumext_tmpa_viii_int .. 4169, 4172
\l__enumext_tmpa_X_dim .. 174
\l__enumext_tmpa_X_int .. 174
\l__enumext_topsep_v_skip .. 1165, 1169, 1369
\l__enumext_topsep_vii_skip .. 1446, 1455, 1459
\l__enumext_topsep_viii_skip .. 1468, 1490, 1494
\__enumext_undefine_anskey_env: .. 80, 85, 2650,
    2650, 2901
\__enumext_unskip_unkern: .. 33, 238, 238, 1157,
    1186, 1219, 1391, 3583, 3584, 3624, 3744, 3745, 3762
\l__enumext_vspace_a_star_v_bool .. 1639
\l__enumext_vspace_a_star_vii_bool .. 1661
\l__enumext_vspace_a_star_viii_bool .. 1672
\l__enumext_vspace_a_star_X_bool .. 100
\__enumext_vspace_above: .. 59, 99, 1607, 1607, 3594
\__enumext_vspace_above_v: .. 60, 1635, 1635, 3698
\l__enumext_vspace_above_v_skip .. 1637, 1641,
    1643
\__enumext_vspace_above_vii: .. 60, 116, 1657, 1657,
    4498
\l__enumext_vspace_above_vii_skip .. 1659, 1663,
    1665
\__enumext_vspace_above_viii: .. 60, 1657, 1668,
    4771
\l__enumext_vspace_above_viii_skip .. 1670, 1674,
    1676
\l__enumext_vspace_b_star_v_bool .. 1650
\l__enumext_vspace_b_star_vii_bool .. 1683
\l__enumext_vspace_b_star_viii_bool .. 1694
\l__enumext_vspace_b_star_X_bool .. 100
\__enumext_vspace_below: .. 60, 100, 1621, 1621, 3632
\__enumext_vspace_below_v: .. 60, 1646, 1646, 3771
\l__enumext_vspace_below_v_skip .. 1648, 1652,
    1654
\__enumext_vspace_below_vii: .. 61, 117, 1679, 1679,
    4508
\l__enumext_vspace_below_vii_skip .. 1681, 1685,
    1687
\__enumext_vspace_below_viii: .. 61, 1679, 1690,
    4779
\l__enumext_vspace_below_viii_skip .. 1692, 1696,
    1698
\__enumext_widest_from:nNn .. 43, 763, 763, 778,
    797
\g__enumext_widest_label_tl .. 28, 38, 67, 502, 506,
    510
\l__enumext_wrap_label_opt_v_bool .. 3302
\l__enumext_wrap_label_opt_vii_bool .. 118, 4561
\l__enumext_wrap_label_opt_viii_bool .. 124,
    4810
\l__enumext_wrap_label_opt_X_bool .. 100
\l__enumext_wrap_label_v_bool .. 3298, 3302, 3310,
    3349, 3364
\l__enumext_wrap_label_vii_bool .. 118, 4561,
    4565, 4573, 4637
\l__enumext_wrap_label_viii_bool .. 124, 4810,
    4814, 4822, 4894
\l__enumext_wrap_label_X_bool .. 100
\__enumext_wrapper_label_v:n .. 3351, 3366, 4062
\__enumext_wrapper_label_vii:n .. 4639
\__enumext_wrapper_label_viii:n .. 4896
\l__enumext_write_aux_file_tl .. 31, 76, 86, 163,
    2456, 2462, 2974, 2980
enumext* .. 6, 4445
enumXi .. 474
enumXii .. 474
enumXiii .. 474

```

enumXiv ..... 474

enumXv ..... 474

enumXvi ..... 474

enumXvii ..... 474

enumXviii ..... 474

Environments provide by **enumext**:

anskey\* 30, 67, 72, 76, 78, 80, 81, 83, 85, 98, 117, 128, 133, 136

enumext\* 27, 28, 31-33, 36, 38, 41, 42, 44, 46-49, 56, 57, 60-66, 68, 69, 71-74, 76, 77, 79-81, 83-86, 91, 92, 96-98, 103, 110, 111, 113-115, 117, 119-123, 125, 127-129, 131, 134, 137, 139

enumext 27, 28, 32, 33, 36, 38-41, 43-52, 55, 57-66, 68, 69, 71-74, 76, 77, 79-81, 83, 85, 86, 89-92, 94, 95, 98, 101, 102, 105, 110, 113, 116, 117, 119, 122, 127, 129, 131, 134, 136, 138

keyans\* 27, 28, 30-34, 38, 41-44, 46-49, 56, 57, 60, 61, 67, 68, 70, 71, 73, 81, 86, 92, 96, 103, 111, 112, 115, 122, 134, 137, 139

keyanspic 27, 28, 30, 31, 34, 38, 39, 42, 67, 68, 70, 73, 74, 81, 85-88, 103-109, 137

keyans 27, 28, 30, 31, 33, 34, 38, 39, 42, 44, 46-49, 51, 55, 57-60, 67, 68, 70, 71, 73, 74, 81, 85-88, 92-95, 101, 103, 105, 106, 109, 113, 123, 134, 137

Environments:

center ..... 110

description ..... 110

enumerate ..... 110

flushleft ..... 110

flushright ..... 110

itemize ..... 110

list 32, 35, 36, 79, 94, 95, 99, 101, 103, 105-107, 110, 113

lrbox ..... 120

minipage 32, 35, 36, 49, 52, 53, 105, 109, 110, 113, 120, 126

multicols ..... 50-53, 58, 98-100

quotation ..... 110

quote ..... 110

scontents ..... 81, 83

tabbing ..... 110

trivlist ..... 110

verbatim ..... 110

verse ..... 110

exp commands:

\exp\_after:wN ..... 4990

\exp\_args:Ne ..... 2862, 2870, 3503, 4978

\exp\_args:NV ... 2582, 2737, 3242, 3260, 3282, 5261

\exp\_not:N . 58, 505, 622, 667, 684, 737, 933, 947, 948, 960, 961, 973, 974, 2521, 2553, 2554, 3013, 3078, 3079, 3091, 3092, 4866, 4867, 4987

\exp\_not:n 294, 309, 322, 330, 338, 561, 581, 622, 623, 667, 668, 684, 685, 737, 738, 934, 1728, 1737, 2188, 2285, 2297, 2459, 2487, 2497, 2507, 2521, 2522, 2829, 2842, 2852, 2977, 3015, 3017, 5090, 5100, 5293, 5298

F

\fbox ..... 2171

\fboxrule ..... 2171

\fboxsep ..... 2171

file commands:

\file\_input\_stop: ..... 5697

first ..... 988

font ..... 514

\footnote ..... 115

\footnote ..... 115, 4420

\footnotemark ..... 4430

\footnotesize ..... 2554, 3079, 3092, 4867

\footnotetext ..... 4414

\foreachkeyans ..... 17, 132, 5226

G

\getkeyans ..... 17, 127, 4976

group commands:

\group\_begin: .. 2552, 2597, 2772, 2859, 3077, 3090, 4865, 5033

\group\_end: 2559, 2613, 2876, 3084, 3097, 4872, 5040

H

\hbadness ..... 4675, 4940

hbox commands:

\hbox\_overlap\_left:n ..... 3158, 4630

\hbox\_set:Nn ..... 494, 3932

\hbox\_set\_end: ..... 4674, 4939

\hbox\_set\_to\_wd:Nnw ..... 4648, 4905

\hfill 544, 549, 555, 556, 1546, 1573, 2521, 3013, 4315, 4379

hook commands:

\hook\_gput\_code:nnn ..... 9, 204, 208, 212, 409

\hook\_gremove\_code:nn ..... 83, 2788

\hook\_gset\_rule:nnnn ..... 410

\hook\_if\_empty:nTF ..... 2786

\hyperlink ..... 78, 87

\hyperlink ..... 2521, 3013

\hypertarget ..... 37

\hypertarget ..... 441

I

\IfDocumentMetadataTF 3175, 3337, 3828, 3836, 3844, 3878, 3886, 3894, 3955, 3965, 3973, 3983, 3988, 4027, 4036, 4113, 4121, 4313, 4377, 4456, 4464, 4606, 4654, 4677, 4724, 4732, 4911, 4942

\IfHyperBoolean ..... 417

\IfPackageLoadedTF ..... 11, 19, 413, 429

\ignorespaces . 936, 949, 962, 975, 4461, 4643, 4729, 4900

\inputlineno ..... 294, 309, 322, 330, 338

int commands:

\int\_add:Nn ..... 4223, 4272

\int\_case:nn ... 1112, 1239, 2036, 2062, 2101, 2125

\int\_case:nnTF ..... 240

\int\_compare:nNnTF .. 395, 655, 672, 692, 699, 1209, 1228, 1382, 1400, 1512, 1528, 1540, 1568, 2149, 2155, 2621, 2625, 2629, 2637, 2683, 2687, 2691, 2888, 2909, 2950, 2955, 2960, 2985, 3073, 3485, 3496, 3518, 3531, 3547, 3562, 3577, 3618, 3683, 3687, 3715, 3740, 3756, 3903, 4010, 4014, 4193, 4203, 4219, 4242, 4252, 4268, 4474, 4478, 4516, 4526, 4684, 4696, 4745, 4757, 4949, 4961, 5144, 5276

\int\_compare\_p:nNn ... 263, 273, 285, 286, 300, 301, 1518, 1519, 2042, 2068, 2404, 2414, 2426, 2427, 2442, 2483, 2660, 2661, 2672, 2673, 2825, 3528

\int\_decr:N ..... 4222, 4271

\int\_eval:n .. 380, 792, 2303, 2454, 2554, 2968, 3079, 3092, 3419, 3464, 4211, 4260, 4867

\int\_from\_alph:n ..... 757, 771

\int\_from\_roman:n ..... 759, 773

\int\_gadd:Nn ..... 4224, 4273

\int\_gdecr:N ..... 2045, 2050, 2054, 2058, 2071

\int\_gincr:N 1878, 1883, 2466, 3023, 3112, 3146, 3317, 3607, 3707, 4051, 4540, 4616, 4789, 4856

\int\_gset:Nn ..... 2094, 4428

\int\_gset\_eq:NN 1777, 1784, 1790, 1796, 1804, 1811, 1817, 1823, 4425

`\int_gzero:N` . 351, 352, 353, 1554, 1581, 2161, 2881, 3623, 3761, 4707, 4973

`\int_if_exist:N`TF 1752, 1788, 1794, 1815, 1821, 1999

`\int_incr:N` 2636, 3484, 3678, 3902, 4473, 4539, 4744, 4788

`\int_mod:nn` . . . . . 4698, 4963

`\int_new:N` . 28, 29, 30, 31, 32, 33, 61, 62, 87, 104, 123, 144, 145, 156, 157, 158, 160, 171, 177, 178, 179, 180, 181, 1754, 2002

`\int_set:Nn` 753, 757, 759, 1891, 1898, 1910, 1919, 2773, 4107, 4108, 4138, 4169, 4192, 4198, 4214, 4241, 4247, 4263, 4675, 4940, 5140, 5278

`\int_set_eq:NN` . . . . . 1879, 1884, 4221, 4270

`\int_sign:n` . . . . . 2096

`\int_step_function:nnN` . . . . . 2420, 2433, 2447

`\int_step_function:nnnN` . . . . . 5282

`\int_step_inline:nn` . . . . . 5192

`\int_step_inline:nnn` . . . . . 4109

`\int_to_roman:n` . . . . . 216, 2400, 2437

`\int_use:N` 373, 378, 379, 1210, 1229, 1541, 1893, 1900, 1912, 1921, 3419, 3439, 3464, 3504, 3548, 3557, 3572, 3578, 4196, 4197, 4209, 4245, 4246, 4258, 5613, 5617, 5623, 5627

`\int_zero:N` . . . . . 4688, 4953

`\item` . 89, 93, 117, 120, 123, 125, 386, 2321, 2327, 2352, 2358, 2480, 2987, 2990, 3164, 3321, 3959, 3961, 4458, 4460, 4726, 4728, 4854

`\item*` . . . . . 6, 15, 70, 3319

`item-pos*` . . . . . 3216

`item-sym*` . . . . . 3216

`\itemindent` . . . . . 95

`\itemindent` . . . . . 95

`itemindent` . . . . . 880

`\itemsep` . . . . . 3949

`\itemwidth` . 464, 2171, 3638, 3644, 3775, 3781, 4232, 4236, 4281, 4285

K

`keyans` . . . . . 15, 3784

`keyans*` . . . . . 15, 4714

`keyanspic` . . . . . 16, 3951

Keys for `\anskey` provide by `enumext`:

`break-col` . . . . . 77, 79, 82, 83

`item-join` . . . . . 77, 79, 82, 84

`item-pos*` . . . . . 77, 79, 82, 84

`item-star` . . . . . 77, 79, 82, 84

`item-sym*` . . . . . 77, 79, 82, 84

Keys for `anskey*` provide by `enumext`:

`break-col` . . . . . 77, 79, 82, 83

`item-join` . . . . . 77, 79, 82, 84

`item-pos*` . . . . . 77, 79, 82, 84

`item-star` . . . . . 77, 79, 82, 84

`item-sym*` . . . . . 77, 79, 82, 84

Keys for environments provide by `enumext`:

`above*` . . . . . 29, 59, 60, 99, 116

`above` . . . . . 29, 59, 60, 99, 116, 122

`after` . . . . . 48, 100, 117, 123

`align` . . . . . 29, 39, 40, 90, 94, 119, 133

`base-fix` . . . . . 45, 62, 73, 97, 128

`before*` . . . . . 48, 99, 116, 122

`before` . . . . . 48

`below*` . . . . . 29, 59–61, 100, 117

`below` . . . . . 29, 59–61, 100, 117, 123

`check-ans` . 31–33, 66–70, 73, 85, 87, 100, 101, 117, 121, 135

`columns-sep` . . . . . 49, 98

`columns` . . . . . 29, 49, 59, 98

`first` . . . . . 48, 120

`font` . . . . . 39, 90, 94, 108, 119

`item-pos*` . . . . . 89, 91

`item-sym*` . . . . . 30, 89, 91

`itemindent` . . . . . 29, 46, 89, 93, 120

`itemsep` . . . . . 44, 96

`labelsep` . . . . . 39, 95, 119

`labelwidth` . . . . . 38–43, 95, 119

`label` . . . . . 28, 38, 40, 43, 106, 110

`lisparindent` . . . . . 96

`list-indent` . . . . . 29, 46, 106

`list-offset` . . . . . 46, 100, 103

`listparindent` . . . . . 46, 120

`mark-ans` . . . . . 71, 73, 78

`mark-pos` . . . . . 71, 133

`mark-ref` . . . . . 71, 73, 75, 78

`mini-env` 29, 36, 49, 58, 59, 73, 99, 110, 113, 114, 116, 117, 122

`mini-right*` . . . . . 29, 32, 49, 73, 113, 114, 116, 117

`mini-right` . . . . . 29, 32, 49, 57, 73, 113, 114, 116, 117

`mini-sep` . . . . . 29, 49, 73, 99

`no-store` . . . . . 31, 66–68, 73, 79, 89

`noitemsep` . . . . . 44

`nosep` . . . . . 44

`parindent` . . . . . 96

`parsep` . . . . . 44, 96, 120

`partopsep` . . . . . 44

`ref` . . . . . 28, 32, 40–42, 135

`resume*` . . . . . 28, 61, 62, 65–67, 73, 100, 117, 129

`resume` . . . . . 28, 35, 61–67, 73, 100, 117, 129

`rightmargin` . . . . . 46, 110

`save-ans` 30, 35, 62–66, 68, 69, 72–74, 79–81, 85, 87, 93, 101, 107, 108, 122–124, 127, 129, 135

`save-key` . . . . . 30, 62, 72, 97, 116

`save-pos` . . . . . 73

`save-ref` . . . . . 31, 37, 71, 73, 75, 77, 78, 86, 87, 93, 124

`save-sep` . . . . . 71, 73, 85, 124

`series` . . . . . 28, 61–65, 73, 97, 100, 116, 117, 129

`show-ans` . . . . . 71, 73, 75, 77, 78, 93, 108, 124

`show-length` . . . . . 33, 47, 134

`show-pos` . . . . . 30, 71, 75, 77, 78, 88, 93, 108, 124

`start*` . . . . . 29, 43, 44, 62

`start` . . . . . 29, 32, 43, 44, 62

`store-key` . . . . . 72

`topsep` . . . . . 44

`widest` . . . . . 28, 32, 43, 44

`wrap-ans` . . . . . 37, 71, 73, 75, 78

`wrap-label*` . . . . . 29, 39, 89, 90, 93, 94, 118, 119, 124

`wrap-label` 29, 39, 89, 90, 93, 94, 106, 108, 118, 119, 124

`wrap-opt` . . . . . 71, 73, 93, 108

keys commands:

`\keys_define:nn` 516, 538, 573, 589, 636, 707, 781, 807, 849, 882, 905, 981, 990, 1069, 1086, 1592, 1703, 1946, 2007, 2166, 2208, 2244, 2249, 2564, 2715, 2751, 3218, 3234, 3254, 3274, 5004, 5102, 5218, 5226

`\keys_if_exist_p:nn` . . . . . 5214, 5215

`\l_keys_key_str` 79, 82, 2582, 2737, 3242, 3260, 3282, 5261, 5369

`\keys_precompile:nnN` . . 128, 200, 200, 5006, 5010, 5014, 5018, 5022, 5026, 5244

`\keys_set:nn` . 530, 874, 1092, 1597, 1602, 1840, 1845, 1932, 1940, 2602, 3498, 3503, 3694, 4491, 4766, 5106, 5111, 5112, 5113, 5114, 5117, 5122, 5123, 5124, 5125,

5126, 5127, 5128, 5160, 5270

\keys_set_known:nn	2869
keyval commands:	
\keyval_parse:NNn	1717, 2274, 5078

L

label	587, 634, 707
Labels provide by <a href="#">enumext</a> :	
\Alph*	38
\Roman*	38
\alph*	38
\arabic*	32, 38
\roman*	38
\labelsep	3943, 3947
labelsep	514
\labelwidth	38
\labelwidth	3943, 3945
labelwidth	514
\lastkern	249
\lastnodetype	240
\lastskip	244
\leftmargin	95
\leftmargin	95, 3943
legacy commands:	
\legacy_if:nTF	4601, 4604, 4879, 4882
\legacy_if_gset_false:n	400, 4328
\legacy_if_set_false:n	4603, 4881
\legacy_if_set_true:n	4566, 4589, 4596, 4610, 4815, 4846
\linewidth	99
\linewidth	3602, 3638, 3704, 3775, 4106, 4141, 4172, 4294, 4359
\list	384
list-indent	880
list-offset	880
\listparindent	3946
listparindent	880

M

\makebox	110
\makebox	2379, 2381, 3201, 3361, 4044, 4634, 4891
\makelabel	89, 90, 94, 110
\makelabel	89, 93, 3183, 3199, 3345, 3359
\makesavenoteenv	435
mark-ans	2164
mark-pos	2164, 2206
mark-ref	2164
mini-env	1067
mini-sep	1067
\minipage	390
\miniright	11, 57, 1510, 1558, 1585, 3621, 3759
mode commands:	
\mode_if_math:TF	2645, 2699
\mode_if_vertical:TF	1146, 1175, 1196, 1220, 1371, 1392
\mode_leave_vertical:	857, 933, 947, 960, 973, 2377, 3156, 4628
msg commands:	
\msg_error:nn	1560, 1587, 2606, 2639, 2643, 2697, 2805, 3685, 3689, 3905, 3963, 4012, 4476, 4747, 4759, 5129, 5188
\msg_error:nnn	612, 659, 676, 729, 1514, 1521, 1526, 1556, 1583, 1852, 1856, 1971, 2588, 2647, 2665, 2677, 2685, 2689, 2693, 2701, 2743, 3248, 3266, 3288, 4480, 4752, 4992, 5001, 5071, 5176, 5207, 5216, 5253, 5274

\msg_error:nnnn	2591, 2619, 2623, 2627, 2631, 2746, 3251, 3269, 3291, 3676, 4008, 4016, 4742, 5052, 5256
\msg_error:nnnnn	560, 580, 2187
\msg_fatal:nn	3486
\msg_fatal:nnn	468
\msg_info:nnn	13, 16, 21, 24, 415, 431
\msg_line_context:	5334, 5339, 5344, 5373, 5378, 5383, 5398, 5413, 5417, 5421, 5425, 5429, 5433, 5440, 5447, 5453, 5467, 5471, 5476, 5480, 5484, 5488, 5493, 5497, 5501, 5505, 5510, 5545, 5549, 5554, 5559, 5563, 5568, 5644, 5648, 5653, 5658, 5663, 5667, 5671, 5675, 5679, 5683, 5687, 5691, 5695
\msg_log:nnn	1991, 1996, 2001
\msg_log:nnnnn	377, 2134, 2139, 2144
\msg_log:nnnnnn	369
\msg_new:nnn	5301, 5305, 5309, 5313, 5318, 5331, 5336, 5341, 5346, 5355, 5363, 5367, 5371, 5376, 5381, 5396, 5411, 5415, 5419, 5423, 5427, 5431, 5435, 5444, 5450, 5456, 5460, 5464, 5469, 5474, 5478, 5482, 5486, 5491, 5495, 5499, 5503, 5508, 5543, 5547, 5552, 5557, 5561, 5566, 5642, 5646, 5651, 5656, 5661, 5665, 5669, 5673, 5677, 5681, 5685, 5689, 5693
\msg_new:nnnn	5322, 5513, 5522, 5531, 5537, 5570, 5580, 5590, 5600, 5610, 5620, 5630, 5636
\msg_term:nnnn	1955, 1960, 3428, 3438, 3470, 3475
\msg_term:nnnnn	2115
\msg_warning:nn	3620, 3758
\msg_warning:nnnn	2152, 2158, 3376, 3381, 4195, 4208, 4244, 4257
\msg_warning:nnnnn	2110, 2120
\multicolsep	98
\multicolsep	1213, 1385, 3568, 3731

N

\NeedsTeXFormat	3
\NewCommandCopy	386
\newcounter	471
\NewDocumentCommand	1510, 2594, 4004, 4976, 5031, 5136, 5185, 5263
\NewDocumentEnvironment	3650, 3784, 3951, 4445, 4714
\newenvsc	2708
\newlabel	37
\newlabel	453
no-store	2005
\noindent	3609, 4303, 4368, 4687, 4952
\nointerlineskip	1222, 1225, 1394, 1397, 1548, 1575, 4303, 4368
noitemsep	805
\nopagebreak	1158, 1187, 1222, 1225, 1394, 1397, 1501, 1507
\normalfont	2553, 3078, 3091, 4866
nosep	805

P

Packages:

caption	113
enumext	27, 37, 40, 66, 95, 105, 133
enumitem	38
expl3	110
footnotehyper	37
hyperref	31, 32, 36, 37, 78, 87, 119, 133
ltxcmd	35
lua-visual-debug	52
multicol	27, 133
scontents	27, 80, 81
shortlst	110, 115, 120

\par . . . 1158, 1187, 1225, 1397, 1501, 1507, 1543, 1548, 1570, 1575, 2529, 3585, 3746, 3764, 3997, 4000, 4126, 4330, 4345, 4391, 4405, 4687, 4952

para commands:

  \para\_end: . . . . . 4704, 4970

\parbox . . . . . 2171

\parindent . . . . . 4667, 4932

\parsep . . . . . 50, 106

\parsep . . . . . 865, 3461, 3928, 3937, 3941

parsep . . . . . 805

\parskip . . . . . 4668, 4933

\partopsep . . . . . 3462, 3762, 3948

partopsep . . . . . 805

peek commands:

  \peek\_meaning:NTF 4545, 4559, 4574, 4585, 4794, 4808, 4823

  \peek\_meaning\_remove:NTF . . . . . 4552, 4801

  \peek\_remove\_spaces:n . . . . . 3325

\phantomsection . . . . . 37

\phantomsection . . . . . 442

prg commands:

  \prg\_do\_nothing: . . . . . 446

  \prg\_new\_protected\_conditional:Npnn . . . . . 218

  \prg\_replicate:nn . . . . . 235

  \prg\_return\_false: . . . . . 222

  \prg\_return\_true: . . . . . 221

\printkeyans . . . . . 18, 127, 5031

prop commands:

  \prop\_const\_from\_keyval:Nn . . . . . 5177

  \prop\_count:N 371, 2303, 2454, 2556, 2968, 3081, 3094, 4869, 5279

  \prop\_get:NnNTF . . . . . 5203

  \prop\_gput\_if\_not\_in:Nnn . . . . . 2301

  \prop\_if\_exist:NTF . . . . . 1989, 4996, 5272

  \prop\_item:Nn . . . . . 4998, 5296

  \prop\_new:N . . . . . 1992

\ProvidesExplPackage . . . . . 4

R

\raggedcolumns . . . . . 3571, 3734

\raisebox . . . . . 4075

\ref . . . . . 75, 86

ref . . . . . 587, 634, 707

\refstepcounter . . . . . 4613, 4884

regex commands:

  \regex\_match:nnTF . . . . . 220, 756, 758, 770, 772, 2801

  \regex\_replace\_once:nnN . . . . . 228

\renewcommand . . . . . 622, 667, 684, 737

\RenewDocumentCommand 1558, 1585, 3164, 3183, 3199, 3321, 3345, 3359, 3961, 4420

\RequirePackage . . . . . 17, 25

resume . . . . . 1701

resume\* . . . . . 1701

rightmargin . . . . . 880

\Roman . . . . . 38, 43

\Roman . . . . . 490

\roman . . . . . 38, 43

\roman . . . . . 491, 605, 5021

S

\s . . . . . 2802

save-ans . . . . . 1944

save-key . . . . . 2242

save-ref . . . . . 2164

save-sep . . . . . 2164

scan commands:

  \scan\_stop: . . . . . 3959, 4458, 4726, 4987, 4990

scontents internal commands:

  \l\_\_scontents\_fname\_out\_tl . . . . . 2761

  \\_\_scontents\_parse\_environment\_keys:n . 2767

  \\_\_scontents\_rescan\_tokens:n . . . . . 2774

  \l\_\_scontents\_storing\_bool . . . . . 2759

  \l\_\_scontents\_writing\_bool . . . . . 2760

seq commands:

  \seq\_clear:N . . . . . 5138, 5281

  \seq\_const\_from\_clist:Nn . . . . . 5131

  \seq\_count:N . . . . . 372, 3980, 5142

  \seq\_gclear:N . . . . . 4418, 4419

  \seq\_gput\_right:Nn . . . . . 2310, 4431, 4432

  \seq\_if\_empty:NTF . . . . . 4437, 5046, 5156

  \seq\_if\_exist:NTF . . . . . 1994, 5044

  \seq\_if\_in:NnNTF . . . . . 5050

  \seq\_item:Nn . . . . . 2799, 4119

  \seq\_map\_function:NN . . . . . 5147

  \seq\_map\_inline:Nn . . . . . 5059, 5065, 5157, 5158

  \seq\_map\_pairwise\_function:NNN . . . . . 4439

  \seq\_new:N . . . . . 124, 125, 127, 142, 172, 173, 1997

  \seq\_pop\_left:NN . . . . . 5146

  \seq\_put\_right:Nn . . . . . 4018, 5154, 5170, 5291

  \seq\_set\_from\_clist:Nn . . . . . 5139

  \seq\_set\_map\_e:NNn . . . . . 5148

  \seq\_use:Nn . . . . . 200, 201, 5287

series . . . . . 1701

\setcounter . . . . . 767, 771, 773, 3419, 3464, 3994

\setenumext . . . . . 7, 129, 5136

\setenumextmeta . . . . . 7, 131, 5177

show-ans . . . . . 2164, 2206

show-length . . . . . 979

show-pos . . . . . 2206

skip commands:

  \skip\_add:Nn 1117, 1126, 1135, 1148, 1152, 1177, 1181, 1198, 1256, 1258, 1272, 1275, 1296, 1298, 1312, 1315, 1335, 1337, 1351, 1354, 1373, 1422, 1423, 1434, 1436, 3937, 3944

  \skip\_gset:Nn . . . . . 1449, 1453, 1457

  \skip\_gset\_eq:NN . . . . . 3941

  \skip\_gzero\_new:N . . . . . 1444, 1445

  \skip\_horizontal:N 948, 961, 974, 4631, 4643, 4691, 4900, 4956

  \skip\_horizontal:n . . . . . 934, 2378, 2386, 3157, 3159, 4534, 4629, 4783, 4927

  \skip\_if\_eq:nnTF 1115, 1124, 1133, 1242, 1282, 1322, 1410, 1446, 1468, 1609, 1623, 1637, 1648, 1659, 1670, 1681, 1692

  \skip\_new:N 81, 82, 83, 88, 89, 90, 91, 92, 93, 148, 192

  \skip\_set:Nn 1100, 1104, 1163, 1167, 1192, 1245, 1246, 1264, 1285, 1286, 1304, 1324, 1325, 1343, 1367, 1413, 1414, 1428, 1448, 1452, 1470, 1474, 1478, 1484, 1488, 1492, 3921

  \skip\_set\_eq:NN 1203, 1204, 1206, 1213, 1378, 1379, 1380, 1385, 3417, 3460, 3461, 4668, 4933

  \skip\_sub:Nn 1252, 1254, 1268, 1270, 1292, 1294, 1308, 1310, 1331, 1333, 1347, 1349, 1420, 1421, 1432, 1433

  \skip\_use:N 1102, 1106, 1150, 1154, 1159, 1179, 1183, 1194, 1200, 1610, 1614, 1617, 1624, 1628, 1631, 3585

  \skip\_vertical:N . . . . . 401, 404, 872, 4329, 4343, 4706, 4972

  \skip\_vertical:n . . . . . 871, 4705, 4971

  \skip\_zero:N 1212, 1226, 1364, 1365, 1366, 1384, 1398, 3462, 3568, 3731, 3948, 3949



\skip_zero_new:N	1443, 1465, 1466, 1467
\c_zero_skip	401, 404, 872, 1115, 1124, 1133, 1283, 1322, 1446, 1468, 1610, 1624, 1637, 1648, 1659, 1670, 1681, 1692, 4329, 4343, 4706, 4972
\small	5009, 5013, 5017, 5021, 5025, 5029
socket commands:	
\socket_assign_plug:nn	3830, 3838, 3846, 3880, 3888, 3896
\socket_new:nn	3802, 3850
\socket_new_plug:nnn	3803, 3810, 3818, 3851, 3858, 3867
\socket_use:n	3831, 3881
\socket_use:nn	3839, 3847, 3889, 3897
\star	3222
start	779
start*	779
start-list-tags	3802, 3850
\stepcounter	3931, 4068, 4424
stop-list-tags	3802, 3850
stop-start-tags	3802, 3850
str commands:	
\c_backslash_str	2647, 5334, 5339, 5344, 5349, 5351, 5353, 5358, 5360, 5458, 5462, 5466, 5476, 5480, 5488, 5489, 5493, 5505, 5506, 5510, 5511, 5532, 5534, 5538, 5540, 5568, 5631, 5633, 5637, 5639, 5648, 5649, 5653, 5658, 5659, 5663, 5667, 5671
\c_colon_str	2453, 2967, 4987
\c_left_brace_str	5439, 5446, 5452
\c_right_brace_str	5439, 5446, 5452
\str_case:nn	256, 315
\str_case:nnTF	1724, 1732, 2281, 2289, 5085, 5094
\str_clear:N	3495, 4490
\str_count:n	235
\str_if_empty:N	1741, 1782, 1809
\str_if_eq:nnTF	3420, 3466, 5187
\str_if_in:nnTF	4983
\str_new:N	84, 132, 147, 187
\str_set:Nn	545, 551, 557, 576, 577, 578, 2184, 2185, 2211, 2212, 3911, 3914
\str_use:N	3203
\string	435
\strutbox	1231, 1234, 1245, 1246, 1257, 1259, 1274, 1277, 1285, 1286, 1297, 1299, 1314, 1317, 1324, 1325, 1336, 1338, 1353, 1356, 1402, 1405, 1413, 1414, 1422, 1423, 1435, 1437, 1448, 1449, 1452, 1459, 1472, 1480, 1486, 1494, 3939, 3944, 3997, 4081

T

tag commands:	
\tag_mc_begin:n	3808, 3856, 3865
\tag_mc_end:	3812, 3860, 3869
\tag_resume:n	3805, 3853, 3967, 3975, 4038, 4123, 4313, 4377
\tag_struct_begin:n	3806, 3807, 3814, 3815, 3816, 3854, 3855, 3862, 3863, 3864, 3976
\tag_struct_end:	3990, 3991
\tag_struct_end:n	3813, 3820, 3821, 3822, 3823, 3861, 3870, 3871, 3872, 3873, 4464, 4732
\tag_suspend:n	3824, 3874, 3957, 3969, 3985, 4029, 4115, 4456, 4724
\tag_tool:n	3968
T <sub>E</sub> X and L <sup>A</sup> T <sub>E</sub> X <sub>ε</sub> commands:	
\@auxout	451
\@currentenv	256, 315
\protected@write	451

tex commands:	
\tex_newlinechar:D	2773
text commands:	
\text_expand:n	4979
\textasteriskcentered	2181, 2198
\the	244, 249
\thepage	457
tl commands:	
\c_space_tl	3049, 5383, 5398, 5421, 5425, 5612, 5613, 5622, 5623, 5683, 5687
\tl_clear:N	543, 550, 2162, 2228, 2238, 2259, 2267, 2473, 2793, 2794, 2908, 2984, 4829
\tl_clear_new:N	500
\tl_const:Nn	50, 484
\tl_gclear:N	363, 364, 365, 1762, 1767, 2883, 3194, 3212, 4349, 4409, 4632
\tl_gclear_new:N	1749
\tl_gput_right:Nn	485
\tl_greplace_all:Nnn	506
\tl_gset:Nn	291, 292, 306, 307, 1750, 1763, 1768, 1987, 2797, 3133, 4580
\tl_gset_eq:NN	502, 3129, 4625
\tl_if_blank:nTF	2586, 2604, 2741, 3246, 3264, 3286, 4623, 5251
\tl_if_empty:N	610, 629, 657, 674, 694, 701, 727, 744, 1775, 1780, 1802, 1807, 1865, 1929, 1937, 1966, 2026, 2317, 2348, 2493, 2838, 2860, 2890, 2918, 2994, 3043, 3154, 4832, 5168
\tl_if_empty:nTF	1830
\tl_if_exist:N	1835
\tl_if_novalue:nTF	2600, 2916, 2992, 3028, 3108, 3127, 3135, 3296, 3493, 3978, 4422, 4488, 4764, 4830
\tl_map_inline:Nn	226, 503
\tl_new:N	42, 43, 44, 47, 52, 53, 56, 57, 63, 65, 66, 68, 69, 105, 106, 107, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 126, 128, 129, 130, 133, 136, 137, 155, 163, 164, 165, 168, 186
\tl_put_left::Ne	2827
\tl_put_left:Nn	2325, 2356, 2478, 2821, 2834, 2840, 2850, 3060, 3100, 4333, 4394, 4851, 4854
\tl_put_right:Nn	501, 620, 665, 682, 735, 2329, 2360, 2407, 2417, 2430, 2445, 2451, 2456, 2480, 2485, 2492, 2495, 2505, 2510, 2513, 2519, 2911, 2914, 2920, 2925, 2952, 2957, 2962, 2965, 2974, 2987, 2990, 2996, 3001, 3011, 4834, 4838
\tl_remove_all:Nn	5167
\tl_remove_once:Nn	2395, 2937
\tl_replace_all:Nnn	505, 5202
\tl_reverse:N	2394, 2396, 2936, 2938
\tl_set:Nn	58, 260, 270, 319, 320, 327, 328, 335, 336, 470, 544, 549, 555, 556, 609, 654, 726, 931, 945, 958, 971, 1864, 1965, 2229, 2239, 2260, 2268, 2550, 2761, 3030, 3075, 3088, 4840, 4863, 5165, 5201, 5271
\tl_set_eq:NN	511, 615, 618, 662, 664, 679, 681, 732, 734, 2393, 2935, 2948, 3308, 3313, 4056, 4058
\tl_to_str:n	1835, 1841, 1846, 4979
\tl_trim_spaces:n	501, 5154, 5165, 5171, 5187
\tl_use:N	507, 510, 631, 696, 703, 746, 1005, 1009, 1013, 1017, 1021, 1025, 1029, 1033, 1037, 1041, 1045, 1049, 1053, 1057, 1061, 1065, 2383, 2400, 2408, 2419, 2432, 2437, 2448, 3116, 3122, 3150, 3185, 3186, 3193, 3205, 3299, 3303, 3311, 3347, 3348, 3354, 3363, 3657, 3790, 4061, 4340, 4401, 4636, 4665, 4666, 4893, 4922, 4925, 4930, 5034, 5035, 5036, 5037, 5038, 5055, 5150, 5269

token commands:

<code>\token_to_str:N</code>	453
<code>\topsep</code>	3762, 3944
<code>topsep</code>	805
<code>\topskip</code>	1212, 1384
<code>\typeout</code>	244, 249, 419, 423, 434, 435

U

<code>\u</code>	229, 2802
<code>\unkern</code>	250
<code>unknown</code>	3232, 3254, 3272
<code>\unskip</code>	245
use commands:	
<code>\use:N</code>	236, 3190, 3209, 3659
<code>\use:n</code>	1715, 2272, 4985, 5076
<code>\use_none:nn</code>	445, 5208
<code>\usecounter</code>	3418, 3463

V

<code>\value</code>	1778, 1784, 1791, 1797, 1805, 1811, 1818, 1824
vbox commands:	
<code>\vbox_set:Nn</code>	4031
<code>\vbox_set_top:Nn</code>	4338, 4399
<code>\vspace</code>	865, 1614, 1617, 1628, 1631, 1641, 1643, 1652, 1654, 1663, 1665, 1674, 1676, 1685, 1687, 1696, 1698

W

<code>widest</code>	779
<code>wrap-ans</code>	2164
<code>wrap-label</code>	514
<code>wrap-label*</code>	514
<code>wrap-opt</code>	2164

Z

<code>\z</code>	2802
-----------------	------