

# enumext

ENUMERATE EXERCISE SHEETS

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©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 L<sup>A</sup>T<sub>E</sub>X 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

1	Introduction	2	6	The storage system	11
1.1	Description and usage	3	6.1	Keys for storage system	11
1.2	The concept of left margin	3	6.1.1	Keys for <code>label</code> and <code>ref</code>	12
1.3	User interface	4	6.1.2	Keys for <code>wrap</code> and <code>display</code>	12
1.3.1	Internal counters	4	6.1.3	Keys for <code>debug</code> and <code>checking</code>	12
1.3.2	Public dimension	4	6.2	The command <code>\anskey</code>	13
1.3.3	Support for <code>multicol</code>	4	6.2.1	Keys for <code>\anskey</code>	13
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>	14
1.3.6	Support for <code>\footnote</code>	4	6.4	The environment <code>keyans</code>	14
2	The environments provided	5	6.4.1	The <code>\item*</code> in <code>keyans</code>	15
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>	16
2.3	The command <code>\item*</code>	5	6.6	Printing stored content	17
2.3.1	Keys for <code>\item*</code>	6	6.6.1	The command <code>\getkeyans</code>	17
2.4	The command <code>\item</code> in <code>enumext*</code>	6	6.6.2	The command <code>\foreachkeyans</code>	17
3	The command <code>\setenumext</code>	6	6.6.3	The command <code>\printkeyans</code>	17
4	The command <code>\setenumextmeta</code>	6	7	Full examples	19
5	The <code>keyval</code> system	7	8	Tagged PDF examples	21
5.1	Keys for <code>label</code> and <code>ref</code>	7	9	The way of non-enumerated lists	21
5.2	Keys for spaces	8	10	References	23
5.2.1	Vertical spaces	8	11	Change history	24
5.2.2	Horizontal spaces	9	12	Index of Documentation	25
5.3	Keys for <code>add code</code>	9	13	Implementation	27
5.4	Keys for <code>start</code> , <code>series</code> and <code>resume</code>	10	14	Index of Implementation	141
5.5	Keys for <code>multicols</code>	10			
5.6	Keys for <code>minipage</code>	10			
5.6.1	The command <code>\miniright</code>	11			
5.6.2	The key <code>mini-right</code>	11			

## Motivation and acknowledgments

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

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

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

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

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License and Requirements

Permission is granted to copy, distribute and/or modify this software under the terms of the LaTeX Project Public License (lpp), version 1.3 or later (<https://www.latex-project.org/lpp1.txt>). The software has the status “maintained”.  
The enumext package loads and requires multicol[3] and scontents[4] packages, need to have a modern TeX distribution such as TeX Live or MiKTeX. It has been tested with the standard classes provided by 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>X 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>X is cool?

\* 

Very True!

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

\* 

Yes

(b) Usually uses the package manager?

\* 

Yes, dnf

(c) Rate the following package and class

i. xsim-exam

\* 

doesn't exist for now :(

ii. xsim

\* 

very good

iii. exsheets

\* 

obsolete

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

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

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

1.  $(x - 1)^2$

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

3. (a) False

(b) Very True!

4. (a) Yes
- ⌘ (b) Yes, dnf

⌘ (c) i. doesn't exist for now :(

⌘ ii. very good

⌘ iii. obsolete

⌘

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

1. First type of questions

A) value

B) correct

C) value

D) value

2. Second type of questions

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

II.  $\alpha = \delta$

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

A) I only

B) II only

C) I and II only

D) I and III only

E) I, II, and III

\* 3. Third type of questions

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

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

A) value

B) value

C) value

D) value

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

A

A)

B


B)

A

C)

A

D)



E)

5. Question with image on left side:

A) value

B) value

C) value

D) correct

E) value

B
- Where what we are interested in the  $\langle label \rangle$  and a “short note” that we leave as an explanation, and then print them:
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- 2 / 156

1. B)  $x = 5$

2. D)

3. C) some note
- ⌘ 4. E) A duck

⌘ 5. D) “other note”

⌘
- ⌘

⌘

⌘

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

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

1.1 Description and usage

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

- 🔗

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

This package can be used with `xelatex`, `lualatex`, `pdflatex` and the classical `latex»dvips»ps2pdf` and is present in  $\text{\TeX}$  Live and  $\text{MiK}\text{\TeX}$ , 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 `mktexlsr`. To produce the documentation run `lualatex enumext.dtx` two times.

enumext.sty

enumext.pdf

README.md

enumext.dtx

»

»

»

»

TDS:tex/latex/enumext/

TDS:doc/latex/enumext/

TDS:doc/latex/enumext/

TDS:source/latex/enumext/

The package is loaded in the usual way:

\usepackage{enumext}

1.2 The concept of left margin

There is a direct relationship between the parameters `\leftmargin`, `\itemindent`, `\labelwidth` and `\labelsep` plus an “*extra space*” that makes it difficult to obtain the desired *horizontal spaces* in a `list` environment.

Usually we don’t want the `list` to go beyond the left margin of the page, but since these four values are related, that causes a problem. The `enumitem`[6] package adds the `\labelindent` parameter to solve some of these problems. A simplified representation of this in the figure 1.



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

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

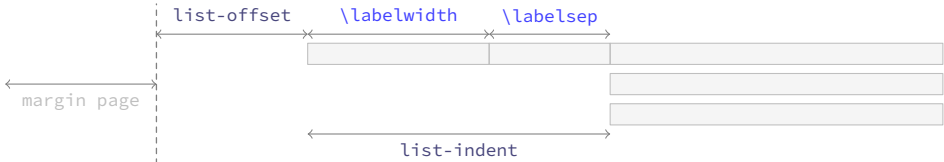


Figure 2: Representation of horizontal lengths concept in `enumext`.

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

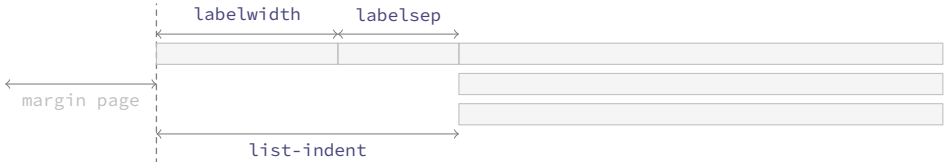


Figure 3: Default horizontal lengths `list-offset=0pt`, `list-indent=\labelwidth+\labelsep` in `enumext`.

### 1.3 User interface

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

#### 1.3.1 Internal counters

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

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

#### 1.3.2 Public dimension

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

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

#### 1.3.3 Support for multicol

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



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

The “non starred” version of the `multicols` environment is always used together with the `\raggedcolumns` command and is controlled by `columns` and `columns-sep` keys. It can be used in all nesting levels of the environment `enumext` and the environment `keyans` and can together with the `mini-env` key. If you need to force a start a new column `\columnbreak` must be used (see §5.5).

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

#### 1.3.4 Support for minipage

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



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

The `minipage` environments on “left side” and “right side” is always used with “aligned on top” `[t]`. It can be used in all nesting levels of the environment `enumext` and the environment `keyans` and is controlled by `mini-env` and `mini-sep` keys. In order to switch from the “left” side `minipage` environment to the “right” side one must use the command `\miniright` (see §5.6).

#### 1.3.5 The \label and \ref system

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

#### 1.3.6 Support for \footnote

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 L<sup>A</sup>T<sub>E</sub>X, `\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 content*” in the environment is placed within a `minipage` environment whose *width* is stored in the dimension `\itemwidth` that NOT includes `labelwidth`, `labelsep`, only the *width of the content*.
- You cannot have floating environments like `figure` or `table` but `\footnote` with `hyperref` support is supported if the `footnotehyper` package is loaded.
- You cannot have any standard list environments like `itemize`, `enumerate`, `description`, `quote`, `quotation`, `verse`, `center`, `flushleft`, `flushright`, `verbatim`, `tabbing`, `trivlist`, `list` and all environments created with `\newtheorem`.

Example with `columns=2`

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

2.3 The command \item\*

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

The `\item*`, `\item*[\langle symbol \rangle]` and `\item*[\langle symbol \rangle][\langle offset \rangle]` works like the numbered `\item`, but placing a `\langle symbol \rangle` to the “left” of the `\langle label \rangle` separated from it by the `\langle offset \rangle` set by the the *second optional argument*. The default values for `\langle symbol \rangle` and `\langle offset \rangle` are `\textasteriskcentered ‘*’` 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: \textasteriskcentered  
Sets the *symbol* to be displayed in the “left” of the box containing the current <label> set by `labelwidth` key for `\item*` in `enumext` and `enumext*`. The *symbol* can be in *text* or *math* mode, for example `item-sym*={\star}`.  
`item-pos*` = {<rigid length>} default: by levels  
Sets the *offset* between the box containing the current <label> defined by `labelwidth` key and the <symbol> set by `item-sym*` key. The default values are set by `labelsep` key at each level. If positive values are passed it will *offset to the left* and if negative values are passed it will *offset to the right*.

2.4 The command \item in enumext\*

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

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

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

3 The command \setenumext

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

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

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

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

4 The command \setenumextmeta

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

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

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



## 5 The keyval system

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

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

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

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

### 5.1 Keys for label and ref

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

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

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

`label` = {  $\langle \backslash alph* | \backslash Alph* | \backslash arabic* | \backslash roman* | \backslash Roman* \rangle$  } 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{\backslash alph*}` will return an error. For full customization of how  $\langle label \rangle$  is displayed use the `font`, `wrap-label` and/or `wrap-label*` keys.

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

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

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

Sets the *width* of the box containing the current  $\langle label \rangle$  set by `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` = {  $\langle code \{ \#1 \} \text{ more code} \rangle$  } 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*` = {  $\langle code \{ \#1 \} \text{ more code} \rangle$  } default: *empty*

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

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

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

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

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

## 5.2 Keys for spaces

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

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

### 5.2.1 Vertical spaces

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

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

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

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

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

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

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

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

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

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

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

`noitemsep` *<value forbidden>* default: *not used*

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

`nosep` *<value forbidden>* default: *not used*

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

`base-fix` *<value forbidden>* default: *not used*

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



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

`above = {<rubber length> | <rigid length>}` default: *not used*

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

`above* = {<rubber length> | <rigid length>}` default: *not used*

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

`below = {<rubber length> | <rigid length>}` default: *not used*

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

`below* = {<rubber length> | <rigid length>}` default: *not used*

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

### 5.2.2 Horizontal spaces

`itemindent = {<rigid length>}` default: *0pt*

Extra *horizontal indentation*, beyond `labelsep`, of the “first line” off each item. This value must be greater than or equal to *0pt* and is applied internally using `\hspace` without modifying the value of `\itemindent`.

`rightmargin = {<rigid length>}` default: *0pt*

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

`listparindent = {<rigid length>}` default: *0pt*

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

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

`before = {<code>}` default: *not used*

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

`before* = {<code>}` default: *not used*

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

`first = {<code>}` default: *not used*

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

- Keep in mind that the code set in this key will affect the entire “body” of the environment and therefore the inner levels of the list and the `keyans` environment. It is recommended to set this key per level. In the `enumext*` and `keyans*` environments this key is executed within the `minipage` environment in which “item content” is placed.

`after = { {code} }` default: *not used*  
 Execute { {code} } “after” finishing the environment. The { {code} } must be passed between braces.

## 5.4 Keys for start, series and resume

`start = { {integer | integer expression} }` default: `1`  
 Sets the *start value* of the numbering on the current level. The { {integer expression} } must be passed between braces, internally is evaluated and pass to the counter defined by `label` key on the current level, i.e. it is equivalent to enter `start={\dimeval{100*\value{chapter}}}` or `start={100*\value{chapter}}`.

`start* = { {integer | string} }` default: *not used*  
 Sets the *start value* of the numbering on the current level. Internally { {string} } is converted and passed as value to the counter defined by `label` key on the current level, i.e. it is equivalent to enter `start=5`, `start=E` or `start=v`.

The following { {keys} } are “only” available for the `enumext*` environment and the “first level” of the `enumext` environment and are ignored if set when nested within each other.

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

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

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

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

## 5.5 Keys for multicols

`columns = { {integer} }` default: `1`  
 Set the *number of columns* to be used by the `multicols` environment within the environment. The value must be a positive integer less than or equal to `10`.

`columns-sep = { {rigid length} }` default: *by level*  
 Set the *space between columns* used by the `multicols` environment within the environment. Internally sets the value of `\columnsep`, by default its value is equal to the sum of the values set in the keys `labelwidth` and `labelsep` of the current level.

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

## 5.6 Keys for minipage

`mini-env = { {rigid length} }` default: *not used*  
 Sets the *width* of the `minipage` environment on the “right side”. This value added to the value set by the `mini-sep` key to determines the *width* of the `minipage` environment on the “left side”, taking `\linewidth` as the maximum reference value.

`mini-sep = { {rigid length} }` default: `0.3333em`  
 Sets the *space between* the `minipage` environment on the “left side” and the `minipage` environment on the “right side”. This separation is applied together with `\hfill`.

### 5.6.1 The command `\miniright`

---

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

---

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

The *starred argument* “\*” inhibits the use of `\centering` command i.e. the usual  $\TeX$  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 `<key>` is “*active*” the `\anskey` command and the environments `anskey*`, `keyans`, `keyans*` and `keyanspic` are available.

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

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

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

### 6.1 Keys for storage system

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

```
save-ans = {<store name>} default: not set
```

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

```
save-key = {<key list>} default: not set
```

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

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

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

`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  $\{\langle code \rangle\}$  must be passed between braces and only affects the current *optional argument* and NOT the “*stored content*” in the *sequence* and *prop list*  $\{\langle store\ name \rangle\}$  set by `save-ans` key. If this key is passed using `\setenumext` it is necessary to use double ‘ $\{\#\#1\}$ ’.

`show-ans = {⟨true | false⟩}` default: false  
 Displays the *argument* passed to the `\anskey`, the *body* for `anskey*` environment, the  $\langle label \rangle$  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*  $\{\langle store\ name \rangle\}$  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`  $\langle value\ forbidden \rangle$  default: not used  
 This is a *meta-key* that does not receive an argument and disables the structure stored in the *sequence*  $\{\langle store\ name \rangle\}$  set by `save-ans` key at the entire level or a nested environment in which it runs. This key is intended for use in internal levels or nested `enumext` or `enumext*` environments in which you want to use `enumext` or `enumext*` but “*without*” using the `\anskey`, “*without*” use `anskey*`, “*without*” interfering with the `check-ans` key and “*without*” storing an unwanted structure in the *sequence*  $\{\langle store\ name \rangle\}$ .



6.2 The command \anskey

`\anskey` `\anskey[⟨keys⟩]{⟨content⟩}`

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

If `save-ref` key are active and the `hyperref`[8] package is detected, `\hyperlink` and `\hypertarget` will be used, otherwise the usual “label and ref” system provided by L<sup>A</sup>T<sub>E</sub>X will be used.

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

6.2.1 Keys for \anskey

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

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

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

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

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

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

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

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

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

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

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

Example

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

1. Text containing our instructions or questions.

\* first answer

2. Text containing our instructions or questions.

(a) Question.

\* second answer
3. Text containing our instructions or questions.

\* third answer

4. Text containing our instructions or questions.

\* fourth answer

6.3 The environment anskey\*

`anskey*` `\begin{anskey*}[⟨key = val⟩] ⟨body content⟩ \end{anskey*}`

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

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

The `anskey*` environment is implemented using the `scontents` package, for the correct operation `\begin{anskey*}` and `\end{anskey*}` must be in different lines, all `⟨keys⟩` must be passed separated by commas and “without separation” of the start of the environment. Comments “%” or “any character” after `\begin{anskey*}` or `[⟨key = val⟩]` on the same line are NOT supported, the package `scontents` will return an “error” message if this happens. In a similar way comments “%” or “any character” after `\end{anskey*}` on the same line the package `scontents` will return a “warning” message.

### 6.3.1 Keys for anskey\*

The `anskey*` environment uses the same  $\langle keys \rangle$  as the `\anskey` command next to the keys inherited from package `scontents`. The environment is available for all levels of the `enumext` environment and the `enumext*` environment, but it is disabled for the `keyans`, `keyans*` and `keyanspic` environments.

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

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 = { \true | false }`

default: *false*

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

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

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}
```

- |   |   |
|---|---|
| * 5. Text containing our instructions or questions. | 7. Text containing our instructions or questions. |
| [5] First answer with verbatim                      | [7] third answer                                  |
| 6. Text containing our instructions or questions.   | 8. Text containing our instructions or questions. |
| (a) Question.                                       | [8] fourth answer                                 |
| [6] second answer                                   |   |

## 6.4 The environments keyans and keyans\*

keyans	<code>\begin{keyans}[\langle key = val \rangle] \item \item[\langle custom \rangle] \item* \item*[\langle content \rangle] \end{keyans}</code>
keyans*	<code>\begin{keyans*}[\langle key = val \rangle] \item \item[\langle custom \rangle] \item* \item*[\langle content \rangle] \end{keyans*}</code>

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.

<code>\begin{enumext}[save-ans=test]</code>	<code>\begin{enumext}[save-ans=test]</code>
<code>\item \langle item content \rangle</code>	<code>\item \langle item content \rangle</code>
<code>\begin{keyans}[\langle key = val \rangle]</code>	<code>\begin{keyans*}[\langle key = val \rangle]</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 item content \rangle</code>	<code>\item* \langle item content \rangle</code>
<code>\item*[\langle content \rangle] \langle item content \rangle</code>	<code>\item*[\langle content \rangle] \langle item content \rangle</code>
<code>\end{keyans}</code>	<code>\end{keyans*}</code>
<code>\end{enumext}</code>	<code>\end{enumext}</code>

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

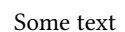


### 6.4.1 The `\item*` in `keyans` and `keyans*`

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

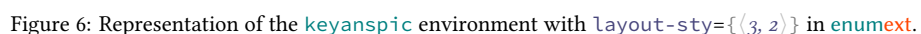
- ### Example

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



## 6.5 The environment keyanspic

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



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

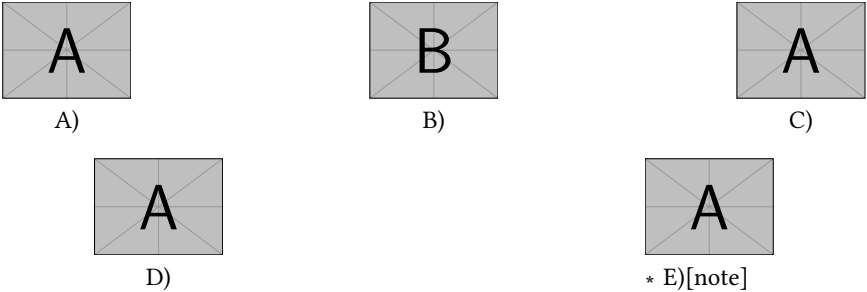
  \item Question with images.

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

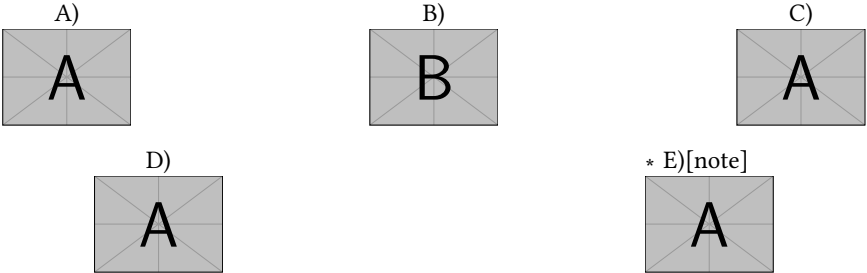
  \item Question with images.

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

1. Question with images.



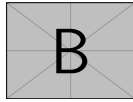
2. Question with images.



3. 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: {;}  
 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=1,show-pos=true,nosep,save-ref=true]
  \item Factor  $3x+3y+3z$ . \anskey{ $3(x+y+z)$ }
  \item True False

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

  \item Related to Linux

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

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

```
\printkeyans{sample}
```

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

[1]

2. True False

(a) ~~LaTeXe~~ is cool?

[2]

3. Related to Linux

(a) You use linux?

[3]

(b) Rate the following package and class

i. `xsim`

[4]

ii. `exsheets`

[5]

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

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


7 Full examples

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

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

and then you can use the excellent [arara](#)<sup>1</sup> tool to compile them.

Example 1

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

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

A

 36 km/h.

B

 360 km/h.

C

 27,8 km/h.

D

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

A

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

B

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

C

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

D

 $1 \text{ \AA} = 1 \times 10^3 \text{ fm}$ .
3. La velocità di  $1,00 \times 10^2$  m/s espressa in km/h è:

A

 36 km/h.

B

 360 km/h.

C

 27,8 km/h.

D

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

A

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

B

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

C

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

D


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

2. A

3. B

4. A

Example 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.

C

 27,8 km/h.

D

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

☒ A

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

B

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

C

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

D


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

☒ 2. A

3. B

☒ 4. A

Example 3

A “simple multiple choice” test .

1. First type of questions

A) value

B) correct

C) value

D) value

2. Second type of questions

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

II.  $\alpha = \delta$

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

☒ A

 I only

☒ B

 II only

☒ C

 I and II only

☒ D

 I and III only

☒ E

 I, II, and III

3. Third type of questions

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

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

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

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19 / 156

A value

B value

C value

D value

E value

4. Question with image and label below:

A

A

B


B

A

C

A

D



E

5. Question with image on left side:

A value

B value

C value

D correct

E value

B

Test keys

1. B),  $x = 5$

2. D

3. C, some note
- ✖ 4. E, A duck


✖ 5. D, other note


✖
- ✖


✖

✖


Example 4

A “simple worksheet” using ducks :) 

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


 Factor  $3x + 3y + 3z$

The following questions need to be cuaqtified :)

 True False

(a)  $\alpha > \delta$

(b) ~~LaTeX~~e is cool?

 Related to Linux

(a) You use linux?

(b) Usually uses the package manager?

(c) Rate the following package and class

i. xsim-exam

ii. xsim

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

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

3. (a) False

(b) Very True!

4. (a) Yes

✖ (b) Yes, dnf

✖ (c) i. doesn't exist for now :(


✖ ii. very good

✖ iii. obsolete

✖

✖

✖

✖
- Example 5
- Adapted from the response given by Stephen in SAT like question format 
- 1

Which choice best describes what happens in the passage?

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

B) One character receives a surprising request from another character.

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

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

2

Which choice best describes what happens in the passage?

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

B) One character receives a surprising request from another character.

3

Which choice best describes what happens in the passage?

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

B) One character receives a surprising request from another character.

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

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

4

Which choice best describes what happens in the passage?

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20 / 156













- |  |  |
|--|--|
| A) One character argues with another character who intrudes on her home. | C) One character reminisces about choices she has made over the years.                     |
| B) One character receives a surprising request from another character.   | D) One character criticizes another character for pursuing an unexpected course of action. |
1. A)                      2. C)                      3. B)                      4. D)

## 8 Tagged PDF examples

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

To compile the tests with `lualatex-dev` the packages `multicol`, `scontents`, `unicode-math`, `geometry`, `graphicx` and `hyperref` are required.

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

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

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

### Fake description environment

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

**Something** A short one-line description.

This is an entry *without* a label.

**Something** A short *one-line* description text.

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

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

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

**Something** A short one-line description.

This is an entry *without* a label.

**Something** A short *one-line* description text.

**Something long** A much *longer* description text may take more than one line or more than one paragraph. Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.

- The small space at the beginning of the “*unlabeled entry*” corresponds to `\labelsep` and can be removed using `\hspace{-\labelsep}` at the beginning of the line.

Description indented by label

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

```
\newlength{\descitemwd}
\settowidth{\descitemwd}{\textbf{Something long}}

and then use labelsep=4pt,labelwidth=\descitemwd,font=\bfseries.
```

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

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

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

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

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

Description with multi-line labels

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

```
\NewDocumentCommand \labelbx { s +m }
{%
  \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.  
**long** 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.

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## 11 Change history

**v1.0** 2024-10-06 – First public release.

12 Index of Documentation

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

C		F	
Document class:		\footnote	5
article	2	I	
book	2	\itemsep	8
exam	2	K	
letter	2	Keys for \anskey provide by enumext:	
report	2	break-col	13
\columnbreak	4, 13	item-join	13
\columnsep	10	item-pos*	13
Commands provide by enumext:		item-star	13
\anskey	11-14	item-sym*	13
\anspic	11, 12, 15, 16	Keys for \foreachkeyans provide by enumext:	
\foreachkeyans	17	after	17
\getkeyans	12, 17	before	17
\item*	5-7, 11, 12, 14, 15	sep	17
\item	5-7, 9, 11, 12, 14	start	17
\miniright	11	step	17
\printkeyans	6, 12, 17	stop	17
\setenumextmeta	6	wrapper	17
\setenumext	5-7, 11, 12, 14, 15, 18	Keys for anskey* provide by enumext:	
Counters defined by enumext:		break-col	13
enumXiii	4	force-eol	14
enumXii	4	item-join	13
enumXiv	4	item-pos*	13
enumXi	4	item-star	13
enumXviii	4	item-sym*	13
enumXvii	4	overwrite	14
enumXvi	4	write-env	14
enumXv	4	Keys for environments provide by enumext:	
E		above*	9
Environments provide by enumext:		above	8, 9
anskey*	11-14, 21	after	10, 11
enumet*	21	align	7, 21, 22
enumext*	4-15, 17, 18	base-fix	8
enumext	4-15, 17, 18, 21	before*	9
keyans*	4-15, 21	before	9
keyanspic	4, 7, 8, 11-15, 21	below*	9
keyans	4-8, 10-16, 21	below	9
Environments:		check-ans	12
Verbatim	14	columns-sep	4, 10, 21
center	5	columns	4, 9, 10, 21
description	5, 21	first	9
enumerate	1, 3, 5, 23	font	7
figure	5	item-pos*	5, 6
flushleft	5	item-sym*	5, 6
flushright	5	itemindent	9
itemize	5, 21	itemsep	8
keyans	21	labelsep	3-7, 9, 10, 12, 21, 22
list	3, 5, 9, 23	labelwidth	3, 4, 6, 7, 9, 10, 12, 21, 22
minipage	3-5, 8, 10, 11, 21, 23	labelwith	5
multicols	3, 4, 10, 21	label	7, 8, 10, 15, 21, 22
quotation	5	layout-sty	15
quote	5	list-indent	3, 9
tabbing	5	list-offset	3, 9, 22
table	5	listparindent	9
task	5	mark-ans	12
trivlist	5	mark-pos	12
verbatim	5	mark-ref	12
verse	5	mini-env	4, 9-11, 21

mini-right*	7, 11	\Roman*	7, 8
mini-right	7, 11, 21	\alph*	7, 8
mini-sep	4, 10, 11	\arabic*	7, 8
mode-box	7	\roman*	7, 8
no-store	11-13, 21	\labelsep	3, 7
noitemsep	8	\labelwidth	3, 7
nosep	8, 21	\linewidth	10
overwrite	14	\listparindent	9
parsep	8, 16		
partopsep	8	<b>P</b>	
ref	4, 8, 21	Packages:	
resume*	7, 10, 11	enumerate	22
resume	7, 10, 11	enumext	1-5, 7, 15, 21-23
rightmargin	9	enumitem	3-5, 9, 22, 23
save-ans	4, 6, 10-17, 21	fancyvrb	14
save-key	10-12, 18	footnotehyper	5
save-ref	4, 7, 12, 13, 17, 21	geometry	21
save-sep	12, 21	graphicx	21
series	7, 10, 11	hyperref	4, 5, 12, 13, 21, 23
show-ans	12, 21	l3keys	7
show-length	8	l3prop	1, 23
show-pos	12, 17	l3seq	1, 23
start*	10	multicol	1, 2, 4, 21, 23
start	10	scontents	1, 2, 13, 14, 21
topsep	8, 9	task	5, 6
widest	7	unicode-math	21
wrap-ans	12	xsim	2
wrap-label*	7, 22	\parsep	8
wrap-label	7, 21, 22	\partopsep	8
wrap-opt	12		
write-env	14	<b>R</b>	
		\raggedcolumns	4
<b>L</b>		\ref	4
\label	4	\rightmargin	9
Labels provide by enumext:			
\Alph*	7, 8, 15	<b>T</b>	
		\topsep	8



## 13 Implementation

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

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

### 13.1 General conventions

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

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

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

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

### 13.2 Initial set up

Start the DocStrip guards.

```
1 <*package>
```

Identify the internal prefix (L<sup>A</sup>T<sub>E</sub>X3 DocStrip convention) for l3doc class.

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

### 13.3 Declaration of the package

First we will make sure we have a minimum (super updated) version of L<sup>A</sup>T<sub>E</sub>X to work correctly.

```
3 \NeedsTeXFormat{LaTeX2e}[2024-06-01]
```

Now declare the `enumext` package.

```
4 \ProvidesExplPackage
5   {enumext}
6   {2024-10-06}
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 }
```

### 13.4 Definition of variables

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

```

\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:` (§13.5.1).

```

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` (§13.10) and then modified by the function `\__enumext_label_style:Nnn` used by `label` key (§13.13).

```

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 (§13.13).

```

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 (§13.24).

```

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` (§13.14) and `label` (§13.12) 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 (§13.17). The variables `\__enumext_leftmargin_X_dim` and `\__enumext_itemindent_X_dim` are used and set by the function `\__enumext_calc_hspace:NNNNNNNNNN` (§13.37.1).

```
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
\__enumext_multicols_right_X_skip
\__enumext_align_label_pos_X_str
```

Internal variables used by `columns` key (§13.21) and `align` key (§13.12).

```
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 { \__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.)

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

Internal variables used by `\miniright` command (§13.22.4) and the keys `mini-right`, `mini-right*`, `mini-env` and `mini-sep` (§13.20, §13.22).

```
87 \int_new:N \__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 \__enumext_minipage_right_skip
93 \skip_new:N \__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 `\__enumext_minipage_stat_int` and others.)

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

The bool vars `\__enumext_wrap_label_X_bool` and `\__enumext_wrap_label_opt_X_bool` are used by `wrap-label` and `wrap-label*` keys (§13.12), the integer `\__enumext_start_X_int` are used by the `start` and `start*` keys (§13.14), the token list `\__enumext_fake_item_indent_X_tl` is used by `itemindent` key (§13.17.1), the variables `\__enumext_label_fill_left_X_tl` and `\__enumext_label_fill_right_X_tl` are used by the `align` key (§13.12). The boolean vars `\__enumext_vspace_a_star_X_bool`, `\__enumext_vspace_b_star_X_bool` are used by `above`, `above*`, `below` and `below*` keys (§13.19).

```
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 (§13.25.1) 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` (§13.29) 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*` (§13.30).

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*` (§13.36) and `\anspic*` (§13.41.2) 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` (§13.47).

```

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 (§13.46) and `\foreachkeyans` command (§13.49).

```

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` (§13.46), `show-pos` key (§13.26), `item-sym*` key (§13.34), `save-key` key (§13.26.2) 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 \__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 } { \__enumext_tmp:n {#1} }

```

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

```

\l__enumext_anspic_args_seq
\l__enumext_anspic_mini_width_dim
\l__enumext_anspic_above_int
\l__enumext_anspic_below_int
\l__enumext_anspic_label_above_bool
\l__enumext_anspic_mini_pos_str
\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 (§13.41.1).

```

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_anspic_label_above_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 (§13.25.3) 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 (§13.8). 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 (§13.26). 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` (§13.8) 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` (§13.42.4).

```

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`.)

### 13.5 Some utility functions

`\keys_precompile:neN` Non-standard kernel variants used by the `\printkeyans` command (§13.46) and `\foreachkeyans` command (§13.49).

`\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. This function is taken directly from the answer given by Henri Menke in [How to test if an expl3 function argument is an integer expression?](#)

`\__enumext_if_is_int:nF`

`\__enumext_if_is_int:nTF`

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

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

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

```
224 \cs_new_protected:Nn \__enumext_regex_counter_style:
225 {
226   \tl_map_inline:Nn \c__enumext_counter_style_tl
227   {
228     \regex_replace_once:nnN { \c{##1}\* }
229     { \c{##1}\cB{\u{__enumext_ref_the_count_tl}\cE} } \__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:`)

### 13.5.1 Utilities for environments and levels

`\__enumext_is_not_nested:`

The function `\__enumext_is_not_nested:` set the variables `\g__enumext_standar_bool` and `\g__enumext_starred_bool` to “*true*” only if the environments `enumext` and `enumext*` are 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` (§13.25.1), `\l__enumext_starred_first_bool` (§13.25.1) and `\l__enumext_anskey_env_bool` (§13.30) 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:.)

### 13.5.2 Utilities for log and terminal

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

```

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:`.)

## 13.6 Copying list and minipage environments

The `list` environment provided by  $\text{\LaTeX}$  has the following plain form:

```

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

```

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

```

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

```

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

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

```

\__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.)

### 13.7 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 (§13.38) and `\__enumext_safe_exec_vii:` in the `enumext*` environment definition (§13.43)

```

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*`.)

### 13.8 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`.)

### 13.9 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

```

### 13.10 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.)

### 13.11 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`.)

### 13.12 Setting keys associated with label

When *tagged* PDF is active `\makelabel` is redefined using `\makebox` to work correctly (§13.33). From the user side it is convenient to have a key that allows using this redefinition with `\makebox` without having `\IfDocumentMetadataTF` active.

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

```

514 \cs_set_protected:Npn \__enumext_tmp:n #1
515 {
516   \keys_define:nn { enumext / #1 }
517   {
518     mode-box .bool_set:N = \l__enumext_mode_box_bool,
519     mode-box .initial:n = false,
520     mode-box .value_forbidden:n = true,
521   }
522 }
523 \clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }

```

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

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

```

524 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
525 {
526   \keys_define:nn { enumext / #1 }
527   {
528     font .tl_set:c = { l__enumext_label_font_style_#2_tl },
529     font .value_required:n = true,
530     labelsep .dim_set:c = { l__enumext_labelsep_#2_dim },
531     labelsep .initial:n = {0.3333em},
532     labelsep .value_required:n = true,
533     labelwidth .dim_set:c = { l__enumext_labelwidth_#2_dim },
534     labelwidth .value_required:n = true,
535     wrap-label .cs_set_protected:cp = { __enumext_wrapper_label_#2:n } ##1,
536     wrap-label .initial:n = {##1},
537     wrap-label .value_required:n = true,
538     wrap-label* .code:n = {
539       \bool_set_true:c { l__enumext_wrap_label_opt_#2_bool }
540       \keys_set:nn { enumext / #1 } { wrap-label = {##1} }
541     },
542     wrap-label* .value_required:n = true,
543   }
544 }
545 \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. For compatibility with *tagged* PDF we must set `\l__enumext_align_label_pos_X_str`.

```

546 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2

```

```

547 {
548   \keys_define:nn { enumext / #1 }
549   {
550     align .choice:,
551     align / left .code:n =
552       {
553         \tl_clear:c { l__enumext_label_fill_left_#2_tl }
554         \tl_set:cn { l__enumext_label_fill_right_#2_tl } { \hfill }
555         \str_set:cn { l__enumext_align_label_pos_#2_str } { l }
556       },
557     align / right .code:n =
558       {
559         \tl_set:cn { l__enumext_label_fill_left_#2_tl } { \hfill }
560         \tl_clear:c { l__enumext_label_fill_right_#2_tl }
561         \str_set:cn { l__enumext_align_label_pos_#2_str } { r }
562       },
563     align / center .code:n =
564       {
565         \tl_set:cn { l__enumext_label_fill_left_#2_tl } { \hfill }
566         \tl_set:cn { l__enumext_label_fill_right_#2_tl } { \hfill }
567         \str_set:cn { l__enumext_align_label_pos_#2_str } { c }
568       },
569     align / unknown .code:n =
570       \msg_error:nneee { enumext } { unknown-choice }
571       { align } { left, ~ right, ~ center } { \exp_not:n {##1} },
572     align .initial:n = left,
573     align .value_required:n = true,
574   }
575 }
576 \clist_map_inline:nn
577 {
578   {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {keyans}{v}
579 }
580 { \__enumext_tmp:nn #1 }

581 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
582 {
583   \keys_define:nn { enumext / #1 }
584   {
585     align .choice:,
586     align / left .code:n = \str_set:cn { l__enumext_align_label_#2_str } { l },
587     align / right .code:n = \str_set:cn { l__enumext_align_label_#2_str } { r },
588     align / center .code:n = \str_set:cn { l__enumext_align_label_#2_str } { c },
589     align / unknown .code:n =
590       \msg_error:nneee { enumext } { unknown-choice }
591       { align } { left, ~ right, ~ center } { \exp_not:n {##1} },
592     align .initial:n = left,
593     align .value_required:n = true,
594   }
595 }
596 \clist_map_inline:nn { {enumext*}{vii}, {keyans*}{viii} } { \__enumext_tmp:nn #1 }

```

(End of definition for *align*.)

### 13.13 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  $\langle label \rangle$ , the value of the variables `\l__enumext_label_X_tl`, the default values for `\labelwidth` and the “*label and ref*” system.

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

Here we set the default  $\langle labels \rangle$  of the *four levels* of `enumext` environment, along with the default value for `labelwidth` key and `ref` key.

```

label
ref
\l__enumext_label_i_tl
\l__enumext_label_ii_tl
\l__enumext_label_iii_tl
\l__enumext_label_iv_tl
597 \cs_set_protected:Npn \__enumext_tmp:nnn #1 #2 #3
598 {
599   \keys_define:nn { enumext / #1 }
600   {
601     label .code:n = {
602       \__enumext_label_style:cnv { l__enumext_label_#2_tl }
603       { l__enumext_counter_#2_tl } {##1}
604       \dim_set_eq:cN { l__enumext_labelwidth_#2_dim }
605       \l__enumext_current_widest_dim

```

```

606         },
607         label .initial:n = #3,
608         label .value_required:n = true,
609         ref .code:n = \__enumext_standar_ref:n {##1},
610         ref .value_required:n = true,
611     }
612 }
613 \__enumext_tmp:nnn { level-1 } { i } { \arabic*. }
614 \__enumext_tmp:nnn { level-2 } { ii } { (\alph*. ) }
615 \__enumext_tmp:nnn { level-3 } { iii } { \roman*. }
616 \__enumext_tmp:nnn { level-4 } { iv } { \Alph*. }

```

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

```

\__enumext_standar_ref:n
\__enumext_standar_ref:

```

The `\__enumext_standar_ref:n` first we will pass the key argument to `\__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 `\__enumext_ref_the_count_tl` and we will execute the function `\__enumext_regex_counter_style:` which will return the modified `\__enumext_ref_key_arg_tl` and we make the value of `\__enumext_ref_the_count_tl` the same as that `\__enumext_the_counter_X_tl` which contains `\theenumX` and finally we set `\__enumext_renew_the_count_X_tl` with the renewed command.

```

617 \cs_new_protected:Npn \__enumext_standar_ref:n #1
618 {
619     \tl_set:Nn \__enumext_ref_key_arg_tl {#1}
620     \tl_if_empty:NTF \__enumext_ref_key_arg_tl
621     {
622         \msg_error:nnn { enumext } { key-ref-empty } { enumext }
623     }
624     {
625         \tl_set_eq:Nc
626         \__enumext_ref_the_count_tl { \__enumext_counter_ \__enumext_level: _tl }
627         \__enumext_regex_counter_style:
628         \tl_set_eq:Nc
629         \__enumext_ref_the_count_tl { \__enumext_the_counter_ \__enumext_level: _tl }
630         \tl_put_right:ce { \__enumext_renew_the_count_ \__enumext_level: _tl }
631         {
632             \exp_not:N \renewcommand { \exp_not:V \__enumext_ref_the_count_tl } { \exp_not:V \__enumext_ref_the_count_tl }
633         }
634     }
635 }

```

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

```

636 \cs_new_protected:Nn \__enumext_standar_ref:
637 {
638     \tl_if_empty:cF { \__enumext_renew_the_count_ \__enumext_level: _tl }
639     {
640         \tl_use:c { \__enumext_renew_the_count_ \__enumext_level: _tl }
641     }
642 }

```

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

### 13.13.2 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
643 \cs_set_protected:Npn \__enumext_tmp:nnn #1 #2 #3
644 {
645     \keys_define:nn { enumext / #1 }
646     {
647         label .code:n = {
648             \__enumext_label_style:cnv { \__enumext_label_#2_tl }
649             { \__enumext_counter_#2_tl } {##1}
650             \dim_set_eq:cN { \__enumext_labelwidth_#2_dim }
651             \__enumext_current_widest_dim
652         },
653         label .initial:n = #3,
654         label .value_required:n = true,
655         ref .code:n = \__enumext_starred_ref:n {##1},
656         ref .value_required:n = true,
657     }
658 }

```

```

659 \__enumext_tmp:nnn { enumext* } { vii } { \arabic*.}
660 \__enumext_tmp:nnn { keyans* } { viii } { \Alph*) }

```

(End of definition for label and others.)

```

\__enumext_starred_ref:n
\__enumext_starred_ref:

```

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

```

661 \cs_new_protected:Npn \__enumext_starred_ref:n #1
662 {
663   \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
664   \int_compare:nNnT { \l__enumext_level_h_int } = { 1 }
665   {
666     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
667     {
668       \msg_error:nnn { enumext } { key-ref-empty } { enumext* }
669     }
670     {
671       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_counter_vii_tl
672       \__enumext_regex_counter_style:
673       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_vii_tl
674       \tl_put_right:Ne \l__enumext_renew_the_count_vii_tl
675       {
676         \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V
677       }
678     }
679   }
680   \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
681   {
682     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
683     {
684       \msg_error:nnn { enumext } { key-ref-empty } { keyans* }
685     }
686     {
687       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_counter_viii_tl
688       \__enumext_regex_counter_style:
689       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_viii_tl
690       \tl_put_right:Ne \l__enumext_renew_the_count_viii_tl
691       {
692         \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V
693       }
694     }
695   }
696 }

```

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.

```

697 \cs_new_protected:Npn \__enumext_starred_ref:
698 {
699   \int_compare:nNnT { \l__enumext_level_h_int } = { 1 }
700   {
701     \tl_if_empty:NF \l__enumext_renew_the_count_vii_tl
702     {
703       \tl_use:N \l__enumext_renew_the_count_vii_tl
704     }
705   }
706   \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
707   {
708     \tl_if_empty:NF \l__enumext_renew_the_count_viii_tl
709     {
710       \tl_use:N \l__enumext_renew_the_count_viii_tl
711     }
712   }
713 }

```

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

### 13.13.3 Define and set label and ref keys for keyans and keyanspic environments

Here we set the default `<label>` for `keyans` and `keyanspic` environment, along with the default value for `labelwidth` and `ref` key. The `keyanspic` environment use the same `<label>` as the `keyans` environment.

```

\__enumext_label_v_tl
\__enumext_label_vi_tl
714 \keys_define:nn { enumext / keyans }
715 {
716   label .code:n = {

```

```

717         \__enumext_label_style:cvn { \__enumext_label_v_tl }
718         { \__enumext_counter_v_tl } {#1}
719         \dim_set_eq:cN { \__enumext_labelwidth_v_dim }
720         \__enumext_current_widest_dim
721         \__enumext_label_style:cvn { \__enumext_label_vi_tl }
722         { \__enumext_counter_vi_tl } {#1}
723         \dim_set_eq:cN { \__enumext_labelwidth_v_dim }
724         \__enumext_current_widest_dim
725     },
726     label .initial:n = \Alph*),
727     label .value_required:n = true,
728     ref .code:n = \__enumext_keyans_ref:n {#1},
729     ref .value_required:n = true,
730 }

```

(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`.

```

731 \cs_new_protected:Npn \__enumext_keyans_ref:n #1
732 {
733     \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
734     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
735     {
736         \msg_error:nnn { enumext } { key-ref-empty } { keyans }
737     }
738     {
739         \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_counter_v_tl
740         \__enumext_regex_counter_style:
741         \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_v_tl
742         \tl_put_right:Ne \l__enumext_renew_the_count_v_tl
743         {
744             \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V \l__
745         }
746     }
747 }

```

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

```

748 \cs_new_protected:Nn \__enumext_keyans_ref:
749 {
750     \tl_if_empty:NF \l__enumext_renew_the_count_v_tl
751     {
752         \tl_use:N \l__enumext_renew_the_count_v_tl
753     }
754 }

```

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

### 13.14 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.

```

755 \cs_new_protected:Npn \__enumext_start_from:NNn #1 #2 #3
756 {
757     \__enumext_if_is_int:nTF { #3 }
758     {
759         \int_set:Nn #2 {#3}
760     }
761     {
762         \regex_match:nVT { \c{Alph} | \c{alph} } {#1}
763         { \int_set:Nn #2 { \int_from_alph:n {#3} } }
764         \regex_match:nVT { \c{Roman} | \c{roman} } {#1}
765         { \int_set:Nn #2 { \int_from_roman:n {#3} } }
766     }
767 }
768 \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:  $\langle integer \text{ or } string \rangle$

The second and third arguments of this function are the values set by `label` and `labelwidth` keys, the four argument can be an  $\langle integer \rangle$  or  $\langle string \rangle$  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.

```
769 \cs_new_protected:Npn \__enumext_widest_from:nNNn #1 #2 #3 #4
770 {
771   \__enumext_if_is_int:nTF {#4}
772   {
773     \setcounter{enumX#1} { #4 }
774   }
775   {
776     \regex_match:nVT { \c{Alph} | \c{alph} } {#2}
777     { \setcounter{enumX#1} { \int_from_alph:n {#4} } }
778     \regex_match:nVT { \c{Roman} | \c{roman} } {#2}
779     { \setcounter{enumX#1} { \int_from_roman:n {#4} } }
780   }
781   \__enumext_label_width_by_box:cv
782   { \l__enumext_labelwidth_#1_dim } { \l__enumext_label_#1_tl }
783 }
784 \cs_generate_variant:Nn \__enumext_widest_from:nNNn { nccn }
```

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

```
start
start*
widest
```

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

```
785 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
786 {
787   \keys_define:nn { enumext / #1 }
788   {
789     start* .code:n = {
790       \__enumext_start_from:ccn
791       { \l__enumext_label_#2_tl }
792       { \l__enumext_start_#2_int } {##1}
793     },
794     start* .value_required:n = true,
795     start .code:n = {
796       \__enumext_start_from:cce
797       { \l__enumext_label_#2_tl }
798       { \l__enumext_start_#2_int } { \int_eval:n {##1} }
799     },
800     start .initial:n = 1,
801     start .value_required:n = true,
802     widest .code:n = {
803       \__enumext_widest_from:nccn {#2}
804       { \l__enumext_label_#2_tl }
805       { \l__enumext_labelwidth_#2_dim } {##1}
806     },
807     widest .value_required:n = true,
808   }
809 }
810 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }
```

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

### 13.15 Setting keys for vertical spaces

```
topsep
partopsep
parsep
noitemsep
nosep
```

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

```
811 \cs_set_protected:Npn \__enumext_tmp:nnnnnn #1 #2 #3 #4 #5 #6
812 {
813   \keys_define:nn { enumext / #1 }
814   {
815     topsep .skip_set:c = { \l__enumext_topsep_#2_skip },
```



```

816     topsep      .initial:n = {#3},
817     topsep      .value_required:n = true,
818     partopsep   .skip_set:c = { l__enumext_partopsep_#2_skip },
819     partopsep   .initial:n = {#4},
820     partopsep   .value_required:n = true,
821     parsep     .skip_set:c = { l__enumext_parsep_#2_skip },
822     parsep     .initial:n = {#5},
823     parsep     .value_required:n = true,
824     itemsep     .skip_set:c = { l__enumext_itemsep_#2_skip },
825     itemsep     .initial:n = {#6},
826     itemsep     .value_required:n = true,
827     noitemsep   .meta:n      = { itemsep = 0pt, parsep = 0pt },
828     noitemsep   .value_forbidden:n = true,
829     nosepp     .meta:n      = {
830                                     itemsep = 0pt, parsep= 0pt,
831                                     topsep = 0pt, partopsep = 0pt,
832                                     },
833     nosepp     .value_forbidden:n = true,
834 }
835 }

```

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

```

836 \__enumext_tmp:nnnnnn { level-1 } { i } { 8.0pt plus 2.0pt minus 4.0pt }
837 { 2.0pt plus 1.0pt minus 1.0pt } { 4.0pt plus 2.0pt minus 1.0pt }
838 { 4.0pt plus 2.0pt minus 1.0pt }
839 \__enumext_tmp:nnnnnn { level-2 } { ii } { 4.0pt plus 2.0pt minus 1.0pt }
840 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
841 { 2.0pt plus 1.0pt minus 1.0pt }
842 \__enumext_tmp:nnnnnn { level-3 } { iii } { 2.0pt plus 1.0pt minus 1.0pt }
843 { 1.0pt minus 1.0pt } { 0pt } { 2.0pt plus 1.0pt minus 1.0pt }
844 \__enumext_tmp:nnnnnn { level-4 } { iv } { 2.0pt plus 1.0pt minus 1.0pt }
845 { 1.0pt minus 1.0pt } { 0pt } { 2.0pt plus 1.0pt minus 1.0pt }
846 \__enumext_tmp:nnnnnn { keyans } { v } { 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 }
849 \__enumext_tmp:nnnnnn { enumext* } { vii } { 8.0pt plus 2.0pt minus 4.0pt }
850 { 2.0pt plus 1.0pt minus 1.0pt } { 4.0pt plus 2.0pt minus 1.0pt }
851 { 4.0pt plus 2.0pt minus 1.0pt }
852 \__enumext_tmp:nnnnnn { keyans* } { viii } { 4.0pt plus 2.0pt minus 1.0pt }
853 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
854 { 2.0pt plus 1.0pt minus 1.0pt }

```

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

### 13.16 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`: apply `\vspace{-\baselineskip}` and set `\topsep=0pt` for the “first level” of the nested `enumext` environment.

```

base-fix
\__enumext_nested_base_line_fix:

```

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

```

855 \keys_define:nn { enumext / level-1 }
856 {
857     base-fix .bool_set:N = \l__enumext_base_line_fix_bool,
858     base-fix .initial:n = false,
859     base-fix .value_forbidden:n = true,
860 }

```

The function `\__enumext_nested_base_line_fix`: passed to the `\__enumext_parse_keys:n` function in the definition of the `enumext` environment (§13.38) will be responsible for applying the *baseline correction* and adjusting the `\keys` for the `enumext` environment and the `\printkeyans` with *starred argument* ‘\*’ (§13.46).

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

```

861 \cs_new_protected:Nn \__enumext_nested_base_line_fix:
862 {
863     \bool_lazy_all:nT
864     {
865         { \bool_if_p:N \l__enumext_starred_first_bool }

```

```

866     { \bool_if_p:N \l__enumext_base_line_fix_bool }
867     { \bool_not_p:n { \l__enumext_print_keyans_star_bool } }
868   }
869   {
870     \mode_leave_vertical:
871     \vspace { -\dim_eval:n { \baselineskip + \parsep } }
872   }

```

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

```

873   \bool_lazy_and:nnT
874   { \bool_if_p:N \l__enumext_starred_first_bool }
875   { \bool_if_p:N \l__enumext_print_keyans_star_bool }
876   {
877     \mode_leave_vertical:
878     \skip_vertical:n { -\baselineskip }
879     \skip_vertical:N \c_zero_skip
880   }

```

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

```

881   \keys_set:nn { enumext / level-1 }
882   {
883     topsep = 0pt, above = 0pt, above* = 0pt,
884   }
885   \bool_set_false:N \l__enumext_base_line_fix_bool
886 }

```

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

### 13.17 Setting keys for horizontal spaces

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

```

887 \cs_set_protected:Npn \l__enumext_tmp:nn #1 #2
888 {
889   \keys_define:nn { enumext / #1 }
890   {
891     itemindent .dim_set:c = { \l__enumext_fake_item_indent_#2_dim },
892     itemindent .value_required:n = true,
893     rightmargin .dim_set:c = { \l__enumext_rightmargin_#2_dim },
894     rightmargin .value_required:n = true,
895     listparindent .dim_set:c = { \l__enumext_listparindent_#2_dim },
896     listparindent .value_required:n = true,
897     list-offset .dim_set:c = { \l__enumext_listoffset_#2_dim },
898     list-offset .value_required:n = true,
899     list-indent .code:n =
900       \bool_set_true:c { \l__enumext_leftmargin_tmp_#2_bool }
901       \dim_set:cn { \l__enumext_leftmargin_tmp_#2_dim } {##1},
902     list-indent .value_required:n = true,
903   }
904 }
905 \clist_map_inline:nn
906 {
907   {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {keyans}{v}
908 }
909 { \l__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.

```

910 \cs_set_protected:Npn \l__enumext_tmp:nn #1 #2
911 {
912   \keys_define:nn { enumext / #1 }
913   {
914     itemindent .dim_set:c = { \l__enumext_fake_item_indent_#2_dim },
915     itemindent .value_required:n = true,
916     rightmargin .dim_set:c = { \l__enumext_rightmargin_#2_dim },
917     rightmargin .value_required:n = true,
918     listparindent .dim_set:c = { \l__enumext_listparindent_#2_dim },
919     listparindent .value_required:n = true,

```

```

920         list-offset .dim_set:c = { l__enumext_listoffset_#2_dim },
921         list-offset .value_required:n = true,
922         list-indent .meta:n = { list-offset = ##1 },
923         list-indent .value_required:n = true,
924     }
925 }
926 \clist_map_inline:nn
927 {
928     {enumext*}{vii}, {keyans*}{viii}
929 }
930 { \__enumext_tmp:nn #1 }

```

### 13.17.1 Functions for setting the fake itemindent

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

```

931 \cs_set_protected:Nn \__enumext_fake_item_indent:
932 {
933     \dim_compare:nNnT
934     { \dim_use:c { l__enumext_fake_item_indent_ \__enumext_level: _dim } }
935     >
936     { \c_zero_dim }
937     {
938         \tl_set:ce { l__enumext_fake_item_indent_ \__enumext_level: _tl }
939         {
940             \exp_not:N \mode_leave_vertical:
941             \exp_not:n { \skip_horizontal:n }
942             { \dim_use:c { l__enumext_fake_item_indent_ \__enumext_level: _dim } }
943             \exp_not:N \ignorespaces
944         }
945     }
946 }
947 \cs_set_protected:Nn \__enumext_keyans_fake_item_indent:
948 {
949     \dim_compare:nNnT
950     { \l__enumext_fake_item_indent_v_dim } > { \c_zero_dim }
951     {
952         \tl_set:Nc \l__enumext_fake_item_indent_v_tl
953         {
954             \exp_not:N \mode_leave_vertical:
955             \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_v_dim
956             \exp_not:N \ignorespaces
957         }
958     }
959 }
960 \cs_set_protected:Nn \__enumext_fake_item_indent_vii:
961 {
962     \dim_compare:nNnT
963     { \l__enumext_fake_item_indent_vii_dim } > { \c_zero_dim }
964     {
965         \tl_set:Nc \l__enumext_fake_item_indent_vii_tl
966         {
967             \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_vii_dim
968             \exp_not:N \ignorespaces
969         }
970     }
971 }
972 \cs_set_protected:Nn \__enumext_fake_item_indent_viii:
973 {
974     \dim_compare:nNnT
975     { \l__enumext_fake_item_indent_viii_dim } > { \c_zero_dim }
976     {
977         \tl_set:Nc \l__enumext_fake_item_indent_viii_tl
978         {
979             \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_viii_dim
980             \exp_not:N \ignorespaces
981         }
982     }
983 }

```

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

### 13.18 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 `\__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.

```

984 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
985 {
986   \keys_define:nn { enumext / #1 }
987   {
988     show-length .bool_set:c = { \__enumext_show_length_#2_bool },
989     show-length .initial:n = false,
990   }
991 }
992 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }
```

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

### 13.19 Setting before, after and first keys

before  
before\*  
after  
first

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

```

993 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
994 {
995   \keys_define:nn { enumext / #1 }
996   {
997     before .tl_set:c = { \__enumext_before_no_starred_key_#2_tl },
998     before .value_required:n = true,
999     before* .tl_set:c = { \__enumext_before_starred_key_#2_tl },
1000     before* .value_required:n = true,
1001     after .tl_set:c = { \__enumext_after_stop_list_#2_tl },
1002     after .value_required:n = true,
1003     first .tl_set:c = { \__enumext_after_list_args_#2_tl },
1004     first .value_required:n = true,
1005   }
1006 }
1007 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }
```

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

#### 13.19.1 Functions for before, after and first keys in enumext

`\__enumext_before_args_exec:`  
`\__enumext_before_keys_exec:`  
`\__enumext_after_stop_list:`  
`\__enumext_after_args_exec:`

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⟩}`.

```

1008 \cs_new_protected:Nn \__enumext_before_args_exec:
1009 {
1010   \tl_use:c { \__enumext_before_starred_key_ \__enumext_level: _tl }
1011 }
```

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⟩}`

```

1012 \cs_new_protected:Nn \__enumext_before_keys_exec:
1013 {
1014   \tl_use:c { \__enumext_before_no_starred_key_ \__enumext_level: _tl }
1015 }
```

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

```

1016 \cs_new_protected:Nn \__enumext_after_stop_list:
1017 {
1018   \tl_use:c { \__enumext_after_stop_list_ \__enumext_level: _tl }
1019 }
```

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.`

```

1020 \cs_new_protected:Nn \__enumext_after_args_exec:
1021 {
1022   \tl_use:c { \__enumext_after_list_args_ \__enumext_level: _tl }
1023 }
```

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

### 13.19.2 Functions for before, after and first keys in keyans

`\__enumext_before_args_exec_v:`  
`\__enumext_before_keys_exec_v:`  
`\__enumext_after_stop_list_v:`  
`\__enumext_after_args_exec_v:`

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

```
1024 \cs_new_protected:Nn \__enumext_before_args_exec_v:
1025 {
1026   \tl_use:N \l__enumext_before_starred_key_v_tl
1027 }
1028 \cs_new_protected:Nn \__enumext_before_keys_exec_v:
1029 {
1030   \tl_use:N \l__enumext_before_no_starred_key_v_tl
1031 }
1032 \cs_new_protected:Nn \__enumext_after_stop_list_v:
1033 {
1034   \tl_use:N \l__enumext_after_stop_list_v_tl
1035 }
1036 \cs_new_protected:Nn \__enumext_after_args_exec_v:
1037 {
1038   \tl_use:N \l__enumext_after_list_args_v_tl
1039 }
```

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

### 13.19.3 Functions for before, after and first keys in enumext\* and keyans\*

`\__enumext_before_args_exec_vii:`  
`\__enumext_before_keys_exec_vii`  
`\__enumext_after_stop_list_vii:`  
`\__enumext_after_args_exec_vii:`

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

```
1040 \cs_new_protected:Nn \__enumext_before_args_exec_vii:
1041 {
1042   \tl_use:N \l__enumext_before_starred_key_vii_tl
1043 }
1044 \cs_new_protected:Nn \__enumext_before_args_exec_viii:
1045 {
1046   \tl_use:N \l__enumext_before_starred_key_viii_tl
1047 }
1048 \cs_new_protected:Nn \__enumext_before_keys_exec_vii:
1049 {
1050   \tl_use:N \l__enumext_before_no_starred_key_vii_tl
1051 }
1052 \cs_new_protected:Nn \__enumext_before_keys_exec_viii:
1053 {
1054   \tl_use:N \l__enumext_before_no_starred_key_viii_tl
1055 }
1056 \cs_new_protected:Nn \__enumext_after_stop_list_vii:
1057 {
1058   \tl_use:N \l__enumext_after_stop_list_vii_tl
1059 }
1060 \cs_new_protected:Nn \__enumext_after_stop_list_viii:
1061 {
1062   \tl_use:N \l__enumext_after_stop_list_viii_tl
1063 }
1064 \cs_new_protected:Nn \__enumext_after_args_exec_vii:
1065 {
1066   \tl_use:N \l__enumext_after_list_args_vii_tl
1067 }
1068 \cs_new_protected:Nn \__enumext_after_args_exec_viii:
1069 {
1070   \tl_use:N \l__enumext_after_list_args_viii_tl
1071 }
```

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

## 13.20 Setting keys for multicols and minipage

`mini-env`  
`mini-sep`  
`columns-sep`  
`columns`

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.

```
1072 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1073 {
1074   \keys_define:nn { enumext / #1 }
1075   {
1076     mini-env      .dim_set:c = { l__enumext_minipage_right_#2_dim },
```

```

1077     mini-env     .value_required:n = true,
1078     mini-sep     .dim_set:c = { l__enumext_minipage_hsep_#2_dim },
1079     mini-sep     .initial:n = 0.3333em,
1080     mini-sep     .value_required:n = true,
1081     columns-sep .dim_set:c = { l__enumext_columns_sep_#2_dim },
1082     columns-sep .value_required:n = true,
1083     columns     .int_set:c = { l__enumext_columns_#2_int },
1084     columns     .initial:n = 1,
1085     columns     .value_required:n = true,
1086   }
1087 }
1088 \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.

```

1089 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1090 {
1091   \keys_define:nn { enumext / #1 }
1092   {
1093     mini-right .tl_gset:c = { g__enumext_miniright_code_#2_tl },
1094     mini-right .value_required:n = true,
1095     mini-right* .code:n = {
1096       \bool_gset_true:c { g__enumext_minipage_center_#2_bool }
1097       \keys_set:nn { enumext / #1 } { mini-right = {##1} }
1098     },
1099     mini-right* .value_required:n = true,
1100   }
1101 }
1102 \clist_map_inline:nn { {enumext*}{vii}, {keyans*}{viii} } { \__enumext_tmp:nn #1 }

```

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

### 13.21 Adjustment of vertical spaces for multicols

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



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

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

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

#### 13.21.1 Adjustment of vertical spaces for multicols in enumext

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

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

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

```

1103 \cs_new_protected:Nn \__enumext_multi_set_vskip:
1104 {
1105   \skip_set:cn { l__enumext_multicols_above_ \__enumext_level: _skip }
1106   {
1107     \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip }
1108   }
1109   \skip_set:cn { l__enumext_multicols_below_ \__enumext_level: _skip }
1110   {

```



```

1111         \skip_use:c { \__enumext_topsep_ \__enumext_level: _skip }
1112     }
1113     \__enumext_add_pre_parsep:
1114 }

```

(End of definition for \\_\_enumext\_multi\_set\_vskip:.)

\\_\_enumext\_add\_pre\_parsep: The function \\_\_enumext\_add\_pre\_parsep: “adjusted” the value of \l\_\_enumext\_multicols\_above\_X\_skip detecting the value of \parsep from the previous level. This is necessary since \parsep from the previous level affects the vertical spaces.

```

1115 \cs_new_protected:Nn \__enumext_add_pre_parsep:
1116 {
1117     \int_case:nn { \l__enumext_level_int }
1118     {
1119         { 2 }{
1120             \skip_if_eq:nnF { \l__enumext_parsep_i_skip } { \c_zero_skip }
1121             {
1122                 \skip_add:Nn \l__enumext_multicols_above_ii_skip
1123                 {
1124                     \l__enumext_parsep_i_skip
1125                 }
1126             }
1127         }
1128         { 3 }{
1129             \skip_if_eq:nnF { \l__enumext_parsep_ii_skip } { \c_zero_skip }
1130             {
1131                 \skip_add:Nn \l__enumext_multicols_above_iii_skip
1132                 {
1133                     \l__enumext_parsep_ii_skip
1134                 }
1135             }
1136         }
1137         { 4 }{
1138             \skip_if_eq:nnF { \l__enumext_parsep_iii_skip } { \c_zero_skip }
1139             {
1140                 \skip_add:Nn \l__enumext_multicols_above_iv_skip
1141                 {
1142                     \l__enumext_parsep_iii_skip
1143                 }
1144             }
1145         }
1146     }
1147 }

```

(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⟩.

```

1148 \cs_new_protected:Nn \__enumext_multi_addvspace:
1149 {
1150     \__enumext_multi_set_vskip:
1151     \mode_if_vertical:T
1152     {
1153         \skip_add:cn { \l__enumext_multicols_above_ \__enumext_level: _skip }
1154         {
1155             \skip_use:c { \l__enumext_partopsep_ \__enumext_level: _skip }
1156         }
1157         \skip_add:cn { \l__enumext_multicols_below_ \__enumext_level: _skip }
1158         {
1159             \skip_use:c { \l__enumext_partopsep_ \__enumext_level: _skip }
1160         }
1161     }
1162     \par\nopagebreak
1163     \addvspace{ \skip_use:c { \l__enumext_multicols_above_ \__enumext_level: _skip } }
1164 }

```

(End of definition for \\_\_enumext\_multi\_addvspace:.)

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

`\__enumext_keyans_multi_set_vskip:`  
`\__enumext_keyans_multi_addvspace:`

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

```

1165 \cs_new_protected:Nn \__enumext_keyans_multi_set_vskip:
1166 {
1167   \skip_set:Nn \l__enumext_multicols_above_v_skip
1168   {
1169     \l__enumext_topsep_v_skip
1170   }
1171   \skip_set:Nn \l__enumext_multicols_below_v_skip
1172   {
1173     \l__enumext_topsep_v_skip
1174   }
1175 }
1176 \cs_new_protected:Nn \__enumext_keyans_multi_addvspace:
1177 {
1178   \__enumext_keyans_multi_set_vskip:
1179   \mode_if_vertical:T
1180   {
1181     \skip_add:Nn \l__enumext_multicols_above_v_skip
1182     {
1183       \skip_use:N \l__enumext_partopsep_v_skip
1184     }
1185     \skip_add:Nn \l__enumext_multicols_below_v_skip
1186     {
1187       \skip_use:N \l__enumext_partopsep_v_skip
1188     }
1189   }
1190   \par\nopagebreak
1191   \addvspace{ \l__enumext_multicols_above_v_skip }
1192 }

```

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

### 13.22 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.

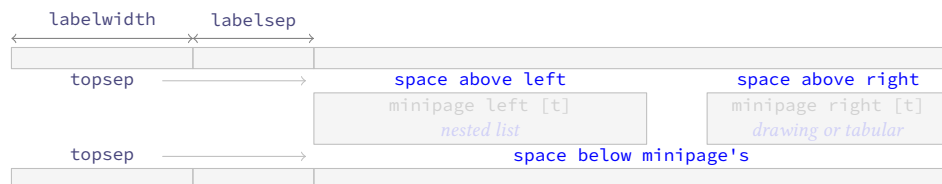


Figure 8: Representation of the `\minipage` spacing adjustment for a nested level.

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` is nested. The setting of the values was more “trial and error” (aprox to `\strutbox`), using the help of the `lua-visual-debug`[14] package, again my attempts to find the correct values using `\showoutput` and `\showboxdepth` absolutely failed.

#### 13.22.1 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`.

```

1193 \cs_new_protected:Nn \__enumext_minipage_set_skip:
1194 {
1195   \skip_set:Nn \l__enumext_minipage_right_skip

```

```

1196     {
1197         \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip }
1198     }
1199     \mode_if_vertical:T
1200     {
1201         \skip_add:Nn \l__enumext_minipage_right_skip
1202         {
1203             \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
1204         }
1205     }
1206     \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:`.

```

1207     \skip_set_eq:cN
1208     { l__enumext_multicols_above_ \__enumext_level: _skip } \l__enumext_minipage_right_skip
1209     \skip_set_eq:cN
1210     { l__enumext_multicols_below_ \__enumext_level: _skip } \l__enumext_minipage_right_skip
1211     \__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`.

```

1212     \int_compare:nNnT
1213     { \int_use:c { l__enumext_columns_ \__enumext_level: _int } } > { 1 }
1214     {
1215         \skip_zero:N \topskip
1216         \skip_set_eq:Nc \multicolsep { l__enumext_multicols_above_ \__enumext_level: _skip }
1217     }
1218 }

```

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

```

1219 \cs_new_protected:Nn \__enumext_minipage_add_space:
1220 {
1221     \__enumext_minipage_set_skip:
1222     \__enumext_unskip_unkern:
1223     \mode_if_vertical:TF
1224     {
1225         \nopagebreak\nointerlineskip
1226     }
1227     {
1228         \par\nopagebreak\nointerlineskip
1229         \skip_zero:c { l__enumext_partopsep_ \__enumext_level: _skip }
1230     }
1231     \int_compare:nNnTF
1232     { \int_use:c { l__enumext_columns_ \__enumext_level: _int } } > { 1 }
1233     {
1234         \addvspace{ 0.445\box_ht:N \strutbox }
1235     }
1236     {
1237         \addvspace{ 0.250\box_ht:N \strutbox }
1238     }
1239 }

```

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

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

```

1240 \cs_new_protected:Nn \__enumext_pre_itemsep_skip:
1241 {
1242     \int_case:nn { \l__enumext_level_int }
1243     {
1244         { 2 }{
1245             \skip_if_eq:nnTF
1246             { \l__enumext_itemsep_i_skip } { \l__enumext_minipage_after_skip }
1247             {
1248                 \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1249                 \skip_set:Nn \l__enumext_multicols_below_ii_skip { 0.350\box_ht:N \strutbox }

```

```

1250     }
1251     {
1252         \dim_compare:nNnT
1253         { \l__enumext_itemsep_i_skip } < { \l__enumext_minipage_after_skip }
1254         {
1255             \skip_sub:Nn
1256             \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1257             \skip_sub:Nn
1258             \l__enumext_multicols_below_ii_skip { \l__enumext_itemsep_i_skip }
1259             \skip_add:Nn
1260             \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1261             \skip_add:Nn
1262             \l__enumext_multicols_below_ii_skip { 0.350\box_ht:N \strutbox }
1263         }
1264         \dim_compare:nNnT
1265         { \l__enumext_itemsep_i_skip } > { \l__enumext_minipage_after_skip }
1266         {
1267             \skip_set:Nn \l__enumext_minipage_temp_skip
1268             {
1269                 \l__enumext_itemsep_i_skip - \l__enumext_minipage_after_skip
1270             }
1271             \skip_sub:Nn
1272             \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1273             \skip_sub:Nn
1274             \l__enumext_multicols_below_ii_skip { \l__enumext_itemsep_i_skip }
1275             \skip_add:Nn
1276             \l__enumext_minipage_after_skip
1277             { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1278             \skip_add:Nn
1279             \l__enumext_multicols_below_ii_skip
1280             { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1281         }
1282     }
1283 }
1284 { 3 }{
1285     \skip_if_eq:nnTF
1286     { \l__enumext_itemsep_ii_skip } { \c_zero_skip }
1287     {
1288         \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1289         \skip_set:Nn \l__enumext_multicols_below_iii_skip { 0.350\box_ht:N \strutbox }
1290     }
1291     {
1292         \dim_compare:nNnT
1293         { \l__enumext_itemsep_ii_skip } < { \l__enumext_minipage_after_skip }
1294         {
1295             \skip_sub:Nn
1296             \l__enumext_minipage_after_skip { \l__enumext_itemsep_ii_skip }
1297             \skip_sub:Nn
1298             \l__enumext_multicols_below_iii_skip { \l__enumext_itemsep_ii_skip }
1299             \skip_add:Nn
1300             \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1301             \skip_add:Nn
1302             \l__enumext_multicols_below_iii_skip { 0.350\box_ht:N \strutbox }
1303         }
1304         \dim_compare:nNnT
1305         { \l__enumext_itemsep_ii_skip } > { \l__enumext_minipage_after_skip }
1306         {
1307             \skip_set:Nn \l__enumext_minipage_temp_skip
1308             {
1309                 \l__enumext_itemsep_ii_skip - \l__enumext_minipage_after_skip
1310             }
1311             \skip_sub:Nn
1312             \l__enumext_minipage_after_skip { \l__enumext_itemsep_ii_skip }
1313             \skip_sub:Nn
1314             \l__enumext_multicols_below_iii_skip { \l__enumext_itemsep_ii_skip }
1315             \skip_add:Nn
1316             \l__enumext_minipage_after_skip
1317             { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1318             \skip_add:Nn
1319             \l__enumext_multicols_below_iii_skip
1320             { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }

```

```

1321         }
1322     }
1323 }
1324 { 4 }{
1325     \skip_if_eq:nnTF { \l__enumext_itemsep_iii_skip } { \c_zero_skip }
1326     {
1327         \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1328         \skip_set:Nn \l__enumext_multicols_below_iv_skip { 0.350\box_ht:N \strutbox }
1329     }
1330     {
1331         \dim_compare:nNnT
1332         { \l__enumext_itemsep_iii_skip } < { \l__enumext_minipage_after_skip }
1333         {
1334             \skip_sub:Nn
1335             \l__enumext_minipage_after_skip { \l__enumext_itemsep_iii_skip }
1336             \skip_sub:Nn
1337             \l__enumext_multicols_below_iv_skip { \l__enumext_itemsep_iii_skip }
1338             \skip_add:Nn
1339             \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1340             \skip_add:Nn
1341             \l__enumext_multicols_below_iv_skip { 0.350\box_ht:N \strutbox }
1342         }
1343         \dim_compare:nNnT
1344         { \l__enumext_itemsep_iii_skip } > { \l__enumext_minipage_after_skip }
1345         {
1346             \skip_set:Nn \l__enumext_minipage_temp_skip
1347             {
1348                 \l__enumext_itemsep_iii_skip - \l__enumext_minipage_after_skip
1349             }
1350             \skip_sub:Nn
1351             \l__enumext_minipage_after_skip { \l__enumext_itemsep_iii_skip }
1352             \skip_sub:Nn
1353             \l__enumext_multicols_below_iv_skip { \l__enumext_itemsep_iii_skip }
1354             \skip_add:Nn
1355             \l__enumext_minipage_after_skip
1356             { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1357             \skip_add:Nn
1358             \l__enumext_multicols_below_iv_skip
1359             { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1360         }
1361     }
1362 }
1363 }
1364 }

```

(End of definition for `\__enumext_pre_itemsep_skip`.)

### 13.22.2 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`.

```

1365 \cs_new_protected:Nn \__enumext_keyans_minipage_set_skip:
1366 {
1367     \skip_zero:N \l__enumext_minipage_after_skip
1368     \skip_zero:N \l__enumext_minipage_left_skip
1369     \skip_zero:N \l__enumext_minipage_right_skip
1370     \skip_set:Nn \l__enumext_minipage_right_skip
1371     {
1372         \l__enumext_topsep_v_skip
1373     }
1374     \mode_if_vertical:T
1375     {
1376         \skip_add:Nn \l__enumext_minipage_right_skip
1377         {
1378             \l__enumext_partopsep_v_skip
1379         }
1380     }
1381     \skip_set_eq:NN \l__enumext_minipage_after_skip \l__enumext_minipage_right_skip
1382     \skip_set_eq:NN \l__enumext_multicols_above_v_skip \l__enumext_minipage_right_skip
1383     \skip_set_eq:NN \l__enumext_multicols_below_v_skip \l__enumext_minipage_right_skip
1384     \__enumext_keyans_pre_itemsep_skip:

```

```

1385 \int_compare:nNt { \__enumext_columns_v_int } > { 1 }
1386 {
1387   \skip_zero:N \topskip
1388   \skip_set_eq:NN \multicolsep \__enumext_minipage_right_skip
1389 }
1390 }
1391 \cs_new_protected:Nn \__enumext_keyans_minipage_add_space:
1392 {
1393   \__enumext_keyans_minipage_set_skip:
1394   \__enumext_unskip_unkern:
1395   \mode_if_vertical:TF
1396   {
1397     \nopagebreak\nointerlineskip
1398   }
1399   {
1400     \par\nopagebreak\nointerlineskip
1401     \skip_zero:N \__enumext_partopsep_v_skip
1402   }
1403   \int_compare:nNtTF { \__enumext_columns_v_int } > { 1 }
1404   {
1405     \addvspace{ 0.445\box_ht:N \strutbox }
1406   }
1407   {
1408     \addvspace{ 0.250\box_ht:N \strutbox }
1409   }
1410 }
1411 \cs_new_protected:Nn \__enumext_keyans_pre_itemsep_skip:
1412 {
1413   \skip_if_eq:nnTF
1414   { \__enumext_itemsep_i_skip } { \__enumext_minipage_after_skip }
1415   {
1416     \skip_set:Nn \__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1417     \skip_set:Nn \__enumext_multicols_below_v_skip { 0.350\box_ht:N \strutbox }
1418   }
1419   {
1420     \dim_compare:nNt
1421     { \__enumext_itemsep_i_skip } < { \__enumext_minipage_after_skip }
1422     {
1423       \skip_sub:Nn \__enumext_minipage_after_skip { \__enumext_itemsep_i_skip }
1424       \skip_sub:Nn \__enumext_multicols_below_v_skip { \__enumext_itemsep_i_skip }
1425       \skip_add:Nn \__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1426       \skip_add:Nn \__enumext_multicols_below_v_skip { 0.350\box_ht:N \strutbox }
1427     }
1428     \dim_compare:nNt
1429     { \__enumext_itemsep_i_skip } > { \__enumext_minipage_after_skip }
1430     {
1431       \skip_set:Nn \__enumext_minipage_temp_skip
1432       {
1433         \__enumext_itemsep_i_skip - \__enumext_minipage_after_skip
1434       }
1435       \skip_sub:Nn \__enumext_minipage_after_skip { \__enumext_itemsep_i_skip }
1436       \skip_sub:Nn \__enumext_multicols_below_v_skip { \__enumext_itemsep_i_skip }
1437       \skip_add:Nn \__enumext_minipage_after_skip
1438       { 0.150\box_ht:N \strutbox + \__enumext_minipage_temp_skip }
1439       \skip_add:Nn \__enumext_multicols_below_v_skip
1440       { 0.350\box_ht:N \strutbox + \__enumext_minipage_temp_skip }
1441     }
1442   }
1443 }

```

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

### 13.22.3 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*`.

```

1444 \cs_new_protected:Nn \__enumext_mini_set_vskip_vii:
1445 {
1446   \skip_zero_new:N \__enumext_minipage_left_skip
1447   \skip_gzero_new:N \g__enumext_minipage_right_skip

```



```

1448 \skip_gzero_new:N \g__enumext_minipage_after_skip
1449 \skip_if_eq:nnTF { \l__enumext_topsep_vii_skip } { \c_zero_skip }
1450 {
1451   \skip_set:Nn \l__enumext_minipage_left_skip { 0.5\box_dp:N \strutbox }
1452   \skip_gset:Nn \g__enumext_minipage_right_skip { 0.325\box_dp:N \strutbox }
1453 }
1454 {
1455   \skip_set:Nn \l__enumext_minipage_left_skip { 0.5875\box_dp:N \strutbox }
1456   \skip_gset:Nn \g__enumext_minipage_right_skip
1457   {
1458     \l__enumext_topsep_vii_skip
1459   }
1460   \skip_gset:Nn \g__enumext_minipage_after_skip
1461   {
1462     0.325\box_dp:N \strutbox + \l__enumext_topsep_vii_skip
1463   }
1464 }
1465 }
1466 \cs_new_protected:Nn \__enumext_mini_set_vskip_viii:
1467 {
1468   \skip_zero_new:N \l__enumext_minipage_after_skip
1469   \skip_zero_new:N \l__enumext_minipage_left_skip
1470   \skip_zero_new:N \l__enumext_minipage_right_skip
1471   \skip_if_eq:nnTF { \l__enumext_topsep_viii_skip } { \c_zero_skip }
1472   {
1473     \skip_set:Nn \l__enumext_minipage_left_skip
1474     {
1475       0.5\box_dp:N \strutbox
1476     }
1477     \skip_set:Nn \l__enumext_minipage_right_skip
1478     {
1479       \l__enumext_partopsep_viii_skip
1480     }
1481     \skip_set:Nn \l__enumext_minipage_after_skip
1482     {
1483       1.6\box_dp:N \strutbox
1484     }
1485   }
1486   {
1487     \skip_set:Nn \l__enumext_minipage_left_skip
1488     {
1489       0.5875\box_dp:N \strutbox
1490     }
1491     \skip_set:Nn \l__enumext_minipage_right_skip
1492     {
1493       \l__enumext_topsep_viii_skip
1494     }
1495     \skip_set:Nn \l__enumext_minipage_after_skip
1496     {
1497       0.325\box_dp:N \strutbox + \l__enumext_topsep_viii_skip
1498     }
1499   }
1500 }

```

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

`\__enumext_mini_addvspace_vii:`  
`\__enumext_mini_addvspace_viii:`

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

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

```

1501 \cs_new_protected:Nn \__enumext_mini_addvspace_vii:
1502 {
1503   \__enumext_mini_set_vskip_vii:
1504   \par\nopagebreak
1505   \addvspace { \l__enumext_minipage_left_skip }
1506 }
1507 \cs_new_protected:Nn \__enumext_mini_addvspace_viii:
1508 {
1509   \__enumext_mini_set_vskip_viii:
1510   \par\nopagebreak

```

```

1511 \addvspace { \l__enumext_minipage_left_skip }
1512 }

```

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

### 13.22.4 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 L<sup>A</sup>T<sub>E</sub>X justification is maintained in the `__enumext_mini_page` on the “right side”.

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

```

1513 \NewDocumentCommand \miniright { s }
1514 {
1515   \int_compare:nNt { \l__enumext_keyans_pic_level_int } = { 1 }
1516   {
1517     \msg_error:nnn { enumext } { wrong-miniright-place }
1518   }
1519   % outside
1520   \bool_lazy_and:nnT
1521   { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
1522   { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
1523   {
1524     \msg_error:nnn { enumext } { wrong-miniright-place }
1525   }
1526   % starred env
1527   \bool_if:NT \l__enumext_starred_bool
1528   {
1529     \msg_error:nnn { enumext } { wrong-miniright-starred }
1530   }
1531   \int_compare:nNtF { \l__enumext_keyans_level_int } = { 1 }
1532   {
1533     \__enumext_keyans_mini_right_cmd:n {#1}
1534   }
1535   { \__enumext_mini_right_cmd:n {#1} }
1536 }

```

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

`\__enumext_mini_right_cmd:n` The function `\__enumext_mini_right_cmd:n` takes as argument the *starred* ‘\*’ of the `\miniright` command in the `enumext` environment. We check if the `mini-env` key is active via the variable `\l__enumext_minipage_right_X_dim`, if so we close the `multicols` environment with the `__enumext_mini_page` environment on the “left side”, then we open the `__enumext_mini_page` environment on the “right side”, apply our adjusted “vertical spaces”, followed by adding the `\centering` command when the *starred argument* ‘\*’ is not present and set zero `\g__enumext_minipage_stat_int`, otherwise we return an error.

```

1537 \cs_new_protected:Npn \__enumext_mini_right_cmd:n #1
1538 {
1539   \dim_compare:nNtF
1540   { \dim_use:c { \l__enumext_minipage_right_ \__enumext_level: _dim } } > { \c_zero_dim }
1541   {
1542     \__enumext_multicols_stop:
1543     \int_compare:nNtF
1544     { \int_use:c { \l__enumext_columns_ \__enumext_level: _int } } = { 1 }
1545     {
1546       \par\addvspace{ \l__enumext_minipage_after_skip }
1547     }
1548     \end__enumext_mini_page
1549     \hfill
1550     \__enumext_mini_page{ \dim_use:c { \l__enumext_minipage_right_ \__enumext_level: _dim } }
1551     \par\nointerlineskip
1552     \addvspace { \l__enumext_minipage_right_skip }
1553     \bool_if:nF {#1}
1554     {
1555       \centering
1556     }
1557     \int_gzero:N \g__enumext_minipage_stat_int
1558   }

```

```

1559     { \msg_error:nnn { enumext } { wrong-miniright-use } }
1560 % paranoia
1561 \RenewDocumentCommand \miniright { s }
1562 {
1563     \msg_error:nn { enumext } { many-miniright-used }
1564 }
1565 }

```

(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.

```

1566 \cs_new_protected:Npn \__enumext_keyans_mini_right_cmd:n #1
1567 {
1568     \dim_compare:nNnTF { \__enumext_minipage_right_v_dim } > { \c_zero_dim }
1569     {
1570         \__enumext_keyans_multicols_stop:
1571         \int_compare:nNnT { \__enumext_columns_v_int } = { 1 }
1572         {
1573             \par\addvspace{ \__enumext_minipage_after_skip }
1574         }
1575         \end__enumext_mini_page
1576         \hfill
1577         \__enumext_mini_page{ \__enumext_minipage_right_v_dim }
1578         \par\nointerlineskip
1579         \addvspace { \__enumext_minipage_right_skip }
1580         \bool_if:nF {#1}
1581         {
1582             \centering
1583         }
1584         \int_gzero:N \g__enumext_minipage_stat_int
1585     }
1586     { \msg_error:nnn { enumext } { wrong-miniright-use } }
1587 % paranoia
1588 \RenewDocumentCommand \miniright { s }
1589 {
1590     \msg_error:nn { enumext } { many-miniright-used }
1591 }
1592 }

```

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

### 13.23 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.

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

```

above*
below
below*
1593 \cs_set_protected:Npn \__enumext_tmp:n #1 #2
1594 {
1595     \keys_define:nn { enumext / #1 }
1596     {
1597         above .skip_set:c = { \__enumext_vspace_above_#2_skip },
1598         above .value_required:n = true,
1599         above* .code:n = \bool_set_true:c { \__enumext_vspace_a_star_#2_bool }
1600             \keys_set:nn { enumext / #1 } { above = {#1} },
1601         above* .value_required:n = true,
1602         below .skip_set:c = { \__enumext_vspace_below_#2_skip },
1603         below .value_required:n = true,
1604         below* .code:n = \bool_set_true:c { \__enumext_vspace_b_star_#2_bool }
1605             \keys_set:nn { enumext / #1 } { below = {#1} },
1606         below* .value_required:n = true,
1607     }
1608 }
1609 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:n #1 }

```

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

### 13.23.1 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.

```

1610 \cs_new_protected:Nn \__enumext_vspace_above:
1611 {
1612   \skip_if_eq:nnF
1613   { \skip_use:c { \__enumext_vspace_above_ \__enumext_level: _skip } } { \c_zero_skip }
1614   {
1615     \bool_if:cTF { \__enumext_vspace_a_star_ \__enumext_level: _bool }
1616     {
1617       \vspace*{ \skip_use:c { \__enumext_vspace_above_ \__enumext_level: _skip } }
1618     }
1619     {
1620       \vspace { \skip_use:c { \__enumext_vspace_above_ \__enumext_level: _skip } }
1621     }
1622   }
1623 }

```

(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.

```

1624 \cs_new_protected:Nn \__enumext_vspace_below:
1625 {
1626   \skip_if_eq:nnF
1627   { \skip_use:c { \__enumext_vspace_below_ \__enumext_level: _skip } } { \c_zero_skip }
1628   {
1629     \bool_if:cTF { \__enumext_vspace_b_star_ \__enumext_level: _bool }
1630     {
1631       \vspace*{ \skip_use:c { \__enumext_vspace_below_ \__enumext_level: _skip } }
1632     }
1633     {
1634       \vspace { \skip_use:c { \__enumext_vspace_below_ \__enumext_level: _skip } }
1635     }
1636   }
1637 }

```

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

### 13.23.2 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.

```

1638 \cs_new_protected:Nn \__enumext_vspace_above_v:
1639 {
1640   \skip_if_eq:nnF { \__enumext_vspace_above_v_skip } { \c_zero_skip }
1641   {
1642     \bool_if:NTF \__enumext_vspace_a_star_v_bool
1643     {
1644       \vspace*{ \__enumext_vspace_above_v_skip }
1645     }
1646     { \vspace { \__enumext_vspace_above_v_skip } }
1647   }
1648 }

```

(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.

```

1649 \cs_new_protected:Nn \__enumext_vspace_below_v:
1650 {
1651   \skip_if_eq:nnF { \__enumext_vspace_below_v_skip } { \c_zero_skip }
1652   {
1653     \bool_if:NTF \__enumext_vspace_b_star_v_bool
1654     {
1655       \vspace*{ \__enumext_vspace_below_v_skip }
1656     }
1657     { \vspace { \__enumext_vspace_below_v_skip } }
1658   }
1659 }

```

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

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

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.

```

1660 \cs_new_protected:Nn \__enumext_vspace_above_vii:
1661 {
1662   \skip_if_eq:nnF { \l__enumext_vspace_above_vii_skip } { \c_zero_skip }
1663   {
1664     \bool_if:NTF \l__enumext_vspace_a_star_vii_bool
1665     {
1666       \vspace*{ \l__enumext_vspace_above_vii_skip }
1667     }
1668     { \vspace { \l__enumext_vspace_above_vii_skip } }
1669   }
1670 }
1671 \cs_new_protected:Nn \__enumext_vspace_above_viii:
1672 {
1673   \skip_if_eq:nnF { \l__enumext_vspace_above_viii_skip } { \c_zero_skip }
1674   {
1675     \bool_if:NTF \l__enumext_vspace_a_star_viii_bool
1676     {
1677       \vspace*{ \l__enumext_vspace_above_viii_skip }
1678     }
1679     { \vspace { \l__enumext_vspace_above_viii_skip } }
1680   }
1681 }

```

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

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.

```

1682 \cs_new_protected:Nn \__enumext_vspace_below_vii:
1683 {
1684   \skip_if_eq:nnF { \l__enumext_vspace_below_vii_skip } { \c_zero_skip }
1685   {
1686     \bool_if:NTF \l__enumext_vspace_b_star_vii_bool
1687     {
1688       \vspace*{ \l__enumext_vspace_below_vii_skip }
1689     }
1690     { \vspace { \l__enumext_vspace_below_vii_skip } }
1691   }
1692 }
1693 \cs_new_protected:Nn \__enumext_vspace_below_viii:
1694 {
1695   \skip_if_eq:nnF { \l__enumext_vspace_below_viii_skip } { \c_zero_skip }
1696   {
1697     \bool_if:NTF \l__enumext_vspace_b_star_viii_bool
1698     {
1699       \vspace*{ \l__enumext_vspace_below_viii_skip }
1700     }
1701     { \vspace { \l__enumext_vspace_below_viii_skip } }
1702   }
1703 }

```

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

### 13.24 Setting series, resume and resume\* keys

The `series` key is responsible for the whole process of the `resume` and `resume*` keys. The idea behind this is to be able to absorb the `<keys>` passed to the *optional argument* of the “first level” of the environments `enumext` and `enumext*`, but, discarding some specific `<keys>`. This implementation is adapted directly from the code provided by Jonathan P. Spratte (@Skillmon) in `chat-Tex-SX`

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

```

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

```

```

1712         resume* .value_forbidden:n = true,
1713     }
1714 }
1715 \clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }

```

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

### 13.24.1 Internal functions for series key

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

```

\__enumext_filter_series:n
  \__enumext_filter_series_key:n
  \__enumext_filter_series_pair:nn
1716 \cs_new:Npn \__enumext_filter_series:n #1
1717 {
1718     \use:e
1719     {
1720         \keyval_parse:NNn
1721         \__enumext_filter_series_key:n
1722         \__enumext_filter_series_pair:nn {#1}
1723     }
1724 }

```

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.

```

1725 \cs_new:Npn \__enumext_filter_series_key:n #1
1726 {
1727     \str_case:nnF {#1}
1728     {
1729         { resume } {} { resume* } {} { base-fix } {}
1730     }
1731     { , { \exp_not:n {#1} } }
1732 }

```

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.

```

1733 \cs_new:Npn \__enumext_filter_series_pair:nn #1#2
1734 {
1735     \str_case:nnF {#1}
1736     {
1737         { series } {} { resume } {} { start } {}
1738         { start* } {} { save-ans } {} { save-key } {}
1739     }
1740     { , { \exp_not:n {#1} } = { \exp_not:n {#2} } }
1741 }

```

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

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

- The value of boolean variable `\l__enumext_resume_active_bool` is set to true by the function `\__enumext_resume_counter:n` which is used by the keys `resume` and `resume*`, in this case we must Make sure it is set to false so that it does not overwrite the default filtered *⟨keys⟩*. This function is passed to the function `\__enumext_parse_keys:n` in the `enumext` environment definition (§13.38) and to the function `\__enumext_parse_keys_vii:n` in the `enumext*` environment definition (§13.43).

```

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

```



```

1757         \int_new:c { g__enumext_series_ \l__enumext_series_str _int }
1758     }
1759 }
1760 }

```

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.

```

1761 \cs_new_protected:Npn \__enumext_resume_last:n #1
1762 {
1763     \bool_if:NT \l__enumext_standar_first_bool
1764     {
1765         \tl_gclear:N \g__enumext_standar_series_tl
1766         \tl_gset:Ne \g__enumext_standar_series_tl { \__enumext_filter_series:n {#1} }
1767     }
1768     \bool_if:NT \l__enumext_starred_first_bool
1769     {
1770         \tl_gclear:N \g__enumext_starred_series_tl
1771         \tl_gset:Ne \g__enumext_starred_series_tl { \__enumext_filter_series:n {#1} }
1772     }
1773 }

```

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

### 13.24.2 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 (§13.38) and the *enumext\** environment definition (§13.43).

```

1774 \cs_new_protected:Npn \__enumext_resume_save_counter:
1775 {
1776     \bool_if:NT \g__enumext_standar_bool
1777     {
1778         \tl_if_empty:NF \l__enumext_series_str
1779         {
1780             \int_gset_eq:cN
1781             { g__enumext_series_ \l__enumext_series_str _int } \value{enumXi}
1782         }
1783         \tl_if_empty:NTF \l__enumext_resume_name_tl
1784         {
1785             \str_if_empty:NT \l__enumext_series_str
1786             {
1787                 \int_gset_eq:NN \g__enumext_resume_int \value{enumXi}
1788             }
1789         }
1790         {
1791             \int_if_exist:cT { g__enumext_series_ \l__enumext_resume_name_tl _int }
1792             {
1793                 \int_gset_eq:cN
1794                 { g__enumext_series_ \l__enumext_resume_name_tl _int } \value{enumXi}
1795             }
1796         }
1797         \int_if_exist:cT { g__enumext_resume_ \l__enumext_store_name_tl _int }
1798         {
1799             \int_gset_eq:cN
1800             { g__enumext_resume_ \l__enumext_store_name_tl _int } \value{enumXi}
1801         }
1802     }
1803     \bool_if:NT \g__enumext_starred_bool
1804     {
1805         \tl_if_empty:NF \l__enumext_series_str
1806         {
1807             \int_gset_eq:cN
1808             { g__enumext_series_ \l__enumext_series_str _int } \value{enumXvii}

```

```

1809     }
1810     \tl_if_empty:NTF \l__enumext_resume_name_tl
1811     {
1812         \str_if_empty:NT \l__enumext_series_str
1813         {
1814             \int_gset_eq:NN \g__enumext_resume_vii_int \value{enumXvii}
1815         }
1816     }
1817     {
1818         \int_if_exist:cT { g__enumext_series_ \l__enumext_resume_name_tl _int }
1819         {
1820             \int_gset_eq:cN
1821             { g__enumext_series_ \l__enumext_resume_name_tl _int } \value{enumXvii}
1822         }
1823     }
1824     \int_if_exist:cT { g__enumext_resume_ \l__enumext_store_name_tl _int }
1825     {
1826         \int_gset_eq:cN
1827         { g__enumext_resume_ \l__enumext_store_name_tl _int } \value{enumXvii}
1828     }
1829 }
1830 }

```

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

### 13.24.3 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.

```

1831 \cs_new_protected:Npn \__enumext_resume_series:n #1
1832 {
1833     \tl_if_empty:NTF {#1}
1834     {
1835         \__enumext_resume_counter:n { }
1836     }
1837     {
1838         \tl_if_exist:cTF { g__enumext_series_ \tl_to_str:n {#1} _tl }
1839         {
1840             \__enumext_resume_counter:n {#1}
1841             \bool_if:NT \g__enumext_standar_bool
1842             {
1843                 \keys_set:nv { enumext / level-1 }
1844                 { g__enumext_series_ \tl_to_str:n {#1} _tl }
1845             }
1846             \bool_if:NT \g__enumext_starred_bool
1847             {
1848                 \keys_set:nv { enumext / enumext* }
1849                 { g__enumext_series_ \tl_to_str:n {#1} _tl }
1850             }
1851         }
1852         {
1853             \bool_if:NT \g__enumext_standar_bool
1854             {
1855                 \msg_error:nnn { enumext } { unknown-series } {#1}
1856             }
1857             \bool_if:NT \g__enumext_starred_bool
1858             {
1859                 \msg_error:nnn { enumext } { unknown-series } {#1}
1860             }
1861         }
1862     }
1863 }

```

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

\\_\_enumext\_resume\_counter:n

\\_\_enumext\_resume\_counter:

\\_\_enumext\_resume\_counter\_series:

\\_\_enumext\_resume\_counter\_save\_ans:

The function \\_\_enumext\_resume\_counter:n will set the variable \l\_\_enumext\_resume\_active\_bool to true and pass the value of the key `resume` to the variable \l\_\_enumext\_series\_name\_tl which will

contain the  $\{\langle series\ name\rangle\}$ . If the variable `\l__enumext_series_name_tl` is empty, that is, we are passing the key *resume without value*, we will execute the function `\__enumext_resume_counter:`; otherwise, when we pass *resume= $\{\langle series\ name\rangle\}$*  we will execute the function `\__enumext_resume_counter_series:`, finally we will execute the function `\__enumext_resume_counter_save_ans:` which is associated with the key *save-ans*.

```

1864 \cs_new_protected:Npn \__enumext_resume_counter:n #1
1865 {
1866   \bool_set_true:N \l__enumext_resume_active_bool
1867   \tl_set:Nn \l__enumext_resume_name_tl {#1}
1868   \tl_if_empty:NTF \l__enumext_resume_name_tl
1869   {
1870     \__enumext_resume_counter:
1871   }
1872   {
1873     \__enumext_resume_counter_series:
1874   }
1875   \__enumext_resume_counter_save_ans:
1876 }

```

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.

```

1877 \cs_new_protected:Nn \__enumext_resume_counter:
1878 {
1879   \bool_if:NT \g__enumext_standar_bool
1880   {
1881     \int_gincr:N \g__enumext_resume_int
1882     \int_set_eq:NN \l__enumext_start_i_int \g__enumext_resume_int
1883   }
1884   \bool_if:NT \g__enumext_starred_bool
1885   {
1886     \int_gincr:N \g__enumext_resume_vii_int
1887     \int_set_eq:NN \l__enumext_start_vii_int \g__enumext_resume_vii_int
1888   }
1889 }

```

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

```

1890 \cs_new_protected:Nn \__enumext_resume_counter_series:
1891 {
1892   \bool_if:NT \g__enumext_standar_bool
1893   {
1894     \int_set:Nn \l__enumext_start_i_int
1895     {
1896       \int_use:c { g__enumext_series_ \l__enumext_resume_name_tl _int } + 1
1897     }
1898   }
1899   \bool_if:NT \g__enumext_starred_bool
1900   {
1901     \int_set:Nn \l__enumext_start_vii_int
1902     {
1903       \int_use:c { g__enumext_series_ \l__enumext_resume_name_tl _int } + 1
1904     }
1905   }
1906 }

```

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.

```

1907 \cs_new_protected:Nn \__enumext_resume_counter_save_ans:
1908 {
1909   \bool_lazy_and:nnT
1910   { \bool_if_p:N \l__enumext_standar_first_bool }
1911   { \bool_if_p:N \l__enumext_store_active_bool }
1912   {
1913     \int_set:Nn \l__enumext_start_i_int
1914     {
1915       \int_use:c { g__enumext_resume_ \l__enumext_store_name_tl _int } + 1
1916     }
1917   }
1918   \bool_lazy_and:nnT

```

```

1919     { \bool_if_p:N \__enumext_starred_first_bool }
1920     { \bool_if_p:N \__enumext_store_active_bool }
1921     {
1922         \int_set:Nn \__enumext_start_vii_int
1923         {
1924             \int_use:c { g__enumext_resume_ \__enumext_store_name_tl _int } + 1
1925         }
1926     }
1927 }

```

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

#### 13.24.4 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.

```

1928 \cs_new_protected:Nn \__enumext_resume_starred:
1929 {
1930     \bool_if:NT \g__enumext_standar_bool
1931     {
1932         \tl_if_empty:NF \g__enumext_standar_series_tl
1933         {
1934             \__enumext_resume_counter:n { }
1935             \keys_set:nV { enumext / level-1 } \g__enumext_standar_series_tl
1936         }
1937     }
1938     \bool_if:NT \g__enumext_starred_bool
1939     {
1940         \tl_if_empty:NF \g__enumext_starred_series_tl
1941         {
1942             \__enumext_resume_counter:n { }
1943             \keys_set:nV { enumext / enumext* } \g__enumext_starred_series_tl
1944         }
1945     }
1946 }

```

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

### 13.25 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.

#### 13.25.1 Setting save-ans key

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

```

1947 \cs_set_protected:Npn \__enumext_tmp:n #1
1948 {
1949     \keys_define:nn { enumext / #1 }
1950     {
1951         save-ans .code:n = \__enumext_storing_set:n {##1},
1952         save-ans .value_required:n = true,
1953     }
1954 }
1955 \clist_map_inline:nn { level-1, enumext* } { { \__enumext_tmp:n {#1} } }

```

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

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

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

```

1956 \cs_new_protected:Nn \__enumext_start_save_ans_msg:
1957 {
1958     \msg_term:nnVV { enumext } { save-ans-log }
1959     \g__enumext_envir_name_tl \__enumext_store_name_tl
1960 }
1961 \cs_new_protected:Nn \__enumext_stop_save_ans_msg:
1962 {

```

```

1963     \msg_term:nnVV { enumext } { save-ans-log-hook }
1964     \g__enumext_envir_name_tl \g__enumext_store_name_tl
1965 }

```

(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.

```

1966 \cs_new_protected:Npn \__enumext_storing_set:n #1
1967 {
1968     \tl_set:Nx \l__enumext_store_name_tl {#1}
1969     \tl_if_empty:NTF \l__enumext_store_name_tl
1970     {
1971         \bool_lazy_or:nnT
1972         { \l__enumext_standar_first_bool } { \l__enumext_starred_first_bool }
1973         {
1974             \msg_error:nnV { enumext } { save-ans-empty } \g__enumext_envir_name_tl
1975         }
1976     }
1977     {
1978         \bool_lazy_or:nnT
1979         { \l__enumext_standar_first_bool } { \l__enumext_starred_first_bool }
1980         {
1981             \__enumext_start_save_ans_msg:
1982             \__enumext_storing_exec:
1983         }
1984     }
1985 }

```

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  $\langle store\ name \rangle$  into the variable \g\_\_enumext\_store\_name\_tl and execute the function \\_\_enumext\_anskey\_env\_make:V creating the environment `anskey*` (§13.30).

```

1986 \cs_new_protected:Nn \__enumext_storing_exec:
1987 {
1988     \bool_set_true:N \l__enumext_store_active_bool
1989     \bool_set_true:N \l__enumext_check_answers_bool
1990     \tl_gset:NV \g__enumext_store_name_tl \l__enumext_store_name_tl
1991     \__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*`.

```

1992     \prop_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _prop }
1993     {
1994         \msg_log:nnV { enumext } { store-prop } \l__enumext_store_name_tl
1995         \prop_new:c { g__enumext_ \l__enumext_store_name_tl _prop }
1996     }
1997     \seq_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _seq }
1998     {
1999         \msg_log:nnV { enumext } { store-seq } \l__enumext_store_name_tl
2000         \seq_new:c { g__enumext_ \l__enumext_store_name_tl _seq }
2001     }
2002     \int_if_exist:cF { g__enumext_resume_ \l__enumext_store_name_tl _int }
2003     {
2004         \msg_log:nnV { enumext } { store-int } \l__enumext_store_name_tl
2005         \int_new:c { g__enumext_resume_ \l__enumext_store_name_tl _int }
2006     }
2007 }

```

(End of definition for \\_\_enumext\_storing\_set:n and \\_\_enumext\_storing\_exec:.)

### 13.25.3 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:

- a) If the list only has one level the number of `\item` + `\item*` = `\anskey`
- b) If the list has *nested levels*, for each level of nesting we need to decrementing by one (for the `\item` or `\item*` that opens the nest) so that the account remains the same.

With `keyans`, `keyans*` and `keyanspic` it is enough to increase in one the integer of `\anskey`. The integers created must be global if they are not lost in the interior levels of nesting and to execute the test we will use a “hook” function after closing the *first level* of the environment.

### 13.25.4 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 2008 \cs_set_protected:Npn \__enumext_tmp:n #1
no-store 2009 {
2010     \keys_define:nn { enumext / #1 }
2011     {
2012         check-ans .bool_set:N = \__enumext_check_ans_key_bool,
2013         check-ans .initial:n = false,
2014         check-ans .value_required:n = true,
2015         no-store .code:n = {
2016             \bool_set_false:N \__enumext_check_answers_bool
2017             \bool_set_false:N \__enumext_check_ans_key_bool
2018         },
2019         no-store .value_forbidden:n = true,
2020     }
2021 }
2022 \clist_map_inline:nn
2023 {
2024     level-1, level-2, level-3, level-4, enumext*
2025 }
2026 { \__enumext_tmp:n {#1} }
```

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

### 13.25.5 Set-up check answer mechanism

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

```

2027 \cs_new_protected:Nn \__enumext_check_ans_active:
2028 {
2029     \tl_if_empty:NF \l__enumext_store_name_tl
2030     {
2031         \bool_if:NT \l__enumext_check_answers_bool
2032         {
2033             \__enumext_check_ans_level:
2034         }
2035     }
2036 }
```



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”.

```

2037 \cs_new_protected:Nn \__enumext_check_ans_level:
2038 {
2039   \int_case:nn { \l__enumext_level_int }
2040   {
2041     { 1 }{
2042       \bool_lazy_all:nT
2043       {
2044         { \bool_if_p:N \g__enumext_starred_bool }
2045         { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
2046       }
2047       {
2048         \int_gdecr:N \g__enumext_item_number_int
2049         \bool_set_false:N \l__enumext_item_number_bool
2050       }
2051     }
2052     { 2 }{
2053       \int_gdecr:N \g__enumext_item_number_int
2054       \bool_set_false:N \l__enumext_item_number_bool
2055     }
2056     { 3 }{
2057       \int_gdecr:N \g__enumext_item_number_int
2058       \bool_set_false:N \l__enumext_item_number_bool
2059     }
2060     { 4 }{
2061       \int_gdecr:N \g__enumext_item_number_int
2062       \bool_set_false:N \l__enumext_item_number_bool
2063     }
2064   }

```

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.

```

2065   \int_case:nn { \l__enumext_level_h_int }
2066   {
2067     { 1 }{
2068       \bool_lazy_all:nT
2069       {
2070         { \bool_if_p:N \g__enumext_standar_bool }
2071         { \int_compare_p:nNn { \l__enumext_level_int } = { 1 } }
2072       }
2073       {
2074         \int_gdecr:N \g__enumext_item_number_int
2075         \bool_set_false:N \l__enumext_item_number_bool
2076       }
2077     }
2078   }
2079 }

```

(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.

```

2080 \cs_new_protected:Nn \__enumext_check_ans_key_hook:
2081 {
2082   \bool_lazy_and:nnT
2083   { \bool_if_p:N \l__enumext_check_ans_key_bool }
2084   { \bool_if_p:N \g__enumext_standar_bool }
2085   {
2086     \bool_gset_true:N \g__enumext_check_ans_key_bool
2087   }
2088   \bool_lazy_and:nnT
2089   { \bool_if_p:N \l__enumext_check_ans_key_bool }
2090   { \bool_if_p:N \g__enumext_starred_bool }
2091   {
2092     \bool_gset_true:N \g__enumext_check_ans_key_bool
2093   }
2094 }

```

(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:`.

```
2095 \cs_new_protected:Nn \__enumext_item_answer_diff:
2096 {
2097     \int_gset:Nn \g__enumext_item_answer_diff_int
2098     {
2099         \int_sign:n { \g__enumext_item_number_int - \g__enumext_item_anskey_int }
2100     }
2101 }
```

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

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

```
2102 \cs_new_protected:Nn \__enumext_check_ans_show:
2103 {
2104     \int_case:nn { \g__enumext_item_answer_diff_int }
2105     {
2106         { -1 } { \__enumext_check_ans_msg_less: }
2107         { 0 } { \__enumext_check_ans_msg_same_ok: }
2108         { 1 } { \__enumext_check_ans_msg_greater: }
2109     }
2110 }
2111 \cs_new_protected:Nn \__enumext_check_ans_msg_less:
2112 {
2113     \msg_warning:nnee { enumext } { item-less-answer } { \g__enumext_store_name_tl }
2114     { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2115 }
2116 \cs_new_protected:Nn \__enumext_check_ans_msg_same_ok:
2117 {
2118     \msg_term:nnee { enumext } { items-same-answer } { \g__enumext_store_name_tl }
2119     { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2120 }
2121 \cs_new_protected:Nn \__enumext_check_ans_msg_greater:
2122 {
2123     \msg_warning:nnee { enumext } { item-greater-answer } { \g__enumext_store_name_tl }
2124     { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2125 }
```

(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:`.

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

```

2145 \cs_new_protected:Nn \__enumext_check_ans_log_msg_greater:
2146 {
2147   \msg_log:nneee { enumext } { item-greater-answer } { \g__enumext_store_name_tl }
2148   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2149 }

```

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

### 13.25.6 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.

```

2150 \cs_new_protected:Npn \__enumext_check_starred_cmd:n #1
2151 {
2152   \int_compare:nNnT
2153     { \g__enumext_check_starred_cmd_int } = { 0 }
2154     {
2155       \msg_warning:nnnV
2156         { enumext } { missing-starred } { #1 } \l__enumext_check_start_line_env_tl
2157     }
2158   \int_compare:nNnT
2159     { \g__enumext_check_starred_cmd_int } > { 1 }
2160     {
2161       \msg_warning:nnnV
2162         { enumext } { many-starred } { #1 } \l__enumext_check_start_line_env_tl
2163     }
2164   \int_gzero:N \g__enumext_check_starred_cmd_int
2165   \tl_clear:N \l__enumext_check_start_line_env_tl
2166 }

```

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

### 13.26 Keys and functions associated with storage

wrap-ans  
wrap-opt  
save-sep  
mark-ans  
mark-pos  
show-ans  
mark-ref  
save-ref

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*`.

```

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

```

```

2201         mark-ref .initial:n = \textreferencemark,
2202         mark-ref .value_required:n = true,
2203         save-ref .bool_set:N = \l__enumext_store_ref_key_bool,
2204         save-ref .initial:n = false,
2205         save-ref .value_required:n = true,
2206     }
2207 }
2208 \clist_map_inline:nn { level-1, enumext* } { \l__enumext_tmp:n {#1} }

```

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

mark-pos For the **keyans** and **keyans\*** environments we will only add the keys mark-pos, show-ans and show-pos.

```

show-ans 2209 \cs_set_protected:Npn \l__enumext_tmp:n #1
show-pos 2210 {
2211     \keys_define:nn { enumext / #1 }
2212     {
2213         mark-pos .choice:,
2214         mark-pos / left .code:n = \str_set:Nn \l__enumext_mark_position_str { l },
2215         mark-pos / right .code:n = \str_set:Nn \l__enumext_mark_position_str { r },
2216         mark-pos .initial:n = right,
2217         mark-pos .value_required:n = true,
2218         show-ans .bool_set:N = \l__enumext_show_answer_bool,
2219         show-ans .initial:n = false,
2220         show-ans .value_required:n = true,
2221         show-pos .bool_set:N = \l__enumext_show_position_bool,
2222         show-pos .initial:n = false,
2223         show-pos .value_required:n = true,
2224     }
2225 }
2226 \clist_map_inline:nn { keyans, keyans* } { \l__enumext_tmp:n {#1} }

```

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

### 13.26.1 Storing structure of the environments

The idea behind “*storing structure*” in the *sequence* is to have a copy of the *structure of the environment* in which the key **save-ans** is being executed so we must capture the *optional argument* passed to the levels of the environment in which it is executed and “*storing*” this in the *sequence*.

```

\__enumext_store_active_keys:n
\__enumext_store_active_keys_vii:n

```

The functions `\__enumext_store_active_keys:n` and `\__enumext_store_active_keys_vii:n` will be responsible for the “*storing keys*” filtered from the *optional argument* of the environment in which the key **save-ans** is executed and the levels within this for the **enumext** and **enumext\*** environments. We will execute this function only if the variable `\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>*.

```

2227 \cs_new_protected:Npn \__enumext_store_active_keys:n #1
2228 {
2229     \bool_if:cF { l__enumext_store_save_key_ \__enumext_level: _bool }
2230     {
2231         \tl_clear:c { l__enumext_save_key_ \__enumext_level: _tl }
2232         \tl_set:ce
2233             { l__enumext_store_save_key_ \__enumext_level: _tl }
2234             { \__enumext_filter_save_key:n {#1} }
2235     }
2236 }
2237 \cs_new_protected:Npn \__enumext_store_active_keys_vii:n #1
2238 {
2239     \bool_if:NF \l__enumext_store_save_key_vii_bool
2240     {
2241         \tl_clear:N \l__enumext_store_save_key_vii_tl
2242         \tl_set:Ne \l__enumext_store_save_key_vii_tl { \__enumext_filter_save_key:n {#1} }
2243     }
2244 }

```

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

### 13.26.2 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.

```

2245 \cs_set_protected:Npn \__enumext_tmp:n #1
2246 {
2247   \keys_define:nn { enumext / enumext* }
2248   {
2249     save-key .code:n = \__enumext_parse_save_key_vii:n {##1},
2250     save-key .value_required:n = true,
2251   }
2252   \keys_define:nn { enumext / #1 }
2253   {
2254     save-key .code:n = \__enumext_parse_save_key:n {##1},
2255     save-key .value_required:n = true,
2256   }
2257 }
2258 \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*`.

```

2259 \cs_new_protected:Npn \__enumext_parse_save_key:n #1
2260 {
2261   \bool_set_true:c { l__enumext_store_save_key_ \__enumext_level: _bool }
2262   \tl_clear:c { l__enumext_save_key_ \__enumext_level: _tl }
2263   \tl_set:ce
2264   { l__enumext_store_save_key_ \__enumext_level: _tl }
2265   { \__enumext_filter_save_key:n {#1} }
2266 }
2267 \cs_new_protected:Npn \__enumext_parse_save_key_vii:n #1
2268 {
2269   \bool_set_true:N \l__enumext_store_save_key_vii_bool
2270   \tl_clear:N \l__enumext_store_save_key_vii_tl
2271   \tl_set:Ne \l__enumext_store_save_key_vii_tl { \__enumext_filter_save_key:n {#1} }
2272 }

```

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

### 13.26.3 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.

```

2273 \cs_new:Npn \__enumext_filter_save_key:n #1
2274 {
2275   \use:e
2276   {
2277     \keyval_parse:NNn
2278     \__enumext_filter_save_key_key:n
2279     \__enumext_filter_save_key_pair:nn {#1}
2280   }
2281 }

```

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.

```

2282 \cs_new:Npn \__enumext_filter_save_key_key:n #1
2283 {
2284   \str_case:nnF {#1}
2285   {
2286     { resume } {} { resume* } {} { no-store } {} { base-fix } {}
2287   }
2288   { , { \exp_not:n {#1} } }
2289 }

```

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.

```

2290 \cs_new:Npn \__enumext_filter_save_key_pair:nn #1#2
2291 {
2292   \str_case:nnF {#1}
2293   {
2294     { series } {} { resume } {} { save-ans } {} { save-ref } {}
2295     { save-key } {} { check-ans } {} { show-ans } {} { show-pos } {}
2296     { wrap-ans } {} { mark-ans } {} { wrap-opt } {} { save-sep } {}
2297     { mark-ref } {} { mini-env } {} { mini-sep } {} { mini-right } {}
2298     { mini-right* } {}
2299   }
2300   { , { \exp_not:n {#1} } = { \exp_not:n {#2} } }
2301 }

```

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

### 13.26.4 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.

```

2302 \cs_new_protected:Npn \__enumext_store_addto_prop:n #1
2303 {
2304   \prop_gput_if_not_in:cen { g__enumext_ \__enumext_store_name_tl _prop }
2305   {
2306     \int_eval:n { \prop_count:c { g__enumext_ \__enumext_store_name_tl _prop } + 1 }
2307   }
2308   { #1 }
2309 }
2310 \cs_generate_variant:Nn \__enumext_store_addto_prop:n { V }

```

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

### 13.26.5 Function for storing content in sequence

```

\__enumext_store_addto_seq:n
\__enumext_store_addto_seq:v
\__enumext_store_addto_seq:V

```

The function `\__enumext_store_addto_seq:n` stores the `{\content}` in *sequence* defined by `save-ans` key. This function is used by `\anskey` in `enumext`, `\item*` in `keyans` and `\anspic` in `keyanspic`.

The form in which the `{\content}` is stored in *sequence* is in a internal `enumext` or `enumext*` environments with the “*same structure*” in which the command was executed.

The “*stored content*” is retrieved by means of the `\printkeyans` command.

```

2311 \cs_new_protected:Npn \__enumext_store_addto_seq:n #1
2312 {
2313   \seq_gput_right:cn { g__enumext_ \__enumext_store_name_tl _seq } { #1 }
2314 }
2315 \cs_generate_variant:Nn \__enumext_store_addto_seq:n { v, V }

```

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

### 13.26.6 Functions for storing structure in the sequence

```

\__enumext_store_level_open:
\__enumext_store_level_close:

```

The “*storing structure*” is handled by the functions `\__enumext_store_level_open:` and `\__enumext_store_level_close:` which are executed per level within the `enumext` environment.

```

2316 \cs_new_protected:Nn \__enumext_store_level_open:
2317 {
2318   \bool_if:NT \__enumext_check_answers_bool
2319   {
2320     \tl_if_empty:cTF { l__enumext_store_save_key_ \__enumext_level: _tl }
2321     {
2322       \__enumext_store_addto_seq:n
2323       {
2324         \item \begin{enumext}
2325       }
2326     }
2327     {
2328       \tl_put_left:cn { l__enumext_store_save_key_ \__enumext_level: _tl }
2329       {

```

```

2330         \item \begin{enumext} [
2331         ]
2332         \tl_put_right:cn { l__enumext_store_save_key_ \_tl }
2333         {
2334         ]
2335         }
2336         \__enumext_store_addto_seq:v { l__enumext_store_save_key_ \_tl }
2337     }
2338 }
2339 }
2340 \cs_new_protected:Nn \__enumext_store_level_close:
2341 {
2342     \bool_if:NT \l__enumext_check_answers_bool
2343     {
2344         \__enumext_store_addto_seq:n { \end{enumext} }
2345     }
2346 }

```

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

\\_\_enumext\_store\_level\_open\_vii:  
 \\_\_enumext\_store\_level\_close\_vii:

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

```

2347 \cs_new_protected:Nn \__enumext_store_level_open_vii:
2348 {
2349     \bool_if:NT \l__enumext_check_answers_bool
2350     {
2351         \tl_if_empty:NTF \l__enumext_store_save_key_vii_tl
2352         {
2353             \__enumext_store_addto_seq:n
2354             {
2355                 \item \begin{enumext*}
2356             }
2357         }
2358         {
2359             \tl_put_left:Nn \l__enumext_store_save_key_vii_tl
2360             {
2361                 \item \begin{enumext*}[
2362             }
2363             \tl_put_right:Nn \l__enumext_store_save_key_vii_tl
2364             {
2365             ]
2366             }
2367             \__enumext_store_addto_seq:V \l__enumext_store_save_key_vii_tl
2368         }
2369     }
2370 }
2371 \cs_new_protected:Nn \__enumext_store_level_close_vii:
2372 {
2373     \bool_if:NT \l__enumext_check_answers_bool
2374     {
2375         \__enumext_store_addto_seq:n { \end{enumext*} }
2376     }
2377 }

```

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

### 13.26.7 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

```

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

```



```

2387     }
2388   }
2389   \skip_horizontal:n { \dim_use:N #2 }
2390 }
2391 \cs_generate_variant:Nn \__enumext_print_keyans_box:NN { cc }

```

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

### 13.27 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 \\_\_enumext\_newlabel\_arg\_two\_tl.

```

2392 \cs_new_protected:Nn \__enumext_store_internal_ref:
2393 {
2394   \cs_set_protected:Npn \__enumext_tmp:n ##1
2395   {
2396     \tl_set_eq:cc { \__enumext_label_copy_##1_tl } { \__enumext_label_##1_tl }
2397     \tl_reverse:c { \__enumext_label_copy_##1_tl }
2398     \tl_remove_once:cn { \__enumext_label_copy_##1_tl } { . }
2399     \tl_reverse:c { \__enumext_label_copy_##1_tl }
2400   }
2401   \clist_map_inline:nn { i, ii, iii, iv, vii } { \__enumext_tmp:n {##1} }
2402   \cs_set:Npn \__enumext_tmp:n ##1
2403   { . \tl_use:c { \__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.

```

2404   \bool_lazy_all:nT
2405   {
2406     { \bool_if_p:N \g__enumext_starred_bool }
2407     { \int_compare_p:nNn { \__enumext_level_int } = { 0 } }
2408   }
2409   {
2410     \tl_put_right:Ne \__enumext_newlabel_arg_two_tl
2411     { \tl_use:N \__enumext_label_copy_vii_tl }
2412   }
2413   \bool_lazy_all:nT
2414   {
2415     { \bool_not_p:n { \g__enumext_standar_bool } }
2416     { \bool_if_p:N \__enumext_standar_bool }
2417     { \int_compare_p:nNn { \__enumext_level_int } > { 0 } }
2418   }
2419   {
2420     \tl_put_right:Ne \__enumext_newlabel_arg_two_tl
2421     {
2422       \tl_use:N \__enumext_label_copy_vii_tl
2423       \int_step_function:nnN { 1 } { \__enumext_level_int } \__enumext_tmp:n
2424     }
2425   }

```

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.

```

2426   \bool_lazy_all:nT
2427   {
2428     { \bool_if_p:N \g__enumext_standar_bool }
2429     { \int_compare_p:nNn { \__enumext_level_int } > { 0 } }
2430     { \int_compare_p:nNn { \__enumext_level_h_int } = { 0 } }
2431   }
2432   {
2433     \tl_put_right:Ne \__enumext_newlabel_arg_two_tl
2434     {
2435       \tl_use:N \__enumext_label_copy_i_tl
2436       \int_step_function:nnN { 2 } { \__enumext_level_int } \__enumext_tmp:n
2437     }
2438   }
2439   \cs_set:Npn \__enumext_tmp:n ##1
2440   { \tl_use:c { \__enumext_label_copy_ \int_to_roman:n {##1} _tl } . }
2441   \bool_lazy_all:nT

```

```

2442     {
2443       { \bool_if_p:N \g__enumext_standar_bool }
2444       { \bool_if_p:N \l__enumext_starred_bool }
2445       { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } }
2446     }
2447     {
2448       \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2449       {
2450         \int_step_function:nnN { 1 } { \l__enumext_level_int } \l__enumext_tmp:n
2451         \tl_use:N \l__enumext_label_copy_vii_tl
2452       }
2453     }

```

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

```

2454     \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
2455     {
2456       \l__enumext_store_name_tl \c_colon_str
2457       \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } }
2458     }

```

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

```

2459     \tl_put_right:Ne \l__enumext_write_aux_file_tl
2460     {
2461       \__enumext_newlabel:nn
2462       { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2463       { \l__enumext_newlabel_arg_two_tl }
2464     }
2465     \l__enumext_write_aux_file_tl
2466   }

```

(End of definition for `\__enumext_store_internal_ref:`)

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

`\__enumext_store_anskey_code:n`

The internal function `\__enumext_store_anskey_code:n` first we pass the  $\langle \textit{argument} \rangle$  to the *prop list*, then checks the state of the variable `\l__enumext_store_ref_key_bool` handled by the *save-ref* key and will call the function `\__enumext_store_internal_ref:` for the “*internal label and ref*” system. Followed by this if the *show-ans* or *show-pos* keys are active we will show the “*wrapped*”  $\langle \textit{argument} \rangle$ .

```

2467   \cs_new_protected:Npn \__enumext_store_anskey_code:n #1
2468   {
2469     \int_gincr:N \g__enumext_item_anskey_int
2470     \__enumext_store_addto_prop:n {#1}
2471     \bool_if:NT \l__enumext_store_ref_key_bool
2472     {
2473       \__enumext_store_internal_ref:
2474     }
2475     \__enumext_anskey_show_wrap_left:n { #1 }

```

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

```

2476     \tl_clear:N \l__enumext_store_anskey_arg_tl
2477     \bool_lazy_and:nnT
2478     { \bool_if_p:N \l__enumext_store_columns_break_bool }
2479     { \bool_not_p:n { \l__enumext_starred_bool } }
2480     {
2481       \tl_put_left:Nn \l__enumext_store_anskey_arg_tl { \columnbreak }
2482     }
2483     \tl_put_right:Nn \l__enumext_store_anskey_arg_tl { \item }

```

If the *item-join* key is present and the command is running under `enumext*` we will add  $\langle \textit{number} \rangle$  to `\l__enumext_store_anskey_arg_tl`.

```

2484     \bool_lazy_and:nnT
2485     { \bool_not_p:n { \l__enumext_starred_bool } }
2486     { \int_compare_p:nNn { \l__enumext_store_item_join_int } > { 1 } }
2487     {
2488       \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2489       {
2490         ( \exp_not:V \l__enumext_store_item_join_int )
2491       }
2492     }

```

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*`.

```

2493   \bool_if:NTF \l__enumext_store_item_star_bool
2494   {
2495     \tl_put_right:Nn \l__enumext_store_anskey_arg_tl { * }
2496     \tl_if_empty:NF \l__enumext_store_item_symbol_tl
2497     {
2498       \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2499       {
2500         [ \exp_not:V \l__enumext_store_item_symbol_tl ]
2501       }
2502     }
2503     \dim_compare:nT
2504     {
2505       \l__enumext_store_item_symbol_sep_dim != \c_zero_dim
2506     }
2507     {
2508       \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2509       {
2510         [ \exp_not:V \l__enumext_store_item_symbol_sep_dim ]
2511       }
2512     }
2513     \tl_put_right:Nn \l__enumext_store_anskey_arg_tl {#1}
2514   }
2515   {
2516     \tl_put_right:Nn \l__enumext_store_anskey_arg_tl {#1}
2517   }

```

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*.

```

2518   \bool_lazy_and:nnT
2519   { \bool_if_p:N \l__enumext_store_ref_key_bool }
2520   { \bool_if_p:N \l__enumext_hyperref_bool }
2521   {
2522     \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2523     {
2524       \hfill \exp_not:N \hyperlink { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2525       { \exp_not:V \l__enumext_mark_ref_sym_tl }
2526     }
2527   }
2528   \__enumext_store_addto_seq:V \l__enumext_store_anskey_arg_tl
2529   }

```

(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.

```

2530   \cs_new_protected:Npn \__enumext_anskey_show_wrap_arg:n #1
2531   {
2532     \par
2533     \bool_if:NTF \l__enumext_starred_bool
2534     {
2535       \__enumext_print_keyans_box:NN
2536       \l__enumext_labelwidth_vii_dim \l__enumext_labelsep_vii_dim
2537     }
2538     {
2539       \__enumext_print_keyans_box:cc
2540       { \l__enumext_labelwidth_ \l__enumext_level: _dim }
2541       { \l__enumext_labelsep_ \l__enumext_level: _dim }
2542     }
2543     \__enumext_anskey_wrapper:n { #1 }
2544   }

```

(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.

```

2545   \cs_new_protected:Npn \__enumext_anskey_show_wrap_left:n #1
2546   {

```

```

2547 \bool_if:NT \l__enumext_show_answer_bool
2548 {
2549   \__enumext_anskey_show_wrap_arg:n { #1 }
2550 }
2551 \bool_if:NT \l__enumext_show_position_bool
2552 {
2553   \tl_set:Nx \l__enumext_mark_answer_sym_tl
2554   {
2555     \group_begin:
2556     \exp_not:N \normalfont
2557     \exp_not:N \footnotesize [ \int_eval:n
2558       {
2559         \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
2560       }
2561     ]
2562     \group_end:
2563   }
2564   \__enumext_anskey_show_wrap_arg:n { #1 }
2565 }
2566 }

```

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

### 13.29 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*`.

```

2567 \keys_define:nn { enumext / anskey }
2568 {
2569   break-col .bool_set:N = \l__enumext_store_columns_break_bool,
2570   break-col .default:n = true,
2571   break-col .value_forbidden:n = true,
2572   item-join .int_set:N = \l__enumext_store_item_join_int,
2573   item-join .value_required:n = true,
2574   item-star .bool_set:N = \l__enumext_store_item_star_bool,
2575   item-star .default:n = true,
2576   item-star .value_forbidden:n = true,
2577   item-sym* .tl_set:N = \l__enumext_store_item_symbol_tl,
2578   item-sym* .value_required:n = true,
2579   item-pos* .dim_set:N = \l__enumext_store_item_symbol_sep_dim,
2580   item-pos* .value_required:n = true,
2581   unknown .code:n = { \__enumext_anskey_unknown:n {#1} },
2582 }

```

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

```

2583 \cs_new_protected:Npn \__enumext_anskey_unknown:n #1
2584 {
2585   \exp_args:NV \__enumext_anskey_unknown:nn \l_keys_key_str {#1}
2586 }
2587 \cs_new_protected:Npn \__enumext_anskey_unknown:nn #1 #2
2588 {
2589   \tl_if_blank:nTF {#2}
2590   {
2591     \msg_error:nnn { enumext } { anskey-cmd-key-unknown } {#1}
2592   }
2593   {
2594     \msg_error:nnnn { enumext } { anskey-cmd-key-value-unknown } {#1} {#2}
2595   }
2596 }

```

(End of definition for \\_\_enumext\_anskey\_unknown:n and \\_\_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 `\__enumext_anskey_safe_outer:` to be sure where we execute the command, then we will check the state of the variable `\l__enumext_check_answers_bool` set by the key `no-store`, if is true we will increment `\g__enumext_item_anskey_int` for the internal “*check answer*” system and

execute the function `\__enumext_anskey_safe_inner:n` to ensure that the command is not nested and that the argument is not empty, finally search the `[\key = val]` and call the function `\__enumext_store_anskey_code:n`.

```

2597 \NewDocumentCommand \anskey { o +m }
2598 {
2599   \__enumext_anskey_safe_outer:
2600   \group_begin:
2601     \bool_if:NT \l__enumext_check_answers_bool
2602     {
2603       \tl_if_novalue:nF {#1}
2604       {
2605         \keys_set:nn { enumext / anskey } {#1}
2606       }
2607       \tl_if_blank:nTF {#2}
2608       {
2609         \msg_error:nn { enumext } { anskey-empty-arg }
2610       }
2611       {
2612         \__enumext_anskey_safe_inner:
2613         \__enumext_store_anskey_code:n {#2}
2614       }
2615     }
2616   \group_end:
2617 }

```

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

### 13.29.1 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.

```

2618 \cs_new_protected:Nn \__enumext_anskey_safe_outer:
2619 {
2620   \bool_if:NF \l__enumext_store_active_bool
2621   {
2622     \msg_error:nnnn { enumext } { anskey-wrong-place }{ anskey }{ enumext }
2623   }
2624   \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
2625   {
2626     \msg_error:nnnn { enumext } { command-wrong-place }{ anskey }{ keyans }
2627   }
2628   \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
2629   {
2630     \msg_error:nnnn { enumext } { command-wrong-place }{ anskey }{ keyans* }
2631   }
2632   \int_compare:nNnT { \l__enumext_keyans_pic_level_int } = { 1 }
2633   {
2634     \msg_error:nnnn { enumext } { command-wrong-place }{ anskey }{ keyanspic }
2635   }
2636 }

```

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.

```

2637 \cs_new_protected:Nn \__enumext_anskey_safe_inner:
2638 {
2639   \int_incr:N \l__enumext_anskey_level_int
2640   \int_compare:nNnT { \l__enumext_anskey_level_int } > { 1 }
2641   {
2642     \msg_error:nn { enumext } { anskey-nested }
2643   }
2644   \bool_if:NF \l__enumext_item_number_bool
2645   {
2646     \msg_error:nn { enumext } { anskey-unnumber-item }
2647   }
2648   \mode_if_math:T
2649   {
2650     \msg_error:nne { enumext } { anskey-math-mode } { \c_backslash_str anskey }
2651   }
2652 }

```

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

### 13.30 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:` (§13.31) which is executed after the environment in which the key `save-ans` is active.

```
2653 \cs_new_protected:Nn \__enumext_undefine_anskey_env:
2654 {
2655   \cs_undefine:c { anskey* }
2656   \cs_undefine:c { endanskey* }
2657   \cs_undefine:c { __scontents_anskey*_env_begin: }
2658   \cs_undefine:c { __scontents_anskey*_env_end: }
2659 }
```

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

```
2660 \__enumext_before_env:nn { enumext }
2661 {
2662   \bool_lazy_and:nnT
2663     { \int_compare_p:nNn { \__enumext_level_int } = { 0 } }
2664     { \int_compare_p:nNn { \__enumext_level_h_int } = { 0 } }
2665     {
2666       \cs_if_free:cF { __scontents_anskey*_env_begin: }
2667       {
2668         \msg_error:nnn { enumext } { anskey-env-error } { anskey* }
2669       }
2670     }
2671 }
2672 \__enumext_before_env:nn { enumext* }
2673 {
2674   \bool_lazy_and:nnT
2675     { \int_compare_p:nNn { \__enumext_level_int } = { 0 } }
2676     { \int_compare_p:nNn { \__enumext_level_h_int } = { 0 } }
2677     {
2678       \cs_if_free:cF { __scontents_anskey*_env_begin: }
2679       {
2680         \msg_error:nnn { enumext } { anskey-env-error } { anskey* }
2681       }
2682     }
2683 }
```

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.

```
2684 \__enumext_before_env:nn { anskey* }
2685 {
2686   \int_compare:nNnT { \__enumext_keyans_level_int } = { 1 }
2687   {
2688     \msg_error:nnn { enumext } { anskey-env-wrong } { keyans }
2689   }
2690   \int_compare:nNnT { \__enumext_keyans_level_h_int } = { 1 }
2691   {
2692     \msg_error:nnn { enumext } { anskey-env-wrong } { keyans* }
2693   }
2694   \int_compare:nNnT { \__enumext_keyans_pic_level_int } = { 1 }
2695   {
2696     \msg_error:nnn { enumext } { anskey-env-wrong } { keyanspic }
2697   }
2698   \bool_if:NF \__enumext_item_number_bool
2699   {
```

```

2700         \msg_error:nn { enumext } { anskey-unnumber-item }
2701     }
2702     \mode_if_math:T
2703     {
2704         \msg_error:nnn { enumext } { anskey-math-mode } { anskey* }
2705     }
2706 }

```

(End of definition for `\__enumext_undefine_anskey_env:`)

**anskey\***

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

To maintain the *scope* of the environment and that it is only active when the key `save-ans` is active we will pass this function to the function `\__enumext_storing_exec:` (§13.25.1) 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**.

```

2707 \cs_new_protected:Npn \__enumext_anskey_env_make:n #1
2708 {
2709     \bool_if:NT \l__enumext_anskey_env_bool
2710     {
2711         \newenvsc{anskey*}[store-env=#1,print-env=false]
2712         \__enumext_anskey_env_exec:
2713     }
2714 }
2715 \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`.

```

2716 \cs_new_protected:Nn \__enumext_anskey_env_define_keys:
2717 {
2718     \keys_define:nn { scontents / scontents }
2719     {
2720         break-col .bool_gset:N = \g__enumext_store_columns_break_bool,
2721         break-col .default:n = true,
2722         break-col .value_forbidden:n = true,
2723         item-join .int_gset:N = \g__enumext_store_item_join_int,
2724         item-join .value_required:n = true,
2725         item-star .bool_gset:N = \g__enumext_store_item_star_bool,
2726         item-star .default:n = true,
2727         item-star .value_forbidden:n = true,
2728         item-sym* .tl_gset:N = \g__enumext_store_item_symbol_tl,
2729         item-sym* .value_required:n = true,
2730         item-pos* .dim_gset:N = \g__enumext_store_item_symbol_sep_dim,
2731         item-pos* .value_required:n = true,
2732         print-env .undefine:,
2733         store-env .undefine:,
2734         write-out .undefine:,
2735         unknown .code:n = { \__enumext_anskey_env_unknown:n {##1} },
2736     }
2737 }

```

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`.

```

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

```



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`.

```

2752 \cs_new_protected:Nn \__enumext_anskey_env_reset_keys:
2753 {
2754   \keys_define:nn { scontents / scontents }
2755   {
2756     break-col .undefine:,
2757     item-join .undefine:,
2758     item-star .undefine:,
2759     item-sym* .undefine:,
2760     item-pos* .undefine:,
2761     write-out .code:n = {
2762       \bool_set_false:N \l__scontents_storing_bool
2763       \bool_set_true:N \l__scontents_writing_bool
2764       \tl_set:Nn \l__scontents_fname_out_tl {##1}
2765     },
2766     write-out .value_required:n = true,
2767     print-env .meta:nn = { scontents } { print-env = ##1 },
2768     print-env .default:n = true,
2769     store-env .meta:nn = { scontents } { store-env = ##1 },
2770     unknown .code:n = { \__scontents_parse_environment_keys:n {##1} },
2771   }
2772 }

```

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*.

```

2773 \cs_new_protected:Npn \__enumext_rescan_anskey_env:n #1
2774 {
2775   \group_begin:
2776   \int_set:Nn \tex_newlinechar:D { `^^J }
2777   \__scontents_rescan_tokens:x
2778   {
2779     \endgroup % This assumes \catcode`\=0... Things might go off otherwise.
2780     #1
2781   }
2782 }

```

(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)*.

```

2783 \cs_new_protected:Nn \__enumext_anskey_env_exec:
2784 {
2785   \__enumext_before_env:nn { anskey* }
2786   {
2787     \__enumext_anskey_env_define_keys:
2788   }

```

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.

```

2789   \hook_if_empty:nF {env/anskey*/after}
2790   {
2791     \hook_gremove_code:nn {env/anskey*/after} { * }
2792   }
2793   \__enumext_after_env:nn { anskey* }
2794   {
2795     \__enumext_anskey_env_save_keys:
2796     \tl_clear:N \l__enumext_store_anskey_env_tl
2797     \tl_clear:N \l__enumext_store_anskey_opt_tl
2798     \bool_if:NT \l__enumext_check_answers_bool
2799     {
2800       \tl_gset:Ne \l__enumext_store_anskey_env_tl
2801       {
2802         \seq_item:ce { g__scontents_name_ \l__enumext_store_name_tl _seq } { -1 }
2803       }
2804       \regex_match:nVTF
2805       { ^\s* \z | ^\s* \u{c__scontents_hidden_space_str} \z }
2806       \l__enumext_store_anskey_env_tl

```

```

2807         {
2808             \msg_error:nn { enumext } { anskey-empty-arg }
2809         }
2810         {
2811             \__enumext_anskey_env_store:
2812         }
2813     }
2814     \__enumext_anskey_env_clean_vars:
2815     \__enumext_anskey_env_reset_keys:
2816 }
2817 }

```

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

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

```

\__enumext_anskey_env_save_keys:
\__enumext_anskey_env_store:
\__enumext_anskey_env_clean_vars:

```

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

```

2818 \cs_new_protected:Nn \__enumext_anskey_env_save_keys:
2819 {
2820     \bool_lazy_and:nnT
2821     { \bool_if_p:N \g__enumext_store_columns_break_bool }
2822     { \bool_not_p:n { \l__enumext_starred_bool } }
2823     {
2824         \tl_put_left:Ne \l__enumext_store_anskey_opt_tl { ,break-col, }
2825     }

```

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

```

2826     \bool_lazy_and:nnT
2827     { \bool_not_p:n { \l__enumext_starred_bool } }
2828     { \int_compare_p:nNn { \g__enumext_store_item_join_int } > { 1 } }
2829     {
2830         \tl_put_left::Ne \l__enumext_store_anskey_opt_tl
2831         {
2832             ,item-join = \exp_not:V \g__enumext_store_item_join_int,
2833         }
2834     }

```

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

```

2835     \bool_if:NT \g__enumext_store_item_star_bool
2836     {
2837         \tl_put_left:Ne \l__enumext_store_anskey_opt_tl
2838         {
2839             ,item-star,
2840         }
2841         \tl_if_empty:NF \g__enumext_store_item_symbol_tl
2842         {
2843             \tl_put_left:Ne \l__enumext_store_anskey_opt_tl
2844             {
2845                 ,item-sym* = \exp_not:V \g__enumext_store_item_symbol_tl,
2846             }
2847         }
2848         \dim_compare:nT
2849         {
2850             \g__enumext_store_item_symbol_sep_dim != \c_zero_dim
2851         }
2852         {
2853             \tl_put_left:Ne \l__enumext_store_anskey_opt_tl
2854             {
2855                 ,item-pos* = \exp_not:V \g__enumext_store_item_symbol_sep_dim,
2856             }
2857         }
2858     }
2859 }

```

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`.

```

2860 \cs_new_protected:Nn \__enumext_anskey_env_store:

```

```

2861 {
2862   \group_begin:
2863   \tl_if_empty:NTF \l__enumext_store_anskey_opt_tl
2864   {
2865     \exp_args:Ne
2866     \__enumext_store_anskey_code:n
2867     {
2868       \__enumext_rescan_anskey_env:n { \l__enumext_store_anskey_env_tl }
2869     }
2870   }
2871   {
2872     \keys_set_known:nV { enumext / anskey } \l__enumext_store_anskey_opt_tl
2873     \exp_args:Ne
2874     \__enumext_store_anskey_code:n
2875     {
2876       \__enumext_rescan_anskey_env:n { \l__enumext_store_anskey_env_tl }
2877     }
2878   }
2879   \group_end:
2880 }

```

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

```

2881 \cs_new_protected:Nn \__enumext_anskey_env_clean_vars:
2882 {
2883   \bool_gset_false:N \g__enumext_store_columns_break_bool
2884   \int_gzero:N \g__enumext_store_item_join_int
2885   \bool_gset_false:N \g__enumext_store_item_star_bool
2886   \tl_gclear:N \g__enumext_store_item_symbol_tl
2887   \dim_gzero:N \g__enumext_store_item_symbol_sep_dim
2888 }

```

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

### 13.31 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*` (§13.30) 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.

```

2889 \cs_new_protected:Nn \__enumext_execute_after_env:
2890 {
2891   \int_compare:nNnT { \l__enumext_level_int } = { 0 }
2892   {
2893     \tl_if_empty:NF \g__enumext_store_name_tl
2894     {
2895       \__enumext_stop_save_ans_msg:
2896       \__enumext_item_answer_diff:
2897       \__enumext_log_global_vars:
2898       \__enumext_log_answer_vars:
2899       \bool_if:NTF \g__enumext_check_ans_key_bool
2900       {
2901         \__enumext_check_ans_show:
2902       }
2903       { \__enumext_check_ans_log: }
2904       \__enumext_undefine_anskey_env:
2905     }
2906     \__enumext_reset_global_vars:
2907   }
2908 }

```

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

- This function is passed to the function `\__enumext_after_env:n` for the environments `enumext` (§13.38) and `enumext*` (§13.43) and it is executed only when the environments are not nested or at some level of these..

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

#### 13.32.1 Storing content in prop list

`\__enumext_keyans_addto_prop:n`

The function `\__enumext_keyans_addto_prop:n` will pass the the current  $\langle label \rangle$  for  $\backslash item^*$  in `keyans` environment and the current  $\langle label \rangle$  for  $\backslash anspic^*$  in `keyanspic` environment followed by the  $\langle contents \rangle$  of the *optional argument* of both commands to the `\l__enumext_store_current_label_tl` variable, which will be stored to the *prop list* defined by the `save-ans` key using the function `\__enumext_store_addto_prop:V`.

```

2909 \cs_new_protected:Npn \__enumext_keyans_addto_prop:n #1
2910 {
2911   \tl_clear:N \l__enumext_store_current_label_tl
2912   \int_compare:nNnTF { \l__enumext_keyans_pic_level_int } = { 1 }
2913   {
2914     \tl_put_right:Ne \l__enumext_store_current_label_tl { \l__enumext_label_vi_tl }
2915   }
2916   {
2917     \tl_put_right:Ne \l__enumext_store_current_label_tl { \l__enumext_label_v_tl }
2918   }

```

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

```

2919   \tl_if_novalue:nF { #1 }
2920   {
2921     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_tl
2922     {
2923       \tl_put_right:Ne \l__enumext_store_current_label_tl
2924       {
2925         \l__enumext_store_keyans_item_opt_sep_tl
2926       }
2927     }
2928     \tl_put_right:Ne \l__enumext_store_current_label_tl { #1 }
2929   }
2930   \__enumext_store_addto_prop:V \l__enumext_store_current_label_tl
2931 }

```

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

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

`\__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  $\backslash item^*$  and  $\backslash anspic^*$  commands. First we will create copies of the current  $\langle labels \rangle$  and remove the dots “.” from them, we do not want to get double dots in references.

```

2932 \cs_new_protected:Nn \__enumext_keyans_store_ref:
2933 {
2934   \bool_if:NT \l__enumext_store_ref_key_bool
2935   {
2936     \cs_set_protected:Npn \__enumext_tmp:n ##1
2937     {
2938       \tl_set_eq:cc { l__enumext_label_copy_##1_tl } { l__enumext_label_##1_tl }
2939       \tl_reverse:c { l__enumext_label_copy_##1_tl }
2940       \tl_remove_once:cn { l__enumext_label_copy_##1_tl } { . }
2941       \tl_reverse:c { l__enumext_label_copy_##1_tl }
2942     }
2943     \clist_map_inline:nn { i, v, vi, vii, viii } { \__enumext_tmp:n {##1} }
2944     \__enumext_keyans_store_ref_aux_i:
2945   }
2946 }

```

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

```

2947 \cs_new_protected:Nn \__enumext_keyans_store_ref_aux_i:
2948 {
2949   \bool_if:NT \g__enumext_starred_bool
2950   {
2951     \tl_set_eq:NN \l__enumext_label_copy_i_tl \l__enumext_label_copy_vii_tl
2952   }
2953   \int_compare:nNnT { \l__enumext_keyans_pic_level_int } = { 1 }

```

```

2954     {
2955       \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2956       { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_vi_tl }
2957     }
2958     \int_compare:nNt { \l__enumext_keyans_level_int } = { 1 }
2959     {
2960       \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2961       { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_v_tl }
2962     }
2963     \int_compare:nNt { \l__enumext_keyans_level_h_int } = { 1 }
2964     {
2965       \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2966       { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_viii_tl }
2967     }
2968     \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
2969     {
2970       \l__enumext_store_name_tl \c_colon_str
2971       \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } }
2972     }
2973     \__enumext_keyans_store_ref_aux_ii:
2974   }

```

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.

```

2975 \cs_new_protected:Nn \__enumext_keyans_store_ref_aux_ii:
2976 {
2977   \tl_put_right:Ne \l__enumext_write_aux_file_tl
2978   {
2979     \__enumext_newlabel:nn
2980     { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2981     { \l__enumext_newlabel_arg_two_tl }
2982   }
2983   \l__enumext_write_aux_file_tl
2984 }

```

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

### 13.32.3 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.

```

2985 \cs_new_protected:Npn \__enumext_keyans_addto_seq:n #1
2986 {
2987   \tl_clear:N \l__enumext_store_current_label_tl
2988   \int_compare:nNtF { \l__enumext_keyans_pic_level_int } = { 1 }
2989   {
2990     \tl_put_right:Ne \l__enumext_store_current_label_tl { \item \l__enumext_label_vi_tl }
2991   }
2992   {
2993     \tl_put_right:Ne \l__enumext_store_current_label_tl { \item \l__enumext_label_v_tl }
2994   }
2995   \tl_if_no_value:nF { #1 }
2996   {
2997     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_tl
2998     {
2999       \tl_put_right:Ne \l__enumext_store_current_label_tl
3000       {
3001         \l__enumext_store_keyans_item_opt_sep_tl
3002       }
3003     }
3004     \tl_put_right:Ne \l__enumext_store_current_label_tl { #1 }
3005   }
3006   \__enumext_keyans_addto_seq_link:
3007 }

```

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.

```

3008 \cs_new_protected:Nn \__enumext_keyans_addto_seq_link:
3009 {
3010   \bool_lazy_and:nnT
3011     { \bool_if_p:N \l__enumext_store_ref_key_bool }
3012     { \bool_if_p:N \l__enumext_hyperref_bool }
3013   {
3014     \tl_put_right:Ne \l__enumext_store_current_label_tl
3015       {
3016         \hfill \exp_not:N \hyperlink
3017           {
3018             \exp_not:V \l__enumext_newlabel_arg_one_tl
3019           }
3020         { \exp_not:V \l__enumext_mark_ref_sym_tl }
3021       }
3022   }
3023   \__enumext_store_addto_seq:V \l__enumext_store_current_label_tl
3024   \bool_if:NT \l__enumext_check_answers_bool
3025   {
3026     \int_gincr:N \g__enumext_item_anskey_int
3027   }
3028 }

```

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

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

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

```

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

```

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

```

3029 \cs_new_protected:Npn \__enumext_keyans_show_left:n #1
3030 {
3031   \tl_if_novalue:nF { #1 }
3032   {
3033     \tl_set:Ne \l__enumext_store_current_opt_arg_tl { #1 }
3034   }
3035   \bool_if:NT \l__enumext_show_answer_bool
3036   {
3037     \__enumext_keyans_show_ans:
3038   }
3039   \bool_if:NT \l__enumext_show_position_bool
3040   {
3041     \__enumext_keyans_show_pos:
3042   }
3043 }
3044 \cs_new_protected:Nn \__enumext_keyans_show_item_opt:
3045 {
3046   \tl_if_empty:NF \l__enumext_store_current_opt_arg_tl
3047   {
3048     \bool_lazy_or:nnT
3049       { \bool_if_p:N \l__enumext_show_answer_bool }
3050       { \bool_if_p:N \l__enumext_show_position_bool }
3051     {
3052       \__enumext_keyans_wrapper_opt:n { \l__enumext_store_current_opt_arg_tl } \c_space_tl
3053     }
3054   }
3055 }
3056 \cs_new_protected:Nn \__enumext_keyans_show_ans:
3057 {
3058   \bool_if:NT \l__enumext_starred_bool
3059   {
3060     \dim_set_eq:NN \l__enumext_labelwidth_i_dim \l__enumext_labelwidth_vii_dim
3061     \dim_set_eq:NN \l__enumext_labelsep_i_dim \l__enumext_labelsep_vii_dim
3062   }
3063   \tl_put_left:Nn \l__enumext_label_v_tl
3064   {
3065     \__enumext_print_keyans_box:NN
3066     \l__enumext_labelwidth_i_dim \l__enumext_labelsep_i_dim
3067   }

```

```

3068 }
3069 \cs_new_protected:Nn \__enumext_keyans_show_pos:
3070 {
3071   \bool_if:NT \l__enumext_starred_bool
3072   {
3073     \dim_set_eq:NN \l__enumext_labelwidth_i_dim \l__enumext_labelwidth_vii_dim
3074     \dim_set_eq:NN \l__enumext_labelsep_i_dim \l__enumext_labelsep_vii_dim
3075   }
3076   \int_compare:nNnTF { \l__enumext_keyans_pic_level_int } = { 1 }
3077   {
3078     \tl_set:Ne \l__enumext_mark_answer_sym_tl
3079     {
3080       \group_begin:
3081       \exp_not:N \normalfont
3082       \exp_not:N \footnotesize [ \int_eval:n
3083       {
3084         \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
3085       }
3086       ]
3087       \group_end:
3088     }
3089   }
3090   {
3091     \tl_set:Ne \l__enumext_mark_answer_sym_tl
3092     {
3093       \group_begin:
3094       \exp_not:N \normalfont
3095       \exp_not:N \footnotesize [ \int_eval:n
3096       {
3097         \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } + 1
3098       }
3099       ]
3100       \group_end:
3101     }
3102   }
3103   \tl_put_left:Nn \l__enumext_label_v_tl
3104   {
3105     \__enumext_print_keyans_box:NN
3106     \l__enumext_labelwidth_i_dim \l__enumext_labelsep_i_dim
3107   }
3108 }

```

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

### 13.33 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.

When *labeling* PDF is active `\makeLabel` is redefined as `\hss #1` and the only way to get the `align` key to work correctly is to redefine `\makeLabel` using `\makebox`. The best way to implement this is to use the conditional command `\IfDocumentMetadataTF` to force this redefinition and the dedicated `mode-box` key to manually activate it by the user.

The `\item` and `\item[⟨custom⟩]` commands work in the usual way on `enumext` and we will add `\item*`, `\item*[⟨symbol⟩]` and `\item*[⟨symbol⟩][⟨offset⟩]`.

`\__enumext_default_item:n` First we will see if the *optional argument* is present, if it is NOT present we will check the state of the variable `\l__enumext_check_answers_bool` set by the key `no-store`, set the boolean variable `\l__enumext_wrap_label_X_bool` to “true” for the key `wrap-label` and execute `\__enumext_item_std:w` and the key `itemindent`, otherwise we will check the state of the boolean variable `\l__enumext_wrap_label_opt_X_bool` set by the key `wrap-label*` and execute `\__enumext_item_std:w` with the *optional argument* and the key `itemindent`.

```

3109 \cs_new_protected:Npn \__enumext_default_item:n #1
3110 {
3111   \tl_if_novalue:nTF {#1}
3112   {
3113     \bool_if:NT \l__enumext_check_answers_bool
3114     {
3115       \int_gincr:N \g__enumext_item_number_int
3116       \bool_set_true:N \l__enumext_item_number_bool

```



```

3117     }
3118     \bool_set_true:c { l__enumext_wrap_label_ \__enumext_level: _bool }
3119     \__enumext_item_std:w \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
3120   }
3121   {
3122     \bool_set_eq:cc
3123     { l__enumext_wrap_label_ \__enumext_level: _bool }
3124     { l__enumext_wrap_label_opt_ \__enumext_level: _bool }
3125     \__enumext_item_std:w [#1] \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
3126   }
3127 }

```

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

\\_\_enumext\_starred\_item:nn  
 \\_\_enumext\_item\_star\_exec:

The `\item*`, `\item*[\langle symbol \rangle]` and `\item*[\langle symbol \rangle][\langle offset \rangle]` works like the *numbered* `\item`, but placing a `\langle symbol \rangle` to the “left” of the `\langle label \rangle` separated from it by the value the second *optional argument* `\langle offset \rangle`.

#1: \l\_\_enumext\_item\_symbol\_X\_tl

#2: \l\_\_enumext\_item\_symbol\_sep\_X\_dim

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

```

3128 \cs_new_protected:Npn \__enumext_starred_item:nn #1 #2
3129 {
3130   \tl_if_novalue:nTF {#1}
3131   {
3132     \tl_gset_eq:Nc
3133     \g__enumext_item_symbol_aux_tl { l__enumext_item_symbol_ \__enumext_level: _tl }
3134   }
3135   {
3136     \tl_gset:Nn \g__enumext_item_symbol_aux_tl {#1}
3137   }
3138   \tl_if_novalue:nTF {#2}
3139   {
3140     \dim_set_eq:cc
3141     { l__enumext_item_symbol_sep_ \__enumext_level: _dim }
3142     { l__enumext_labelsep_ \__enumext_level: _dim }
3143   }
3144   {
3145     \dim_set:cn { l__enumext_item_symbol_sep_ \__enumext_level: _dim } {#2}
3146   }
3147   \bool_if:NT \l__enumext_check_answers_bool
3148   {
3149     \int_gincr:N \g__enumext_item_number_int
3150     \bool_set_true:N \l__enumext_item_number_bool
3151   }
3152   \bool_set_true:c { l__enumext_wrap_label_ \__enumext_level: _bool }
3153   \__enumext_item_std:w \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
3154 }

```

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

```

3155 \cs_new_protected:Nn \__enumext_item_star_exec:
3156 {
3157   \tl_if_empty:cF { l__enumext_item_symbol_ \__enumext_level: _tl }
3158   {
3159     \mode_leave_vertical:
3160     \skip_horizontal:n { -\dim_use:c { l__enumext_item_symbol_sep_ \__enumext_level: _dim } }
3161     \hbox_overlap_left:n { \g__enumext_item_symbol_aux_tl }
3162     \skip_horizontal:n { \dim_use:c { l__enumext_item_symbol_sep_ \__enumext_level: _dim } }
3163   }
3164 }

```

(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 are passed to `\__enumext_list_arg_two_X:` used in the definition of the `enumext` environment (§13.38).

```

3165 \cs_new_protected:Nn \__enumext_redefine_item:
3166 {
3167   \RenewDocumentCommand \item { s o o }
3168   {
3169     \bool_if:nTF {##1}
3170     {
3171       \__enumext_starred_item:nn {##2} {##3}
3172     }
3173     { \__enumext_default_item:n {##2} }
3174   }
3175 }

```

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

The function \\_\_enumext\_make\_label: redefine \make\_label for the keys mode-box, align, font, wrap-label, wrap-label\* and \item\* for enumext environment. This function are passed to \\_\_enumext\_list\_arg\_two\_X: used in the definition of the enumext environment (§13.38).

```

3176 \cs_new_protected:Nn \__enumext_make_label:
3177 {
3178   \IfDocumentMetadataTF
3179   {
3180     \__enumext_make_label_box:
3181   }
3182   {
3183     \bool_if:NTF \__enumext_mode_box_bool
3184     {
3185       \__enumext_make_label_box:
3186     }
3187     {
3188       \__enumext_make_label_std:
3189     }
3190   }
3191 }

```

Standard definition when \DocumentMetadata is not active.

```

3192 \cs_new_protected:Nn \__enumext_make_label_std:
3193 {
3194   \RenewDocumentCommand \make_label { m }
3195   {
3196     \tl_use:c { l__enumext_label_fill_left_ \__enumext_level: _tl }
3197     \tl_use:c { l__enumext_label_font_style_ \__enumext_level: _tl }
3198     \bool_if:cTF { l__enumext_wrap_label_ \__enumext_level: _bool }
3199     {
3200       \__enumext_item_star_exec:
3201       \use:c { __enumext_wrapper_label_ \__enumext_level: :n } { ##1 }
3202     }
3203     { ##1 }
3204     \tl_use:c { l__enumext_label_fill_right_ \__enumext_level: _tl }
3205     \tl_gclear:N \g__enumext_item_symbol_aux_tl
3206   }
3207 }

```

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

```

3208 \cs_new_protected:Nn \__enumext_make_label_box:
3209 {
3210   \RenewDocumentCommand \make_label { m }
3211   {
3212     \makebox
3213     [ \dim_use:c { l__enumext_labelwidth_ \__enumext_level: _dim } ]
3214     [ \str_use:c { l__enumext_align_label_pos_ \__enumext_level: _str } ]
3215     {
3216       \tl_use:c { l__enumext_label_font_style_ \__enumext_level: _tl }
3217       \bool_if:cTF { l__enumext_wrap_label_ \__enumext_level: _bool }
3218       {
3219         \__enumext_item_star_exec:
3220         \use:c { __enumext_wrapper_label_ \__enumext_level: :n } { ##1 }
3221       }
3222       { ##1 }
3223       \tl_gclear:N \g__enumext_item_symbol_aux_tl
3224     }
3225   }
3226 }

```

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

### 13.34 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*
3227 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
3228 {
3229   \keys_define:nn { enumext / #1 }
3230   {
3231     item-sym* .tl_set:c = { l__enumext_item_symbol_#2_tl },
3232     item-sym* .value_required:n = true,
3233     item-sym* .initial:n = {\textasteriskcentered},
3234     item-pos* .dim_set:c = { l__enumext_item_symbol_sep_#2_dim },
3235     item-pos* .value_required:n = true,
3236   }
3237 }
3238 \clist_map_inline:nn
3239 {
3240   {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {enumext*}{vii}
3241 }
3242 { \__enumext_tmp:nn #1 }

```

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

### 13.35 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).

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

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

```

__enumext_keyans_unknown_keys:n
__enumext_keyans_unknown_keys:nn
3243 \cs_set_protected:Npn \__enumext_tmp:n #1
3244 {
3245   \keys_define:nn { enumext / #1 }
3246   {
3247     unknown .code:n = { \__enumext_keyans_unknown_keys:n {##1} }
3248   }
3249 }
3250 \clist_map_inline:nn { keyans, keyans*, keyanspic } { \__enumext_tmp:n {#1} }

```

Internal functions for handling `unknown` key.

```

3251 \cs_new_protected:Npn \__enumext_keyans_unknown_keys:n #1
3252 {
3253   \exp_args:NV \__enumext_keyans_unknown_keys:nn \l_keys_key_str {#1}
3254 }
3255 \cs_new_protected:Npn \__enumext_keyans_unknown_keys:nn #1#2
3256 {
3257   \tl_if_blank:nTF {#2}
3258   {
3259     \msg_error:nnn { enumext } { keyans-unknown-key } {#1}
3260   }
3261   {
3262     \msg_error:nnnn { enumext } { keyans-unknown-key-value } {#1} {#2}
3263   }
3264 }

```

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

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

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

```

__enumext_starred_unknown_keys:n
__enumext_starred_unknown_keys:nn
3265 \keys_define:nn { enumext / enumext* }
3266 {
3267   unknown .code:n = { \__enumext_starred_unknown_keys:n {#1} }
3268 }

```

Internal functions for handling `unknown` key.

```

3269 \cs_new_protected:Npn \__enumext_starred_unknown_keys:n #1
3270 {
3271   \exp_args:NV \__enumext_starred_unknown_keys:nn \l_keys_key_str {#1}
3272 }
3273 \cs_new_protected:Npn \__enumext_starred_unknown_keys:nn #1#2
3274 {
3275   \tl_if_blank:nTF {#2}
3276   {
3277     \msg_error:nnn { enumext } { starred-unknown-key } {#1}
3278   }
3279   {
3280     \msg_error:nnnn { enumext } { starred-unknown-key-value } {#1} {#2}
3281   }
3282 }

```

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

### 13.35.3 Handling unknown keys for enumext

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

```

unknown
\__enumext_standar_unknown_keys:n
\__enumext_standar_unknown_keys:nn
3283 \cs_set_protected:Npn \__enumext_tmp:n #1
3284 {
3285   \keys_define:nn { enumext / #1 }
3286   {
3287     unknown .code:n = { \__enumext_standar_unknown_keys:n {##1} }
3288   }
3289 }
3290 \clist_map_inline:nn { level-1,level-2,level-3,level-4 } { \__enumext_tmp:n {#1} }

```

Internal functions for handling `unknown` key.

```

3291 \cs_new_protected:Npn \__enumext_standar_unknown_keys:n #1
3292 {
3293   \exp_args:NV \__enumext_standar_unknown_keys:nn \l_keys_key_str {#1}
3294 }
3295 \cs_new_protected:Npn \__enumext_standar_unknown_keys:nn #1#2
3296 {
3297   \tl_if_blank:nTF {#2}
3298   {
3299     \msg_error:nnn { enumext } { standar-unknown-key } {#1}
3300   }
3301   {
3302     \msg_error:nnnn { enumext } { standar-unknown-key-value } {#1} {#2}
3303   }
3304 }

```

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

### 13.36 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.

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

```

3305 \cs_new_protected:Npn \__enumext_keyans_default_item:n #1
3306 {
3307   \tl_if_novalue:nTF { #1 }
3308   {
3309     \bool_set_true:N \__enumext_wrap_label_v_bool
3310     \__enumext_item_std:w \tl_use:N \__enumext_fake_item_indent_v_tl
3311   }
3312   {
3313     \bool_set_eq:NN \__enumext_wrap_label_v_bool \__enumext_wrap_label_opt_v_bool
3314     \__enumext_item_std:w [#1] \tl_use:N \__enumext_fake_item_indent_v_tl
3315   }
3316 }

```

(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.

```

3317 \cs_new_protected:Npn \__enumext_keyans_starred_item:n #1
3318 {
3319   \tl_set_eq:NN \l__enumext_store_current_label_tmp_tl \l__enumext_label_v_tl
3320   \__enumext_keyans_show_left:n { #1 }
3321   \bool_set_true:N \l__enumext_wrap_label_v_bool
3322   \__enumext_item_std:w \tl_use:N \l__enumext_fake_item_indent_v_tl
3323   \__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.

```

3324   \tl_set_eq:NN \l__enumext_label_v_tl \l__enumext_store_current_label_tmp_tl
3325   \__enumext_keyans_addto_prop:n { #1 }
3326   \__enumext_keyans_store_ref:
3327   \__enumext_keyans_addto_seq:n { #1 }
3328   \int_gincr:N \g__enumext_check_starred_cmd_int
3329 }

```

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

`\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 are passed to `\__enumext_list_arg_two_v:` used in the definition of the `keyans` environment (§13.37.2).

`\__enumext_keyans_redefine_item:`

```

3330 \cs_new_protected:Nn \__enumext_keyans_redefine_item:
3331 {
3332   \RenewDocumentCommand \item { s o }
3333   {
3334     \bool_if:NTF {##1}
3335     {
3336       \peek_remove_spaces:n
3337       {
3338         \__enumext_keyans_starred_item:n {##2}
3339       }
3340     }
3341     {
3342       \__enumext_keyans_default_item:n {##2}
3343     }
3344   }
3345 }

```

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

`\__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 `mode-box`, `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 (§13.37.2).

```

3346 \cs_new_protected:Nn \__enumext_keyans_make_label:
3347 {
3348   \IfDocumentMetadataTF
3349   {
3350     \__enumext_keyans_make_label_box:
3351   }
3352   {
3353     \bool_if:NTF \l__enumext_mode_box_bool
3354     {
3355       \__enumext_keyans_make_label_box:
3356     }
3357     {
3358       \__enumext_keyans_make_label_std:
3359     }
3360   }
3361 }

```

Standard definition when `\DocumentMetadata` is not active.

```

3362 \cs_new_protected:Nn \__enumext_keyans_make_label_std:
3363 {
3364   \RenewDocumentCommand \makeLabel { m }
3365   {
3366     \tl_use:N \l__enumext_label_fill_left_v_tl
3367     \tl_use:N \l__enumext_label_font_style_v_tl
3368     \bool_if:NTF \l__enumext_wrap_label_v_bool
3369     {
3370       \__enumext_wrapper_label_v:n { ##1 }
3371     }
3372     { ##1 }
3373     \tl_use:N \l__enumext_label_fill_right_v_tl
3374   }
3375 }

```

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

```

3376 \cs_new_protected:Nn \__enumext_keyans_make_label_box:
3377 {
3378   \RenewDocumentCommand \makeLabel { m }
3379   {
3380     \makebox[ \l__enumext_labelwidth_v_dim ][ \l__enumext_align_label_pos_v_str ]
3381     {
3382       \tl_use:N \l__enumext_label_font_style_v_tl
3383       \bool_if:NTF \l__enumext_wrap_label_v_bool
3384       {
3385         \__enumext_wrapper_label_v:n { ##1 }
3386       }
3387       { ##1 }
3388     }
3389   }
3390 }

```

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

### 13.37 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`.

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

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

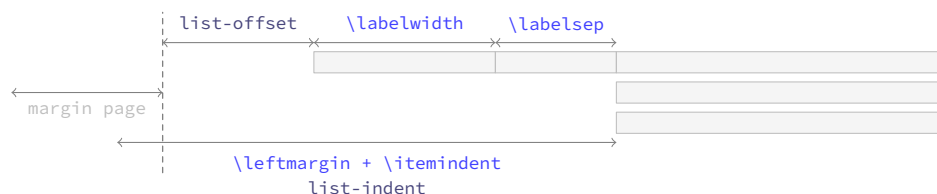


Figure 9: Representation of standard horizontal lengths in `list` environment.

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

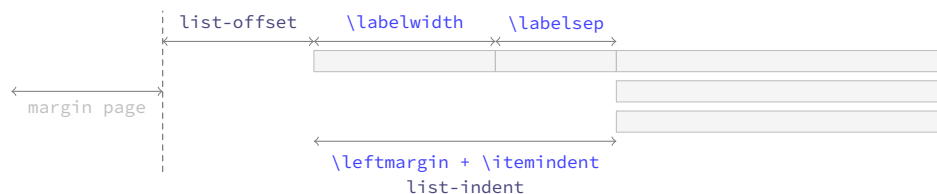


Figure 10: Representation of horizontal lengths concept in list in `enumext`.

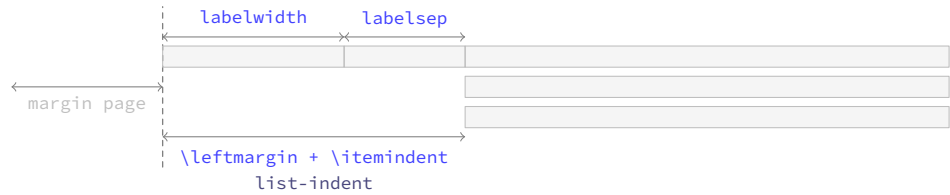
Where the default values will look like in the figure 11.

```

\__enumext_calc_hspace:NNNNNNN
\__enumext_calc_hspace:ccccccc

```

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

Figure 11: Default horizontal lengths in `enumext`.

```

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

```

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

This function is passed to `\__enumext_list_arg_two_X`: which is used in the definition of the `enumext` and `keyans` environments (§13.37.2).

```

3391 \cs_new_protected:Npn \__enumext_calc_hspace:NNNNNNN #1 #2 #3 #4 #5 #6 #7
3392 {
3393   \dim_compare:nNnT { #1 } < { \c_zero_dim }
3394   {
3395     \msg_warning:nnnV { enumext } { width-non-positive } { labelwidth } { #1 }
3396     \dim_set:Nn #1 { \dim_abs:n { #1 } }
3397   }
3398   \dim_compare:nNnT { #2 } < { \c_zero_dim }
3399   {
3400     \msg_warning:nnnV { enumext } { width-negative } { labelsep } { #2 }
3401     \dim_set:Nn #2 { \dim_abs:n { #2 } }
3402   }

```

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

```

3403   \bool_if:nF #7 { \dim_set:Nn #4 { #1 + #2 } }

```

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

```

3404   \dim_compare:nNnTF { #4 } < { \c_zero_dim }
3405   {
3406     \dim_set:Nn #6 { #1 + #2 - #4 }
3407     \dim_set:Nn #5 { #1 + #2 + #3 - #6 }
3408   }
3409   {
3410     \dim_compare:nNnT { #4 } = { #1 + #2 }
3411     { \dim_set:Nn #6 { \c_zero_dim } }
3412     \dim_compare:nNnT { #4 } < { #1 + #2 }
3413     { \dim_set:Nn #6 { #1 + #2 - #4 } }
3414     \dim_compare:nNnT { #4 } > { #1 + #2 }
3415     {
3416       \dim_set:Nn #6 { -#1 - #2 + #4 }
3417       \dim_set:Nn #6 { #6*-1 }
3418     }
3419     \dim_set:Nn #5 { #1 + #2 + #3 - #6 }
3420   }
3421 }
3422 \cs_generate_variant:Nn \__enumext_calc_hspace:NNNNNNN { ccccccc }

```

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

### 13.37.2 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:
3423 \cs_set_protected:Npn \__enumext_tmp:n #1
3424 {
3425   \cs_new_protected:cpn { __enumext_list_arg_two_#1: }
3426   {
3427     \__enumext_calc_hspace:ccccccc
3428     { \__enumext_labelwidth_#1_dim } { \__enumext_labelsep_#1_dim }
3429     { \__enumext_listoffset_#1_dim } { \__enumext_leftmargin_tmp_#1_dim }
3430     { \__enumext_leftmargin_#1_dim } { \__enumext_itemindent_#1_dim }
3431     { \__enumext_leftmargin_tmp_#1_bool }

```



```

3432 \clist_map_inline:nn
3433 { labelsep, labelwidth, itemindent, leftmargin, rightmargin, listparindent }
3434 { \dim_set_eq:cc {####1} { \__enumext_####1_#1_dim } }
3435 \clist_map_inline:nn { topsep, parsep, partopsep, itemsep }
3436 { \skip_set_eq:cc {####1} { \__enumext_####1_#1_skip } }
3437 \usecounter { enumX#1 }
3438 \setcounter { enumX#1 } { \int_eval:n { \int_use:c { \__enumext_start_#1_int } - 1 } }
3439 \str_if_eq:nnTF {#1} { v }
3440 {
3441   \__enumext_keyans_redefine_item:
3442   \__enumext_keyans_make_label:
3443   \__enumext_keyans_ref:
3444   \__enumext_keyans_fake_item_indent:
3445   \bool_if:cT { \__enumext_show_length_#1_bool }
3446   {
3447     \msg_term:nnnn { enumext } { list-lengths-not-nested } { v } { keyans }
3448   }
3449 }
3450 {
3451   \__enumext_redefine_item:
3452   \__enumext_make_label:
3453   \__enumext_standar_ref:
3454   \__enumext_fake_item_indent:
3455   \bool_if:cT { \__enumext_show_length_#1_bool }
3456   {
3457     \msg_term:nnne { enumext } { list-lengths } {#1}
3458     { \int_use:N \__enumext_level_int }
3459   }
3460 }
3461 }
3462 }
3463 \clist_map_inline:nn { i, ii, iii, iv, v } { \__enumext_tmp:n {#1} }

```

(End of definition for \\_\_enumext\_list\_arg\_two\_i: and others.)

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

```

3464 \cs_set_protected:Npn \__enumext_tmp:n #1
3465 {
3466   \cs_new_protected:cpn { __enumext_list_arg_two_#1: }
3467   {
3468     \bool_set_true:c { \__enumext_leftmargin_tmp_#1_bool }
3469     \dim_zero:c { \__enumext_leftmargin_tmp_#1_dim }
3470     \__enumext_calc_hspace:cccccc
3471     { \__enumext_labelwidth_#1_dim } { \__enumext_labelsep_#1_dim }
3472     { \__enumext_listoffset_#1_dim } { \__enumext_leftmargin_tmp_#1_dim }
3473     { \__enumext_leftmargin_#1_dim } { \__enumext_itemindent_#1_dim }
3474     { \__enumext_leftmargin_tmp_#1_bool }
3475     \clist_map_inline:nn
3476     { labelsep, labelwidth, itemindent, leftmargin, rightmargin, listparindent }
3477     { \dim_set_eq:cc {####1} { \__enumext_####1_#1_dim } }
3478     \clist_map_inline:nn { topsep, parsep, partopsep, itemsep }
3479     { \skip_set_eq:cc {####1} { \__enumext_####1_#1_skip } }
3480     \skip_set_eq:Nc \parsep { \__enumext_itemsep_#1_skip }
3481     \skip_zero:N \partopsep
3482     \usecounter { enumX#1 }
3483     \setcounter { enumX#1 } { \int_eval:n { \int_use:c { \__enumext_start_#1_int } - 1 } }
3484     \__enumext_starred_ref:
3485     \str_if_eq:nnTF {#1} { vii }
3486     {
3487       \__enumext_fake_item_indent_vii:
3488       \bool_if:cT { \__enumext_show_length_vii_bool }
3489       { \msg_term:nnnn { enumext } { list-lengths-not-nested } { vii } { enumext* } }
3490     }
3491     {
3492       \__enumext_fake_item_indent_viii:
3493       \bool_if:cT { \__enumext_show_length_#1_bool }
3494       { \msg_term:nnnn { enumext } { list-lengths-not-nested } { #1 } { keyans* } }
3495     }

```

```

3496     }
3497   }
3498   \clist_map_inline:nn { vii, viii } { \__enumext_tmp:n {#1} }

```

(End of definition for \\_\_enumext\_list\_arg\_two\_vii: and \\_\_enumext\_list\_arg\_two\_viii:.)

### 13.38 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”.

```

3499 \cs_new_protected:Nn \__enumext_safe_exec:
3500 {
3501   \__enumext_internal_mini_page:
3502   \__enumext_is_not_nested:
3503   \int_incr:N \l__enumext_level_int
3504   \int_compare:nNt { \l__enumext_level_int } > { 4 }
3505   { \msg_fatal:nn { enumext } { list-too-deep } }
3506   \bool_set_true:N \l__enumext_standar_bool
3507   \bool_set_false:N \l__enumext_starred_bool
3508   \__enumext_is_on_first_level:
3509 }

```

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

\\_\_enumext\_parse\_keys:n The \\_\_enumext\_parse\_store\_keys:n function first we will clear the variable \l\_\_enumext\_series\_str used by the key `series` and then we check if we are at the “first level”, if so we process the *⟨keys⟩* and then execute the function \\_\_enumext\_parse\_series:n used by the key `series` and call the function \\_\_enumext\_nested\_base\_line\_fix: used by the key `base-fix`, otherwise we will pass the *⟨keys⟩* to the inner levels of the environment then we execute the function \\_\_enumext\_store\_active\_keys:n and reprocess the *⟨keys⟩* to pass them to the *sequence* if the key `save-key` is not active.

```

3510 \cs_new_protected:Npn \__enumext_parse_keys:n #1
3511 {
3512   \tl_if_novalue:nF {#1}
3513   {
3514     \str_clear:N \l__enumext_series_str
3515     \int_compare:nNtF { \l__enumext_level_int } = { 1 }
3516     {
3517       \keys_set:nn { enumext / level-1 } {#1}
3518       \__enumext_parse_series:n {#1}
3519       \__enumext_nested_base_line_fix:
3520     }
3521     {
3522       \exp_args:Ne \keys_set:nn
3523       { enumext / level-\int_use:N \l__enumext_level_int } {#1}
3524     }
3525     \__enumext_store_active_keys:n {#1}
3526   }
3527 }

```

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

\\_\_enumext\_start\_store\_level: The \\_\_enumext\_start\_store\_level: function activate the “storing structure” mechanism in the *sequence* for the command \anskey and the environment `anskey*`.

```

3528 \cs_new_protected:Nn \__enumext_start_store_level:
3529 {
3530   \bool_lazy_all:nT
3531   {
3532     { \bool_if_p:N \l__enumext_store_active_bool }
3533     { \bool_not_p:n { \l__enumext_keyans_env_bool } }
3534     { \bool_if_p:N \g__enumext_standar_bool }
3535   }
3536   {
3537     \int_compare:nNt { \l__enumext_level_int } > { 1 }
3538     {
3539       \bool_set_true:c { l__enumext_store_upper_level_ \__enumext_level: _bool }
3540       \__enumext_store_level_open:
3541     }
3542   }

```

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

```

3543   \bool_lazy_all:nT
3544   {
3545     { \bool_if_p:N \__enumext_store_active_bool }
3546     { \bool_not_p:n { \__enumext_keyans_env_bool } }
3547     { \int_compare_p:nNn { \__enumext_level_h_int } = { 1 } }
3548   }
3549   {
3550     \int_compare:nNnT { \__enumext_level_int } > { 0 }
3551     {
3552       \bool_set_true:c { \__enumext_store_upper_level_ \__enumext_level: _bool }
3553       \__enumext_store_level_open:
3554     }
3555   }
3556 }

```

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

`\__enumext_stop_store_level:` The `\__enumext_stop_store_level:` function stop the “*storing structure*” mechanism in the *sequence* for the command `\anskey` and the environment `anskey*`.

```

3557 \cs_new_protected:Nn \__enumext_stop_store_level:
3558 {
3559   \bool_if:cT { \__enumext_store_upper_level_ \__enumext_level: _bool }
3560   {
3561     \__enumext_store_level_close:
3562   }
3563 }

```

(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.

```

3564 \cs_new_protected:Nn \__enumext_multicols_start:
3565 {
3566   \int_compare:nNnT
3567   { \int_use:c { \__enumext_columns_ \__enumext_level: _int } } > { 1 }
3568   {
3569     \dim_compare:nNnT
3570     { \dim_use:c { \__enumext_columns_sep_ \__enumext_level: _dim } } = { \c_zero_dim }
3571     {
3572       \dim_set:cn { \__enumext_columns_sep_ \__enumext_level: _dim }
3573       {
3574         ( \dim_use:c { \__enumext_labelwidth_ \__enumext_level: _dim }
3575         + \dim_use:c { \__enumext_labelsep_ \__enumext_level: _dim }
3576         ) / \int_use:c { \__enumext_columns_ \__enumext_level: _int }
3577         - \dim_use:c { \__enumext_listoffset_ \__enumext_level: _dim }
3578       }
3579     }
3580     \dim_set_eq:Nc \columnsep { \__enumext_columns_sep_ \__enumext_level: _dim }
3581     \int_compare:nNnT { \__enumext_level_int } > { 1 }
3582     {
3583       \dim_zero:N \columnseprule
3584     }
3585   }

```

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.

```

3585   \bool_if:cF { \__enumext_minipage_active_ \__enumext_level: _bool }
3586   {
3587     \skip_zero:N \multicolsep
3588     \__enumext_multi_addvspace:
3589   }
3590   \raggedcolumns
3591   \begin{multicols}{ \int_use:c { \__enumext_columns_ \__enumext_level: _int } }
3592 }
3593 }

```

(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:`.

```

3594 \cs_new_protected:Nn \__enumext_multicols_stop:
3595 {
3596   \int_compare:nNtF
3597     { \int_use:c { \__enumext_columns_ \__enumext_level: _int } } > { 1 }
3598   {
3599     \__enumext_stop_list:
3600     \__enumext_stop_store_level:
3601     \end{multicols}
3602     \__enumext_unskip_unkern:
3603     \__enumext_unskip_unkern:
3604     \par\addvspace{ \skip_use:c { \__enumext_multicols_below_ \__enumext_level: _skip } }
3605   }
3606   {
3607     \__enumext_stop_list:
3608     \__enumext_stop_store_level:
3609   }
3610 }

```

(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.

```

3611 \cs_new_protected:Nn \__enumext_before_list:
3612 {
3613   \__enumext_vspace_above:
3614   \__enumext_before_args_exec:
3615   \__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.

```

3616   \dim_compare:nNtF
3617     { \dim_use:c { \__enumext_minipage_right_ \__enumext_level: _dim } } > { \c_zero_dim }
3618   {
3619     \dim_set:cn { \__enumext_minipage_left_ \__enumext_level: _dim }
3620     {
3621       \linewidth
3622       - \dim_use:c { \__enumext_minipage_right_ \__enumext_level: _dim }
3623       - \dim_use:c { \__enumext_minipage_hsep_ \__enumext_level: _dim }
3624     }

```

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.

```

3625     \bool_set_true:c { \__enumext_minipage_active_ \__enumext_level: _bool }
3626     \int_gincr:N \g__enumext_minipage_stat_int
3627     \__enumext_minipage_add_space:
3628     \noindent
3629     \__enumext_mini_page{ \dim_use:c { \__enumext_minipage_left_ \__enumext_level: _dim } }
3630   }
3631   \__enumext_multicols_start:
3632 }

```

(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.

```

3633 \cs_new_protected:Nn \__enumext_second_part:

```

```

3634 {
3635   \bool_if:cTF { l__enumext_minipage_active_ \__enumext_level: _bool }
3636   {
3637     \int_compare:nNt { \g__enumext_minipage_stat_int } = { 1 }
3638     {
3639       \msg_warning:nn { enumext } { missing-miniright }
3640       \miniright
3641     }
3642     \int_gzero:N \g__enumext_minipage_stat_int
3643     \__enumext_unskip_unkern: % remove topsep + [partopsep]
3644     \end__enumext_mini_page
3645   }
3646   {
3647     \__enumext_multicols_stop:
3648   }

```

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.

```

3649   \__enumext_after_stop_list:
3650   \__enumext_check_ans_key_hook:
3651   \__enumext_vspace_below:
3652   \bool_set_false:N \l__enumext_standar_bool
3653   \__enumext_resume_save_counter:
3654 }

```

(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.

```

3655 \cs_new_protected:Nn \__enumext_set_item_width:
3656 {
3657   \dim_set:Nn \itemwidth { \linewidth }
3658   \dim_compare:nT
3659   {
3660     \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim } != \c_zero_dim
3661   }
3662   {
3663     \dim_sub:Nn \itemwidth
3664     {
3665       \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim }
3666     }
3667   }
3668 }

```

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

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

```

3669 \NewDocumentEnvironment{enumext}{0}{}
3670 {
3671   \__enumext_safe_exec:
3672   \__enumext_parse_keys:n {#1}
3673   \__enumext_before_list:
3674   \__enumext_start_store_level:
3675   \__enumext_start_list:nn
3676   { \tl_use:c { l__enumext_label_ \__enumext_level: _tl } }
3677   {
3678     \use:c { __enumext_list_arg_two_ \__enumext_level: : }
3679     \__enumext_before_keys_exec:
3680   }
3681   \__enumext_set_item_width:
3682   \__enumext_after_args_exec:
3683 }
3684 {
3685   \__enumext_second_part:
3686 }

```

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

As we don't want our check to be executed `check-ans` by levels but on the complete list, we will take it out of the `enumext` environment using the “hook” function `\__enumext_after_env:nn`.

```

3687 \__enumext_after_env:n {enumext}
3688 {
3689   \__enumext_execute_after_env:
3690 }

```

### 13.39 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”.

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.

```

3691 \cs_new_protected:Nn \__enumext_keyans_safe_exec:
3692 {
3693   \bool_if:NF \l__enumext_store_active_bool
3694   {
3695     \msg_error:nnnn { enumext } { wrong-place } { keyans } { save-ans }
3696   }
3697   \int_incr:N \l__enumext_keyans_level_int
3698   \bool_set_true:N \l__enumext_keyans_env_bool
3699   \__enumext_keyans_name_and_start:
3700   % Set false for interfering with enumext nested in keyans (yes, its possible and crayze)
3701   \bool_set_false:N \l__enumext_store_active_bool
3702   \int_compare:nNnT { \l__enumext_keyans_level_int } > { 1 }
3703   {
3704     \msg_error:nn { enumext } { keyans-nested }
3705   }
3706   \int_compare:nNnT { \l__enumext_level_int } > { 1 }
3707   {
3708     \msg_error:nn { enumext } { keyans-wrong-level }
3709   }
3710 }

```

(End of definition for `\__enumext_keyans_safe_exec:`)

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

```

3711 \cs_new_protected:Npn \__enumext_keyans_parse_keys:n #1
3712 {
3713   \keys_set:nn { enumext / keyans } {#1}
3714 }

```

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

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

```

\__enumext_keyans_multicols_start:
\__enumext_keyans_multicols_stop:
\__enumext_second_part_v:
3715 \cs_new_protected:Nn \__enumext_before_list_v:
3716 {
3717   \__enumext_vspace_above_v:
3718   \__enumext_before_args_exec_v:
3719   \dim_compare:nNnT { \l__enumext_minipage_right_v_dim } > { \c_zero_dim }
3720   {
3721     \dim_set:Nn \l__enumext_minipage_left_v_dim
3722     {
3723       \linewidth - \l__enumext_minipage_right_v_dim - \l__enumext_minipage_hsep_v_dim
3724     }
3725     \bool_set_true:N \l__enumext_minipage_active_v_bool
3726     \int_gincr:N \g__enumext_minipage_stat_int
3727     \__enumext_keyans_minipage_add_space:
3728     \__enumext_mini_page{ \l__enumext_minipage_left_v_dim }
3729   }
3730   \__enumext_keyans_multicols_start:
3731 }
3732 \cs_new_protected:Nn \__enumext_keyans_multicols_start:
3733 {
3734   \int_compare:nNnT { \l__enumext_columns_v_int } > { 1 }
3735   {
3736     \dim_compare:nNnT { \l__enumext_columns_sep_v_dim } = { \c_zero_dim }
3737     {
3738       \dim_set:Nn \l__enumext_columns_sep_v_dim
3739       {

```

```

3740         (
3741             \l__enumext_labelwidth_v_dim + \l__enumext_labelsep_v_dim
3742         ) / \l__enumext_columns_v_int
3743         - \l__enumext_listoffset_v_dim
3744     }
3745 }
3746 \dim_set_eq:NN \columnsep \l__enumext_columns_sep_v_dim
3747 \dim_zero:N \columnseprule % no rule here
3748 \bool_if:NF \l__enumext_minipage_active_v_bool
3749 {
3750     \skip_zero:N \multicolsep
3751     \__enumext_keyans_multi_addvspace:
3752 }
3753 \raggedcolumns
3754 \begin{multicols}{\l__enumext_columns_v_int}
3755 }
3756 }
3757 \cs_new_protected:Nn \__enumext_keyans_multicols_stop:
3758 {
3759     \int_compare:nNnTF { \l__enumext_columns_v_int } > { 1 }
3760     {
3761         \__enumext_stop_list:
3762         \end{multicols}
3763         \__enumext_unskip_unkern:
3764         \__enumext_unskip_unkern:
3765         \par\addvspace{ \l__enumext_multicols_below_v_skip }
3766     }
3767     {
3768         \__enumext_stop_list:
3769     }
3770 }
3771 \cs_new_protected:Nn \__enumext_second_part_v:
3772 {
3773     \bool_if:NTF \l__enumext_minipage_active_v_bool
3774     {
3775         \int_compare:nNnT { \g__enumext_minipage_stat_int } = { 1 }
3776         {
3777             \msg_warning:nn { enumext } { missing-miniright }
3778             \miniright
3779         }
3780         \int_gzero:N \g__enumext_minipage_stat_int
3781         \__enumext_unskip_unkern: % remove \topsep + [\partopsep]
3782         \end__enumext_mini_page
3783         \par\addvspace{ \l__enumext_minipage_after_skip }
3784     }
3785     {
3786         \__enumext_keyans_multicols_stop:
3787     }
3788     \bool_set_false:N \l__enumext_keyans_env_bool
3789     \__enumext_after_stop_list_v:
3790     \__enumext_vspace_below_v:
3791 }

```

(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.

```

3792 \cs_new_protected:Nn \__enumext_keyans_set_item_width:
3793 {
3794     \dim_set:Nn \itemwidth { \linewidth }
3795     \dim_compare:nT
3796     {
3797         \l__enumext_listoffset_v_dim != \c_zero_dim
3798     }
3799     {
3800         \dim_sub:Nn \itemwidth { \l__enumext_listoffset_v_dim }
3801     }
3802 }

```

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



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

```

3803 \NewDocumentEnvironment{keyans}{0}{ }
3804 {
3805   \__enumext_keyans_safe_exec:
3806   \__enumext_keyans_parse_keys:n {#1}
3807   \__enumext_before_list_v:
3808   \__enumext_start_list:nn
3809   { \tl_use:N \__enumext_label_v_tl }
3810   {
3811     \__enumext_list_arg_two_v:
3812     \__enumext_before_keys_exec_v:
3813   }
3814   \__enumext_keyans_set_item_width:
3815   \__enumext_after_args_exec_v:
3816 }
3817 {
3818   \__enumext_check_starred_cmd:n { item }
3819   \__enumext_second_part_v:
3820 }

```

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

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

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

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

#### 13.40.1 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
3821 \socket_new:nn {tagsupport/enumext/starred}{ 1 }
3822 \socket_new_plug:nnn {tagsupport/enumext/starred} {start-list-tags}
3823 {
3824   \tag_resume:n {#1}
3825   \tag_struct_begin:n {tag=LI}
3826   \tag_struct_begin:n {tag=Lbl}
3827   \tag_mc_begin:n {tag=Lbl}
3828 }
3829 \socket_new_plug:nnn {tagsupport/enumext/starred} {stop-start-tags}
3830 {
3831   \tag_mc_end:
3832   \tag_struct_end:n {tag=Lbl}
3833   \tag_struct_begin:n {tag=LBody}
3834   \tag_struct_begin:n {tag=text-unit}
3835   \tag_struct_begin:n {tag=text}
3836 }
3837 \socket_new_plug:nnn {tagsupport/enumext/starred} {stop-list-tags}
3838 {
3839   \tag_struct_end:n {tag=text}
3840   \tag_struct_end:n {tag=text-unit}
3841   \tag_struct_end:n {tag=LBody}
3842   \tag_struct_end:n {tag=LI}
3843   \tag_suspend:n {#1}
3844 }

```

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

```

3845 \cs_new_protected_nopar:Npn \__enumext_start_list_tag:n #1
3846 {
3847   \IfDocumentMetadataTF
3848   {
3849     \socket_assign_plug:nn {tagsupport/enumext/starred} {start-list-tags}
3850     \socket_use:n {tagsupport/enumext/starred} {#1}
3851   } {}
3852 }
3853 \cs_new_protected_nopar:Nn \__enumext_stop_start_list_tag:
3854 {

```

```

3855     \IfDocumentMetadataTF
3856     {
3857         \socket_assign_plug:nn {tagsupport/enumext/starred} {stop-start-tags}
3858         \socket_use:nn {tagsupport/enumext/starred} { }
3859     } {}
3860 }
3861 \cs_new_protected_nopar:Npn \__enumext_stop_list_tag:n #1
3862 {
3863     \IfDocumentMetadataTF
3864     {
3865         \socket_assign_plug:nn {tagsupport/enumext/starred} {stop-list-tags}
3866         \socket_use:nn {tagsupport/enumext/starred} {#1}
3867     } {}
3868 }

```

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

### 13.40.2 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:

```

3869 \socket_new:nn {tagsupport/enumext/keyanspic}{ 0 }
3870 \socket_new_plug:nnn {tagsupport/enumext/keyanspic} {start-list-tags}
3871 {
3872     \tag_resume:n {keyanspic}
3873     \tag_struct_begin:n {tag=LI}
3874     \tag_struct_begin:n {tag=Lbl}
3875     \tag_mc_begin:n {tag=Lbl}
3876 }
3877 \socket_new_plug:nnn {tagsupport/enumext/keyanspic} {stop-start-tags}
3878 {
3879     \tag_mc_end:
3880     \tag_struct_end:n {tag=Lbl}
3881     \tag_struct_begin:n {tag=LBody}
3882     \tag_struct_begin:n {tag=text-unit}
3883     \tag_struct_begin:n {tag=text}
3884     \tag_mc_begin:n {tag=text}
3885 }
3886 \socket_new_plug:nnn {tagsupport/enumext/keyanspic} {stop-list-tags}
3887 {
3888     \tag_mc_end:
3889     \tag_struct_end:n {tag=text-unit}
3890     \tag_struct_end:n {tag=text}
3891     \tag_struct_end:n {tag=LBody}
3892     \tag_struct_end:n {tag=LI}
3893     \tag_suspend:n {keyanspic}
3894 }

```

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

```

3895 \cs_new_protected_nopar:Nn \__enumext_anspic_start_list_tag:
3896 {
3897     \IfDocumentMetadataTF
3898     {
3899         \socket_assign_plug:nn {tagsupport/enumext/keyanspic} {start-list-tags}
3900         \socket_use:n {tagsupport/enumext/keyanspic}
3901     } {}
3902 }
3903 \cs_new_protected_nopar:Nn \__enumext_anspic_stop_start_list_tag:
3904 {
3905     \IfDocumentMetadataTF
3906     {
3907         \socket_assign_plug:nn {tagsupport/enumext/keyanspic} {stop-start-tags}
3908         \socket_use:nn {tagsupport/enumext/keyanspic}
3909     } {}
3910 }
3911 \cs_new_protected_nopar:Nn \__enumext_anspic_stop_list_tag:
3912 {
3913     \IfDocumentMetadataTF
3914     {
3915         \socket_assign_plug:nn {tagsupport/enumext/keyanspic} {stop-list-tags}
3916         \socket_use:nn {tagsupport/enumext/keyanspic}
3917     } {}
3918 }

```

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

### 13.41 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.

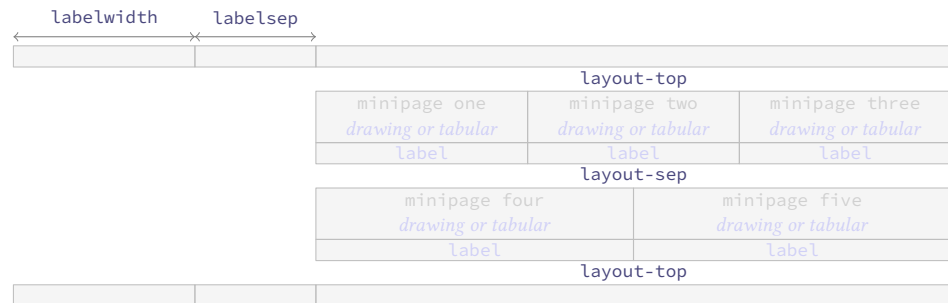


Figure 12: Representation of the `keyanspic` spacing in `enumext`.

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

#### 13.41.1 The environment `keyanspic`

First we define the key that allows us to process the position of the `<label>` centered “*above*” or “*below*” which will be `label-pos`, the vertical separation of these from *drawing or tabular* will be handled with the key `label-sep`. The “*layout style*” will be handled with the key `layout-sty` will take two values separated by comma `{(n° upper, n° lower)}` and will determine the number of `minipage` environments in which all arguments of `\anspic` will be printed at the “upper” and “lower” within the environments separated by the value of the key `layout-sep`. The vertical space “top” and “bottom” of the environment will be handled with the key `layout-top`.

```

3919 \keys_define:nn { enumext / keyanspic }
3920 {
3921   label-pos .choice:,
3922   label-pos / above .code:n =
3923     \bool_set_true:N \l__enumext_anspic_label_above_bool
3924     \str_set:Nn \l__enumext_anspic_mini_pos_str { t },
3925   label-pos / below .code:n =
3926     \bool_set_false:N \l__enumext_anspic_label_above_bool
3927     \str_set:Nn \l__enumext_anspic_mini_pos_str { b },
3928   label-pos / unknown .code:n =
3929     \msg_error:nnee { enumext } { unknown-choice }
3930     { label-pos } { above,~ below } { \exp_not:n {#1} },
3931   label-pos .initial:n = below,
3932   label-pos .value_required:n = true,
3933   label-sep .skip_set:N = \l__enumext_anspic_label_sep_skip,
3934   label-sep .value_required:n = true,
3935   layout-sty .tl_set:N = \l__enumext_anspic_layout_style_tl,
3936   layout-sty .value_required:n = true,
3937   layout-sep .code:n = \keys_set:nn { enumext / keyans }
3938     { parsep = #1 },
3939   layout-sep .value_required:n = true,
3940   layout-top .code:n = \keys_set:nn { enumext / keyans }
3941     { topsep = #1 },
3942   layout-top .value_required:n = true,
3943   unknown .code:n = { \l__enumext_keyans_unknown_keys:n {#1} }
3944 }

```

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

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

```

\__enumext_keyans_pic_parse_keys:n
\__enumext_keyans_pic_skip_abs:N
\__enumext_keyans_pic_arg_two:
3945 \cs_new_protected:Nn \__enumext_keyans_pic_safe_exec:
3946 {
3947   \int_incr:N \l__enumext_keyans_pic_level_int
3948   \int_compare:nNt { \l__enumext_keyans_pic_level_int } > { 1 }
3949   {

```

```

3950         \msg_error:nn { enumext } { keyanspic-nested }
3951     }
3952     \__enumext_keyans_name_and_start:
3953 }

```

Parse [*key* = *val*] for **keyanspic** environment.

```

3954 \cs_new_protected:Npn \__enumext_keyans_pic_parse_keys:n #1
3955 {
3956     \tl_if_novalue:nF {#1}
3957     {
3958         \keys_set:nn { enumext / keyanspic } {#1}
3959     }
3960 }

```

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

```

3961 \cs_new_protected:Npn \__enumext_keyans_pic_skip_abs:N #1
3962 {
3963     \dim_compare:nNt { #1 } < { \c_zero_dim }
3964     {
3965         \skip_set:Nn #1 { -#1 }
3966     }
3967 }

```

The `\__enumext_keyans_pic_arg_two:` function will be used in the *second argument* of the `list` environment that defines the **keyanspic** environment, with this we will take the configuration of the “*spaces*” and the keys `label`, `wrap-label`, `parsep` and `topsep` from the **keyans** environment. The first thing we need to do is set the boolean variable `\__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.

```

3968 \cs_new_protected:Npn \__enumext_keyans_pic_arg_two:
3969 {
3970     \bool_set_false:N \__enumext_leftmargin_tmp_v_bool
3971     \__enumext_list_arg_two_v:
3972     \__enumext_keyans_pic_skip_abs:N \parsep

```

Now we increment the counter `enumXv` of the **keyans** environment and save the *total height* of the (*label*) in `\l__enumext_anspic_label_htdp_dim` used by `\anspic` and we will adjust the values of `\parsep` only if the key `label-pos` is set to *below*.

```

3973     \bool_if:NF \l__enumext_anspic_label_above_bool
3974     {
3975         \stepcounter { enumXv }
3976         \hbox_set:Nn \l__enumext_anspic_label_box { \l__enumext_label_v_tl }
3977         \dim_set:Nn \l__enumext_anspic_label_htdp_dim
3978         {
3979             \box_ht_plus_dp:N \l__enumext_anspic_label_box
3980         }
3981         \skip_add:Nn \parsep
3982         {
3983             \l__enumext_anspic_label_htdp_dim
3984             + \box_dp:N \strutbox
3985             + \l__enumext_anspic_label_sep_skip
3986         }
3987     }

```

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

```

3988     \dim_add:Nn \leftmargin { -\labelwidth - \labelsep }
3989     \skip_add:Nn \topsep { 0.5\box_dp:N \strutbox }
3990     \dim_zero:N \listparindent
3991     \skip_zero:N \partopsep
3992     \skip_zero:N \itemsep
3993 }

```

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

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

```

3994 \NewDocumentEnvironment{keyanspic}{ o }
3995 {
3996     \__enumext_keyans_pic_safe_exec:
3997     \__enumext_keyans_pic_parse_keys:n {#1}

```

```

3998 \begin{list} { } { \_enumext_keyanspic_arg_two: }
3999 \IfDocumentMetadataTF
4000 {
4001   \tag_suspend:n {list}
4002 }{}
4003 \item[] \scan_stop:
4004 % paranoia
4005 \RenewDocumentCommand \item {}
4006 {
4007   \msg_error:nn { enumext } { keyanspic-item-cmd }
4008 }
4009 \IfDocumentMetadataTF
4010 {
4011   \tag_resume:n {keyanspic}
4012   \tag_tool:n {para/tagging=false}
4013   \tag_suspend:n {keyanspic}
4014 } { }
4015 }
4016 {
4017   \IfDocumentMetadataTF
4018   {
4019     \tag_resume:n {keyanspic}
4020     \tag_struct_begin:n {tag=L,attribute=enumerate}
4021   } { }

```

Now we process the command `\anspic`, if the key `layout-sty` 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*.

```

4022 \_enumext_anspic_exec:
4023 \IfDocumentMetadataTF
4024 {
4025   \tag_suspend:n {keyanspic}
4026 } { }
4027 \end{list}
4028 \IfDocumentMetadataTF
4029 {
4030   \tag_struct_end:
4031   \tag_struct_end:
4032 } { }

```

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

```

4033 \_enumext_check_starred_cmd:n { anspic }
4034 \setcounter { enumXvi } { 0 }
4035 \bool_if:NTF \l__enumext_anspic_label_above_bool
4036 {
4037   \par\addvspace{ 0.5\box_dp:N \strutbox }
4038 }
4039 {
4040   \par
4041   \addvspace
4042   {
4043     \dim_eval:n
4044     {
4045       \l__enumext_anspic_label_htdp_dim + \box_ht_plus_dp:N \strutbox
4046       + \l__enumext_anspic_label_sep_skip + \l__enumext_topsep_v_skip
4047     }
4048   }
4049 }
4050 }

```

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

### 13.41.2 The command `\anspic`

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

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

`\anspic`

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

```

4051 \NewDocumentCommand \anspic { s o +m }
4052 {
4053   \bool_if:NF \l__enumext_store_active_bool
4054   {
4055     \msg_error:nnnn { enumext } { wrong-place } { keyanspic } { save-ans }
4056   }
4057   \int_compare:nNnT { \l__enumext_level_int } > { 1 }
4058   {
4059     \msg_error:nn { enumext } { keyanspic-wrong-level }
4060   }
4061   \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
4062   {
4063     \msg_error:nnnn { enumext } { command-wrong-place } { anspic } { keyans }
4064   }
4065   \seq_put_right:Nn \l__enumext_anspic_args_seq
4066   {
4067     \__enumext_anspic_args:nnn { #1 } { #2 } { #3 }
4068   }
4069 }

```

The `\__enumext_anspic_body_dim:n` function will set the value of `\l__enumext_anspic_body_htdp_dim` equal to the “height plus depth” of the *mandatory argument* if the key `label-pos` is set “below”.

```

4070 \cs_new_protected:Npn \__enumext_anspic_body_dim:n #1
4071 {
4072   \bool_if:NF \l__enumext_anspic_label_above_bool
4073   {
4074     \IfDocumentMetadataTF
4075     {
4076       \tag_suspend:n {keyanspic}
4077     } { }
4078     \vbox_set:Nn \l__enumext_anspic_body_box { #1 }
4079     \dim_set:Nn \l__enumext_anspic_body_htdp_dim
4080     {
4081       \box_ht_plus_dp:N \l__enumext_anspic_body_box
4082     }
4083     \IfDocumentMetadataTF
4084     {
4085       \tag_resume:n {keyanspic}
4086     } { }
4087   }
4088 }

```

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.

```

4089 \cs_new_protected:Npn \__enumext_anspic_label:nn #1 #2
4090 {
4091   \makebox[ \l__enumext_anspic_mini_width_dim ][ c ]
4092   {
4093     \bool_if:nT { #1 }
4094     {
4095       \__enumext_keyans_addto_prop:n { #2 }
4096       \__enumext_keyans_store_ref:
4097       \__enumext_keyans_addto_seq:n { #2 }
4098       \int_gincr:N \g__enumext_check_starred_cmd_int
4099       \bool_lazy_or:nnT
4100       { \bool_if_p:N \l__enumext_show_answer_bool }
4101       { \bool_if_p:N \l__enumext_show_position_bool }
4102       {
4103         \tl_set_eq:NN \l__enumext_label_v_tl \l__enumext_label_vi_tl
4104         \__enumext_keyans_show_left:n { #2 }
4105         \tl_set_eq:NN \l__enumext_label_vi_tl \l__enumext_label_v_tl
4106       }
4107     }
4108     \tl_use:N \l__enumext_label_font_style_v_tl
4109     \__enumext_wrapper_label_v:n { \l__enumext_label_vi_tl }
4110     \__enumext_keyans_show_item_opt:

```

```

4111     }
4112 }

The function \__enumext_anspic_label_pos:nnn will be in charge of handling the “counter” and the position of the  $\langle label \rangle$ , set by label-pos key which will have the same configuration as the keyans environment.

4113 \cs_new_protected:Npn \__enumext_anspic_label_pos:nnn #1 #2 #3
4114 {
4115   \stepcounter { enumXvi }
4116   \__enumext_anspic_body_dim:n { #3 }
4117   \bool_if:NTF \l__enumext_anspic_label_above_bool
4118   {
4119     \__enumext_anspic_label:nn { #1 } { #2 }
4120   }
4121   {
4122     \raisebox
4123     {
4124       -\dim_eval:n
4125       {
4126         \l__enumext_anspic_label_htdp_dim
4127         + \l__enumext_anspic_body_htdp_dim
4128         + \box_dp:N \strutbox
4129         + \l__enumext_anspic_label_sep_skip
4130       }
4131     }
4132     [ opt ] [ opt ]
4133     {
4134       \__enumext_anspic_label:nn { #1 } { #2 }
4135     }
4136   }
4137 }
4138 %

```

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.

```

4139 \cs_new_protected:Nn \__enumext_anspic_args:nnn
4140 {
4141   \__enumext_anspic_start_list_tag:
4142   \__enumext_anspic_label_pos:nnn { #1 } { #2 } { #3 }
4143   \__enumext_anspic_stop_start_list_tag:
4144   \bool_if:NTF \l__enumext_anspic_label_above_bool
4145   {
4146     \[\l__enumext_anspic_label_sep_skip] #3
4147   }
4148   {
4149     \[ #3
4150   }
4151   \__enumext_anspic_stop_list_tag:
4152 }

```

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

```

4153 \cs_new_protected:Nn \__enumext_anspic_print:n
4154 {
4155   \clist_map_function:nN { #1 } \__enumext_anspic_row:n
4156 }
4157 \cs_generate_variant:Nn \__enumext_anspic_print:n { e, V }

```

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

```

4158 \cs_new_protected:Nn \__enumext_anspic_row:n
4159 {
4160   \dim_set:Nn \l__enumext_anspic_mini_width_dim { \linewidth / #1 }
4161   \int_set:Nn \l__enumext_anspic_above_int { \l__enumext_anspic_below_int }
4162   \int_set:Nn \l__enumext_anspic_below_int { \l__enumext_anspic_above_int + #1 }
4163   \int_step_inline:nnn
4164   { \l__enumext_anspic_above_int + 1 }
4165   { \l__enumext_anspic_below_int }
4166   {
4167     \IfDocumentMetadataTF
4168     {
4169       \tag_suspend:n {minipage}

```



```

4170         } { }
4171         \begin{minipage}[ \l__enumext_anspic_mini_pos_str ]{ \l__enumext_anspic_mini_width_dim }
4172             \centering
4173             \seq_item:Nn \l__enumext_anspic_args_seq { ##1 }
4174         \end{minipage}
4175         \IfDocumentMetadataTF
4176         {
4177             \tag_resume:n {minipage}
4178         } { }
4179     }
4180 \par
4181 }

```

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

```

4182 \cs_new_protected:Nn \__enumext_anspic_exec:
4183 {
4184     \tl_if_empty:NTF \l__enumext_anspic_layout_style_tl
4185     {
4186         \__enumext_anspic_print:e { \seq_count:N \l__enumext_anspic_args_seq }
4187     }
4188     {
4189         \__enumext_anspic_print:V \l__enumext_anspic_layout_style_tl
4190     }
4191 }

```

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

### 13.42 The horizontal environments

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

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

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

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

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

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

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

#### 13.42.1 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:

```

```

4192 \cs_new_protected:Nn \__enumext_starred_columns_set_vii:
4193 {
4194     \dim_compare:nNnT { \l__enumext_columns_sep_vii_dim } = { \c_zero_dim }
4195     {
4196         \dim_set:Nn \l__enumext_columns_sep_vii_dim
4197         {
4198             ( \l__enumext_labelwidth_vii_dim + \l__enumext_labelsep_vii_dim )
4199             / \l__enumext_columns_vii_int
4200         }
4201     }
4202     \int_set:Nn \l__enumext_tmpa_vii_int { \l__enumext_columns_vii_int - 1 }
4203     \dim_set:Nn \l__enumext_item_width_vii_dim
4204     {
4205         ( \linewidth - \l__enumext_columns_sep_vii_dim * \l__enumext_tmpa_vii_int )
4206         / \l__enumext_columns_vii_int
4207         - \l__enumext_labelwidth_vii_dim

```

```

4208     - \l__enumext_labelsep_vii_dim
4209 }

```

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

```

4210 \dim_compare:nNnT { \l__enumext_rightmargin_vii_dim } > { \c_zero_dim }
4211 {
4212   \dim_sub:Nn \l__enumext_item_width_vii_dim
4213   {
4214     ( \l__enumext_rightmargin_vii_dim * \l__enumext_tmpa_vii_int )
4215     / \l__enumext_columns_vii_int
4216   }
4217   \dim_add:Nn \l__enumext_columns_sep_vii_dim
4218   {
4219     \l__enumext_rightmargin_vii_dim
4220   }
4221 }
4222 }

```

Same implementation for the `keyans*` environment.

```

4223 \cs_new_protected:Nn \__enumext_starred_columns_set_viii:
4224 {
4225   \dim_compare:nNnT { \l__enumext_columns_sep_viii_dim } = { \c_zero_dim }
4226   {
4227     \dim_set:Nn \l__enumext_columns_sep_viii_dim
4228     {
4229       ( \l__enumext_labelwidth_viii_dim + \l__enumext_labelsep_viii_dim )
4230       / \l__enumext_columns_viii_int
4231     }
4232   }
4233   \int_set:Nn \l__enumext_tmpa_viii_int { \l__enumext_columns_viii_int - 1 }
4234   \dim_set:Nn \l__enumext_item_width_viii_dim
4235   {
4236     ( \linewidth - \l__enumext_columns_sep_viii_dim * \l__enumext_tmpa_viii_int )
4237     / \l__enumext_columns_viii_int
4238     - \l__enumext_labelwidth_viii_dim
4239     - \l__enumext_labelsep_viii_dim
4240   }
4241   \dim_compare:nNnT { \l__enumext_rightmargin_viii_dim } > { \c_zero_dim }
4242   {
4243     \dim_sub:Nn \l__enumext_item_width_viii_dim
4244     {
4245       ( \l__enumext_rightmargin_viii_dim * \l__enumext_tmpa_vii_int )
4246       / \l__enumext_columns_viii_int
4247     }
4248     \dim_add:Nn \l__enumext_columns_sep_viii_dim
4249     {
4250       \l__enumext_rightmargin_viii_dim
4251     }
4252   }
4253 }

```

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

### 13.42.2 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.

```

4254 \cs_new_protected:Npn \__enumext_starred_joined_item_vii:n #1
4255 {
4256   \int_set:Nn \l__enumext_joined_item_vii_int {#1}
4257   \dim_compare:nNnT { \l__enumext_joined_item_vii_int } > { \l__enumext_columns_vii_int }
4258   {
4259     \msg_warning:nnee { enumext } { item-joined }
4260     { \int_use:N \l__enumext_joined_item_vii_int }
4261     { \int_use:N \l__enumext_columns_vii_int }
4262     \int_set:Nn \l__enumext_joined_item_vii_int
4263     {
4264       \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1
4265     }
4266   }
4267   \int_compare:nNnT
4268   { \l__enumext_joined_item_vii_int }

```

```

4269     >
4270     { \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1 }
4271     {
4272         \msg_warning:nnee { enumext } { item-joined-columns }
4273         { \int_use:N \l__enumext_joined_item_vii_int }
4274         {
4275             \int_eval:n
4276             { \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1 }
4277         }
4278         \int_set:Nn \l__enumext_joined_item_vii_int
4279         {
4280             \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1
4281         }
4282     }
4283     \int_compare:nNnTF { \l__enumext_joined_item_vii_int } > { 1 }
4284     {
4285         \int_set_eq:NN \l__enumext_joined_item_aux_vii_int \l__enumext_joined_item_vii_int
4286         \int_decr:N \l__enumext_joined_item_aux_vii_int
4287         \int_add:Nn \l__enumext_item_column_pos_vii_int { \l__enumext_joined_item_aux_vii_int }
4288         \int_gadd:Nn \g__enumext_item_count_all_vii_int { \l__enumext_joined_item_aux_vii_int }
4289         \dim_set:Nn \l__enumext_joined_width_vii_dim
4290         {
4291             \l__enumext_item_width_vii_dim * \l__enumext_joined_item_vii_int
4292             + ( \l__enumext_labelwidth_vii_dim + \l__enumext_labelsep_vii_dim
4293               + \l__enumext_columns_sep_vii_dim
4294               )*\l__enumext_joined_item_aux_vii_int
4295         }
4296         \dim_set_eq:NN \itemwidth \l__enumext_joined_width_vii_dim
4297     }
4298     {
4299         \dim_set_eq:NN \l__enumext_joined_width_vii_dim \l__enumext_item_width_vii_dim
4300         \dim_set_eq:NN \itemwidth \l__enumext_item_width_vii_dim
4301     }
4302 }

```

Same implementation for the `keyans*` environment.

```

4303 \cs_new_protected:Npn \__enumext_starred_joined_item_viii:n #1
4304 {
4305     \int_set:Nn \l__enumext_joined_item_viii_int {#1}
4306     \int_compare:nNnT { \l__enumext_joined_item_viii_int } > { \l__enumext_columns_viii_int }
4307     {
4308         \msg_warning:nnee { enumext } { item-joined }
4309         { \int_use:N \l__enumext_joined_item_viii_int }
4310         { \int_use:N \l__enumext_columns_viii_int }
4311         \int_set:Nn \l__enumext_joined_item_viii_int
4312         {
4313             \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1
4314         }
4315     }
4316     \int_compare:nNnT
4317     { \l__enumext_joined_item_viii_int }
4318     >
4319     { \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1 }
4320     {
4321         \msg_warning:nnee { enumext } { item-joined-columns }
4322         { \int_use:N \l__enumext_joined_item_viii_int }
4323         {
4324             \int_eval:n
4325             { \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1 }
4326         }
4327         \int_set:Nn \l__enumext_joined_item_viii_int
4328         {
4329             \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1
4330         }
4331     }
4332     \int_compare:nNnTF { \l__enumext_joined_item_viii_int } > { 1 }
4333     {
4334         \int_set_eq:NN \l__enumext_joined_item_aux_viii_int \l__enumext_joined_item_viii_int
4335         \int_decr:N \l__enumext_joined_item_aux_viii_int
4336         \int_add:Nn \l__enumext_item_column_pos_viii_int { \l__enumext_joined_item_aux_viii_int }
4337         \int_gadd:Nn \g__enumext_item_count_all_viii_int { \l__enumext_joined_item_aux_viii_int }
4338         \dim_set:Nn \l__enumext_joined_width_viii_dim

```

```

4339     {
4340         \l__enumext_item_width_viii_dim * \l__enumext_joined_item_viii_int
4341         + ( \l__enumext_labelwidth_viii_dim + \l__enumext_labelsep_viii_dim
4342           + \l__enumext_columns_sep_viii_dim
4343           )*\l__enumext_joined_item_aux_viii_int
4344     }
4345     \dim_set_eq:NN \itemwidth \l__enumext_joined_width_viii_dim
4346 }
4347 {
4348     \dim_set_eq:NN \l__enumext_joined_width_viii_dim \l__enumext_item_width_viii_dim
4349     \dim_set_eq:NN \itemwidth \l__enumext_item_width_viii_dim
4350 }
4351 }

```

(End of definition for \\_\_enumext\_starred\_joined\_item\_vii:n and \\_\_enumext\_starred\_joined\_item\_viii:n)

### 13.42.3 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`.

```

4352 \cs_new_protected:Nn \__enumext_start_mini_vii:
4353 {
4354     \dim_compare:nNnT { \l__enumext_minipage_right_vii_dim } > { \c_zero_dim }
4355     {
4356         \dim_set:Nn \l__enumext_minipage_left_vii_dim
4357         {
4358             \linewidth
4359             - \l__enumext_minipage_right_vii_dim
4360             - \l__enumext_minipage_hsep_vii_dim
4361         }
4362         \bool_set_true:N \l__enumext_minipage_active_vii_bool
4363         \dim_gset_eq:NN
4364             \g__enumext_minipage_right_vii_dim
4365             \l__enumext_minipage_right_vii_dim
4366         \__enumext_mini_addvspace_vii:
4367         \nointerlineskip\noindent
4368         \__enumext_mini_page{ \l__enumext_minipage_left_vii_dim }
4369     }
4370 }

```

The function `\__enumext_stop_mini_vii:` closes the `\__enumext_mini_page` environment on the “left side”, applies `\hfill` and set the variable `\g__enumext_minipage_active_vii_bool` to “true” which will be used in the function `\__enumext_after_env:n` to execute the `minipage` on the “right side”. At this point we will execute the `\__enumext_stop_list:` and `\__enumext_stop_store_level_vii:` functions stopping the `list` environment and the level saving mechanism for storage in *sequence* of the `\anskey` command and `anskey*` environment. This function is passed to the `\__enumext_after_list_vii:` function in the second part of the `enumext*` environment definition (§13.43).

```

4371 \cs_new_protected:Nn \__enumext_stop_mini_vii:
4372 {
4373     \bool_if:NTF \l__enumext_minipage_active_vii_bool
4374     {
4375         \__enumext_stop_list:
4376         \__enumext_stop_store_level_vii:
4377         \IfDocumentMetadataTF { \tag_resume:n {enumext*} } { }
4378         \end__enumext_mini_page
4379         \hfill
4380         \bool_gset_true:N \g__enumext_minipage_active_vii_bool
4381     }
4382     {
4383         \__enumext_stop_list:
4384         \__enumext_stop_store_level_vii:
4385     }
4386 }

```

(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.

```

4387 \__enumext_after_env:nn {enumext*}
4388 {
4389   \bool_if:NT \g__enumext_minipage_active_vii_bool
4390   {
4391     \__enumext_minipage:w [ t ] { \g__enumext_minipage_right_vii_dim }
4392     \legacy_if_gset_false:n { @minipage }
4393     \skip_vertical:N \c_zero_skip
4394     \par\addvspace { \g__enumext_minipage_right_skip }
4395     \bool_if:NF \g__enumext_minipage_center_vii_bool
4396     {
4397       \tl_put_left:Nn \g__enumext_miniright_code_vii_tl
4398       {
4399         \centering
4400       }
4401     }
4402     \vbox_set_top:Nn \l__enumext_miniright_code_vii_box
4403     {
4404       \tl_use:N \g__enumext_miniright_code_vii_tl
4405     }
4406     \box_use_drop:N \l__enumext_miniright_code_vii_box
4407     \skip_vertical:N \c_zero_skip
4408     \__enumext_endminipage:
4409     \par\addvspace{ \g__enumext_minipage_after_skip }
4410   }
4411   \bool_gset_false:N \g__enumext_minipage_active_vii_bool
4412   \bool_gset_true:N \g__enumext_minipage_center_vii_bool
4413   \tl_gclear:N \g__enumext_miniright_code_vii_tl
4414   \dim_gzero:N \g__enumext_minipage_right_vii_dim
4415   \bool_gset_false:N \g__enumext_starred_bool
4416 }

```

```

\__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.

```

4417 \cs_new_protected:Nn \__enumext_start_mini_viii:
4418 {
4419   \dim_compare:nNnT { \l__enumext_minipage_right_viii_dim } > { \c_zero_dim }
4420   {
4421     \dim_set:Nn \l__enumext_minipage_left_viii_dim
4422     {
4423       \linewidth
4424       - \l__enumext_minipage_right_viii_dim
4425       - \l__enumext_minipage_hsep_viii_dim
4426     }
4427     \bool_set_true:N \l__enumext_minipage_active_viii_bool
4428     \dim_gset_eq:NN
4429     \g__enumext_minipage_right_viii_dim
4430     \l__enumext_minipage_right_viii_dim
4431     \__enumext_mini_addvspace_viii:
4432     \nointerlineskip\noindent
4433     \__enumext_mini_page{ \l__enumext_minipage_left_viii_dim }
4434   }
4435 }
4436 \cs_new_protected:Nn \__enumext_stop_mini_viii:
4437 {
4438   \bool_if:NTF \l__enumext_minipage_active_viii_bool
4439   {
4440     \__enumext_stop_list:
4441     \IfDocumentMetadataTF { \tag_resume:n {keyans*} } { }
4442     \end__enumext_mini_page
4443     \hfill
4444     \bool_gset_true:N \g__enumext_minipage_active_viii_bool
4445   }
4446   {
4447     \__enumext_stop_list:
4448   }
4449 }
4450 \__enumext_after_env:nn {keyans*}
4451 {
4452   \bool_if:NT \g__enumext_minipage_active_viii_bool
4453   {
4454     \__enumext_mini_page{ \g__enumext_minipage_right_viii_dim }

```

```

4455 \par\addvspace { \g__enumext_minipage_right_skip }
4456 \bool_if:NF \g__enumext_minipage_center_viii_bool
4457 {
4458   \tl_put_left:Nn \g__enumext_miniright_code_viii_tl
4459   {
4460     \centering
4461   }
4462 }
4463 \vbox_set_top:Nn \l__enumext_miniright_code_viii_box
4464 {
4465   \tl_use:N \g__enumext_miniright_code_viii_tl
4466 }
4467 \box_use_drop:N \l__enumext_miniright_code_viii_box
4468 \end__enumext_mini_page
4469 \par\addvspace{ \g__enumext_minipage_after_skip }
4470 }
4471 \bool_gset_false:N \g__enumext_minipage_active_viii_bool
4472 \bool_gset_true:N \g__enumext_minipage_center_viii_bool
4473 \tl_gclear:N \g__enumext_miniright_code_viii_tl
4474 \dim_gzero:N \g__enumext_minipage_right_viii_dim
4475 }

```

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

### 13.42.4 Redefining \footnote command

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

```

4476 \cs_new_protected:Nn \__enumext_footnotetext:nn
4477 {
4478   \footnotetext[#1]{#2}
4479 }
4480 \cs_new_protected:Nn \__enumext_renew_footnote:
4481 {
4482   \seq_gclear:N \g__enumext_footnote_arg_seq
4483   \seq_gclear:N \g__enumext_footnote_int_seq
4484   \RenewDocumentCommand \footnote { o +m }
4485   {
4486     \tl_if_novalue:nTF {##1}
4487     {
4488       \stepcounter{footnote}
4489       \int_gset_eq:Nc \g__enumext_footnote_int { c@footnote }
4490     }
4491     {
4492       \int_gset:Nn \g__enumext_footnote_int { ##1 }
4493     }
4494     \footnotemark [ \g__enumext_footnote_int ]
4495     \seq_gput_right:Nn \g__enumext_footnote_arg_seq { ##2 }
4496     \seq_gput_right:NV \g__enumext_footnote_int_seq \g__enumext_footnote_int
4497   }
4498 }
4499 \cs_new_protected:Nn \__enumext_print_footnote:
4500 {
4501   \seq_if_empty:NF \g__enumext_footnote_int_seq
4502   {
4503     \seq_map_pairwise_function:NNN
4504     \g__enumext_footnote_int_seq
4505     \g__enumext_footnote_arg_seq
4506     \__enumext_footnotetext:nn
4507   }
4508 }

```

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

### 13.43 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.

```

4509 \NewDocumentEnvironment{enumext*}{ o }
4510 {
4511   \__enumext_safe_exec_vii:
4512   \__enumext_parse_keys_vii:n {#1}
4513   \__enumext_before_list_vii:
4514   \__enumext_start_store_level_vii:
4515   \__enumext_start_list:nn { }
4516   {
4517     \__enumext_list_arg_two_vii:
4518     \__enumext_before_keys_exec_vii:
4519   }
4520   \IfDocumentMetadataTF { \tag_suspend:n {enumext*} } { }
4521   \__enumext_starred_columns_set_vii:
4522   \item[] \scan_stop:
4523   \cs_set_eq:NN \__enumext_stop_item_tmp_vii: \__enumext_first_item_tmp_vii:
4524   \cs_set_eq:NN \item \__enumext_start_item_tmp_vii:
4525   \ignorespaces
4526 }
4527 {
4528   \IfDocumentMetadataTF { \tag_struct_end:n {tag=text-unit} } { }
4529   \__enumext_stop_item_tmp_vii:
4530   \__enumext_remove_extra_parsep_vii:
4531   \__enumext_after_list_vii:
4532 }

```

(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.

```

4533 \cs_new_protected:Nn \__enumext_safe_exec_vii:
4534 {
4535   \__enumext_internal_mini_page:
4536   \__enumext_is_not_nested:
4537   \int_incr:N \l__enumext_level_h_int
4538   \int_compare:nNnT { \l__enumext_level_h_int } > { 1 }
4539   {
4540     \msg_error:nn { enumext } { nested }
4541   }
4542   \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
4543   {
4544     \msg_error:nnn { enumext } { nested-horizontal } { keyans* }
4545   }
4546   \bool_set_true:N \l__enumext_starred_bool
4547   \bool_set_false:N \l__enumext_standar_bool
4548   \__enumext_is_on_first_level:
4549 }

```

(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.

```

4550 \cs_new_protected:Npn \__enumext_parse_keys_vii:n #1
4551 {
4552   \tl_if_novalue:nF {#1}
4553   {
4554     \str_clear:N \l__enumext_series_str
4555     \keys_set:nn { enumext / enumext* } {#1}
4556     \__enumext_parse_series:n {#1}
4557     \__enumext_store_active_keys_vii:n {#1}
4558   }
4559 }

```



(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_vii:` and `\__enumext_start_mini_vii:` used by the keys `before*`, `mini-env`, `mini-right` and `mini-right*`.

```

4560 \cs_new_protected:Nn \__enumext_before_list_vii:
4561 {
4562     \__enumext_vspace_above_vii:
4563     \__enumext_check_ans_active:
4564     \__enumext_before_args_exec_vii:
4565     \__enumext_start_mini_vii:
4566 }
```

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

`\__enumext_after_list_vii:` The function `\__enumext_after_list_vii:` first calls the function `\__enumext_stop_mini_vii:` which internally calls `\__enumext_stop_list:` and `\__enumext_stop_store_level_vii:` (§13.42.3) 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 `\__enumext_starred_bool` to false and call the `\__enumext_resume_save_counter:` function used by the `series`, `resume` and `resume*` keys.

```

4567 \cs_new_protected:Nn \__enumext_after_list_vii:
4568 {
4569     \__enumext_stop_mini_vii:
4570     \__enumext_after_stop_list_vii:
4571     \__enumext_check_ans_key_hook:
4572     \__enumext_vspace_below_vii:
4573     \bool_set_false:N \__enumext_starred_bool
4574     \__enumext_resume_save_counter:
4575 }
```

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

`\__enumext_start_store_level_vii:` and `\__enumext_stop_store_level_vii:` activate the “*storing structure*” mechanism in *sequence* for `\anskey` command and `anskey*` environment if `enumext*` are nested in `enumext`.

```

4576 \cs_new_protected:Nn \__enumext_start_store_level_vii:
4577 {
4578     \bool_if:NT \__enumext_store_active_bool
4579     {
4580         \int_compare:nNnT { \__enumext_level_int } > { 0 }
4581         {
4582             \__enumext_store_level_open_vii:
4583         }
4584     }
4585 }
4586 \cs_new_protected:Nn \__enumext_stop_store_level_vii:
4587 {
4588     \bool_if:NT \__enumext_store_active_bool
4589     {
4590         \int_compare:nNnT { \__enumext_level_int } > { 0 }
4591         {
4592             \__enumext_store_level_close_vii:
4593         }
4594     }
4595 }
```

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

### 13.43.1 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.

```

4596 \cs_new_protected_nopar:Nn \__enumext_first_item_tmp_vii:
4597 {
4598     \skip_horizontal:n
4599     {
4600         -\__enumext_labelwidth_vii_dim - \__enumext_labelsep_vii_dim

```

```

4601     }
4602     \ignorespaces
4603 }

```

(End of definition for `\__enumext_first_item_tmp_vii:`)

```

\__enumext_start_item_tmp_vii:
\__enumext_item_peek_args_vii:
\__enumext_joined_item_vii:w
\__enumext_standar_item_vii:w
\__enumext_starred_item_vii:w
\__enumext_starred_item_vii_aux_i:w
\__enumext_starred_item_vii_aux_ii:w
\__enumext_starred_item_vii_aux_iii:w

```

First we will call the function `\__enumext_stop_item_tmp_vii:` that we will redefine later, we will increment the value of `\l__enumext_item_column_pos_vii_int` that will count the item's by rows and the value of `\g__enumext_item_count_all_vii_int` that will count the total of item's in the environment. After that we will call the function `\__enumext_item_peek_args_vii:` that will handle the arguments passed to `\item`.

```

4604 \cs_new_protected_nopar:Nn \__enumext_start_item_tmp_vii:
4605 {
4606     \__enumext_stop_item_tmp_vii:
4607     \int_incr:N \l__enumext_item_column_pos_vii_int
4608     \int_gincr:N \g__enumext_item_count_all_vii_int
4609     \__enumext_item_peek_args_vii:
4610 }

```

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).

```

4611 \cs_new_protected:Nn \__enumext_item_peek_args_vii:
4612 {
4613     \peek_meaning:NTF (
4614     { \__enumext_joined_item_vii:w }
4615     { \__enumext_joined_item_vii:w (1) }
4616 }

```

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`.

```

4617 \cs_new_protected:Npn \__enumext_joined_item_vii:w (#1)
4618 {
4619     \__enumext_starred_joined_item_vii:n {#1}
4620     \peek_meaning_remove:NTF *
4621     { \__enumext_starred_item_vii:w }
4622     { \__enumext_standar_item_vii:w }
4623 }

```

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 ]`.

```

4624 \cs_new_protected:Npn \__enumext_standar_item_vii:w
4625 {
4626     \bool_set_false:N \l__enumext_item_starred_vii_bool
4627     \peek_meaning:NTF [
4628     {
4629         \bool_set_eq:NN \l__enumext_wrap_label_vii_bool \l__enumext_wrap_label_opt_vii_bool
4630         \__enumext_start_item_vii:w
4631     }
4632     {
4633         \bool_set_true:N \l__enumext_wrap_label_vii_bool
4634         \legacy_if_set_true:n { @noitemarg }
4635         \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ] \ignorespaces
4636     }
4637 }

```

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>]`.

```

4638 \cs_new_protected:Npn \__enumext_starred_item_vii:w
4639 {
4640     \bool_set_true:N \l__enumext_item_starred_vii_bool
4641     \bool_set_true:N \l__enumext_wrap_label_vii_bool
4642     \peek_meaning:NTF [
4643     { \__enumext_starred_item_vii_aux_i:w }

```

```

4644     { \__enumext_starred_item_vii_aux_ii:w }
4645   }
4646 \cs_new_protected:Npn \__enumext_starred_item_vii_aux_i:w [#1]
4647 {
4648   \tl_gset:Nn \g__enumext_item_symbol_aux_vii_tl {#1}
4649   \__enumext_starred_item_vii_aux_ii:w
4650 }
4651 \cs_new_protected:Npn \__enumext_starred_item_vii_aux_iii:w
4652 {
4653   \peek_meaning:NTF [
4654     { \__enumext_starred_item_vii_aux_iii:w }
4655     {
4656       \dim_set_eq:NN \l__enumext_item_symbol_sep_vii_dim \l__enumext_labelsep_vii_dim
4657       \legacy_if_set_true:n { @noitemarg }
4658       \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ] \ignorespaces
4659     }
4660   }
4661 \cs_new_protected:Npn \__enumext_starred_item_vii_aux_iii:w [#1]
4662 {
4663   \dim_set:Nn \l__enumext_item_symbol_sep_vii_dim {#1}
4664   \legacy_if_set_true:n { @noitemarg }
4665   \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ] \ignorespaces
4666 }

```

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

\\_\_enumext\_fake\_make\_label\_vii:n

The \\_\_enumext\_fake\_make\_label\_vii:n function will be in charge of handling our definition of \item. First we increment the counter `enumXvii` for the enumerated items and activate support for the *check answers* mechanism, followed by support for `\item*[\langle symbol \rangle][\langle offset \rangle]` if present, then the `wrap-label` and `wrap-label*` keys which we execute using `\makebox` whose width will be given by the `labelwidth` key and position by the `align` key, inside the argument of this we will execute the `font` key together with the function defined by the `wrap-label` or `wrap-label*` keys. Finally we execute the `labelsep` key applying a `\skip_horizontal:N` and `\ignorespaces`.

- For compatibility with *tagged* PDF and *hyperref* when an environment `enumext` is nested in `enumext*` and the key `save-ans` is not active need setting the `\if@hyper@item` switch to “true”. The explanation for this is given by the master Heiko Oberdiek on `\refstepcounter{enumi}` twice (or more) creates destination with the same identifier. This patch is only needed if you are running `pdflatex` and not if you are running `lualatex`

```

4667 \cs_new_protected_nopar:Npn \__enumext_fake_make_label_vii:n #1
4668 {
4669   \legacy_if:nT { @noitemarg }
4670   {
4671     \legacy_if_set_false:n { @noitemarg }
4672     \legacy_if:nT { @nmbrrlist }
4673     {
4674       \IfDocumentMetadataTF
4675       {
4676         \bool_if:NT \l__enumext_hyperref_bool
4677         {
4678           \legacy_if_set_true:n { @hyper@item }
4679         }
4680       } { }
4681       \refstepcounter{enumXvii}
4682       \bool_if:NT \l__enumext_check_answers_bool
4683       {
4684         \int_gincr:N \g__enumext_item_number_int
4685         \bool_set_true:N \l__enumext_item_number_bool
4686       }
4687     }
4688   }
4689   \bool_if:NT \l__enumext_item_starred_vii_bool
4690   {
4691     \tl_if_blank:VT \g__enumext_item_symbol_aux_vii_tl
4692     {
4693       \tl_gset_eq:NN
4694       \g__enumext_item_symbol_aux_vii_tl \l__enumext_item_symbol_vii_tl
4695     }
4696     \mode_leave_vertical:
4697     \skip_horizontal:n { -\l__enumext_item_symbol_sep_vii_dim }
4698     \hbox_overlap_left:n { \g__enumext_item_symbol_aux_vii_tl }
4699     \skip_horizontal:N \l__enumext_item_symbol_sep_vii_dim

```

```

4700     \tl_gclear:N \g__enumext_item_symbol_aux_vii_tl
4701   }
4702   \makebox[ \l__enumext_labelwidth_vii_dim ][ \l__enumext_align_label_vii_str ]
4703   {
4704     \tl_use:N \l__enumext_label_font_style_vii_tl
4705     \bool_if:NTF \l__enumext_wrap_label_vii_bool
4706     {
4707       \__enumext_wrapper_label_vii:n {#1}
4708     }
4709     { #1 }
4710   }
4711   \skip_horizontal:N \l__enumext_labelsep_vii_dim \ignorespaces
4712 }

```

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

### 13.43.2 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 “*item content*” in a *horizontal box* where the width will be `\itemwidth` plus `\labelwidth` plus `\labelsep`.

```

4713 \cs_new_protected_nopar:Npn \__enumext_start_item_vii:w [#1]
4714 {
4715   \cs_set_eq:NN \__enumext_stop_item_tmp_vii: \__enumext_stop_item_vii:
4716   \hbox_set_to_wd:Nnw \l__enumext_item_text_vii_box
4717   {
4718     \l__enumext_joined_width_vii_dim
4719     + \l__enumext_labelwidth_vii_dim
4720     + \l__enumext_labelsep_vii_dim
4721   }

```

If `\DocumentMetadata` is not active and the state of the variable `\l__enumext_footnotes_key_bool` is false, we will redefine the `\footnote` command.

```

4722   \IfDocumentMetadataTF { }
4723   {
4724     \bool_if:NF \l__enumext_footnotes_key_bool
4725     {
4726       \__enumext_renew_footnote:
4727     }
4728   }

```

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

```

4729   \__enumext_start_list_tag:n {enumext*}
4730   \__enumext_fake_make_label_vii:n {#1}
4731   \__enumext_stop_start_list_tag:

```

Finally we open the `minipage` environment, capture the “*item content*”, make `\parindent` take the value of the key `listparindent` and `\parskip` take the value of the key `parsep`, then execute the keys `itemindent` and `first`.

Here the use of `\unskip` and `\skip_horizontal:n` with the value of `listparindent` is necessary, otherwise an unwanted space is created when using `\item[opt]` and the value passed to the key `itemindent` is incremented.

```

4732   \__enumext_minipage:w [ t ]{ \l__enumext_joined_width_vii_dim }
4733   \dim_set_eq:NN \parindent \l__enumext_listparindent_vii_dim
4734   \skip_set_eq:NN \parskip \l__enumext_parsep_vii_skip
4735   \__enumext_unskip_unkern:
4736   \__enumext_unskip_unkern:
4737   \skip_horizontal:n { -\l__enumext_listparindent_vii_dim } \ignorespaces
4738   \tl_use:N \l__enumext_fake_item_indent_vii_tl
4739   \tl_use:N \l__enumext_after_list_args_vii_tl
4740 }

```

The `\__enumext_stop_item_vii:` function will finish the fetching `\item` and “*item content*” by closing the `minipage` environment, the *sockets* for *tagging* PDF and the *horizontal box*.

```

4741 \cs_new_protected_nopar:Nn \__enumext_stop_item_vii:
4742 {
4743   \__enumext_endminipage:
4744   \__enumext_stop_list_tag:n {enumext*}
4745   \hbox_set_end:

```

Here we will reduce the *warnings* a bit by setting the value of `\hbadness` to `10000`, print `\item` and “*item content*” from the *horizontal box* and *footnotes* if it was redefined.

```

4746 \int_set:Nn \hbadness { 10000 }
4747 \box_use_drop:N \l__enumext_item_text_vii_box
4748 \IfDocumentMetadataTF { }
4749 {
4750   \bool_if:NF \l__enumext_footnotes_key_bool
4751   {
4752     \__enumext_print_footnote:
4753   }
4754 }

```

Finally apply the *vertical space* between rows set by `itemsep` key passed to `\parsep` using `\par\noindent` and *horizontal space* between columns set by `columns-sep` key using `\skip_horizontal:N`.

```

4755 \int_compare:nNnTF
4756 { \l__enumext_item_column_pos_vii_int } = { \l__enumext_columns_vii_int }
4757 {
4758   \par\noindent
4759   \int_zero:N \l__enumext_item_column_pos_vii_int
4760 }
4761 {
4762   \skip_horizontal:N \l__enumext_columns_sep_vii_dim
4763 }
4764 }

```

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

`\__enumext_remove_extra_parsep_vii:`

Remove the extra *vertical space* equal to `\parsep=\itemsep` when the total number of `\item` is divisible by the number of `\item` in the last row of the environment. Here the use of `\unskip` or `\removeatlastskip` fails and does not obtain the expected result, using `\vspace` is the option and in this case, we can use a simplified version since we are always in *(vertical mode)*.

```

4765 \cs_new_protected:Nn \__enumext_remove_extra_parsep_vii:
4766 {
4767   \int_compare:nNnT
4768   {
4769     \int_mod:nn
4770     { \g__enumext_item_count_all_vii_int } { \l__enumext_columns_vii_int }
4771   }
4772   =
4773   { 0 }
4774   {
4775     \para_end:
4776     \skip_vertical:n { -\l__enumext_itemsep_vii_skip }
4777     \skip_vertical:N \c_zero_skip
4778     \int_gzero:N \g__enumext_item_count_all_vii_int
4779   }
4780 }

```

(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`.

```

4781 \__enumext_after_env:nn {enumext*}
4782 {
4783   \__enumext_execute_after_env:
4784 }

```

### 13.44 The environment `keyans*`

`keyans*`

The implementation of `keyans*` environment is the similar as that used by the `enumext*` environment except for the `\__enumext_check_starred_cmd:n` function added in the second part.

```

4785 \NewDocumentEnvironment{keyans*}{ o }
4786 {
4787   \__enumext_safe_exec_viii:
4788   \__enumext_parse_keys_viii:n {#1}
4789   \__enumext_before_list_viii:
4790   \__enumext_start_list:nn { }
4791   {
4792     \__enumext_list_arg_two_viii:
4793     \__enumext_before_keys_exec_viii:
4794   }

```

```

4795     \IfDocumentMetadataTF { \tag_suspend:n {keyans*} } { }
4796     \__enumext_starred_columns_set_viii:
4797     \item[] \scan_stop:
4798     \cs_set_eq:NN \__enumext_stop_item_tmp_viii: \__enumext_first_item_tmp_viii:
4799     \cs_set_eq:NN \item \__enumext_start_item_tmp_viii:
4800     \ignorespaces
4801   }
4802   {
4803     \IfDocumentMetadataTF { \tag_struct_end:n {tag=text-unit} } { }
4804     \__enumext_stop_item_tmp_viii:
4805     \__enumext_remove_extra_parsep_viii:
4806     \__enumext_check_starred_cmd:n { item }
4807     \__enumext_after_list_viii:
4808   }

```

(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.

```

4809 \cs_new_protected:Nn \__enumext_safe_exec_viii:
4810 {
4811   \bool_if:NF \l__enumext_store_active_bool
4812   {
4813     \msg_error:nnnn { enumext } { wrong-place } { keyans* } { save-ans }
4814   }
4815   \int_incr:N \l__enumext_keyans_level_h_int
4816   \int_compare:nNnT { \l__enumext_keyans_level_h_int } > { 1 }
4817   {
4818     \msg_error:nn { enumext } { nested }
4819   }
4820   \__enumext_keyans_name_and_start:
4821   \bool_if:NT \l__enumext_starred_bool
4822   {
4823     \msg_error:nnn { enumext } { nested-horizontal } { enumext* }
4824   }
4825   \bool_set_true:N \l__enumext_starred_bool
4826   % Set false for interfering with enumext nested in keyans* (yes, its possible and crayze)
4827   \bool_set_false:N \l__enumext_store_active_bool
4828   \int_compare:nNnT { \l__enumext_level_int } > { 1 }
4829   {
4830     \msg_error:nn { enumext } { keyans-wrong-level }
4831   }
4832 }

```

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

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

```

4833 \cs_new_protected:Npn \__enumext_parse_keys_viii:n #1
4834 {
4835   \tl_if_novalue:nF {#1}
4836   {
4837     \keys_set:nn { enumext / keyans* } {#1}
4838   }
4839 }

```

(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`.

```

4840 \cs_new_protected:Nn \__enumext_before_list_viii:
4841 {
4842   \__enumext_vspace_above_viii:
4843   \__enumext_before_args_exec_viii:
4844   \__enumext_start_mini_viii:
4845 }

```

(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.

```
4846 \cs_new_protected:Nn \__enumext_after_list_viii:
4847 {
4848     \__enumext_stop_mini_viii:
4849     \__enumext_after_stop_list_viii:
4850     \__enumext_vspace_below_viii:
4851 }
```

(End of definition for `\__enumext_after_list_viii:`)

### 13.44.1 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.

```
4852 \cs_new_protected_nopar:Nn \__enumext_first_item_tmp_viii:
4853 {
4854     \skip_horizontal:n
4855     {
4856         -\__enumext_labelwidth_viii_dim - \__enumext_labelsep_viii_dim
4857     }
4858     \ignorespaces
4859 }
```

(End of definition for `\__enumext_first_item_tmp_viii:`)

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

```
4860 \cs_new_protected_nopar:Nn \__enumext_start_item_tmp_viii:
4861 {
4862     \__enumext_stop_item_tmp_viii:
4863     \int_incr:N \l__enumext_item_column_pos_viii_int
4864     \int_gincr:N \g__enumext_item_count_all_viii_int
4865     \__enumext_item_peek_args_viii:
4866 }
```

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).

```
4867 \cs_new_protected:Nn \__enumext_item_peek_args_viii:
4868 {
4869     \peek_meaning:NTF (
4870         { \__enumext_joined_item_viii:w }
4871         { \__enumext_joined_item_viii:w (1) }
4872 }
```

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`.

```
4873 \cs_new_protected:Npn \__enumext_joined_item_viii:w (#1)
4874 {
4875     \__enumext_starred_joined_item_viii:n {#1}
4876     \peek_meaning_remove:NTF *
4877     { \__enumext_starred_item_viii:w }
4878     { \__enumext_standar_item_viii:w }
4879 }
```



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 ]`.

```

4880 \cs_new_protected:Npn \__enumext_standar_item_viii:w
4881 {
4882   \bool_set_false:N \l__enumext_item_starred_viii_bool
4883   \peek_meaning:NTF [
4884     {
4885       \bool_set_eq:NN \l__enumext_wrap_label_viii_bool \l__enumext_wrap_label_opt_viii_bool
4886       \__enumext_start_item_viii:w
4887     }
4888     {
4889       \bool_set_true:N \l__enumext_wrap_label_viii_bool
4890       \legacy_if_set_true:n { @noitemarg }
4891       \__enumext_start_item_viii:w [ \l__enumext_label_viii_tl ] \ignorespaces
4892     }
4893   }

```

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

```

\__enumext_starred_item_viii:w
\__enumext_starred_item_viii_aux_i:w
\__enumext_starred_item_viii_aux_ii:w
\__enumext_starred_item_exec:

```

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⟩]`.

```

4894 \cs_new_protected:Npn \__enumext_starred_item_viii:w
4895 {
4896   \bool_set_true:N \l__enumext_item_starred_viii_bool
4897   \bool_set_true:N \l__enumext_wrap_label_viii_bool
4898   \peek_meaning:NTF [
4899     { \__enumext_starred_item_viii_aux_i:w }
4900     { \__enumext_starred_item_viii_aux_ii:w }
4901   }

```

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`.

```

4902 \cs_new_protected:Npn \__enumext_starred_item_viii_aux_i:w [#1]
4903 {
4904   \tl_clear:N \l__enumext_store_current_label_tl
4905   \tl_if_no_value:nF { #1 }
4906   {
4907     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_tl
4908     {
4909       \tl_put_right:Ne \l__enumext_store_current_label_tl
4910       {
4911         \l__enumext_store_keyans_item_opt_sep_tl
4912       }
4913       \tl_put_right:Ne \l__enumext_store_current_label_tl { #1 }
4914     }
4915     \tl_set:Ne \l__enumext_store_current_opt_arg_tl { #1 }
4916   }
4917   \__enumext_starred_item_viii_aux_ii:w
4918 }
4919 \cs_new_protected:Npn \__enumext_starred_item_viii_aux_ii:w
4920 {
4921   \legacy_if_set_true:n { @noitemarg }
4922   \__enumext_start_item_viii:w [ \l__enumext_label_viii_tl ] \ignorespaces
4923 }

```

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.

```

4924 \cs_new_protected:Npn \__enumext_starred_item_exec:
4925 {
4926   \tl_put_left:Ne \l__enumext_store_current_label_tl { \l__enumext_label_viii_tl }
4927   \__enumext_store_addto_prop:V \l__enumext_store_current_label_tl
4928   \__enumext_keyans_store_ref:
4929   \tl_put_left:Ne \l__enumext_store_current_label_tl { \item }

```

```

4930 \__enumext_keyans_addto_seq_link:
4931 \int_gincr:N \__enumext_check_starred_cmd_int
4932 \bool_if:NT \__enumext_show_answer_bool
4933 {
4934   \__enumext_print_keyans_box:NN \__enumext_labelwidth_i_dim \__enumext_labelsep_i_dim
4935 }
4936 \bool_if:NT \__enumext_show_position_bool
4937 {
4938   \tl_set:Nx \__enumext_mark_answer_sym_tl
4939   {
4940     \group_begin:
4941     \exp_not:N \normalfont
4942     \exp_not:N \footnotesize [ \int_eval:n
4943       {
4944         \prop_count:c { g__enumext_ \__enumext_store_name_tl _prop }
4945       }
4946     ]
4947     \group_end:
4948   }
4949   \__enumext_print_keyans_box:NN \__enumext_labelwidth_i_dim \__enumext_labelsep_i_dim
4950 }
4951 }

```

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

\\_\_enumext\_fake\_make\_label\_viii:n

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

```

4952 \cs_new_protected_nopar:Npn \__enumext_fake_make_label_viii:n #1
4953 {
4954   \legacy_if:nT { @noitemarg }
4955   {
4956     \legacy_if_set_false:n { @noitemarg }
4957     \legacy_if:nT { @nmbrrlist }
4958     {
4959       \refstepcounter{enumXviii}
4960     }
4961   }
4962   \bool_if:NT \__enumext_item_starred_viii_bool
4963   {
4964     \__enumext_starred_item_exec:
4965   }
4966   \makebox[ \__enumext_labelwidth_viii_dim ][ \__enumext_align_label_viii_str ]
4967   {
4968     \tl_use:N \__enumext_label_font_style_viii_tl
4969     \bool_if:NTF \__enumext_wrap_label_viii_bool
4970     {
4971       \__enumext_wrapper_label_viii:n {#1}
4972     }
4973     { #1 }
4974   }
4975   \skip_horizontal:N \__enumext_labelsep_viii_dim \ignorespaces
4976 }

```

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

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

\\_\_enumext\_start\_item\_viii:w

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

\\_\_enumext\_stop\_item\_viii:

```

4977 \cs_new_protected_nopar:Npn \__enumext_start_item_viii:w [#1]
4978 {
4979   \cs_set_eq:NN \__enumext_stop_item_tmp_viii: \__enumext_stop_item_viii:
4980   \hbox_set_to_wd:Nnw \__enumext_item_text_viii_box
4981   {
4982     \l__enumext_joined_width_viii_dim
4983     + \l__enumext_labelwidth_viii_dim
4984     + \l__enumext_labelsep_viii_dim
4985   }
4986   \IfDocumentMetadataTF { }
4987   {
4988     \bool_if:NF \__enumext_footnotes_key_bool
4989     {
4990       \__enumext_renew_footnote:
4991     }

```

```

4992     }
4993     \__enumext_start_list_tag:n {keyans*}
4994     \__enumext_fake_make_label_viii:n {#1}
4995     \__enumext_stop_start_list_tag:
4996     \__enumext_minipage:w [ t ]{ \l__enumext_joined_width_viii_dim }
4997     \dim_set_eq:NN \parindent \l__enumext_listparindent_viii_dim
4998     \skip_set_eq:NN \parskip \l__enumext_parsep_viii_skip
4999     \__enumext_unskip_unkern:
5000     \__enumext_unskip_unkern:
5001     \skip_horizontal:n { -\l__enumext_listparindent_viii_dim } \ignorespaces
5002     \tl_use:N \l__enumext_fake_item_indent_viii_tl
5003     \bool_if:NT \l__enumext_item_starred_viii_bool
5004     {
5005         \__enumext_keyans_show_item_opt:
5006     }
5007     \tl_use:N \l__enumext_after_list_args_viii_tl
5008 }
5009 \cs_new_protected_nopar:Nn \__enumext_stop_item_viii:
5010 {
5011     \__enumext_endminipage:
5012     \__enumext_stop_list_tag:n {keyans*}
5013     \hbox_set_end:
5014     \int_set:Nn \hbadness { 10000 }
5015     \box_use_drop:N \l__enumext_item_text_viii_box
5016     \IfDocumentMetadataTF { }
5017     {
5018         \bool_if:NF \l__enumext_footnotes_key_bool
5019         {
5020             \__enumext_print_footnote:
5021         }
5022     }
5023     \int_compare:nNnTF
5024     { \l__enumext_item_column_pos_viii_int } = { \l__enumext_columns_viii_int }
5025     {
5026         \par\noindent
5027         \int_zero:N \l__enumext_item_column_pos_viii_int
5028     }
5029     {
5030         \skip_horizontal:N \l__enumext_columns_sep_viii_dim
5031     }
5032 }

```

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

\\_\_enumext\_remove\_extra\_parsep\_viii:

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

```

5033 \cs_new_protected:Nn \__enumext_remove_extra_parsep_viii:
5034 {
5035     \int_compare:nNnT
5036     {
5037         \int_mod:nn
5038         { \g__enumext_item_count_all_viii_int }
5039         { \l__enumext_columns_viii_int }
5040     }
5041     =
5042     { 0 }
5043     {
5044         \para_end:
5045         \skip_vertical:n { -\l__enumext_itemsep_viii_skip }
5046         \skip_vertical:N \c_zero_skip
5047         \int_gzero:N \g__enumext_item_count_all_viii_int
5048     }
5049 }

```

(End of definition for \\_\_enumext\_remove\_extra\_parsep\_viii:.)

### 13.45 The command \getkeyans

\getkeyans  
\\_\_enumext\_getkeyans\_aux:n  
\\_\_enumext\_getkeyans:n

The `\getkeyans` command takes a *mandatory argument* of the form  $\langle \textit{store name} : \textit{position} \rangle$ . Retrieve a “single content” stored by `\anskey`, `\anspic*` and `\item*` and `anskey*` from *prop list* defined by `save-anskey`.

```

5050 \NewDocumentCommand \getkeyans { m }
5051 {

```

```

5052 \exp_args:Ne \__enumext_getkeyans_aux:n
5053 { \tl_to_str:e { \text_expand:n {#1} } }
5054 }

```

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

```

5055 \cs_new_protected:Npn \__enumext_getkeyans_aux:n #1
5056 {
5057   \str_if_in:nnTF {#1} { : }
5058   {
5059     \use:e
5060     {
5061       \cs_set:Npn \exp_not:N \__enumext_tmp:w ##1 \c_colon_str ##2 \scan_stop:
5062       { {##1} {##2} }
5063     }
5064     \exp_after:wN \__enumext_getkeyans:nn \__enumext_tmp:w #1 \scan_stop:
5065   }
5066   { \msg_error:nnn { enumext } { missing-colon } {#1} }
5067 }

```

The internal function `\__enumext_getkeyans:nn` will check for the existence of the *prop list*, if it does not exist it will return an error message, then it will fetch the content specified by the *second argument* from *prop list*.

```

5068 \cs_new_protected:Npn \__enumext_getkeyans:nn #1 #2
5069 {
5070   \prop_if_exist:cTF { g__enumext_#1_prop }
5071   {
5072     \prop_item:cn { g__enumext_#1_prop }{#2}
5073   }
5074   {
5075     \msg_error:nnn { enumext } { undefined-storage-anskey } {#1}
5076   }
5077 }

```

(End of definition for `\getkeyans`, `\__enumext_getkeyans_aux:n`, and `\__enumext_getkeyans:nn`. This function is documented on page 17.)

### 13.46 The command `\printkeyans`

The `\printkeyans` command prints “all stored content” in the *sequence* defined by the *save-ans* key.

The first thing we will do is define a set of *filtered keys* with which we will control the options of the different nesting levels for the environment `enumext` and `enumext*` by storing their values in the list of tokens `\l__enumext_print_keyans_X_tl`.

The variable `\l__enumext_print_keyans_starred_tl` will have the default *keys* for `\printkeyans*` and will be set by `\setenumext[⟨print*⟩]` and the variable `\l__enumext_print_keyans_vii_tl` will have the default keys for the environment `enumext*` nested within the *sequence* and will be set by `\setenumext[⟨print,*⟩]`, the rest of the variables will be for the environment `enumext` and will be set by `\setenumext[⟨print,level⟩]`.

```

5078 \keys_define:nn { enumext / print }
5079 {
5080   print* .code:n = \keys_precompile:neN { enumext / enumext* }
5081               { \__enumext_filter_save_key:n {#1} }
5082               \l__enumext_print_keyans_starred_tl, % starred cmd
5083   print* .initial:n = { nosep, label=\arabic*., columns=2, first=\small, font=\small },
5084   print-1 .code:n = \keys_precompile:neN { enumext / level-1 }
5085               { \__enumext_filter_save_key:n {#1} }
5086               \l__enumext_print_keyans_i_tl,
5087   print-1 .initial:n = { nosep, label=\arabic*., columns=2, first=\small, font=\small },
5088   print-2 .code:n = \keys_precompile:neN { enumext / level-2 }
5089               { \__enumext_filter_save_key:n {#1} }
5090               \l__enumext_print_keyans_ii_tl,
5091   print-2 .initial:n = { nosep, label=(\alph*), first=\small, font=\small },
5092   print-3 .code:n = \keys_precompile:neN { enumext / level-3 }
5093               { \__enumext_filter_save_key:n {#1} }
5094               \l__enumext_print_keyans_iii_tl,
5095   print-3 .initial:n = { nosep, label=\roman*., first=\small, font=\small },
5096   print-4 .code:n = \keys_precompile:neN { enumext / level-4 }
5097               { \__enumext_filter_save_key:n {#1} }
5098               \l__enumext_print_keyans_iv_tl,
5099   print-4 .initial:n = { nosep, label=\Alph*., first=\small, font=\small },
5100   print-* .code:n = \keys_precompile:neN { enumext / enumext* }

```

```

5101         { \__enumext_filter_save_key:n {#1} }
5102         \__enumext_print_keyans_vii_tl, % starred nested
5103     print-* .initial:n = { nosep, label=\arabic*., first=\small, font=\small },
5104 }

```

- The reason for storing  $\langle keys \rangle$  in token lists using `\keys_precompile:neN` is because the keys are set via `\setenumext` but are later executed by running the command `\printkeyans` and they are not handled directly by its *optional argument*, except those related to the *first* opening level.

`\printkeyans`

`\__enumext_printkeyans:nnn`

Create a user command to print “*all stored content*” in *sequence* for `\anskey`, `anskey*`, `\item*` and `\anspic*`. Within a group we will run our “*precompiled keys*” and then call the internal function `\__enumext_printkeyans:nnn`.

```

5105 \NewDocumentCommand \printkeyans { s O{} m }
5106 {
5107     \group_begin:
5108     \tl_use:N \__enumext_print_keyans_i_tl
5109     \tl_use:N \__enumext_print_keyans_ii_tl
5110     \tl_use:N \__enumext_print_keyans_iii_tl
5111     \tl_use:N \__enumext_print_keyans_iv_tl
5112     \tl_use:N \__enumext_print_keyans_vii_tl
5113     \__enumext_printkeyans:nnn { #1 } { #2 } { #3 }
5114     \group_end:
5115 }

```

The internal function `\__enumext_printkeyans:nnn` will check for the existence of the *sequence*, if it does not exist it will return an error message, then it will check if not empty.

```

5116 \cs_new_protected:Npn \__enumext_printkeyans:nnn #1 #2 #3
5117 {
5118     \seq_if_exist:cTF { g__enumext_#3_seq }
5119     {
5120         \seq_if_empty:cF { g__enumext_#3_seq }
5121         {

```

If the *starred argument* ‘*\**’ is present we will check that the environment `enumext*` is not saved in the *sequence*, then execute the variable `\__enumext_print_keyans_starred_tl` that contains the default  $\langle keys \rangle$  for the environment `enumext*`, we set `\__enumext_base_line_fix_bool` and `\__enumext_print_keyans_star_bool` to true for *baseline correction*, open the `enumext*` environment passing the *optional argument* and map the *sequence*, then set `\__enumext_base_line_fix_bool` and `\__enumext_print_keyans_star_bool` to false.

```

5122     \bool_if:nTF {#1}
5123     {
5124         \seq_if_in:cnTF { g__enumext_#3_seq } { \end{enumext*} }
5125         {
5126             \msg_error:nnnn { enumext } { print-starred } {#3} { enumext* }
5127         }
5128         {
5129             \tl_use:N \__enumext_print_keyans_starred_tl
5130             \bool_set_true:N \__enumext_base_line_fix_bool
5131             \bool_set_true:N \__enumext_print_keyans_star_bool
5132             \begin{enumext*}[#2]
5133                 \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
5134                 \end{enumext*}
5135             \bool_set_false:N \__enumext_base_line_fix_bool
5136             \bool_set_false:N \__enumext_print_keyans_star_bool
5137         }
5138     }

```

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

```

5139         {
5140             \begin{enumext}[#2]
5141                 \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
5142             \end{enumext}
5143         }
5144     }
5145 }
5146 {
5147     \msg_error:nnn { enumext } { undefined-storage-anskey } {#3}
5148 }
5149 }

```

(End of definition for `\printkeyans` and `\__enumext_printkeyans:nnn`. This function is documented on page 17.)

### 13.47 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`.

```
\__enumext_filter_first_level:n
\__enumext_filter_first_level_key:n
\__enumext_filter_first_level_pair:nn
```

```
5150 \cs_new:Npn \__enumext_filter_first_level:n #1
5151 {
5152   \use:e
5153   {
5154     \keyval_parse:NNn
5155     \__enumext_filter_first_level_key:n
5156     \__enumext_filter_first_level_pair:nn {#1}
5157   }
5158 }
```

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*`.

```
5159 \cs_new:Npn \__enumext_filter_first_level_key:n #1
5160 {
5161   \str_case:nnF {#1}
5162   {
5163     { resume } {}
5164     { resume* } {}
5165   }
5166   { , { \exp_not:n {#1} } }
5167 }
```

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.

```
5168 \cs_new:Npn \__enumext_filter_first_level_pair:nn #1#2
5169 {
5170   \str_case:nnF {#1}
5171   {
5172     { series } {}
5173     { resume } {}
5174     { save-ans } {}
5175   }
5176   { , { \exp_not:n {#1} } = { \exp_not:n {#2} } }
5177 }
```

(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`.

```
5178 \keys_define:nn { enumext / meta-families }
5179 {
5180   enumext-1 .code:n =
5181     {
5182       \keys_set:ne { enumext / level-1 }
5183       {
5184         \__enumext_filter_first_level:n {#1}
5185       }
5186     } ,
5187   enumext-2 .code:n = { \keys_set:nn { enumext / level-2 } {#1} } ,
5188   enumext-3 .code:n = { \keys_set:nn { enumext / level-3 } {#1} } ,
5189   enumext-4 .code:n = { \keys_set:nn { enumext / level-4 } {#1} } ,
5190   keyans .code:n = { \keys_set:nn { enumext / keyans } {#1} } ,
5191   enumext* .code:n =
5192     {
5193       \keys_set:ne { enumext / enumext* }
5194       {
5195         \__enumext_filter_first_level:n {#1}
5196       }
5197     } ,
5198   keyans* .code:n = { \keys_set:nn { enumext / keyans* } {#1} } ,
5199   print* .code:n = { \keys_set:nn { enumext / print } { print* = {#1} } } ,
5200   print-1 .code:n = { \keys_set:nn { enumext / print } { print-1 = {#1} } } ,
5201   print-2 .code:n = { \keys_set:nn { enumext / print } { print-2 = {#1} } } ,
5202   print-3 .code:n = { \keys_set:nn { enumext / print } { print-3 = {#1} } } ,
5203   print-4 .code:n = { \keys_set:nn { enumext / print } { print-4 = {#1} } } ,
```

```

5204     print-* .code:n = { \keys_set:nn { enumext / print } { print-* = {#1} } } ,
5205     unknown .code:n = { \msg_error:nn { enumext } { unknown-key-family } } ,
5206 }

```

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

```

5207 \seq_const_from_clist:Nn \c__enumext_all_families_seq
5208 {
5209     enumext-1, enumext-2, enumext-3, enumext-4, keyans, enumext*,
5210     keyans*, print-1, print-2, print-3, print-4, print-*, print*,
5211 }

```

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

```

\__enumext_set_parse:n
\__enumext_set_error:nn
5212 \NewDocumentCommand \setenumext { 0{enumext,1} +m }
5213 {
5214     \seq_clear:N \l__enumext_setkey_tmpa_seq
5215     \seq_set_from_clist:Nn \l__enumext_setkey_tmpb_seq {#1}
5216     \int_set:Nn \l__enumext_setkey_tmpa_int
5217     {
5218         \seq_count:N \l__enumext_setkey_tmpb_seq
5219     }
5220     \int_compare:nNnTF { \l__enumext_setkey_tmpa_int } > { 1 }
5221     {
5222         \seq_pop_left:NN \l__enumext_setkey_tmpb_seq \l__enumext_setkey_tmpa_tl
5223         \seq_map_function:NN \l__enumext_setkey_tmpb_seq \__enumext_set_parse:n
5224         \seq_set_map_e:NNn \l__enumext_setkey_tmpa_seq \l__enumext_setkey_tmpa_seq
5225         {
5226             \tl_use:N \l__enumext_setkey_tmpa_tl - ##1
5227         }
5228     }
5229     {
5230         \seq_put_right:Ne \l__enumext_setkey_tmpa_seq { \tl_trim_spaces:n {#1} }
5231     }
5232     \seq_if_empty:NNTF \l__enumext_setkey_tmpa_seq
5233     { \seq_map_inline:Nn \c__enumext_all_families_seq }
5234     { \seq_map_inline:Nn \l__enumext_setkey_tmpa_seq }
5235     {
5236         \keys_set:nn { enumext / meta-families } { ##1 = {#2} }
5237     }
5238 }

```

Internal functions used by the `\setenumext` command.

```

5239 \cs_new_protected:Npn \__enumext_set_parse:n #1
5240 {
5241     \tl_set:Ne \l__enumext_setkey_tmpb_tl { \tl_trim_spaces:n {#1} }
5242     \clist_map_inline:nn { 0, 1, 2, 3, 4, * } % <- max level
5243     { \tl_remove_all:Nn \l__enumext_setkey_tmpb_tl {##1} }
5244     \tl_if_empty:NNTF \l__enumext_setkey_tmpb_tl
5245     {
5246         \seq_put_right:Ne \l__enumext_setkey_tmpa_seq
5247         { \tl_trim_spaces:n {#1} }
5248     }
5249     { \__enumext_set_error:nn {#1} { } }
5250 }
5251 \cs_new_protected:Npn \__enumext_set_error:nn #1 #2
5252 { \msg_error:nnn { enumext } { invalid-key } {#1} {#2} }

```

(End of definition for `\setenumext`, `\__enumext_set_parse:n`, and `\__enumext_set_error:nn`. This function is documented on page 6.)

### 13.48 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
5253 \prop_const_from_keyval:Nn \c__enumext_meta_paths_prop
5254 {
5255     {enumext,1} = level-1,
5256     {enumext,2} = level-2,
5257     {enumext,3} = level-3,
5258     {enumext,4} = level-4,

```



```

5259     {enumext*} = enumext*
5260 }

```

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

```

5261 \NewDocumentCommand \setenumextmeta { s O{enumext,1} m +m }
5262 {
5263   \str_if_eq:eeTF { \tl_trim_spaces:n {#3} } { unknown }
5264   { \msg_error:nn { enumext } { prohibited-unknown } }
5265   {
5266     \bool_if:nTF {#1}
5267     {
5268       \int_step_inline:nn { 4 }
5269       { \__enumext_add_meta_key:nnn { enumext, ##1 } {#3} {#4} }
5270       \__enumext_add_meta_key:nnn { enumext* } {#3} {#4}
5271     }
5272     { \__enumext_add_meta_key:nnn {#2} {#3} {#4} }
5273   }
5274 }

```

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

```

5275 \cs_new_protected:Npn \__enumext_add_meta_key:nnn #1
5276 {
5277   \tl_set:Nn \l__enumext_meta_path_tl {#1}
5278   \tl_replace_all:Nnn \l__enumext_meta_path_tl { ~ } {}
5279   \prop_get:NVNTF
5280   \c__enumext_meta_paths_prop \l__enumext_meta_path_tl \l__enumext_meta_path_tl
5281   { \__enumext_def_meta_key:Vnn \l__enumext_meta_path_tl }
5282   {
5283     \msg_error:nnn { enumext } { unknown-set } {#1}
5284     \use_none:nn
5285   }
5286 }
5287 \cs_new_protected:Npn \__enumext_def_meta_key:nnn #1#2#3
5288 {
5289   \bool_lazy_or:nnTF
5290   { \keys_if_exist:p:nn { enumext / #1 } {#2} }
5291   { \keys_if_exist:p:nn { enumext / enumext* } {#2} }
5292   { \msg_error:nnn { enumext } { already-defined } {#2} }
5293   {
5294     \keys_define:nn { enumext / #1 }
5295     {
5296       #2 .meta:n = {#3},
5297       #2 .value_forbidden:n = true
5298     }
5299   }
5300 }
5301 \cs_generate_variant:Nn \__enumext_def_meta_key:nnn { V }

```

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

### 13.49 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.

```

5302 \keys_define:nn { enumext / foreach }
5303 {
5304   before .tl_set:N = \l__enumext_foreach_before_tl,
5305   before .value_required:n = true,
5306   after .tl_set:N = \l__enumext_foreach_after_tl,
5307   after .value_required:n = true,
5308   start .int_set:N = \l__enumext_foreach_start_int,
5309   start .value_required:n = true,
5310   stop .int_set:N = \l__enumext_foreach_stop_int,
5311   stop .value_required:n = true,
5312   step .int_set:N = \l__enumext_foreach_step_int,
5313   step .value_required:n = true,
5314   wrapper .cs_set_protected:Np = \__enumext_foreach_wrapper:n #1,
5315   wrapper .value_required:n = true,

```

```

5316     sep      .tl_set:N = \l__enumext_foreach_sep_tl,
5317     sep      .value_required:n = true,
5318     unknown .code:n = { \l__enumext_parse_foreach_keys:n {#1} }
5319   }
5320 \keys_precompile:nnN { enumext / foreach }
5321 {
5322   before={},after={},start=1,step=1,stop=0,wrapper=#1,sep={; }
5323 }
5324 \g__enumext_foreach_default_keys_tl

```

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

```

5325 \cs_new_protected:Npn \l__enumext_parse_foreach_keys:nn #1#2
5326 {
5327   \tl_if_blank:nTF {#2}
5328   {
5329     \msg_error:nnn { enumext } { for-key-unknown } {#1}
5330   }
5331   {
5332     \msg_error:nnnn { enumext } { for-key-value-unknown } {#1} {#2}
5333   }
5334 }
5335 \cs_new_protected:Npn \l__enumext_parse_foreach_keys:n #1
5336 {
5337   \exp_args:NV \l__enumext_parse_foreach_keys:nn \l_keys_key_str {#1}
5338 }

```

We create the command.

```

5339 \NewDocumentCommand \foreachkeyans { +0{ } m }
5340 {
5341   \l__enumext_foreach_keyans:nn {#1} {#2}
5342 }

```

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

```

5343 \cs_new_protected:Npn \l__enumext_foreach_keyans:nn #1 #2
5344 {
5345   \tl_use:N \g__enumext_foreach_default_keys_tl
5346   \keys_set:nn { enumext / foreach } {#1}
5347   \tl_set:Nn \l__enumext_foreach_name_prop_tl {#2}
5348   \prop_if_exist:cF { g__enumext_#2_prop }
5349   {
5350     \msg_error:nnn { enumext } { undefined-storage-anskey } {#2}
5351   }
5352   \int_compare:nNnT { \l__enumext_foreach_stop_int } = { 0 }
5353   {
5354     \int_set:Nn \l__enumext_foreach_stop_int
5355     { \prop_count:c { g__enumext_#2_prop } }
5356   }
5357   \seq_clear:N \l__enumext_foreach_print_seq
5358   \int_step_function:nnnN
5359   { \l__enumext_foreach_start_int }
5360   { \l__enumext_foreach_step_int }
5361   { \l__enumext_foreach_stop_int }
5362   \l__enumext_foreach_add_body:n
5363   \seq_use:NV \l__enumext_foreach_print_seq \l__enumext_foreach_sep_tl
5364 }
5365 \cs_new_protected:Npn \l__enumext_foreach_add_body:n #1
5366 {
5367   \seq_put_right:Ne \l__enumext_foreach_print_seq
5368   {
5369     \exp_not:V \l__enumext_foreach_before_tl
5370     \l__enumext_foreach_wrapper:n
5371     {
5372       \prop_item:cn { g__enumext_ \l__enumext_foreach_name_prop_tl _prop }{#1}
5373     }
5374     \exp_not:V \l__enumext_foreach_after_tl
5375   }
5376 }

```

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

### 13.50 Messages

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

```

5377 \msg_new:nnn { enumext } { package-load }
5378 {
5379   The ~ '#1' ~ package ~ is ~ already ~ loaded.
5380 }
5381 \msg_new:nnn { enumext } { package-not-load }
5382 {
5383   The ~ '#1' ~ package ~ will ~ be ~ loaded ~ as ~ a ~ dependency.
5384 }
5385 \msg_new:nnn { enumext } { package-load-foot }
5386 {
5387   The ~ '#1' ~ package ~ is ~ loaded ~ with ~ the ~ option ~ '#2'.
5388 }
```

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

```

5389 \msg_new:nnn { enumext } { counters }
5390 {
5391   The ~ counter ~ '#1' ~ is ~ already ~ defined ~ by ~ some ~ \\
5392   package ~ or ~ macro, ~ it ~ cannot ~ be ~ continued.
5393 }
```

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

```

5394 \msg_new:nnn { enumext } { unknown-choice }
5395 {
5396   The ~ value ~ '#3' ~ for ~ '#1' ~ key ~ is ~ invalid ~ use ~ ('#2').
5397 }
```

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

```

5398 \msg_new:nnnn { enumext } { anskey-env-error }
5399 {
5400   The ~ '#1' ~ environment ~is~ reserved ~ by ~\\
5401   'enumext' ~ package, ~ It~ is~ already~ defined.
5402 }
5403 {
5404   The ~ anskey* ~ environment ~ is ~ defined ~ internally ~
5405   for ~ the ~ 'save-ans' ~ key.\\
5406 }
```

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

```

5407 \msg_new:nnn { enumext } { store-prop }
5408 {
5409   * ~ Package ~ enumext: ~ Creating ~
5410   \c_backslash_str g__enumext_#1_prop ~ \msg_line_context:.
5411 }
5412 \msg_new:nnn { enumext } { store-seq }
5413 {
5414   * ~ Package ~ enumext: ~ Creating ~
5415   \c_backslash_str g__enumext_#1_seq ~ \msg_line_context:.
5416 }
5417 \msg_new:nnn { enumext } { store-int }
5418 {
5419   * ~ Package ~ enumext: ~ Creating ~
5420   \c_backslash_str g__enumext_resume_#1_int ~ \msg_line_context:.
5421 }
5422 \msg_new:nnn { enumext } { prop-seq-int-hook }
5423 {
5424   * ~ Package ~ enumext: ~ Elements ~ in ~
5425   \c_backslash_str g__enumext_#1_prop ~ = ~ #2.\\
5426   * ~ Package ~ enumext: ~ Elements ~ in ~
5427   \c_backslash_str g__enumext_#1_seq ~ = ~ #3.\\
5428   * ~ Package ~ enumext: ~ Value ~ off ~
5429   \c_backslash_str g__enumext_resume_#1_int ~ = ~ #4.
5430 }
5431 \msg_new:nnn { enumext } { item-answer-hook }
5432 {
5433   * ~ Package ~ enumext: ~ Value ~ off ~
5434   \c_backslash_str g__enumext_item_number_int ~ = ~ #1.\\
5435   * ~ Package ~ enumext: ~ Value ~ off ~
5436   \c_backslash_str g__enumext_item_anskey_int ~ = ~ #2.\\
5437   * ~ Package ~ enumext: ~ Difference ~ item_number_int ~ - ~ item_anskey_int ~ = ~ #3.
5438 }
```

Message used by `[⟨key = val⟩]` system and `\setenumext` command.

```

5439 \msg_new:nnn { enumext } { invalid-key }
5440 {
5441   The ~ key ~ '#1' ~ is ~ not ~ know ~ the ~ level ~ #2.
5442 }
5443 \msg_new:nnn { enumext } { unknown-key-family }
5444 {
5445   Unknown~key~family~`\l_keys_key_str'~for~enumext.
5446 }

```

Messages used in length calculation.

```

5447 \msg_new:nnn { enumext } { width-negative }
5448 {
5449   Ignoring ~ negative ~ value ~ '#1=#2' ~ \msg_line_context:.\
5450   The ~ key ~ '#1'~ accepts ~ values ~ >= ~ 0pt.
5451 }
5452 \msg_new:nnn { enumext } { width-zero }
5453 {
5454   Invalid ~ '#1=#2' ~ \msg_line_context:.\
5455   The ~ key ~ '#1'~ accepts ~ values ~ > ~ 0pt.
5456 }

```

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

```

5457 \msg_new:nnn { enumext } { list-lengths }
5458 {
5459   **** ~ Lengths ~ used ~ by ~ 'enumext' ~ level ~ '#2' ~ \msg_line_context:~\c_space_tl ****\
5460   \__enumext_show_length:nnn { dim } { labelsep } {#1}
5461   \__enumext_show_length:nnn { dim } { labelwidth } {#1}
5462   \__enumext_show_length:nnn { dim } { itemindent } {#1}
5463   \__enumext_show_length:nnn { dim } { leftmargin } {#1}
5464   \__enumext_show_length:nnn { dim } { rightmargin } {#1}
5465   \__enumext_show_length:nnn { dim } { listparindent } {#1}
5466   \__enumext_show_length:nnn { skip } { topsep } {#1}
5467   \__enumext_show_length:nnn { skip } { parsep } {#1}
5468   \__enumext_show_length:nnn { skip } { partopsep } {#1}
5469   \__enumext_show_length:nnn { skip } { itemsep } {#1}
5470   ****~
5471 }

```

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

```

5472 \msg_new:nnn { enumext } { list-lengths-not-nested }
5473 {
5474   **** ~ Lengths ~ used ~ by ~ '#2' ~ environment ~ \msg_line_context:~\c_space_tl ****\
5475   \__enumext_show_length:nnn { dim } { labelsep } {#1}
5476   \__enumext_show_length:nnn { dim } { labelwidth } {#1}
5477   \__enumext_show_length:nnn { dim } { itemindent } {#1}
5478   \__enumext_show_length:nnn { dim } { leftmargin } {#1}
5479   \__enumext_show_length:nnn { dim } { rightmargin } {#1}
5480   \__enumext_show_length:nnn { dim } { listparindent } {#1}
5481   \__enumext_show_length:nnn { skip } { topsep } {#1}
5482   \__enumext_show_length:nnn { skip } { parsep } {#1}
5483   \__enumext_show_length:nnn { skip } { partopsep } {#1}
5484   \__enumext_show_length:nnn { skip } { itemsep } {#1}
5485   ****~
5486 }

```

Messages used by `ref` key.

```

5487 \msg_new:nnn { enumext } { key-ref-empty }
5488 {
5489   Key ~ 'ref' ~ need ~ a ~ value ~ in ~ '#1'~ \msg_line_context:.
5490 }

```

Messages used by `save-ans` key.

```

5491 \msg_new:nnn { enumext } { save-ans-empty }
5492 {
5493   Key ~ 'save-ans' ~ need ~ a ~ value ~ in ~ '#1'~ \msg_line_context:.
5494 }
5495 \msg_new:nnn { enumext } { save-ans-log }
5496 {
5497   * ~ Package ~ enumext: ~ Start ~ #1\c_space_tl with ~ save-ans=#2 ~ \msg_line_context:.
5498 }
5499 \msg_new:nnn { enumext } { save-ans-log-hook }
5500 {

```

```

5501     * ~ Package ~ enumext: ~ Stop ~ #1\c_space_tl with ~ save-ans=#2 ~ \msg_line_context:.
5502   }
5503   \msg_new:nnn { enumext } { save-ans-hook }
5504   {
5505     Stop ~ storing ~ for ~ 'save-ans=#1' ~ \msg_line_context:.
5506   }

```

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

```

5507   \msg_new:nnn { enumext } { need-save-ans }
5508   {
5509     Key ~ '#1'~ works ~ only ~ with ~ the ~ 'save-ans' ~ key ~ in ~ '#2'~ \msg_line_context:.
5510   }
5511   \msg_new:nnn { enumext } { items-same-answer }
5512   {
5513     *****\
5514     * ~ Package ~ enumext: ~ Checking ~ answers ~ in ~ '#1' ~
5515     for ~ \c_left_brace_str #2 \c_right_brace_str\
5516     * ~ started ~ #3 ~ and ~ close ~ \msg_line_context: : ~
5517     'OK', ~ all ~ items ~ with ~ answer.\
5518     *****
5519   }
5520   \msg_new:nnn { enumext } { item-greater-answer }
5521   {
5522     Checking ~ answers ~ in ~ '#1' ~ for ~ \c_left_brace_str #2 \c_right_brace_str\
5523     started ~ #3 ~ and ~ close ~ \msg_line_context: : ~'NOT ~ OK'\
5524     Items ~ > ~ Answers.
5525   }
5526   \msg_new:nnn { enumext } { item-less-answer }
5527   {
5528     Checking ~ answers ~ in ~ '#1' ~ for ~ \c_left_brace_str #2 \c_right_brace_str\
5529     started ~ #3 ~ and ~ close ~ \msg_line_context: : ~'NOT ~ OK'\
5530     Items ~ < ~ Answers.
5531   }

```

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

```

5532   \msg_new:nnn { enumext } { missing-starred }
5533   {
5534     Missing ~ '\c_backslash_str #1*' ~ #2.
5535   }
5536   \msg_new:nnn { enumext } { many-starred }
5537   {
5538     Many ~ '\c_backslash_str #1*' ~ #2.
5539   }

```

Messages used by `\printkeyans*` command.

```

5540   \msg_new:nnn { enumext } { print-starred }
5541   {
5542     \c_backslash_str printkeyans*:~ The ~ sequence ~ '#1' ~ already ~ contains ~
5543     #2 ~ environment ~ \msg_line_context:.
5544   }

```

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

```

5545   \msg_new:nnn { enumext } { list-too-deep }
5546   {
5547     Too ~ deep ~ nesting ~ for ~ 'enumext' ~ \msg_line_context:~ \
5548     The ~ maximum ~ level ~ of ~ nesting ~ is ~ 4.
5549   }

```

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

```

5550   \msg_new:nnn { enumext } { anskey-unnumber-item }
5551   {
5552     Can't ~ store ~ with ~ a ~ unnumbered ~ \c_backslash_str item ~ \msg_line_context:.
5553   }
5554   \msg_new:nnn { enumext } { anskey-already-stored }
5555   {
5556     Content ~ already ~ stored ~ for ~ this ~ \c_backslash_str item ~ \msg_line_context:.
5557   }
5558   \msg_new:nnn { enumext } { anskey-empty-arg }
5559   {
5560     Can't ~ store ~ empty ~ content ~ \msg_line_context:.
5561   }
5562   \msg_new:nnn { enumext } { anskey-wrong-place }
5563   {

```

```

5564     Wrong ~ place ~ for ~ command ~ '\c_backslash_str #1' ~ \msg_line_context:~ \\
5565     '\c_backslash_str #1' ~ works ~ in ~ the ~ environment ~ '#2'.
5566 }
5567 \msg_new:nnn { enumext } { anskey-nested }
5568 {
5569     The ~ command ~ \c_backslash_str anskey~ can't ~ be ~ nested ~ \msg_line_context:.
5570 }
5571 \msg_new:nnn { enumext } { anskey-math-mode }
5572 {
5573     #1 ~ can't ~ work ~ in ~ math ~ mode ~ \msg_line_context:.
5574 }
5575 \msg_new:nnn { enumext } { anskey-env-wrong }
5576 {
5577     The ~ environment ~ anskey* ~ cannot ~ use ~ in ~ '#1' ~ \msg_line_context:.
5578 }
5579 \msg_new:nnn { enumext } { ans-pic-wrong-place }
5580 {
5581     Wrong ~ place ~ for ~ command ~ '\c_backslash_str #1' ~ \msg_line_context:~ \\
5582     '\c_backslash_str #1' ~ works ~ in ~ the ~ environment ~ '#2'.
5583 }
5584 \msg_new:nnn { enumext } { command-wrong-place }
5585 {
5586     Wrong ~ place ~ for ~ command ~ '\c_backslash_str #1' ~ \msg_line_context:~ \\
5587     '\c_backslash_str #1' ~ works ~ outside ~ the ~ environment ~ '#2'.
5588 }
5589 \msg_new:nnnn { enumext } { anskey-env-key-unknown }
5590 {
5591     The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment~
5592     'anskey*' ~ and ~ is ~ being ~ ignored.
5593 }
5594 {
5595     The ~ environment ~ 'anskey*' ~ does ~ not ~ have ~ a ~ key ~ called ~'#1'.\\
5596     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5597 }
5598 \msg_new:nnnn { enumext } { anskey-env-key-value-unknown }
5599 {
5600     The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~
5601     'anskey*' ~ and ~ is ~ being ~ ignored.
5602 }
5603 {
5604     The ~ environment ~ 'anskey*' ~ does ~ not ~ have ~ a ~ key ~ called ~'#1'.\\
5605     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5606 }
5607 \msg_new:nnnn { enumext } { anskey-cmd-key-unknown }
5608 { The ~ key ~ '#1' ~ is ~ unknown ~ by ~ '\c_backslash_str anskey' ~ and ~ is ~ being ~ ignored.}
5609 {
5610     The ~ command ~ '\c_backslash_str anskey' ~ does ~ not ~ have ~ a ~ key ~ called ~'#1'.\\
5611     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5612 }
5613 \msg_new:nnnn { enumext } { anskey-cmd-key-value-unknown }
5614 { The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ '\c_backslash_str anskey' ~ and ~ is ~ being ~ ignored.}
5615 {
5616     The ~ command ~ '\c_backslash_str anskey' ~ does ~ not ~ have ~ a ~ key ~ called ~'#1'.\\
5617     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5618 }

```

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

```

5619 \msg_new:nnn { enumext } { keyans-nested }
5620 {
5621     The ~ environment ~ 'keyans' ~ can't ~ be ~ nested ~ \msg_line_context:.
5622 }
5623 \msg_new:nnn { enumext } { keyans-wrong-level }
5624 {
5625     Wrong ~ level ~ position ~ for ~ 'keyans' ~ \msg_line_context:~ \\
5626     The ~ environment ~ 'keyans' ~ can ~ only ~ be ~ in ~ the ~ first ~ level.
5627 }
5628 \msg_new:nnn { enumext } { wrong-place }
5629 {
5630     Wrong ~ place ~ for ~ '#1' ~ environment ~ \msg_line_context:~ \\
5631     '#1' ~ is ~ only ~ found ~ with ~ '#2' ~ in ~ 'enumext.
5632 }
5633 \msg_new:nnn { enumext } { keyanspic-nested }

```

```

5634 {
5635     The ~ environment ~ 'keyanspic' ~ can't ~ be ~ nested~ \msg_line_context:~.
5636 }
5637 \msg_new:nnn { enumext } { keyanspic-wrong-level }
5638 {
5639     Wrong ~ level ~ position ~ for ~ 'keyanspic' ~ \msg_line_context:~ \\
5640     The ~ environment ~ 'keyans' ~ can ~ only ~ be ~ in ~ the ~ first ~ level.
5641 }
5642 \msg_new:nnn { enumext } { keyanspic-item-cmd }
5643 {
5644     Can't ~ use ~ \c_backslash_str item ~ in ~ keyanspic ~ \msg_line_context:.
5645 }
5646 \msg_new:nnnn { enumext } { keyans-unknown-key }
5647 {
5648     The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment~
5649     '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
5650 }
5651 {
5652     The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5653     ~ have ~ a ~ key ~ called ~'#1'.\\
5654     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5655 }
5656 \msg_new:nnnn { enumext } { keyans-unknown-key-value }
5657 {
5658     The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~
5659     '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
5660 }
5661 {
5662     The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5663     ~ have ~ a ~ key ~ called ~'#1'.\\
5664     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5665 }

```

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

```

5666 \msg_new:nnnn { enumext } { starred-unknown-key }
5667 {
5668     The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment~
5669     '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
5670 }
5671 {
5672     The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5673     ~ have ~ a ~ key ~ called ~'#1'.\\
5674     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5675 }
5676 \msg_new:nnnn { enumext } { starred-unknown-key-value }
5677 {
5678     The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~
5679     '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
5680 }
5681 {
5682     The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5683     ~ have ~ a ~ key ~ called ~'#1'.\\
5684     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5685 }

```

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

```

5686 \msg_new:nnnn { enumext } { standar-unknown-key }
5687 {
5688     The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment ~ '\l__enumext_envir_name_tl' \c_space_tl
5689     ~ on ~ level ~ \int_use:N \l__enumext_level_int \c_space_tl and ~ is ~ being ~ ignored.
5690 }
5691 {
5692     The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5693     ~ have ~ a ~ key ~ called ~'#1' ~ on ~ level ~ \int_use:N \l__enumext_level_int.\\
5694     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5695 }
5696 \msg_new:nnnn { enumext } { standar-unknown-key-value }
5697 {
5698     The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~ '\l__enumext_envir_name_tl' \c_space_
5699     ~ on ~ level ~ \int_use:N \l__enumext_level_int \c_space_tl and ~ is ~ being ~ ignored.
5700 }
5701 {

```



```

5702     The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
5703     ~ have ~ a ~ key ~ called ~ '#1' ~ on ~ level ~ \int_use:N \l__enumext_level_int.\\
5704     Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
5705   }

```

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

```

5706 \msg_new:nnnn { enumext } { for-key-unknown }
5707 { The~key~'#1'~is~unknown~by~'\c_backslash_str foreachkeyans'~and~is~being~ignored.}
5708 {
5709   The~command~'\c_backslash_str foreachkeyans'~does~not~have~a~key~called~'#1'.\\
5710   Check~that~you~have~spelled~the~key~name~correctly.
5711 }
5712 \msg_new:nnnn { enumext } { for-key-value-unknown }
5713 { The~key~'#1=#2'~is~unknown~by~'\c_backslash_str foreachkeyans'~and~is~being~ignored. }
5714 {
5715   The~command~'\c_backslash_str foreachkeyans'~does~not~have~a~key~called~'#1'.\\
5716   Check~that~you~have~spelled~the~key~name~correctly.
5717 }

```

Messages used by `\getkeyans` command.

```

5718 \msg_new:nnn { enumext } { undefined-storage-anskey }
5719 {
5720   Storage ~ named ~ '#1' ~ is ~ not ~ defined ~ \msg_line_context:.
5721 }

```

Messages used by `\miniright` command.

```

5722 \msg_new:nnn { enumext } { missing-miniright }
5723 {
5724   Missing ~ '\c_backslash_str miniright' ~ in ~ \msg_line_context:.\\
5725   The ~ key ~ 'mini-env' ~ need ~ '\c_backslash_str miniright'.
5726 }
5727 \msg_new:nnn { enumext } { wrong-miniright-place }
5728 {
5729   Wrong ~ place ~ for ~ '\c_backslash_str miniright' ~ \msg_line_context:.~ \\
5730   Works ~ in ~ 'enumext' ~ and ~ 'keyans' ~ with ~ key ~ 'mini-env'.
5731 }
5732 \msg_new:nnn { enumext } { wrong-miniright-use }
5733 {
5734   Wrong ~ use ~ for ~ '\c_backslash_str miniright' ~ \msg_line_context:.~ \\
5735   '\c_backslash_str miniright' ~ need ~ a ~ key ~ 'mini-env'.
5736 }
5737 \msg_new:nnn { enumext } { wrong-miniright-starred }
5738 {
5739   Can't ~ use ~ \c_backslash_str miniright ~ in ~ starred ~ environments ~ \msg_line_context:.
5740 }
5741 \msg_new:nnn { enumext } { many-miniright-used }
5742 {
5743   Can't ~ use ~ \c_backslash_str miniright ~ more ~ than ~ once ~ \msg_line_context:.
5744 }

```

Messages used by `\setenumextmeta` command.

```

5745 \msg_new:nnn { enumext } { unknown-set }
5746 {
5747   Argument ~ [#1] ~ is ~ unknown ~ by ~ \c_backslash_str setenumextmeta ~ \msg_line_context:.
5748 }
5749 \msg_new:nnn { enumext } { already-defined }
5750 {
5751   The ~ key ~ '#1' ~ is ~ already ~ defined ~ \msg_line_context:.
5752 }
5753 \msg_new:nnn { enumext } { prohibited-unknown }
5754 {
5755   The ~ name ~ 'unknown' ~ can't ~ be ~ chosen~ for ~ a ~ meta ~ key ~ \msg_line_context:.
5756 }

```

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

```

5757 \msg_new:nnn { enumext } { nested }
5758 {
5759   The ~ environment ~ \l__enumext_envir_name_tl \c_space_tl can't ~ be ~ nested ~ \msg_line_con
5760 }
5761 \msg_new:nnn { enumext } { nested-horizontal }
5762 {
5763   The ~ environment ~ \l__enumext_envir_name_tl \c_space_tl can't ~ be ~ nested ~ in ~ '#1' ~ '
5764 }

```

```
5765 \msg_new:nnn { enumext } { item-joined }
5766 {
5767   Items ~ joined ~ (#1) ~ > ~ #2 ~ columns ~\msg_line_context:.
5768 }
5769 \msg_new:nnn { enumext } { item-joined-columns }
5770 {
5771   Not ~ space ~ to ~ join ~ items ~ (#1) ~ > ~ #2 ~\msg_line_context:.
5772 }
```

### 13.51 Finish package

Finish package implementation.

```
5773 \file_input_stop:
5774 \</package>
```

# 14 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	
\*	228
\+	220
\-	220
\\	236, 2779, 4146, 4149, 5391, 5400, 5405, 5425, 5427, 5434, 5436, 5449, 5454, 5459, 5474, 5513, 5515, 5517, 5522, 5523, 5528, 5529, 5547, 5564, 5581, 5586, 5595, 5604, 5610, 5616, 5625, 5630, 5639, 5653, 5663, 5673, 5683, 5693, 5703, 5709, 5715, 5724, 5729, 5734
A	
above	1593
above*	1593
\addvspace	1163, 1191, 1234, 1237, 1405, 1408, 1505, 1511, 1546, 1552, 1573, 1579, 3604, 3765, 3783, 4037, 4041, 4394, 4409, 4455, 4469
after	993
align	546
\Alph	38, 43, 44
\Alph	488, 616, 660, 726, 5099
\alph	38, 43, 44
\alph	489, 614, 5091
\anskey	13, 77, 79, 2597
anskey*	13, 2707
\anspic	16, 106, 108, 4051
\anspic*	71
\arabic	32, 38
\arabic	487, 613, 659, 5083, 5087, 5103
B	
base-fix	855
\baselineskip	52
\baselineskip	871, 878
before	993
before*	993
below	1593
below*	1593
bool commands:	
\bool_gset_false:N	357, 358, 359, 2883, 2885, 4411, 4415, 4471
\bool_gset_true:N	265, 275, 1096, 2086, 2092, 4380, 4412, 4444, 4472
\bool_if:NTF	427, 439, 456, 1527, 1615, 1629, 1642, 1653, 1664, 1675, 1686, 1697, 1746, 1763, 1768, 1776, 1803, 1841, 1846, 1853, 1857, 1879, 1884, 1892, 1899, 1930, 1938, 2031, 2229, 2239, 2318, 2342, 2349, 2373, 2471, 2493, 2533, 2547, 2551, 2601, 2620, 2644, 2698, 2709, 2798, 2835, 2899, 2934, 2949, 3024, 3035, 3039, 3058, 3071, 3113, 3147, 3183, 3198, 3217, 3353, 3368, 3383, 3445, 3455, 3488, 3493, 3559, 3585, 3635, 3693, 3748, 3773, 3973, 4035, 4053, 4072, 4117, 4144, 4373, 4389, 4395, 4438, 4452, 4456, 4578, 4588, 4676, 4682, 4689, 4705, 4724, 4750, 4811, 4821, 4932, 4936, 4962, 4969, 4988, 5003, 5018
\bool_if:nTF	1553, 1580, 3169, 3334, 3403, 4093, 5122, 5266
\bool_if_p:N	284, 299, 865, 866, 874, 875, 1910, 1911, 1919, 1920, 2044, 2070, 2083, 2084, 2089, 2090, 2406, 2416, 2428, 2443, 2444, 2478, 2519, 2520, 2821, 3011, 3012, 3049, 3050, 3532, 3534, 3545, 4100, 4101
\bool_lazy_all:nTF	282, 297, 863, 2042, 2068, 2404, 2413, 2426, 2441, 3530, 3543
\bool_lazy_and:nnTF	261, 271, 873, 1520, 1909, 1918, 2082, 2088, 2477, 2484, 2518, 2662, 2674, 2820, 2826, 3010
\bool_lazy_or:nnTF	1971, 1978, 3048, 4099, 5289
\bool_new:N	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
\bool_not_p:n	262, 272, 867, 2415, 2479, 2485, 2822, 2827, 3533, 3546
\bool_set_eq:NN	3122, 3313, 4629, 4885
\bool_set_false:N	436, 885, 2016, 2017, 2049, 2054, 2058, 2062, 2075, 2762, 3507, 3652, 3701, 3788, 3926, 3970, 4547, 4573, 4626, 4827, 4882, 5135, 5136
\bool_set_true:N	289, 290, 304, 305, 416, 420, 539, 900, 1599, 1604, 1866, 1988, 1989, 2261, 2269, 2763, 3116, 3118, 3150, 3152, 3309, 3321, 3468, 3506, 3539, 3552, 3625, 3698, 3725, 3923, 4362, 4427, 4546, 4633, 4640, 4641, 4685, 4825, 4889, 4896, 4897, 5130, 5131
box commands:	
\box_dp:N	1451, 1452, 1455, 1462, 1475, 1483, 1489, 1497, 3984, 3989, 4037, 4128
\box_ht:N	1234, 1237, 1248, 1249, 1260, 1262, 1277, 1280, 1288, 1289, 1300, 1302, 1317, 1320, 1327, 1328, 1339, 1341, 1356, 1359, 1405, 1408, 1416, 1417, 1425, 1426, 1438, 1440
\box_ht_plus_dp:N	3979, 4045, 4081
\box_new:N	70, 149, 150, 183, 189
\box_use_drop:N	4406, 4467, 4747, 5015
\box_wd:N	495
C	
\c	228, 229, 762, 764, 776, 778
\catcode	2779
\cB	229
\cE	229
\centering	1555, 1582, 4172, 4399, 4460
check-ans	2008
Document class:	
article	45
clist commands:	
\clist_const:Nn	195
\clist_map_function:nN	4155
\clist_map_inline:Nn	545, 810, 992, 1007, 1088, 1609
\clist_map_inline:nn	49, 60, 78, 86, 99, 111, 141, 170, 194, 523, 576, 596, 905, 926, 1102, 1715, 1955, 2022, 2208, 2226, 2258, 2401, 2943, 3238, 3250, 3290, 3432, 3435, 3463, 3475, 3478, 3498, 5242
\columnbreak	77
\columnbreak	2481
columns	1072
columns-sep	1072
\columnsep	99
\columnsep	3580, 3746
\columnseprule	99
\columnseprule	3583, 3747

Commands provide by **enumext**:

\anskey 30, 67, 68, 73, 74, 76, 78, 79, 86, 88, 98, 99, 118,  
127, 129, 136  
\anspic\* . . . . . 30, 31, 71, 74, 86, 87, 108, 127, 129  
\anspic . . . . . 30, 74, 106, 108, 136  
\foreachkeyans . . . . . 132, 139  
\getkeyans . . . . . 74, 127, 139  
\item\* 30, 31, 71, 74, 86, 87, 89, 90, 93, 119, 120, 125, 127,  
129  
\item . . . . . 89, 93, 112, 119, 121, 124, 125  
\miniright . . . . . 29, 50, 58, 59, 100, 139  
\printkeyans\* . . . . . 128  
\printkeyans . . . . . 30, 74, 128, 129  
\setenumextmeta . . . . . 131, 139  
\setenumext . . . . . 30, 129–131, 135

Counters defined by **enumext**:

enumXiii . . . . . 28, 38  
enumXii . . . . . 28, 38  
enumXiv . . . . . 28, 38  
enumXi . . . . . 28, 38  
enumXviii . . . . . 28, 38  
enumXvii . . . . . 28, 38, 120  
enumXvi . . . . . 28, 38  
enumXv . . . . . 28, 38

cs commands:

\cs\_generate\_variant:Nn . 200, 201, 497, 513, 768,  
784, 2310, 2315, 2391, 2715, 3422, 4157, 5301  
\cs\_if\_exist:NTF . . . . . 467  
\cs\_if\_free:NTF . . . . . 2666, 2678  
\cs\_new:Nn . . . . . 214  
\cs\_new:Npn . 232, 1716, 1725, 1733, 2273, 2282, 2290,  
5150, 5159, 5168  
\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, 636, 697, 748, 861,  
1008, 1012, 1016, 1020, 1024, 1028, 1032, 1036, 1040,  
1044, 1048, 1052, 1056, 1060, 1064, 1068, 1103, 1115,  
1148, 1165, 1176, 1193, 1219, 1240, 1365, 1391, 1411,  
1444, 1466, 1501, 1507, 1610, 1624, 1638, 1649, 1660,  
1671, 1682, 1693, 1774, 1877, 1890, 1907, 1928, 1956,  
1961, 1986, 2027, 2037, 2080, 2095, 2102, 2111, 2116,  
2121, 2126, 2135, 2140, 2145, 2316, 2340, 2347, 2371,  
2378, 2392, 2618, 2637, 2653, 2716, 2752, 2783, 2818,  
2860, 2881, 2889, 2932, 2947, 2975, 3008, 3044, 3056,  
3069, 3155, 3165, 3176, 3192, 3208, 3330, 3346, 3362,  
3376, 3499, 3528, 3557, 3564, 3594, 3611, 3633, 3655,  
3691, 3715, 3732, 3757, 3771, 3792, 3945, 4139, 4153,  
4158, 4182, 4192, 4223, 4352, 4371, 4417, 4436, 4476,  
4480, 4499, 4533, 4560, 4567, 4576, 4586, 4611, 4765,  
4809, 4840, 4846, 4867, 4924, 5033  
\cs\_new\_protected:Npn 202, 206, 210, 449, 465, 482,  
492, 498, 617, 661, 731, 755, 769, 1537, 1566, 1742,  
1761, 1831, 1864, 1966, 2150, 2227, 2237, 2259, 2267,  
2302, 2311, 2467, 2530, 2545, 2583, 2587, 2707, 2738,  
2742, 2773, 2909, 2985, 3029, 3109, 3128, 3251, 3255,  
3269, 3273, 3291, 3295, 3305, 3317, 3391, 3425, 3466,  
3510, 3711, 3954, 3961, 3968, 4070, 4089, 4113, 4254,  
4303, 4550, 4617, 4624, 4638, 4646, 4651, 4661, 4833,  
4873, 4880, 4894, 4902, 4919, 5055, 5068, 5116, 5239,  
5251, 5275, 5287, 5325, 5335, 5343, 5365  
\cs\_new\_protected\_nopar:Nn . . . 3853, 3895, 3903,  
3911, 4596, 4604, 4741, 4852, 4860, 5009  
\cs\_new\_protected\_nopar:Npn . . 3845, 3861, 4667,  
4713, 4952, 4977  
\cs\_set:Npn . . . . . 2402, 2439, 5061

\cs\_set\_eq:NN . . 4523, 4524, 4715, 4798, 4799, 4979  
\cs\_set\_protected:Nn . . . . . 931, 947, 960, 972  
\cs\_set\_protected:Npn 45, 54, 71, 79, 94, 100, 134,  
166, 174, 514, 524, 546, 581, 597, 643, 785, 811, 887,  
910, 984, 993, 1072, 1089, 1593, 1704, 1947, 2008,  
2167, 2209, 2245, 2394, 2936, 3227, 3243, 3283, 3423,  
3464  
\cs\_to\_str:N . . . . . 484, 507  
\cs\_undefine:N . . . . . 2655, 2656, 2657, 2658

## D

\d . . . . . 220  
\DeclareDocumentEnvironment . . . . . 397  
dim commands:

\dim\_abs:n . . . . . 3396, 3401  
\dim\_add:Nn . . . . . 3988, 4217, 4248  
\dim\_compare:nNnTF . 933, 949, 962, 974, 1252, 1264,  
1292, 1304, 1331, 1343, 1420, 1428, 1539, 1568, 3393,  
3398, 3404, 3410, 3412, 3414, 3569, 3616, 3719, 3736,  
3963, 4194, 4210, 4225, 4241, 4354, 4419  
\dim\_compare:nTF . . . . . 2503, 2848, 3658, 3795  
\dim\_eval:n . . . . . 871, 4043, 4124  
\dim\_gset\_eq:NN . . . . . 4363, 4428  
\dim\_gzero:N . . . . . 2887, 4414, 4474  
\dim\_new:N . 67, 74, 75, 76, 96, 143, 151, 152, 182, 184,  
185, 191  
\dim\_set:Nn . . 495, 901, 3145, 3396, 3401, 3403, 3406,  
3407, 3411, 3413, 3416, 3417, 3419, 3572, 3619, 3657,  
3721, 3738, 3794, 3977, 4079, 4160, 4196, 4203, 4227,  
4234, 4289, 4338, 4356, 4421, 4663  
\dim\_set\_eq:NN 604, 650, 719, 723, 3060, 3061, 3073,  
3074, 3140, 3434, 3477, 3580, 3746, 4296, 4299, 4300,  
4345, 4348, 4349, 4656, 4733, 4997  
\dim\_sub:Nn . . . . . 3663, 3800, 4212, 4243  
\dim\_use:N 934, 942, 1540, 1550, 2381, 2384, 2389, 3160,  
3162, 3213, 3570, 3574, 3575, 3577, 3617, 3622, 3623,  
3629, 3660, 3665  
\dim\_zero:N . . . . . 3469, 3583, 3747, 3990  
\dim\_zero\_new:N . . . . . 464  
\c\_zero\_dim 936, 950, 963, 975, 1540, 1568, 2505, 2850,  
3393, 3398, 3404, 3411, 3570, 3617, 3660, 3719, 3736,  
3797, 3963, 4194, 4210, 4225, 4241, 4354, 4419  
\dimeval . . . . . 2174

## E

\end . . . 2344, 2375, 3601, 3762, 4027, 4174, 5124, 5134, 5142  
end internal commands:

\end\_\_enumext\_mini\_page . 1548, 1575, 3644, 3782,  
4378, 4442, 4468  
\endgroup . . . . . 2779  
\endlist . . . . . 385  
\endminipage . . . . . 391  
enumext . . . . . 5, 3669

enumext internal commands:

\l\_\_enumext\_\_ref\_the\_count\_tl . . . . . 41  
\l\_\_enumext\_\_resume\_name\_tl . . . . . 63  
\\_\_enumext\_add\_meta\_key:nnn . . . 132, 5253, 5269,  
5270, 5272, 5275  
\\_\_enumext\_add\_pre\_parsep: . 51, 1113, 1115, 1115  
\\_\_enumext\_after\_args\_exec: 48, 1008, 1020, 3682  
\\_\_enumext\_after\_args\_exec\_v: 1024, 1036, 3815  
\\_\_enumext\_after\_args\_exec\_vii: . . 1040, 1064  
\\_\_enumext\_after\_args\_exec\_viii: . . . . . 1068  
\\_\_enumext\_after\_env:nn 83–85, 101, 114, 122, 206,  
206, 2793, 3687, 4387, 4450, 4781  
\\_\_enumext\_after\_hyperref: . . . 36, 409, 411, 411

```

\l__enumext_after_list_args_v_tl . . . . . 1038
\l__enumext_after_list_args_vii_tl 1066, 4739
\l__enumext_after_list_args_viii_tl . . 1070,
    5007
\__enumext_after_list_vii: 114, 118, 4531, 4567,
    4567
\__enumext_after_list_viii: . . 124, 4807, 4846,
    4846
\__enumext_after_stop_list: 48, 101, 1008, 1016,
    3649
\__enumext_after_stop_list_v: 1024, 1032, 3789
\l__enumext_after_stop_list_v_tl . . . . . 1034
\__enumext_after_stop_list_vii: . . 118, 1040,
    1056, 4570
\l__enumext_after_stop_list_vii_tl . . 1058
\__enumext_after_stop_list_viii: . 1060, 4849
\l__enumext_after_stop_list_viii_tl . . 1062
\l__enumext_align_label_pos_v_str . . . . 3380
\l__enumext_align_label_pos_X_str . . . . . 79
\l__enumext_align_label_vii_str . . . . . 4702
\l__enumext_align_label_viii_str . . . . . 4966
\l__enumext_align_label_X_str . . . . . 174
\c__enumext_all_envs_clist . . 195, 545, 810, 992,
    1007, 1088, 1609
\c__enumext_all_families_seq . . 131, 5207, 5233
\l__enumext_anskey_env_bool 33, 82, 34, 290, 305,
    2709
\__enumext_anskey_env_clean_vars: . 85, 2814,
    2818, 2881
\__enumext_anskey_env_define_keys: 82, 2707,
    2716, 2787
\__enumext_anskey_env_exec: 83, 2712, 2783, 2783
\__enumext_anskey_env_make:n 67, 82, 1991, 2707,
    2707, 2715
\__enumext_anskey_env_reset_keys: 83, 84, 2752,
    2815
\__enumext_anskey_env_reset_keys:\__-
    enumext_rescan_anskey_env:n . . . . . 2707
\__enumext_anskey_env_save_keys: . . 84, 2795,
    2818, 2818
\__enumext_anskey_env_store: . . 84, 2811, 2818,
    2860
\__enumext_anskey_env_unknown:n 82, 2735, 2738
\__enumext_anskey_env_unknown:nn . 2740, 2742
\l__enumext_anskey_level_int . . 28, 2639, 2640
\__enumext_anskey_safe_inner: . 80, 2612, 2618,
    2637
\__enumext_anskey_safe_inner:n . . . . . 80
\__enumext_anskey_safe_outer: . 79, 2599, 2618,
    2618
\__enumext_anskey_show_wrap_arg:n . 78, 2530,
    2530, 2549, 2564
\__enumext_anskey_show_wrap_left:n 78, 2475,
    2545, 2545
\__enumext_anskey_unknown:n 79, 2567, 2581, 2583
\__enumext_anskey_unknown:nn . 2567, 2585, 2587
\__enumext_anskey_wrapper:n . . . . . 2171, 2543
\l__enumext_anspic_above_int . 142, 4161, 4162,
    4164
\__enumext_anspic_args:nnn 109, 110, 4051, 4067,
    4139
\l__enumext_anspic_args_seq 108–110, 142, 4065,
    4173, 4186
\l__enumext_anspic_below_int . 142, 4161, 4162,
    4165
\l__enumext_anspic_body_box . . . 142, 4078, 4081
\__enumext_anspic_body_dim:n . . 109, 4051, 4070,
    4116
\l__enumext_anspic_body_htdp_dim . . 109, 142,
    4079, 4127
__enumext_anspic_exec: . . . . . 4051
\__enumext_anspic_exec: . . . . . 111, 4022, 4182
\__enumext_anspic_label:nn 109, 4051, 4089, 4119,
    4134
\l__enumext_anspic_label_above_bool . . 142,
    3923, 3926, 3973, 4035, 4072, 4117, 4144
\l__enumext_anspic_label_box . . 142, 3976, 3979
\l__enumext_anspic_label_htdp_dim . 107, 142,
    3977, 3983, 4045, 4126
\__enumext_anspic_label_pos:nnn . . 110, 4051,
    4113, 4142
\l__enumext_anspic_label_sep_skip 3933, 3985,
    4046, 4129, 4146
\l__enumext_anspic_layout_style_tl 3935, 4184,
    4189
\l__enumext_anspic_mini_pos_str . . 142, 3924,
    3927, 4171
\l__enumext_anspic_mini_width_dim 142, 4091,
    4160, 4171
\__enumext_anspic_print:n 110, 4051, 4153, 4157,
    4186, 4189
\__enumext_anspic_row:n . . 110, 4051, 4155, 4158
\__enumext_anspic_start_list_tag: 3869, 3895,
    4141
\__enumext_anspic_stop_list_tag: . 3869, 3911,
    4151
\__enumext_anspic_stop_start_list_tag: 3869,
    3903, 4143
\__enumext_at_begin_document:n . . 35, 202, 202,
    382, 388
\l__enumext_base_line_fix_bool 45, 46, 129, 857,
    866, 885, 5130, 5135
\__enumext_before_args_exec: 48, 100, 118, 1008,
    1008, 3614
\__enumext_before_args_exec_v: 1024, 1024, 3718
\__enumext_before_args_exec_vii: . 1040, 1040,
    4564
\__enumext_before_args_exec_viii: 1044, 4843
\__enumext_before_env:nn 82, 206, 210, 2660, 2672,
    2684, 2785
\__enumext_before_keys_exec: . . 48, 1008, 1012,
    3679
\__enumext_before_keys_exec_v: 1024, 1028, 3812
\__enumext_before_keys_exec_vii . . . . . 1040
\__enumext_before_keys_exec_vii: . 1048, 4518
\__enumext_before_keys_exec_viii: 1052, 4793
\__enumext_before_list: . . 100, 3611, 3611, 3673
\__enumext_before_list_v: . . 3715, 3715, 3807
\__enumext_before_list_vii: . . 118, 4513, 4560,
    4560
\__enumext_before_list_viii: . . 123, 4789, 4840,
    4840
\l__enumext_before_no_starred_key_v_tl 1030
\l__enumext_before_no_starred_key_vii_-
    tl . . . . . 1050
\l__enumext_before_no_starred_key_viii_-
    tl . . . . . 1054
\l__enumext_before_starred_key_v_tl . . 1026
\l__enumext_before_starred_key_vii_tl . 1042
\l__enumext_before_starred_key_viii_tl 1046

```

```

\__enumext_calc_hspace:NNNNNNN 95, 3391, 3391,
3422, 3427, 3470
\__enumext_check_ans_active: 68, 100, 118, 2027,
2027, 3615, 4563
\g__enumext_check_ans_item_tl . . . . . 87
\g__enumext_check_ans_key_bool 69, 70, 153, 357,
2086, 2092, 2899
\l__enumext_check_ans_key_bool 69, 2012, 2017,
2083, 2089
\__enumext_check_ans_key_hook: . . 69, 101, 118,
2080, 2080, 3650, 4571
\__enumext_check_ans_level: . 68, 69, 2027, 2033,
2037
\__enumext_check_ans_log: 70, 85, 2126, 2126, 2903
\__enumext_check_ans_log_msg_greater: 2126,
2132, 2145
\__enumext_check_ans_log_msg_less: 2126, 2130,
2135
\__enumext_check_ans_log_msg_same_ok: 2126,
2131, 2140
\__enumext_check_ans_msg_greater: 2102, 2108,
2121
\__enumext_check_ans_msg_less: 2102, 2106, 2111
\__enumext_check_ans_msg_same_ok: 2102, 2107,
2116
\__enumext_check_ans_show: . . 70, 85, 2102, 2102,
2901
\l__enumext_check_answers_bool 67, 68, 79, 89, 90,
153, 1989, 2016, 2031, 2318, 2342, 2349, 2373, 2601,
2798, 3024, 3113, 3147, 4682
\__enumext_check_starred_cmd:n 34, 71, 87, 122,
2150, 2150, 3818, 4033, 4806
\g__enumext_check_starred_cmd_int . . 94, 153,
2153, 2159, 2164, 3328, 4098, 4931
\l__enumext_check_start_line_env_tl . 34, 153,
320, 328, 336, 2156, 2162, 2165
\l__enumext_columns_sep_v_dim 3736, 3738, 3746
\l__enumext_columns_sep_vii_dim . . 4194, 4196,
4205, 4217, 4293, 4762
\l__enumext_columns_sep_viii_dim . 4225, 4227,
4236, 4248, 4342, 5030
\l__enumext_columns_v_int 1385, 1403, 1571, 3734,
3742, 3754, 3759
\l__enumext_columns_vii_int . . 4199, 4202, 4206,
4215, 4257, 4261, 4264, 4270, 4276, 4280, 4756, 4770
\l__enumext_columns_viii_int . 4230, 4233, 4237,
4246, 4306, 4310, 4313, 4319, 4325, 4329, 5024, 5039
\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, 739
\l__enumext_counter_vi_tl . . . . . 45, 479
\l__enumext_counter_vii_tl . . . . . 45, 480, 671
\l__enumext_counter_viii_tl . . . . . 45, 481, 687
\l__enumext_current_widest_dim 28, 67, 509, 605,
651, 720, 724
\__enumext_def_meta_key:nnn . . . 132, 5253, 5281,
5287, 5301
\__enumext_default_item:n . . . 3109, 3109, 3173
\__enumext_define_counters:Nn 28, 465, 465, 474,
475, 476, 477, 478, 479, 480, 481
\__enumext_endminipage: . 36, 382, 391, 405, 4408,
4743, 5011
\g__enumext_envir_name_tl 33, 34, 291, 306, 365,
1959, 1964, 1974, 2114, 2119, 2124, 2138, 2143, 2148
\l__enumext_envir_name_tl . 33, 34, 34, 260, 270,
319, 327, 335, 5649, 5652, 5659, 5662, 5669, 5672,
5679, 5682, 5688, 5692, 5698, 5702, 5759, 5763
\__enumext_execute_after_env: 35, 66, 70, 81, 85,
2889, 2889, 3689, 4783
\__enumext_fake_item_indent: . . 931, 931, 3454
\l__enumext_fake_item_indent_v_dim 950, 955
\l__enumext_fake_item_indent_v_tl 952, 3310,
3314, 3322
\__enumext_fake_item_indent_vii: . . 931, 960,
3487
\l__enumext_fake_item_indent_vii_dim 963, 967
\l__enumext_fake_item_indent_vii_tl 965, 4738
\__enumext_fake_item_indent_viii: . 931, 972,
3492
\l__enumext_fake_item_indent_viii_dim . 975,
979
\l__enumext_fake_item_indent_viii_tl . . 977,
5002
\l__enumext_fake_item_indent_X_tl . . . . . 100
\__enumext_fake_make_label_vii:n . 120, 4667,
4667, 4730
\__enumext_fake_make_label_viii:n 4952, 4952,
4994
\__enumext_filter_first_level:n . . 130, 5150,
5150, 5184, 5195
\__enumext_filter_first_level_key:n 130, 5150,
5155, 5159
\__enumext_filter_first_level_pair:nn . 130,
5150, 5156, 5168
\__enumext_filter_save_key:n . . 73, 2234, 2242,
2265, 2271, 2273, 2273, 5081, 5085, 5089, 5093, 5097,
5101
\__enumext_filter_save_key_key:n . . 73, 2273,
2278, 2282
\__enumext_filter_save_key_pair:nn 74, 2273,
2279, 2290
\__enumext_filter_series:n 62, 1716, 1716, 1754,
1766, 1771
\__enumext_filter_series_key:n 62, 1716, 1721,
1725
\__enumext_filter_series_pair:nn . . 62, 1716,
1722, 1733
\__enumext_first_item_tmp_vii: 116, 118, 4523,
4596, 4596
\__enumext_first_item_tmp_viii: . . 124, 4798,
4852, 4852
\g__enumext_footnote_arg_seq . 171, 4482, 4495,
4505
\g__enumext_footnote_int . 171, 4489, 4492, 4494,
4496
\g__enumext_footnote_int_seq . 171, 4483, 4496,
4501, 4504
\__enumext_footnotes_key_bool . . . . . 36
\l__enumext_footnotes_key_bool 31, 37, 121, 161,
420, 427, 436, 4724, 4750, 4988, 5018
\__enumext_footnotetext:nn . . . 4476, 4476, 4506
\__enumext_foreach_add_body:n . 133, 5302, 5362,
5365
\l__enumext_foreach_after_tl . . . . . 5306, 5374

```



`\l__enumext_foreach_before_tl` . . . . 5304, 5369  
`\g__enumext_foreach_default_keys_tl` 132, 126, 5324, 5345  
`\__enumext_foreach_keyans:nn` . . 133, 5302, 5341, 5343  
`\l__enumext_foreach_name_prop_tl` . 126, 5347, 5372  
`\l__enumext_foreach_print_seq` 126, 5357, 5363, 5367  
`\l__enumext_foreach_sep_tl` . . . . . 5316, 5363  
`\l__enumext_foreach_start_int` . . . . 5308, 5359  
`\l__enumext_foreach_step_int` . . . . 5312, 5360  
`\l__enumext_foreach_stop_int` . 5310, 5352, 5354, 5361  
`\__enumext_foreach_wrapper:n` . . . . . 5314, 5370  
`\__enumext_getkeyans:nn` . . 128, 5050, 5064, 5068  
`\__enumext_getkeyans_aux:n` 128, 5050, 5052, 5055  
`\l__enumext_hyperref_bool` . 31, 36, 37, 161, 416, 439, 456, 2520, 3012, 4676  
`\__enumext_hypertarget:nn` 37, 411, 441, 445, 461  
`\__enumext_if_is_int:n` . . . . . 218  
`\__enumext_if_is_int:nTF` . . . . . 218, 757, 771  
`\__enumext_internal_mini_page:` 36, 98, 117, 393, 393, 3501, 4535  
`\__enumext_is_not_nested:` 28, 33, 98, 117, 254, 254, 3502, 4536  
`\__enumext_is_on_first_level:` . 28, 33, 98, 117, 254, 280, 3508, 4548  
`\g__enumext_item_anskey_int` 79, 88, 153, 352, 379, 380, 2099, 2469, 3026  
`\__enumext_item_answer_diff:` 70, 85, 2095, 2095, 2896  
`\g__enumext_item_answer_diff_int` 70, 153, 353, 2097, 2104, 2128  
`\l__enumext_item_column_pos_vii_int` 119, 4264, 4270, 4276, 4280, 4287, 4607, 4756, 4759  
`\l__enumext_item_column_pos_viii_int` . 124, 4313, 4319, 4325, 4329, 4336, 4863, 5024, 5027  
`\l__enumext_item_column_pos_X_int` . . . . . 174  
`\g__enumext_item_count_all_vii_int` 119, 4288, 4608, 4770, 4778  
`\g__enumext_item_count_all_viii_int` 124, 4337, 4864, 5038, 5047  
`\g__enumext_item_count_all_X_int` . . . . . 174  
`\g__enumext_item_number_bool` . . . . . 153  
`\l__enumext_item_number_bool` 69, 159, 2049, 2054, 2058, 2062, 2075, 2644, 2698, 3116, 3150, 4685  
`\g__enumext_item_number_int` . . 69, 153, 351, 378, 380, 2048, 2053, 2057, 2061, 2074, 2099, 3115, 3149, 4684  
`\__enumext_item_peek_args_vii:` 119, 4604, 4609, 4611  
`\__enumext_item_peek_args_viii:` . . 124, 4860, 4865, 4867  
`\__enumext_item_star_exec:` 90, 3128, 3155, 3200, 3219  
`\l__enumext_item_starred_vii_bool` 4626, 4640, 4689  
`\l__enumext_item_starred_viii_bool` 4882, 4896, 4962, 5003  
`\l__enumext_item_starred_X_bool` . . . . . 174  
`\__enumext_item_std:w` 36, 89, 90, 94, 382, 386, 3119, 3125, 3153, 3310, 3314, 3322  
`\g__enumext_item_symbol_aux_tl` . 90, 130, 3133, 3136, 3161, 3205, 3223  
`\g__enumext_item_symbol_aux_vii_tl` 4648, 4691, 4694, 4698, 4700  
`\g__enumext_item_symbol_aux_X_tl` . . . . . 174  
`\l__enumext_item_symbol_sep_vii_dim` . 4656, 4663, 4697, 4699  
`\l__enumext_item_symbol_vii_tl` . . . . . 4694  
`\l__enumext_item_text_vii_box` . . . . 4716, 4747  
`\l__enumext_item_text_viii_box` . . . 4980, 5015  
`\l__enumext_item_text_X_box` . . . . . 174  
`\l__enumext_item_width_vii_dim` . . 4203, 4212, 4291, 4299, 4300  
`\l__enumext_item_width_viii_dim` . . 4234, 4243, 4340, 4348, 4349  
`\l__enumext_item_width_X_dim` . . . . . 174  
`\l__enumext_itemindent_X_dim` . . . . . 71  
`\l__enumext_itemsep_i_skip` . . 1246, 1253, 1256, 1258, 1265, 1269, 1272, 1274, 1414, 1421, 1423, 1424, 1429, 1433, 1435, 1436  
`\l__enumext_itemsep_ii_skip` . . 1286, 1293, 1296, 1298, 1305, 1309, 1312, 1314  
`\l__enumext_itemsep_iii_skip` . 1325, 1332, 1335, 1337, 1344, 1348, 1351, 1353  
`\l__enumext_itemsep_vii_skip` . . . . . 4776  
`\l__enumext_itemsep_viii_skip` . . . . . 5045  
`\l__enumext_joined_item_aux_vii_int` . 4285, 4286, 4287, 4288, 4294  
`\l__enumext_joined_item_aux_viii_int` . 4334, 4335, 4336, 4337, 4343  
`\l__enumext_joined_item_aux_X_int` . . . . . 174  
`\__enumext_joined_item_vii:w` . . 119, 4604, 4614, 4615, 4617  
`\l__enumext_joined_item_vii_int` . . 4256, 4257, 4260, 4262, 4268, 4273, 4278, 4283, 4285, 4291  
`\__enumext_joined_item_viii:w` 124, 4860, 4870, 4871, 4873  
`\l__enumext_joined_item_viii_int` . 4305, 4306, 4309, 4311, 4317, 4322, 4327, 4332, 4334, 4340  
`\l__enumext_joined_item_X_int` . . . . . 174  
`\l__enumext_joined_width_vii_dim` . 4289, 4296, 4299, 4718, 4732  
`\l__enumext_joined_width_viii_dim` 4338, 4345, 4348, 4982, 4996  
`\l__enumext_joined_width_X_dim` . . . . . 174  
`\__enumext_keyans_addto_prop:n` 86, 2909, 2909, 3325, 4095  
`\__enumext_keyans_addto_seq:n` . 87, 2985, 2985, 3327, 4097  
`\__enumext_keyans_addto_seq_link:` 2985, 3006, 3008, 4930  
`\__enumext_keyans_default_item:n` . . 93, 3305, 3305, 3342  
`\l__enumext_keyans_env_bool` 34, 3533, 3546, 3698, 3788  
`\__enumext_keyans_fake_item_indent:` 931, 947, 3444  
`\l__enumext_keyans_level_h_int` . . 123, 28, 680, 706, 2628, 2690, 2963, 4542, 4815, 4816  
`\l__enumext_keyans_level_int` . . 28, 1531, 2624, 2686, 2958, 3697, 3702, 4061  
`\__enumext_keyans_make_label:` 39, 94, 3346, 3346, 3442  
`\__enumext_keyans_make_label_box:` 3346, 3350, 3355, 3376  
`\__enumext_keyans_make_label_std:` 3346, 3358, 3362



\\_\_enumext\_keyans\_mini\_right\_cmd:n 59, 1533, 1566, 1566  
 \\_\_enumext\_keyans\_mini\_set\_vskip: . . . . . 55  
 \\_\_enumext\_keyans\_minipage\_add\_space: 1365, 1391, 3727  
 \\_\_enumext\_keyans\_minipage\_set\_skip: . 1365, 1365, 1393  
 \\_\_enumext\_keyans\_multi\_addvspace: 1165, 1176, 3751  
 \\_\_enumext\_keyans\_multi\_set\_vskip: 52, 1165, 1165, 1178  
 \\_\_enumext\_keyans\_multicols\_start: 3715, 3730, 3732  
 \\_\_enumext\_keyans\_multicols\_stop: 1570, 3715, 3757, 3786  
 \\_\_enumext\_keyans\_name\_and\_start: 28, 34, 123, 313, 313, 3699, 3952, 4820  
 \\_\_enumext\_keyans\_parse\_keys:n 3711, 3711, 3806  
 \\_\_enumext\_keyans\_pic\_arg\_two: 107, 3945, 3968, 3998  
 \l\_\_enumext\_keyans\_pic\_level\_int .. 28, 1515, 2632, 2694, 2912, 2953, 2988, 3076, 3947, 3948  
 \\_\_enumext\_keyans\_pic\_parse\_keys:n 3945, 3954, 3997  
 \g\_\_enumext\_keyans\_pic\_parsep\_skip ... 142  
 \\_\_enumext\_keyans\_pic\_safe\_exec: . 106, 3945, 3945, 3996  
 \\_\_enumext\_keyans\_pic\_skip\_abs:N . 107, 3945, 3961, 3972  
 \\_\_enumext\_keyans\_pre\_itemsep\_skip: .. 1365, 1384, 1411  
 \\_\_enumext\_keyans\_redefine\_item: .. 94, 3330, 3330, 3441  
 \\_\_enumext\_keyans\_ref: . . . . . 43, 731, 748, 3443  
 \\_\_enumext\_keyans\_ref:n . . . . . 43, 728, 731, 731  
 \\_\_enumext\_keyans\_safe\_exec: . 3691, 3691, 3805  
 \\_\_enumext\_keyans\_set\_item\_width: 103, 3792, 3792, 3814  
 \\_\_enumext\_keyans\_show\_ans: .. 3029, 3037, 3056  
 \\_\_enumext\_keyans\_show\_item\_opt: .. 94, 3029, 3044, 3323, 4110, 5005  
 \\_\_enumext\_keyans\_show\_left:n . 94, 3029, 3029, 3320, 4104  
 \\_\_enumext\_keyans\_show\_pos: .. 3029, 3041, 3069  
 \\_\_enumext\_keyans\_starred\_item:n .. 94, 3317, 3317, 3338  
 \\_\_enumext\_keyans\_store\_ref: .. 86, 2932, 2932, 3326, 4096, 4928  
 \\_\_enumext\_keyans\_store\_ref\_aux\_i: 86, 2932, 2944, 2947  
 \\_\_enumext\_keyans\_store\_ref\_aux\_ii: 87, 2932, 2973, 2975  
 \\_\_enumext\_keyans\_unknown\_keys:n . 3243, 3247, 3251, 3943  
 \\_\_enumext\_keyans\_unknown\_keys:nn 3243, 3253, 3255  
 \\_\_enumext\_keyans\_wrapper\_opt:n .. 2177, 3052  
 \l\_\_enumext\_label\_copy\_i\_tl .. 2435, 2951, 2956, 2961, 2966  
 \l\_\_enumext\_label\_copy\_v\_tl . . . . . 2961  
 \l\_\_enumext\_label\_copy\_vi\_tl . . . . . 2956  
 \l\_\_enumext\_label\_copy\_vii\_tl 2411, 2422, 2451, 2951  
 \l\_\_enumext\_label\_copy\_viii\_tl . . . . . 2966  
 \l\_\_enumext\_label\_copy\_X\_tl . . . . . 163  
 \l\_\_enumext\_label\_fill\_left\_v\_tl . . . . . 3366  
 \l\_\_enumext\_label\_fill\_left\_X\_tl . . . . . 100  
 \l\_\_enumext\_label\_fill\_right\_v\_tl . . . . 3373  
 \l\_\_enumext\_label\_fill\_right\_X\_tl . . . . 100  
 \l\_\_enumext\_label\_font\_style\_v\_tl 3367, 3382, 4108  
 \l\_\_enumext\_label\_font\_style\_vii\_tl ... 4704  
 \l\_\_enumext\_label\_font\_style\_viii\_tl .. 4968  
 \l\_\_enumext\_label\_i\_tl . . . . . 597  
 \l\_\_enumext\_label\_ii\_tl . . . . . 597  
 \l\_\_enumext\_label\_iii\_tl . . . . . 597  
 \l\_\_enumext\_label\_iv\_tl . . . . . 597  
 \\_\_enumext\_label\_style:Nnn 28, 38, 498, 498, 513, 602, 648, 717, 721  
 \l\_\_enumext\_label\_v\_tl 87, 714, 2917, 2993, 3063, 3103, 3319, 3324, 3809, 3976, 4103, 4105  
 \l\_\_enumext\_label\_vi\_tl 87, 714, 2914, 2990, 4103, 4105, 4109  
 \l\_\_enumext\_label\_vii\_tl . 643, 4635, 4658, 4665  
 \l\_\_enumext\_label\_viii\_tl 643, 4891, 4922, 4926  
 \l\_\_enumext\_label\_width\_by\_box .. 67, 494, 495  
 \\_\_enumext\_label\_width\_by\_box:Nn 38, 492, 492, 497, 509, 781  
 \l\_\_enumext\_labelsep\_i\_dim ... 3061, 3066, 3074, 3106, 4934, 4949  
 \l\_\_enumext\_labelsep\_v\_dim . . . . . 3741  
 \l\_\_enumext\_labelsep\_vii\_dim . 2536, 3061, 3074, 4198, 4208, 4292, 4600, 4656, 4711, 4720  
 \l\_\_enumext\_labelsep\_viii\_dim 4229, 4239, 4341, 4856, 4975, 4984  
 \l\_\_enumext\_labelwidth\_i\_dim . 3060, 3066, 3073, 3106, 4934, 4949  
 \l\_\_enumext\_labelwidth\_v\_dim . . . . . 3380, 3741  
 \l\_\_enumext\_labelwidth\_vii\_dim ... 2536, 3060, 3073, 4198, 4207, 4292, 4600, 4702, 4719  
 \l\_\_enumext\_labelwidth\_viii\_dim .. 4229, 4238, 4341, 4856, 4966, 4983  
 \l\_\_enumext\_leftmargin\_tmp\_v\_bool . 107, 3970  
 \l\_\_enumext\_leftmargin\_tmp\_X\_bool . . . . . 71  
 \l\_\_enumext\_leftmargin\_tmp\_X\_dim . . . . . 71  
 \l\_\_enumext\_leftmargin\_X\_dim . . . . . 71  
 \\_\_enumext\_level: 214, 214, 626, 629, 630, 638, 640, 934, 938, 942, 1010, 1014, 1018, 1022, 1105, 1107, 1109, 1111, 1153, 1155, 1157, 1159, 1163, 1197, 1203, 1208, 1210, 1213, 1216, 1229, 1232, 1540, 1544, 1550, 1613, 1615, 1617, 1620, 1627, 1629, 1631, 1634, 2229, 2231, 2233, 2261, 2262, 2264, 2320, 2328, 2332, 2336, 2540, 2541, 3118, 3119, 3123, 3124, 3125, 3133, 3141, 3142, 3145, 3152, 3153, 3157, 3160, 3162, 3196, 3197, 3198, 3201, 3204, 3213, 3214, 3216, 3217, 3220, 3539, 3552, 3559, 3567, 3570, 3572, 3574, 3575, 3576, 3577, 3580, 3585, 3591, 3597, 3604, 3617, 3619, 3622, 3623, 3625, 3629, 3635, 3660, 3665, 3676, 3678  
 \l\_\_enumext\_level\_h\_int 117, 28, 263, 286, 300, 664, 699, 1522, 2045, 2065, 2430, 2664, 2676, 3547, 4537, 4538  
 \l\_\_enumext\_level\_int . 98, 28, 216, 273, 285, 301, 395, 1117, 1242, 1521, 2039, 2071, 2407, 2417, 2423, 2429, 2436, 2445, 2450, 2663, 2675, 2891, 3458, 3503, 3504, 3515, 3523, 3537, 3550, 3581, 3706, 4057, 4580, 4590, 4828, 5689, 5693, 5699, 5703  
 \\_\_enumext\_list\_arg\_two\_i: . . . . . 3423  
 \\_\_enumext\_list\_arg\_two\_ii: . . . . . 3423  
 \\_\_enumext\_list\_arg\_two\_iii: . . . . . 3423

```

\__enumext_list_arg_two_iv: . . . . . 3423
\__enumext_list_arg_two_v: . 94, 3423, 3811, 3971
\__enumext_list_arg_two_vii: . . . . . 3464, 4517
\__enumext_list_arg_two_viii: . . . . . 3464, 4792
\l__enumext_listoffset_v_dim . 3743, 3797, 3800
\l__enumext_listparindent_vii_dim 4733, 4737
\l__enumext_listparindent_viii_dim 4997, 5001
\__enumext_log_answer_vars: . 35, 367, 375, 2898
\__enumext_log_global_vars: . 35, 367, 367, 2897
\__enumext_make_label: . 39, 91, 3176, 3176, 3452
\__enumext_make_label_box: . . 3176, 3180, 3185,
    3208
\__enumext_make_label_std: . . 3176, 3188, 3192
\l__enumext_mark_answer_sym_tl 75, 2183, 2386,
    2553, 3078, 3091, 4938
\l__enumext_mark_position_str 130, 2187, 2188,
    2214, 2215, 2384
\l__enumext_mark_ref_sym_tl . 2200, 2525, 3020
\l__enumext_meta_path_tl . 126, 5277, 5278, 5280,
    5281
\c__enumext_meta_paths_prop . . . . . 131, 5253
\__enumext_mini_addvspace_vii: 57, 1501, 1501,
    4366
\__enumext_mini_addvspace_viii: 57, 1501, 1507,
    4431
__enumext_mini_env* . . . . . 393
\__enumext_mini_page 1550, 1577, 3629, 3728, 4368,
    4433, 4454
\__enumext_mini_right_cmd:n . 58, 59, 1535, 1537,
    1537
\__enumext_mini_set_vskip_vii: 56, 1444, 1444,
    1503
\__enumext_mini_set_vskip_viii: 56, 1444, 1466,
    1509
\__enumext_minipage:w 36, 382, 390, 399, 4391, 4732,
    4996
\l__enumext_minipage_active_v_bool 3725, 3748,
    3773
\g__enumext_minipage_active_vii_bool . 114,
    4380, 4389, 4411
\l__enumext_minipage_active_vii_bool . 4362,
    4373
\g__enumext_minipage_active_viii_bool 4444,
    4452, 4471
\l__enumext_minipage_active_viii_bool 4427,
    4438
\g__enumext_minipage_active_X_bool . . 174
\l__enumext_minipage_active_X_bool . . . 87
\__enumext_minipage_add_space: . 53, 100, 1193,
    1219, 3627
\g__enumext_minipage_after_skip 87, 1448, 1460,
    4409, 4469
\l__enumext_minipage_after_skip . . 52, 100, 87,
    1206, 1246, 1248, 1253, 1256, 1260, 1265, 1269, 1272,
    1276, 1288, 1293, 1296, 1300, 1305, 1309, 1312, 1316,
    1327, 1332, 1335, 1339, 1344, 1348, 1351, 1355, 1367,
    1381, 1414, 1416, 1421, 1423, 1425, 1429, 1433, 1435,
    1437, 1468, 1481, 1495, 1546, 1573, 3783
\g__enumext_minipage_center_vii_bool . 4395,
    4412
\g__enumext_minipage_center_viii_bool 4456,
    4472
\g__enumext_minipage_center_X_bool . . 174
\l__enumext_minipage_hsep_v_dim . . . . . 3723
\l__enumext_minipage_hsep_vii_dim . . . 4360
\l__enumext_minipage_hsep_viii_dim . . 4425
\l__enumext_minipage_left_skip 87, 1368, 1446,
    1451, 1455, 1469, 1473, 1487, 1505, 1511
\l__enumext_minipage_left_v_dim . 3721, 3728
\l__enumext_minipage_left_vii_dim 4356, 4368
\l__enumext_minipage_left_viii_dim 4421, 4433
\l__enumext_minipage_left_X_dim . . . . . 87
\g__enumext_minipage_right_skip 87, 1447, 1452,
    1456, 4394, 4455
\l__enumext_minipage_right_skip . 52, 87, 1195,
    1201, 1206, 1208, 1210, 1369, 1370, 1376, 1381, 1382,
    1383, 1388, 1470, 1477, 1491, 1552, 1579
\l__enumext_minipage_right_v_dim . 1568, 1577,
    3719, 3723
\g__enumext_minipage_right_vii_dim 114, 4364,
    4391, 4414
\l__enumext_minipage_right_vii_dim 114, 4354,
    4359, 4365
\g__enumext_minipage_right_viii_dim . 4429,
    4454, 4474
\l__enumext_minipage_right_viii_dim . 4419,
    4424, 4430
\g__enumext_minipage_right_X_dim . . . . . 174
\g__enumext_minipage_right_X_skip . . . 174
\__enumext_minipage_set_skip: . 52, 1193, 1193,
    1221
\g__enumext_minipage_stat_int . . 100, 87, 1557,
    1584, 3626, 3637, 3642, 3726, 3775, 3780
\l__enumext_minipage_temp_skip 87, 1267, 1277,
    1280, 1307, 1317, 1320, 1346, 1356, 1359, 1431, 1438,
    1440
\l__enumext_miniright_code_vii_box 4402, 4406
\g__enumext_miniright_code_vii_tl 114, 4397,
    4404, 4413
\l__enumext_miniright_code_viii_box . 4463,
    4467
\g__enumext_miniright_code_viii_tl 4458, 4465,
    4473
\l__enumext_miniright_code_X_box . . . . . 174
\l__enumext_mode_box_bool . . . 518, 3183, 3353
\__enumext_multi_addvspace: . 51, 99, 1148, 1148,
    3588
\__enumext_multi_set_vskip: 50, 1103, 1103, 1150
\l__enumext_multicols_above_ii_skip . . 1122
\l__enumext_multicols_above_iii_skip . . 1131
\l__enumext_multicols_above_iv_skip . . 1140
\l__enumext_multicols_above_v_skip 1167, 1181,
    1191, 1382
\l__enumext_multicols_above_X_skip . . . . 79
\l__enumext_multicols_below_ii_skip . . 1249,
    1258, 1262, 1274, 1279
\l__enumext_multicols_below_iii_skip . 1289,
    1298, 1302, 1314, 1319
\l__enumext_multicols_below_iv_skip . . 1328,
    1337, 1341, 1353, 1358
\l__enumext_multicols_below_v_skip 1171, 1185,
    1383, 1417, 1424, 1426, 1436, 1439, 3765
\l__enumext_multicols_below_X_skip . . . . 79
\g__enumext_multicols_right_X_skip . . . . 79
\__enumext_multicols_start: 99, 100, 3564, 3564,
    3631
\__enumext_multicols_stop: 100, 1542, 3594, 3594,
    3647

```

```

\__enumext_nested_base_line_fix: . 45, 98, 855,
    861, 3519
\__enumext_newlabel:nn    31, 37, 77, 449, 449, 2461,
    2979
\l__enumext_newlabel_arg_one_tl    31, 37, 77, 86,
    163, 2454, 2462, 2524, 2968, 2980, 3018
\l__enumext_newlabel_arg_two_tl    31, 37, 76, 163,
    2410, 2420, 2433, 2448, 2463, 2955, 2960, 2965, 2981
\__enumext_parse_foreach_keys:n . . 5302, 5318,
    5335
\__enumext_parse_foreach_keys:nn . 5302, 5325,
    5337
\__enumext_parse_keys:n    45, 62, 3510, 3510, 3672
\__enumext_parse_keys_vii:n    62, 4512, 4550, 4550
\__enumext_parse_keys_viii:n . 4788, 4833, 4833
\__enumext_parse_save_key:n    73, 2254, 2259, 2259
\__enumext_parse_save_key_vii:n    73, 2249, 2259,
    2267
\__enumext_parse_series:n    62, 98, 117, 1742, 1742,
    3518, 4556
\__enumext_parse_store_keys:n . . . . . 98
\l__enumext_parsep_i_skip . . . . . 1120, 1124
\l__enumext_parsep_ii_skip . . . . . 1129, 1133
\l__enumext_parsep_iii_skip . . . . . 1138, 1142
\l__enumext_parsep_vii_skip . . . . . 4734
\l__enumext_parsep_viii_skip . . . . . 4998
\l__enumext_partopsep_v_skip . 1183, 1187, 1378,
    1401
\l__enumext_partopsep_viii_skip . . . . . 1479
\__enumext_phantomsection: 37, 411, 442, 446, 462
\__enumext_pre_itemsep_skip: . . 53, 1211, 1240,
    1240
\__enumext_print_footnote: . . . 4476, 4499, 4752,
    5020
\__enumext_print_keyans_box:NN    75, 2378, 2378,
    2391, 2535, 2539, 3065, 3105, 4934, 4949
\l__enumext_print_keyans_i_tl . . . . 5086, 5108
\l__enumext_print_keyans_ii_tl . . . 5090, 5109
\l__enumext_print_keyans_iii_tl . . 5094, 5110
\l__enumext_print_keyans_iv_tl . . . 5098, 5111
\l__enumext_print_keyans_star_bool    45, 46, 129,
    130, 867, 875, 5131, 5136
\l__enumext_print_keyans_starred_tl    128, 129,
    130, 5082, 5129
\l__enumext_print_keyans_vii_tl    128, 5102, 5112
\l__enumext_print_keyans_X_tl . . . . . 130
\__enumext_printkeyans:nnn    129, 5105, 5113, 5116
\__enumext_redefine_item: . 90, 3165, 3165, 3451
\l__enumext_ref_key_arg_tl    41, 50, 229, 619, 620,
    632, 663, 666, 676, 682, 692, 733, 734, 744
\l__enumext_ref_the_count_tl . 41, 50, 626, 629,
    632, 671, 673, 676, 687, 689, 692, 739, 741, 744
\__enumext_regex_counter_style: . . 32, 41, 224,
    224, 627, 672, 688, 740
\__enumext_register_counter_style:Nn . . 482,
    482, 487, 488, 489, 490, 491
\__enumext_remove_extra_parsep_vii: . . 4530,
    4765, 4765
\__enumext_remove_extra_parsep_viii: . 4805,
    5033, 5033
\__enumext_renew_footnote: . . . 4476, 4480, 4726,
    4990
\l__enumext_renew_the_count_v_tl    742, 750, 752
\l__enumext_renew_the_count_vii_tl    674, 701,
    703
\l__enumext_renew_the_count_viii_tl    690, 708,
    710
\l__enumext_renew_the_count_X_tl . . . . . 50
\__enumext_rescan_anskey_env:n . . 83, 84, 2773,
    2868, 2876
\__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,
    2906
\l__enumext_resume_active_bool    62, 64, 61, 1746,
    1866
\__enumext_resume_counter: . . 64, 65, 1864, 1870,
    1877
\__enumext_resume_counter:n . 62, 64, 1835, 1840,
    1864, 1864, 1934, 1942
\__enumext_resume_counter_save_ans: 65, 1864,
    1875, 1907
\__enumext_resume_counter_series: . 65, 1864,
    1873, 1890
\g__enumext_resume_int . . . 61, 1787, 1881, 1882
\__enumext_resume_last:n    62, 63, 1742, 1748, 1761
\l__enumext_resume_name_tl    61, 1783, 1791, 1794,
    1810, 1818, 1821, 1867, 1868, 1896, 1903
\__enumext_resume_save_counter: . 63, 101, 118,
    1774, 1774, 3653, 4574
\__enumext_resume_series:n . 64, 1710, 1831, 1831
\__enumext_resume_starred: . 66, 1711, 1928, 1928
\g__enumext_resume_vii_int    61, 1814, 1886, 1887
\l__enumext_rightmargin_vii_dim . . 4210, 4214,
    4219
\l__enumext_rightmargin_viii_dim . 4241, 4245,
    4250
\__enumext_safe_exec: . . 36, 98, 3499, 3499, 3671
\__enumext_safe_exec_vii: . 36, 4511, 4533, 4533
\__enumext_safe_exec_viii: 123, 4787, 4809, 4809
\__enumext_second_part: . . 100, 3633, 3633, 3685
\__enumext_second_part_v: . . . 3715, 3771, 3819
\l__enumext_series_name_tl . . . . . 64, 65
\l__enumext_series_str . . 63, 98, 117, 1708, 1744,
    1752, 1753, 1755, 1757, 1778, 1781, 1785, 1805, 1808,
    1812, 3514, 4554
\__enumext_set_error:nn . . . . . 5212, 5249, 5251
\__enumext_set_item_width: 101, 3655, 3655, 3681
\__enumext_set_parse:n . . . . . 5212, 5223, 5239
\l__enumext_setkey_tmpa_int . . . 121, 5216, 5220
\l__enumext_setkey_tmpa_seq . . 121, 5214, 5224,
    5230, 5232, 5234, 5246
\l__enumext_setkey_tmpa_tl . . . 121, 5222, 5226
\l__enumext_setkey_tmpb_seq . . 121, 5215, 5218,
    5222, 5223
\l__enumext_setkey_tmpb_tl    121, 5241, 5243, 5244
\l__enumext_show_answer_bool . 2194, 2218, 2547,
    3035, 3049, 4100, 4932
\__enumext_show_length:nnn . . 48, 232, 232, 5460,
    5461, 5462, 5463, 5464, 5465, 5466, 5467, 5468, 5469,
    5475, 5476, 5477, 5478, 5479, 5480, 5481, 5482, 5483,
    5484
\l__enumext_show_position_bool . . 2197, 2221,
    2551, 3039, 3050, 4101, 4936
\g__enumext_standar_bool    33, 98, 34, 262, 265, 284,
    358, 1776, 1841, 1853, 1879, 1892, 1930, 2070, 2084,
    2415, 2428, 2443, 3534

```

```

\l__enumext_standar_bool 98, 101, 34, 2416, 3506,
    3652, 4547
\l__enumext_standar_first_bool 33, 98, 34, 289,
    1763, 1910, 1972, 1979
\__enumext_standar_item_vii:w . 119, 4604, 4622,
    4624
\__enumext_standar_item_viii:w 124, 125, 4860,
    4878, 4880
\__enumext_standar_ref: . . . . 41, 617, 636, 3453
\__enumext_standar_ref:n . . . . 41, 609, 617, 617
\g__enumext_standar_series_tl . 61, 1765, 1766,
    1932, 1935
\__enumext_standar_unknown_keys:n 3283, 3287,
    3291
\__enumext_standar_unknown_keys:nn 3283, 3293,
    3295
\g__enumext_starred_bool 33, 117, 34, 272, 275, 299,
    359, 1803, 1846, 1857, 1884, 1899, 1938, 2044, 2090,
    2406, 2949, 4415
\l__enumext_starred_bool 117, 118, 123, 34, 1527,
    2444, 2479, 2485, 2533, 2822, 2827, 3058, 3071, 3507,
    4546, 4573, 4821, 4825
\__enumext_starred_columns_set_vii: . . 4192,
    4192, 4521
\__enumext_starred_columns_set_viii: . 4192,
    4223, 4796
\l__enumext_starred_first_bool 33, 117, 34, 304,
    865, 874, 1768, 1919, 1972, 1979
\__enumext_starred_item:nn . . . 3128, 3128, 3171
\__enumext_starred_item_exec: . 125, 4894, 4924,
    4964
\__enumext_starred_item_vii:w . 119, 4604, 4621,
    4638
\__enumext_starred_item_vii_aux_i:w . . 4604,
    4643, 4646
\__enumext_starred_item_vii_aux_ii:w . 4604,
    4644, 4649, 4651
\__enumext_starred_item_vii_aux_iii:w 4604,
    4654, 4661
\__enumext_starred_item_viii:w 124, 125, 4877,
    4894, 4894
\__enumext_starred_item_viii_aux_i:w . . 125,
    4894, 4899, 4902
\__enumext_starred_item_viii_aux_ii:w . 125,
    4894, 4900, 4917, 4919
\__enumext_starred_joined_item_vii:n 112, 119,
    4254, 4254, 4619
\__enumext_starred_joined_item_viii:n . 112,
    124, 4254, 4303, 4875
\__enumext_starred_ref: . . . . 42, 661, 697, 3484
\__enumext_starred_ref:n . . . . 42, 655, 661, 661
\g__enumext_starred_series_tl . 61, 1770, 1771,
    1940, 1943
\__enumext_starred_unknown_keys:n 3265, 3267,
    3269
\__enumext_starred_unknown_keys:nn 3265, 3271,
    3273
\__enumext_start_from:NNn 43, 755, 755, 768, 790,
    796
\l__enumext_start_i_int . . . . . 1882, 1894, 1913
\__enumext_start_item_tmp_vii: 116, 4524, 4604,
    4604
\__enumext_start_item_tmp_viii: . . 4799, 4860,
    4860
\__enumext_start_item_vii:w 119, 121, 4630, 4635,
    4658, 4665, 4713, 4713
\__enumext_start_item_viii:w . . 125, 4886, 4891,
    4922, 4977, 4977
\g__enumext_start_line_tl 33, 34, 292, 307, 364,
    2114, 2119, 2124, 2138, 2143, 2148
\__enumext_start_list:nn . 36, 95, 382, 384, 3675,
    3808, 4515, 4790
\__enumext_start_list_tag:n . . 3821, 3845, 4729,
    4993
\__enumext_start_mini_vii: 118, 4352, 4352, 4565
\__enumext_start_mini_viii: . . . 123, 4417, 4417,
    4844
\__enumext_start_save_ans_msg: . . 66, 67, 1956,
    1956, 1981
\__enumext_start_store_level: . 98, 3528, 3528,
    3674
\__enumext_start_store_level_vii: 118, 4514,
    4576, 4576
\l__enumext_start_vii_int . . . 1887, 1901, 1922
\l__enumext_start_X_int . . . . . 100
\__enumext_stop_item_tmp_vii: 116, 118, 119, 121,
    4523, 4529, 4606, 4715
\__enumext_stop_item_tmp_viii: 124, 4798, 4804,
    4862, 4979
\__enumext_stop_item_vii: 121, 4713, 4715, 4741
\__enumext_stop_item_viii: . . . 4977, 4979, 5009
\__enumext_stop_list: 36, 114, 118, 382, 385, 3599,
    3607, 3761, 3768, 4375, 4383, 4440, 4447
\__enumext_stop_list_tag:n . . . 3821, 3861, 4744,
    5012
\__enumext_stop_mini_vii: 114, 118, 4352, 4371,
    4569
\__enumext_stop_mini_viii: 124, 4417, 4436, 4848
\__enumext_stop_save_ans_msg: . 66, 1956, 1961,
    2895
\__enumext_stop_start_list_tag: . . 3821, 3853,
    4731, 4995
\__enumext_stop_store_level: 99, 100, 3557, 3557,
    3600, 3608
\__enumext_stop_store_level_vii: . . 114, 118,
    4376, 4384, 4576, 4586
\l__enumext_store_active_bool 30, 67, 112, 1911,
    1920, 1988, 2620, 3532, 3545, 3693, 3701, 4053, 4578,
    4588, 4811, 4827
\__enumext_store_active_keys:n 72, 73, 98, 2227,
    2227, 3525
\__enumext_store_active_keys_vii:n 72, 73, 117,
    2227, 2237, 4557
\__enumext_store_addto_prop:n 74, 86, 2302, 2302,
    2310, 2470, 2930, 4927
\__enumext_store_addto_seq:n 74, 87, 2311, 2311,
    2315, 2322, 2336, 2344, 2353, 2367, 2375, 2528, 3023
\l__enumext_store_anskey_arg_tl 30, 77, 78, 112,
    2476, 2481, 2483, 2488, 2495, 2498, 2508, 2513, 2516,
    2522, 2528
\__enumext_store_anskey_code:n 77, 80, 84, 2467,
    2467, 2613, 2866, 2874
\l__enumext_store_anskey_env_tl . . 30, 83, 112,
    2796, 2800, 2806, 2868, 2876
\l__enumext_store_anskey_opt_tl . . 30, 84, 112,
    2797, 2824, 2830, 2837, 2843, 2853, 2863, 2872
\__enumext_store_anskey_safe_outer: . . . . 80
\g__enumext_store_columns_break_bool . 2720,

```



2821, 2883  
 \l\_\_enumext\_store\_columns\_break\_bool . 2478, 2569  
 \l\_\_enumext\_store\_current\_label\_tl 30, 86, 87, 125, 112, 2911, 2914, 2917, 2923, 2928, 2930, 2987, 2990, 2993, 2999, 3004, 3014, 3023, 4904, 4909, 4913, 4926, 4927, 4929  
 \l\_\_enumext\_store\_current\_label\_tmp\_tl . 30, 112, 3319, 3324  
 \l\_\_enumext\_store\_current\_opt\_arg\_tl 30, 125, 112, 3033, 3046, 3052, 4915  
 \\_\_enumext\_store\_internal\_ref: . 76, 77, 2392, 2392, 2473  
 \g\_\_enumext\_store\_item\_join\_int . 2723, 2828, 2832, 2884  
 \l\_\_enumext\_store\_item\_join\_int . 2486, 2490, 2572  
 \g\_\_enumext\_store\_item\_star\_bool . 2725, 2835, 2885  
 \l\_\_enumext\_store\_item\_star\_bool . 2493, 2574  
 \g\_\_enumext\_store\_item\_symbol\_sep\_dim 2730, 2850, 2855, 2887  
 \l\_\_enumext\_store\_item\_symbol\_sep\_dim 2505, 2510, 2579  
 \g\_\_enumext\_store\_item\_symbol\_tl . 2728, 2841, 2845, 2886  
 \l\_\_enumext\_store\_item\_symbol\_tl . 2496, 2500, 2577  
 \l\_\_enumext\_store\_keyans\_item\_opt\_sep\_-tl . . . . 2180, 2921, 2925, 2997, 3001, 4907, 4911  
 \\_\_enumext\_store\_level\_close: . 74, 2316, 2340, 3561  
 \\_\_enumext\_store\_level\_close\_vii: . 75, 2347, 2371, 4592  
 \\_\_enumext\_store\_level\_open: 74, 99, 2316, 2316, 3540, 3553  
 \\_\_enumext\_store\_level\_open\_vii: . 75, 2347, 2347, 4582  
 \g\_\_enumext\_store\_name\_tl 30, 67, 112, 363, 370, 371, 372, 373, 1964, 1990, 2113, 2118, 2123, 2137, 2142, 2147, 2893  
 \l\_\_enumext\_store\_name\_tl 30, 67, 68, 112, 1797, 1800, 1824, 1827, 1915, 1924, 1959, 1968, 1969, 1990, 1991, 1992, 1994, 1995, 1997, 1999, 2000, 2002, 2004, 2005, 2029, 2304, 2306, 2313, 2456, 2457, 2559, 2802, 2970, 2971, 3084, 3097, 4944  
 \l\_\_enumext\_store\_ref\_key\_bool 77, 2203, 2471, 2519, 2934, 3011  
 \l\_\_enumext\_store\_save\_key\_vii\_bool . 2239, 2269  
 \l\_\_enumext\_store\_save\_key\_vii\_tl 2241, 2242, 2270, 2271, 2351, 2359, 2363, 2367  
 \l\_\_enumext\_store\_save\_key\_X\_bool . 72, 130  
 \l\_\_enumext\_store\_save\_key\_X\_tl . 72, 73, 130  
 \l\_\_enumext\_store\_upper\_level\_X\_bool . 130  
 \\_\_enumext\_storing\_exec: 67, 82, 1966, 1982, 1986  
 \\_\_enumext\_storing\_set:n 66, 67, 1951, 1966, 1966  
 \l\_\_enumext\_the\_counter\_v\_tl . . . . . 741  
 \l\_\_enumext\_the\_counter\_vii\_tl . . . . . 673  
 \l\_\_enumext\_the\_counter\_viii\_tl . . . . . 689  
 \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, 514, 523, 1704, 1715, 1947, 1955, 2008, 2026, 2167, 2208, 2209, 2226, 2245, 2258, 2394, 2401, 2402, 2423, 2436, 2439, 2450, 2936, 2943, 3243, 3250, 3283, 3290, 3423, 3463, 3464, 3498  
 \\_\_enumext\_tmp:nn 524, 545, 546, 580, 581, 596, 785, 810, 887, 909, 910, 930, 984, 992, 993, 1007, 1072, 1088, 1089, 1102, 1593, 1609, 3227, 3242  
 \\_\_enumext\_tmp:nnn 597, 613, 614, 615, 616, 643, 659, 660  
 \\_\_enumext\_tmp:nnnnn 811, 836, 839, 842, 844, 846, 849, 852  
 \\_\_enumext\_tmp:w . . . . . 5061, 5064  
 \l\_\_enumext\_tmpa\_vii\_int 4202, 4205, 4214, 4245  
 \l\_\_enumext\_tmpa\_viii\_int . . . . . 4233, 4236  
 \l\_\_enumext\_tmpa\_X\_dim . . . . . 174  
 \l\_\_enumext\_tmpa\_X\_int . . . . . 174  
 \l\_\_enumext\_topsep\_v\_skip 1169, 1173, 1372, 4046  
 \l\_\_enumext\_topsep\_vii\_skip . 1449, 1458, 1462  
 \l\_\_enumext\_topsep\_viii\_skip . 1471, 1493, 1497  
 \\_\_enumext\_undefine\_anskey\_env: . 81, 85, 2653, 2653, 2904  
 \\_\_enumext\_unskip\_unkern: . 33, 238, 238, 1222, 1394, 3602, 3603, 3643, 3763, 3764, 3781, 4735, 4736, 4999, 5000  
 \l\_\_enumext\_vspace\_a\_star\_v\_bool . . . . . 1642  
 \l\_\_enumext\_vspace\_a\_star\_vii\_bool . . . 1664  
 \l\_\_enumext\_vspace\_a\_star\_viii\_bool . . . 1675  
 \l\_\_enumext\_vspace\_a\_star\_X\_bool . . . . . 100  
 \\_\_enumext\_vspace\_above: 60, 100, 1610, 1610, 3613  
 \\_\_enumext\_vspace\_above\_v: . 60, 1638, 1638, 3717  
 \l\_\_enumext\_vspace\_above\_v\_skip . 1640, 1644, 1646  
 \\_\_enumext\_vspace\_above\_vii: 61, 118, 1660, 1660, 4562  
 \l\_\_enumext\_vspace\_above\_vii\_skip 1662, 1666, 1668  
 \\_\_enumext\_vspace\_above\_viii: . 61, 1660, 1671, 4842  
 \l\_\_enumext\_vspace\_above\_viii\_skip 1673, 1677, 1679  
 \l\_\_enumext\_vspace\_b\_star\_v\_bool . . . . . 1653  
 \l\_\_enumext\_vspace\_b\_star\_vii\_bool . . . 1686  
 \l\_\_enumext\_vspace\_b\_star\_viii\_bool . . . 1697  
 \l\_\_enumext\_vspace\_b\_star\_X\_bool . . . . . 100  
 \\_\_enumext\_vspace\_below: 60, 101, 1624, 1624, 3651  
 \\_\_enumext\_vspace\_below\_v: . 60, 1649, 1649, 3790  
 \l\_\_enumext\_vspace\_below\_v\_skip . 1651, 1655, 1657  
 \\_\_enumext\_vspace\_below\_vii: 61, 118, 1682, 1682, 4572  
 \l\_\_enumext\_vspace\_below\_vii\_skip 1684, 1688, 1690  
 \\_\_enumext\_vspace\_below\_viii: . 61, 1682, 1693, 4850  
 \l\_\_enumext\_vspace\_below\_viii\_skip 1695, 1699, 1701  
 \\_\_enumext\_widest\_from:nnNn . 44, 769, 769, 784, 803  
 \g\_\_enumext\_widest\_label\_tl 28, 38, 67, 502, 506, 510  
 \l\_\_enumext\_wrap\_label\_opt\_v\_bool . . . . 3313  
 \l\_\_enumext\_wrap\_label\_opt\_vii\_bool 119, 4629  
 \l\_\_enumext\_wrap\_label\_opt\_viii\_bool . 125, 4885  
 \l\_\_enumext\_wrap\_label\_opt\_X\_bool . . . . 100  
 \l\_\_enumext\_wrap\_label\_v\_bool 3309, 3313, 3321, 3368, 3383

<code>\l_enumext_wrap_label_vii_bool</code> . . . . .	119, 4629, 4633, 4641, 4705
<code>\l_enumext_wrap_label_viii_bool</code> . . . . .	125, 4885, 4889, 4897, 4969
<code>\l_enumext_wrap_label_X_bool</code> . . . . .	100
<code>\_enumext_wrapper_label_v:n</code> . . . . .	3370, 3385, 4109
<code>\_enumext_wrapper_label_vii:n</code> . . . . .	4707
<code>\_enumext_wrapper_label_viii:n</code> . . . . .	4971
<code>\l_enumext_write_aux_file_tl</code> . . . . .	31, 77, 87, 163, 2459, 2465, 2977, 2983
<code>enumext*</code> . . . . .	5, 4509
<code>enumXi</code> . . . . .	474
<code>enumXii</code> . . . . .	474
<code>enumXiii</code> . . . . .	474
<code>enumXiv</code> . . . . .	474
<code>enumXv</code> . . . . .	474
<code>enumXvi</code> . . . . .	474
<code>enumXvii</code> . . . . .	474
<code>enumXviii</code> . . . . .	474
Environments provide by <code>enumext</code> :	
<code>anskey*</code> 30, 67, 73, 76, 78, 81–83, 85, 98, 99, 118, 127, 129, 134, 136	
<code>enumext*</code> 27, 28, 31–33, 36, 38, 39, 41, 42, 44, 46, 48–50, 56, 57, 61–64, 66–69, 71–77, 79, 81, 84–86, 92, 97–99, 104, 111, 112, 114–116, 118, 120–124, 126–131, 135, 138, 139	
<code>enumext</code> 27, 28, 32, 33, 36, 38–46, 48–52, 55, 58–64, 66–69, 71–74, 76, 77, 79, 81, 84–86, 89–93, 95, 96, 99, 101, 102, 106, 111, 114, 117, 118, 120, 123, 128–131, 135, 136, 138	
<code>keyans*</code> 27, 28, 30–34, 38, 41–44, 46, 48–50, 56, 57, 61, 67, 68, 71, 72, 74, 81, 86, 92, 97, 104, 112, 113, 116, 122, 123, 135, 137, 139	
<code>keyanspic</code> 27, 28, 30, 31, 34, 38, 39, 42, 67, 68, 71, 74, 81, 86–88, 92, 104–110, 137	
<code>keyans</code> 27, 28, 30, 31, 33, 34, 38, 39, 42, 44, 46, 48, 49, 52, 55, 58–60, 67, 68, 71, 72, 74, 81, 86–88, 92–96, 102, 104, 106, 107, 110, 114, 124, 135, 137	
Environments:	
<code>center</code> . . . . .	111
<code>description</code> . . . . .	111
<code>enumerate</code> . . . . .	111
<code>flushleft</code> . . . . .	111
<code>flushright</code> . . . . .	111
<code>itemize</code> . . . . .	111
<code>list</code> . . . . .	32, 35, 36, 79, 95, 100, 101, 104, 106, 107, 111, 114
<code>lrbox</code> . . . . .	121
<code>minipage</code> 32, 35, 36, 50, 52, 53, 106, 108, 110, 111, 114, 121	
<code>multicols</code> . . . . .	50–53, 58, 99, 100
<code>quotation</code> . . . . .	111
<code>quote</code> . . . . .	111
<code>scontents</code> . . . . .	82, 84
<code>tabbing</code> . . . . .	111
<code>trivlist</code> . . . . .	111
<code>verbatim</code> . . . . .	111
<code>verse</code> . . . . .	111
exp commands:	
<code>\exp_after:wN</code> . . . . .	5064
<code>\exp_args:Ne</code> . . . . .	2865, 2873, 3522, 5052
<code>\exp_args:NV</code> . . . . .	2585, 2740, 3253, 3271, 3293, 5337
<code>\exp_not:N</code> . . . . .	58, 505, 632, 676, 692, 744, 940, 943, 954, 955, 956, 967, 968, 979, 980, 2524, 2556, 2557, 3016, 3081, 3082, 3094, 3095, 4941, 4942, 5061
<code>\exp_not:n</code> 294, 309, 322, 330, 338, 571, 591, 632, 676, 692, 744, 941, 1731, 1740, 2191, 2288, 2300, 2462,	
2490, 2500, 2510, 2524, 2525, 2832, 2845, 2855, 2980, 3018, 3020, 3930, 5166, 5176, 5369, 5374	
<b>F</b>	
<code>\fbox</code> . . . . .	2174
<code>\fboxrule</code> . . . . .	2174
<code>\fboxsep</code> . . . . .	2174
file commands:	
<code>\file_input_stop:</code> . . . . .	5773
<code>first</code> . . . . .	993
<code>font</code> . . . . .	524
<code>\footnote</code> . . . . .	116
<code>\footnote</code> . . . . .	116, 4484
<code>\footnotemark</code> . . . . .	4494
<code>\footnotesize</code> . . . . .	2557, 3082, 3095, 4942
<code>\footnotetext</code> . . . . .	4478
<code>\foreachkeyans</code> . . . . .	17, 132, 5302
<b>G</b>	
<code>\getkeyans</code> . . . . .	17, 127, 5050
group commands:	
<code>\group_begin:</code> . . . . .	2555, 2600, 2775, 2862, 3080, 3093, 4940, 5107
<code>\group_end:</code> . . . . .	2562, 2616, 2879, 3087, 3100, 4947, 5114
<b>H</b>	
<code>\hbadness</code> . . . . .	4746, 5014
hbox commands:	
<code>\hbox_overlap_left:n</code> . . . . .	3161, 4698
<code>\hbox_set:Nn</code> . . . . .	494, 3976
<code>\hbox_set_end:</code> . . . . .	4745, 5013
<code>\hbox_set_to_wd:Nnw</code> . . . . .	4716, 4980
<code>\hfill</code> 554, 559, 565, 566, 1549, 1576, 2524, 3016, 4379, 4443	
hook commands:	
<code>\hook_gput_code:nnn</code> . . . . .	9, 204, 208, 212, 409
<code>\hook_gremove_code:nn</code> . . . . .	84, 2791
<code>\hook_gset_rule:nnnn</code> . . . . .	410
<code>\hook_if_empty:nTF</code> . . . . .	2789
<code>\hyperlink</code> . . . . .	78, 87
<code>\hyperlink</code> . . . . .	2524, 3016
<code>\hypertarget</code> . . . . .	37
<code>\hypertarget</code> . . . . .	441
<b>I</b>	
<code>\IfDocumentMetadataTF</code> 3178, 3348, 3847, 3855, 3863, 3897, 3905, 3913, 3999, 4009, 4017, 4023, 4028, 4074, 4083, 4167, 4175, 4377, 4441, 4520, 4528, 4674, 4722, 4748, 4795, 4803, 4986, 5016	
<code>\IfHyperBoolean</code> . . . . .	417
<code>\IfPackageLoadedTF</code> . . . . .	11, 19, 413, 429
<code>\ignorespaces</code> . . . . .	943, 956, 968, 980, 4525, 4602, 4635, 4658, 4665, 4711, 4737, 4800, 4858, 4891, 4922, 4975, 5001
<code>\inputlineno</code> . . . . .	294, 309, 322, 330, 338
int commands:	
<code>\int_add:Nn</code> . . . . .	4287, 4336
<code>\int_case:nn</code> . . . . .	1117, 1242, 2039, 2065, 2104, 2128
<code>\int_case:nnTF</code> . . . . .	240
<code>\int_compare:nNnTF</code> . . . . .	395, 664, 680, 699, 706, 1212, 1231, 1385, 1403, 1515, 1531, 1543, 1571, 2152, 2158, 2624, 2628, 2632, 2640, 2686, 2690, 2694, 2891, 2912, 2953, 2958, 2963, 2988, 3076, 3504, 3515, 3537, 3550, 3566, 3581, 3596, 3637, 3702, 3706, 3734, 3759, 3775, 3948, 4057, 4061, 4257, 4267, 4283, 4306, 4316, 4332, 4538, 4542, 4580, 4590, 4755, 4767, 4816, 4828, 5023, 5035, 5220, 5352

<code>\int_compare_p:nN</code> . . . . .	263, 273, 285, 286, 300, 301, 1521, 1522, 2045, 2071, 2407, 2417, 2429, 2430, 2445, 2486, 2663, 2664, 2675, 2676, 2828, 3547
<code>\int_decr:N</code> . . . . .	4286, 4335
<code>\int_eval:n</code> . . . . .	380, 798, 2306, 2457, 2557, 2971, 3082, 3095, 3438, 3483, 4275, 4324, 4942
<code>\int_from_alph:n</code> . . . . .	763, 777
<code>\int_from_roman:n</code> . . . . .	765, 779
<code>\int_gadd:Nn</code> . . . . .	4288, 4337
<code>\int_gdecr:N</code> . . . . .	2048, 2053, 2057, 2061, 2074
<code>\int_gincr:N</code> 1881, 1886, 2469, 3026, 3115, 3149, 3328, 3626, 3726, 4098, 4608, 4684, 4864, 4931	
<code>\int_gset:Nn</code> . . . . .	2097, 4492
<code>\int_gset_eq:NN</code> 1780, 1787, 1793, 1799, 1807, 1814, 1820, 1826, 4489	
<code>\int_gzero:N</code> . . . . .	351, 352, 353, 1557, 1584, 2164, 2884, 3642, 3780, 4778, 5047
<code>\int_if_exist:NTF</code> 1755, 1791, 1797, 1818, 1824, 2002	
<code>\int_incr:N</code> 2639, 3503, 3697, 3947, 4537, 4607, 4815, 4863	
<code>\int_mod:nn</code> . . . . .	4769, 5037
<code>\int_new:N</code> . . . . .	28, 29, 30, 31, 32, 33, 61, 62, 87, 104, 123, 144, 145, 156, 157, 158, 160, 171, 177, 178, 179, 180, 181, 1757, 2005
<code>\int_set:Nn</code> 759, 763, 765, 1894, 1901, 1913, 1922, 2776, 4161, 4162, 4202, 4233, 4256, 4262, 4278, 4305, 4311, 4327, 4746, 5014, 5216, 5354	
<code>\int_set_eq:NN</code> . . . . .	1882, 1887, 4285, 4334
<code>\int_sign:n</code> . . . . .	2099
<code>\int_step_function:nnN</code> . . . . .	2423, 2436, 2450
<code>\int_step_function:nnnN</code> . . . . .	5358
<code>\int_step_inline:nn</code> . . . . .	5268
<code>\int_step_inline:nnn</code> . . . . .	4163
<code>\int_to_roman:n</code> . . . . .	216, 2403, 2440
<code>\int_use:N</code> 373, 378, 379, 1213, 1232, 1544, 1896, 1903, 1915, 1924, 3438, 3458, 3483, 3523, 3567, 3576, 3591, 3597, 4260, 4261, 4273, 4309, 4310, 4322, 5689, 5693, 5699, 5703	
<code>\int_zero:N</code> . . . . .	4759, 5027
<code>\item</code> . . . . .	89, 93, 118, 121, 124, 126, 386, 2324, 2330, 2355, 2361, 2483, 2990, 2993, 3167, 3332, 4003, 4005, 4522, 4524, 4797, 4799, 4929
<code>\item*</code> . . . . .	5, 15, 71, 3330
<code>item-pos*</code> . . . . .	3227
<code>item-sym*</code> . . . . .	3227
<code>\itemindent</code> . . . . .	96
<code>\itemindent</code> . . . . .	95
<code>itemindent</code> . . . . .	887
<code>\itemsep</code> . . . . .	3992
<code>\itemwidth</code> . . . . .	464, 2174, 3657, 3663, 3794, 3800, 4296, 4300, 4345, 4349

K

<code>keyans</code> . . . . .	14, 3803
<code>keyans*</code> . . . . .	14, 4785
<code>keyanspic</code> . . . . .	15, 3994

Keys for `\anskey` provide by `enumext`:

<code>break-col</code> . . . . .	77, 79, 82–84
<code>item-join</code> . . . . .	77, 79, 82–84
<code>item-pos*</code> . . . . .	78, 79, 82–84
<code>item-star</code> . . . . .	78, 79, 82–84
<code>item-sym*</code> . . . . .	78, 79, 82–84

Keys for `anskey*` provide by `enumext`:

<code>break-col</code> . . . . .	77, 79, 82–84
<code>item-join</code> . . . . .	77, 79, 82–84

<code>item-pos*</code> . . . . .	78, 79, 82–84
<code>item-star</code> . . . . .	78, 79, 82–84
<code>item-sym*</code> . . . . .	78, 79, 82–84

Keys for environments provide by `enumext`:

<code>above*</code> . . . . .	29, 46, 59–61, 100, 118
<code>above</code> . . . . .	29, 46, 59–61, 100, 118, 123
<code>after</code> . . . . .	48, 101, 118, 124
<code>align</code> . . . . .	29, 39, 89, 91, 94, 120, 134
<code>base-fix</code> . . . . .	45, 62, 73, 98
<code>before*</code> . . . . .	48, 100, 118, 123
<code>before</code> . . . . .	48
<code>below*</code> . . . . .	29, 59–61, 101, 118
<code>below</code> . . . . .	29, 59–61, 101, 118, 124
<code>check-ans</code> . . . . .	31–33, 66–71, 74, 85, 88, 101, 118, 122, 136
<code>columns-sep</code> . . . . .	49, 99, 122
<code>columns</code> . . . . .	29, 49, 59, 99
<code>first</code> . . . . .	48, 121
<code>font</code> . . . . .	39, 91, 94, 109, 120
<code>item-pos*</code> . . . . .	90, 92
<code>item-sym*</code> . . . . .	30, 90, 92
<code>itemindent</code> . . . . .	29, 46, 47, 89, 90, 93, 94, 121
<code>itemsep</code> . . . . .	44, 97, 122
<code>label-pos</code> . . . . .	106, 107, 109, 110
<code>label-sep</code> . . . . .	106
<code>labelsep</code> . . . . .	39, 96, 120
<code>labelwidth</code> . . . . .	38–42, 44, 96, 120
<code>label</code> . . . . .	28, 38, 40, 43, 44, 107, 111
<code>layout-sep</code> . . . . .	106
<code>layout-sty</code> . . . . .	106, 108, 110, 111
<code>layout-top</code> . . . . .	106
<code>lisparindent</code> . . . . .	97
<code>list-indent</code> . . . . .	29, 46, 107
<code>list-offset</code> . . . . .	46, 101, 103
<code>listparindent</code> . . . . .	46, 121
<code>mark-ans</code> . . . . .	71, 74, 78
<code>mark-pos</code> . . . . .	71, 72, 134
<code>mark-ref</code> . . . . .	71, 74, 76, 78
<code>mini-env</code> 29, 36, 49, 58, 59, 74, 100, 111, 114, 115, 118, 123	
<code>mini-right*</code> . . . . .	29, 32, 50, 74, 114, 115, 118
<code>mini-right</code> . . . . .	29, 32, 50, 57, 74, 114, 115, 118
<code>mini-sep</code> . . . . .	29, 49, 74, 100
<code>mode-box</code> . . . . .	39, 89, 91, 94, 95
<code>no-store</code> . . . . .	31, 66–68, 73, 79, 89, 90
<code>noitemsep</code> . . . . .	44
<code>nosep</code> . . . . .	44
<code>parindent</code> . . . . .	97
<code>parsep</code> . . . . .	44, 97, 107, 121
<code>partopsep</code> . . . . .	44
<code>ref</code> . . . . .	28, 32, 40–42, 135
<code>resume*</code> . . . . .	28, 61, 62, 66, 67, 73, 101, 118, 130
<code>resume</code> . . . . .	28, 35, 61–67, 73, 74, 101, 118, 130
<code>rightmargin</code> . . . . .	46, 112
<code>save-ans</code> 30, 35, 62–68, 70, 72–74, 79–82, 85–87, 93, 102, 108, 109, 120, 123–125, 127, 128, 130, 135	
<code>save-key</code> . . . . .	30, 62, 73, 98, 117
<code>save-pos</code> . . . . .	74
<code>save-ref</code> . . . . .	31, 37, 71, 74, 76–78, 86, 87, 94, 125
<code>save-sep</code> . . . . .	71, 74, 86, 125
<code>series</code> . . . . .	28, 61–66, 74, 98, 101, 117, 118, 130
<code>show-ans</code> . . . . .	71, 72, 74, 75, 77, 78, 94, 109, 125
<code>show-length</code> . . . . .	33, 48, 135
<code>show-pos</code> . . . . .	30, 71, 72, 75, 77, 78, 88, 94, 109, 125
<code>start*</code> . . . . .	29, 43, 44, 62
<code>start</code> . . . . .	29, 32, 43, 44, 62
<code>store-key</code> . . . . .	72



topsep	44, 46, 107
widest	28, 32, 44
wrap-ans	37, 71, 74, 75, 78
wrap-label*	29, 39, 89, 91, 93, 94, 119, 120, 125
wrap-label	29, 39, 89-91, 93, 94, 107, 109, 119, 120, 125
wrap-opt	71, 74, 94, 109
keys commands:	
\keys_define:nn	516, 526, 548, 583, 599, 645, 714, 787, 813, 855, 889, 912, 986, 995, 1074, 1091, 1595, 1706, 1949, 2010, 2169, 2211, 2247, 2252, 2567, 2718, 2754, 3229, 3245, 3265, 3285, 3919, 5078, 5178, 5294, 5302
\keys_if_exist_p:nn	5290, 5291
\l_keys_key_str	79, 82, 2585, 2740, 3253, 3271, 3293, 5337, 5445
\keys_precompile:nnN	129, 200, 200, 5080, 5084, 5088, 5092, 5096, 5100, 5320
\keys_set:nn	540, 881, 1097, 1600, 1605, 1843, 1848, 1935, 1943, 2605, 3517, 3522, 3713, 3937, 3940, 3958, 4555, 4837, 5182, 5187, 5188, 5189, 5190, 5193, 5198, 5199, 5200, 5201, 5202, 5203, 5204, 5236, 5346
\keys_set_known:nn	2872
keyval commands:	
\keyval_parse:NNn	1720, 2277, 5154

L

label	597, 643, 714
label-pos	3919
label-sep	3919
Labels provide by enumext:	
\Alph*	38
\Roman*	38
\alph*	38
\arabic*	32, 38
\roman*	38
\labelsep	3988
labelsep	524
\labelwidth	38
\labelwidth	3988
labelwidth	524
\lastkern	249
\lastnodetype	240
\lastskip	244
layout-sep	3919
layout-sty	3919
layout-top	3919
\leftmargin	96
\leftmargin	95, 3988
legacy commands:	
\legacy_if:nTF	4669, 4672, 4954, 4957
\legacy_if_gset_false:n	400, 4392
\legacy_if_set_false:n	4671, 4956
\legacy_if_set_true:n	4634, 4657, 4664, 4678, 4890, 4921
\linewidth	100
\linewidth	3621, 3657, 3723, 3794, 4160, 4205, 4236, 4358, 4423
\list	384
list-indent	887
list-offset	887
\listparindent	3990
listparindent	887

M

\makebox	111
\makebox	2382, 2384, 3212, 3380, 4091, 4702, 4966

\makelabel	89, 91, 94, 111
\makelabel	89, 93, 3194, 3210, 3364, 3378
\makesavenoteenv	435
mark-ans	2167
mark-pos	2167, 2209
mark-ref	2167
mini-env	1072
mini-sep	1072
\minipage	390
\miniright	11, 58, 1513, 1561, 1588, 3640, 3778
mode commands:	
\mode_if_math:TF	2648, 2702
\mode_if_vertical:TF	1151, 1179, 1199, 1223, 1374, 1395
\mode_leave_vertical:	870, 877, 940, 954, 2380, 3159, 4696
mode-box	514
msg commands:	
\msg_error:nn	1563, 1590, 2609, 2642, 2646, 2700, 2808, 3704, 3708, 3950, 4007, 4059, 4540, 4818, 4830, 5205, 5264
\msg_error:nnn	622, 668, 684, 736, 1517, 1524, 1529, 1559, 1586, 1855, 1859, 1974, 2591, 2650, 2668, 2680, 2688, 2692, 2696, 2704, 2746, 3259, 3277, 3299, 4544, 4823, 5066, 5075, 5147, 5252, 5283, 5292, 5329, 5350
\msg_error:nnnn	2594, 2622, 2626, 2630, 2634, 2749, 3262, 3280, 3302, 3695, 4055, 4063, 4813, 5126, 5332
\msg_error:nnnnn	570, 590, 2190, 3929
\msg_fatal:nn	3505
\msg_fatal:nnn	468
\msg_info:nnn	13, 16, 21, 24, 415, 431
\msg_line_context:	5410, 5415, 5420, 5449, 5454, 5459, 5474, 5489, 5493, 5497, 5501, 5505, 5509, 5516, 5523, 5529, 5543, 5547, 5552, 5556, 5560, 5564, 5569, 5573, 5577, 5581, 5586, 5621, 5625, 5630, 5635, 5639, 5644, 5720, 5724, 5729, 5734, 5739, 5743, 5747, 5751, 5755, 5759, 5763, 5767, 5771
\msg_log:nnn	1994, 1999, 2004
\msg_log:nnnnn	377, 2137, 2142, 2147
\msg_log:nnnnnn	369
\msg_new:nnn	5377, 5381, 5385, 5389, 5394, 5407, 5412, 5417, 5422, 5431, 5439, 5443, 5447, 5452, 5457, 5472, 5487, 5491, 5495, 5499, 5503, 5507, 5511, 5520, 5526, 5532, 5536, 5540, 5545, 5550, 5554, 5558, 5562, 5567, 5571, 5575, 5579, 5584, 5619, 5623, 5628, 5633, 5637, 5642, 5718, 5722, 5727, 5732, 5737, 5741, 5745, 5749, 5753, 5757, 5761, 5765, 5769
\msg_new:nnnn	5398, 5589, 5598, 5607, 5613, 5646, 5656, 5666, 5676, 5686, 5696, 5706, 5712
\msg_term:nnnn	1958, 1963, 3447, 3457, 3489, 3494
\msg_term:nnnnn	2118
\msg_warning:nn	3639, 3777
\msg_warning:nnnn	2155, 2161, 3395, 3400, 4259, 4272, 4308, 4321
\msg_warning:nnnnn	2113, 2123
\multicolsep	99
\multicolsep	1216, 1388, 3587, 3750

N

\NeedsTeXFormat	3
\NewCommandCopy	386
\newcounter	471
\NewDocumentCommand	1513, 2597, 4051, 5050, 5105, 5212, 5261, 5339
\NewDocumentEnvironment	3669, 3803, 3994, 4509, 4785

<code>\newenvsc</code>	2711
<code>\newlabel</code>	37
<code>\newlabel</code>	453
<code>no-store</code>	2008
<code>\noindent</code>	3628, 4367, 4432, 4758, 5026
<code>\nointerlineskip</code>	1225, 1228, 1397, 1400, 1551, 1578, 4367, 4432
<code>noitemsep</code>	811
<code>\nopagebreak</code>	1162, 1190, 1225, 1228, 1397, 1400, 1504, 1510
<code>\normalfont</code>	2556, 3081, 3094, 4941
<code>nosep</code>	811

P

Packages:	
<code>caption</code>	114
<code>enumext</code>	27, 37, 40, 66, 95, 96, 106, 134
<code>enumitem</code>	38
<code>expl3</code>	111
<code>footnotehyper</code>	37
<code>hyperref</code>	31, 32, 36, 37, 78, 87, 120, 134
<code>ltxcmd</code>	35
<code>lua-visual-debug</code>	52
<code>multicol</code>	27, 134
<code>scontents</code>	27, 81, 82
<code>shortlst</code>	111, 116, 121
<code>\par</code>	1162, 1190, 1228, 1400, 1504, 1510, 1546, 1551, 1573, 1578, 2532, 3604, 3765, 3783, 4037, 4040, 4180, 4394, 4409, 4455, 4469, 4758, 5026
para commands:	
<code>\para_end:</code>	4775, 5044
<code>\parbox</code>	2174
<code>\parindent</code>	4733, 4997
<code>\parsep</code>	51, 107
<code>\parsep</code>	871, 3480, 3972, 3981
<code>parsep</code>	811
<code>\parskip</code>	4734, 4998
<code>\partopsep</code>	3481, 3781, 3991
<code>partopsep</code>	811
peek commands:	
<code>\peek_meaning:NTF</code>	4613, 4627, 4642, 4653, 4869, 4883, 4898
<code>\peek_meaning_remove:NTF</code>	4620, 4876
<code>\peek_remove_spaces:n</code>	3336
<code>\phantomsection</code>	37
<code>\phantomsection</code>	442
prg commands:	
<code>\prg_do_nothing:</code>	446
<code>\prg_new_protected_conditional:Npnn</code>	218
<code>\prg_replicate:nn</code>	235
<code>\prg_return_false:</code>	222
<code>\prg_return_true:</code>	221
<code>\printkeyans</code>	17, 128, 5105
prop commands:	
<code>\prop_const_from_keyval:Nn</code>	5253
<code>\prop_count:N</code>	371, 2306, 2457, 2559, 2971, 3084, 3097, 4944, 5355
<code>\prop_get:NnNTF</code>	5279
<code>\prop_gput_if_not_in:Nnn</code>	2304
<code>\prop_if_exist:NTF</code>	1992, 5070, 5348
<code>\prop_item:Nn</code>	5072, 5372
<code>\prop_new:N</code>	1995
<code>\ProvidesExplPackage</code>	4

R

<code>\raggedcolumns</code>	3590, 3753
<code>\raisebox</code>	4122

<code>\ref</code>	76, 86
<code>ref</code>	597, 643, 714
<code>\refstepcounter</code>	4681, 4959
regex commands:	
<code>\regex_match:nnTF</code>	220, 762, 764, 776, 778, 2804
<code>\regex_replace_once:nnN</code>	228
<code>\renewcommand</code>	632, 676, 692, 744
<code>\RenewDocumentCommand</code>	1561, 1588, 3167, 3194, 3210, 3332, 3364, 3378, 4005, 4484
<code>\RequirePackage</code>	17, 25
<code>resume</code>	1704
<code>resume*</code>	1704
<code>rightmargin</code>	887
<code>\Roman</code>	38, 43, 44
<code>\Roman</code>	490
<code>\roman</code>	38, 43, 44
<code>\roman</code>	491, 615, 5095

S

<code>\s</code>	2805
<code>save-ans</code>	1947
<code>save-key</code>	2245
<code>save-ref</code>	2167
<code>save-sep</code>	2167
scan commands:	
<code>\scan_stop:</code>	4003, 4522, 4797, 5061, 5064
scontents internal commands:	
<code>\l_scontents_fname_out_tl</code>	2764
<code>\_scontents_parse_environment_keys:n</code>	2770
<code>\_scontents_rescan_tokens:n</code>	2777
<code>\l_scontents_storing_bool</code>	2762
<code>\l_scontents_writing_bool</code>	2763
seq commands:	
<code>\seq_clear:N</code>	5214, 5357
<code>\seq_const_from_clist:Nn</code>	5207
<code>\seq_count:N</code>	372, 4186, 5218
<code>\seq_gclear:N</code>	4482, 4483
<code>\seq_gput_right:Nn</code>	2313, 4495, 4496
<code>\seq_if_empty:NTF</code>	4501, 5120, 5232
<code>\seq_if_exist:NTF</code>	1997, 5118
<code>\seq_if_in:NnTF</code>	5124
<code>\seq_item:Nn</code>	2802, 4173
<code>\seq_map_function:NN</code>	5223
<code>\seq_map_inline:Nn</code>	5133, 5141, 5233, 5234
<code>\seq_map_pairwise_function:NNN</code>	4503
<code>\seq_new:N</code>	124, 125, 127, 142, 172, 173, 2000
<code>\seq_pop_left:NN</code>	5222
<code>\seq_put_right:Nn</code>	4065, 5230, 5246, 5367
<code>\seq_set_from_clist:Nn</code>	5215
<code>\seq_set_map_e:NNn</code>	5224
<code>\seq_use:Nn</code>	200, 201, 5363
<code>series</code>	1704
<code>\setcounter</code>	773, 777, 779, 3438, 3483, 4034
<code>\setenumext</code>	6, 130, 5212
<code>\setenumextmeta</code>	6, 131, 5253
<code>show-ans</code>	2167, 2209
<code>show-length</code>	984
<code>show-pos</code>	2209
skip commands:	
<code>\skip_add:Nn</code>	1122, 1131, 1140, 1153, 1157, 1181, 1185, 1201, 1259, 1261, 1275, 1278, 1299, 1301, 1315, 1318, 1338, 1340, 1354, 1357, 1376, 1425, 1426, 1437, 1439, 3981, 3989
<code>\skip_gset:Nn</code>	1452, 1456, 1460
<code>\skip_gzero_new:N</code>	1447, 1448

<code>\skip_horizontal:N</code>	955, 967, 979, 4699, 4711, 4762, 4975, 5030
<code>\skip_horizontal:n</code>	... 941, 2381, 2389, 3160, 3162, 4598, 4697, 4737, 4854, 5001
<code>\skip_if_eq:nnTF</code>	1120, 1129, 1138, 1245, 1285, 1325, 1413, 1449, 1471, 1612, 1626, 1640, 1651, 1662, 1673, 1684, 1695
<code>\skip_new:N</code>	81, 82, 83, 88, 89, 90, 91, 92, 93, 148, 192
<code>\skip_set:Nn</code>	1105, 1109, 1167, 1171, 1195, 1248, 1249, 1267, 1288, 1289, 1307, 1327, 1328, 1346, 1370, 1416, 1417, 1431, 1451, 1455, 1473, 1477, 1481, 1487, 1491, 1495, 3965
<code>\skip_set_eq:NN</code>	1206, 1207, 1209, 1216, 1381, 1382, 1383, 1388, 3436, 3479, 3480, 4734, 4998
<code>\skip_sub:Nn</code>	1255, 1257, 1271, 1273, 1295, 1297, 1311, 1313, 1334, 1336, 1350, 1352, 1423, 1424, 1435, 1436
<code>\skip_use:N</code>	1107, 1111, 1155, 1159, 1163, 1183, 1187, 1197, 1203, 1613, 1617, 1620, 1627, 1631, 1634, 3604
<code>\skip_vertical:N</code>	... 401, 404, 879, 4393, 4407, 4777, 5046
<code>\skip_vertical:n</code>	... 878, 4776, 5045
<code>\skip_zero:N</code>	1215, 1229, 1367, 1368, 1369, 1387, 1401, 3481, 3587, 3750, 3991, 3992
<code>\skip_zero_new:N</code>	... 1446, 1468, 1469, 1470
<code>\c_zero_skip</code>	... 401, 404, 879, 1120, 1129, 1138, 1286, 1325, 1449, 1471, 1613, 1627, 1640, 1651, 1662, 1673, 1684, 1695, 4393, 4407, 4777, 5046
<code>\small</code>	... 5083, 5087, 5091, 5095, 5099, 5103
socket commands:	
<code>\socket_assign_plug:nn</code>	... 3849, 3857, 3865, 3899, 3907, 3915
<code>\socket_new:nn</code>	... 3821, 3869
<code>\socket_new_plug:nnn</code>	3822, 3829, 3837, 3870, 3877, 3886
<code>\socket_use:n</code>	... 3850, 3900
<code>\socket_use:nn</code>	... 3858, 3866, 3908, 3916
<code>start</code>	... 785
<code>start*</code>	... 785
<code>start-list-tags</code>	... 3821, 3869
<code>\stepcounter</code>	... 3975, 4115, 4488
<code>stop-list-tags</code>	... 3821, 3869
<code>stop-start-tags</code>	... 3821, 3869
str commands:	
<code>\c_backslash_str</code>	2650, 5410, 5415, 5420, 5425, 5427, 5429, 5434, 5436, 5534, 5538, 5542, 5552, 5556, 5564, 5565, 5569, 5581, 5582, 5586, 5587, 5608, 5610, 5614, 5616, 5644, 5707, 5709, 5713, 5715, 5724, 5725, 5729, 5734, 5735, 5739, 5743, 5747
<code>\c_colon_str</code>	... 2456, 2970, 5061
<code>\c_left_brace_str</code>	... 5515, 5522, 5528
<code>\c_right_brace_str</code>	... 5515, 5522, 5528
<code>\str_case:nn</code>	... 256, 315
<code>\str_case:nnTF</code>	... 1727, 1735, 2284, 2292, 5161, 5170
<code>\str_clear:N</code>	... 3514, 4554
<code>\str_count:n</code>	... 235
<code>\str_if_empty:NTF</code>	... 1744, 1785, 1812
<code>\str_if_eq:nnTF</code>	... 3439, 3485, 5263
<code>\str_if_in:nnTF</code>	... 5057
<code>\str_new:N</code>	... 84, 132, 147, 187
<code>\str_set:Nn</code>	... 555, 561, 567, 586, 587, 588, 2187, 2188, 2214, 2215, 3924, 3927
<code>\str_use:N</code>	... 3214
<code>\string</code>	... 435
<code>\strutbox</code>	... 1234, 1237, 1248, 1249, 1260, 1262, 1277, 1280, 1288, 1289, 1300, 1302, 1317, 1320, 1327, 1328, 1339,

1341, 1356, 1359, 1405, 1408, 1416, 1417, 1425, 1426, 1438, 1440, 1451, 1452, 1455, 1462, 1475, 1483, 1489, 1497, 3984, 3989, 4037, 4045, 4128
T
tag commands:
\tag_mc_begin:n . . . . . 3827, 3875, 3884
\tag_mc_end: . . . . . 3831, 3879, 3888
\tag_resume:n . . 3824, 3872, 4011, 4019, 4085, 4177, 4377, 4441
\tag_struct_begin:n . 3825, 3826, 3833, 3834, 3835, 3873, 3874, 3881, 3882, 3883, 4020
\tag_struct_end: . . . . . 4030, 4031
\tag_struct_end:n 3832, 3839, 3840, 3841, 3842, 3880, 3889, 3890, 3891, 3892, 4528, 4803
\tag_suspend:n . 3843, 3893, 4001, 4013, 4025, 4076, 4169, 4520, 4795
\tag_tool:n . . . . . 4012
TeX and L <sup>A</sup> T <sub>E</sub> X 2 <sub>ε</sub> commands:
\@auxout . . . . . 451
\@currentenv . . . . . 256, 315
\protected@write . . . . . 451
tex commands:
\tex_newlinechar:D . . . . . 2776
text commands:
\text_expand:n . . . . . 5053
\textasteriskcentered . . . . . 2184, 3233
\textreferencemark . . . . . 2201
\the . . . . . 244, 249
\thepage . . . . . 457
tl commands:
\c_space_tl 3052, 5459, 5474, 5497, 5501, 5688, 5689, 5698, 5699, 5759, 5763
\tl_clear:N . . 553, 560, 2165, 2231, 2241, 2262, 2270, 2476, 2796, 2797, 2911, 2987, 4904
\tl_clear_new:N . . . . . 500
\tl_const:Nn . . . . . 50, 484
\tl_gclear:N . 363, 364, 365, 1765, 1770, 2886, 3205, 3223, 4413, 4473, 4700
\tl_gclear_new:N . . . . . 1752
\tl_gput_right:Nn . . . . . 485
\tl_greplace_all:Nnn . . . . . 506
\tl_gset:Nn 291, 292, 306, 307, 1753, 1766, 1771, 1990, 2800, 3136, 4648
\tl_gset_eq:NN . . . . . 502, 3132, 4693
\tl_if_blank:nTF 2589, 2607, 2744, 3257, 3275, 3297, 4691, 5327
\tl_if_empty:NTF . 620, 638, 666, 682, 701, 708, 734, 750, 1778, 1783, 1805, 1810, 1868, 1932, 1940, 1969, 2029, 2320, 2351, 2496, 2841, 2863, 2893, 2921, 2997, 3046, 3157, 4184, 4907, 5244
\tl_if_empty:nTF . . . . . 1833
\tl_if_exist:NTF . . . . . 1838
\tl_if_novalue:nTF . . 2603, 2919, 2995, 3031, 3111, 3130, 3138, 3307, 3512, 3956, 4486, 4552, 4835, 4905
\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 . . . . . 2830
\tl_put_left:Nn 2328, 2359, 2481, 2824, 2837, 2843, 2853, 3063, 3103, 4397, 4458, 4926, 4929
\tl_put_right:Nn 501, 630, 674, 690, 742, 2332, 2363, 2410, 2420, 2433, 2448, 2454, 2459, 2483, 2488, 2495, 2498, 2508, 2513, 2516, 2522, 2914, 2917, 2923, 2928,

2955, 2960, 2965, 2968, 2977, 2990, 2993, 2999, 3004, 3014, 4909, 4913	
<code>\tl_remove_all:Nn</code>	5243
<code>\tl_remove_once:Nn</code>	2398, 2940
<code>\tl_replace_all:Nnn</code>	505, 5278
<code>\tl_reverse:N</code>	2397, 2399, 2939, 2941
<code>\tl_set:Nn</code>	58, 260, 270, 319, 320, 327, 328, 335, 336, 470, 554, 559, 565, 566, 619, 663, 733, 938, 952, 965, 977, 1867, 1968, 2232, 2242, 2263, 2271, 2553, 2764, 3033, 3078, 3091, 4915, 4938, 5241, 5277, 5347
<code>\tl_set_eq:NN</code>	511, 625, 628, 671, 673, 687, 689, 739, 741, 2396, 2938, 2951, 3319, 3324, 4103, 4105
<code>\tl_to_str:n</code>	1838, 1844, 1849, 5053
<code>\tl_trim_spaces:n</code>	501, 5230, 5241, 5247, 5263
<code>\tl_use:N</code>	507, 510, 640, 703, 710, 752, 1010, 1014, 1018, 1022, 1026, 1030, 1034, 1038, 1042, 1046, 1050, 1054, 1058, 1062, 1066, 1070, 2386, 2403, 2411, 2422, 2435, 2440, 2451, 3119, 3125, 3153, 3196, 3197, 3204, 3216, 3310, 3314, 3322, 3366, 3367, 3373, 3382, 3676, 3809, 4108, 4404, 4465, 4704, 4738, 4739, 4968, 5002, 5007, 5108, 5109, 5110, 5111, 5112, 5129, 5226, 5345
token commands:	
<code>\token_to_str:N</code>	453
<code>\topsep</code>	3781, 3989
<code>topsep</code>	811
<code>\topskip</code>	1215, 1387
<code>\typeout</code>	244, 249, 419, 423, 434, 435

U

<code>\u</code>	229, 2805
<code>\unkern</code>	250
unknown	3243, 3265, 3283
<code>\unskip</code>	245
use commands:	
<code>\use:N</code>	236, 3201, 3220, 3678
<code>\use:n</code>	1718, 2275, 5059, 5152
<code>\use_none:nn</code>	445, 5284
<code>\usecounter</code>	3437, 3482

V

<code>\value</code>	1781, 1787, 1794, 1800, 1808, 1814, 1821, 1827
vbox commands:	
<code>\vbox_set:Nn</code>	4078
<code>\vbox_set_top:Nn</code>	4402, 4463
<code>\vspace</code>	871, 1617, 1620, 1631, 1634, 1644, 1646, 1655, 1657, 1666, 1668, 1677, 1679, 1688, 1690, 1699, 1701

W

widest	785
<code>wrap-ans</code>	2167
<code>wrap-label</code>	524
<code>wrap-label*</code>	524
<code>wrap-opt</code>	2167

Z

<code>\z</code>	2805
-----------------	------