

# enumext

ENUMERATE EXERCISE SHEETS

v1.6 2025-06-21<sup>\*</sup>

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

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

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

## Abstract

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

## Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>	5.7	Keys for multicol	11
1.1	Description and usage	2	5.8	Keys for minipage	11
1.2	The concept of left margin	3	5.8.1	The command <code>\miniright</code>	11
1.3	User interface	3	5.8.2	The key <code>mini-right</code>	12
1.3.1	Public counters	3	<b>6</b>	<b>The storage system</b>	12
1.3.2	Public dimension	3	6.1	Keys for storage system	12
1.3.3	Support for multicol	4	6.1.1	Keys for <code>label</code> and <code>ref</code>	13
1.3.4	Support for minipage	4	6.1.2	Keys for wrap and marks	13
1.3.5	The <code>\label</code> and <code>\ref</code> system	4	6.1.3	Keys for debug and checking	14
1.3.6	Support for <code>\footnote</code>	4	6.2	The command <code>\anskey</code>	14
<b>2</b>	<b>The environments provided</b>	<b>5</b>	6.2.1	Keys for <code>\anskey</code>	14
2.1	The environment <code>enumext</code>	5	6.3	The environment <code>anskey*</code>	15
2.2	The environment <code>enumext*</code>	5	6.3.1	Keys for <code>anskey*</code>	15
2.3	The command <code>\item*</code>	5	6.4	The environment <code>keyans</code>	16
2.3.1	Keys for <code>\item*</code>	6	6.4.1	The <code>\item*</code> in <code>keyans</code>	17
2.4	The command <code>\item</code> in <code>enumext*</code>	6	6.5	The environment <code>keyanspic</code>	17
<b>3</b>	<b>The command <code>\setenumext</code></b>	<b>6</b>	6.5.1	Keys for <code>keyanspic</code>	18
<b>4</b>	<b>The command <code>\setenumextmeta</code></b>	<b>6</b>	6.5.2	The command <code>\anspic</code>	18
<b>5</b>	<b>The keyval system</b>	<b>7</b>	6.6	Printing stored content	19
5.1	Keys for <code>label</code> and <code>ref</code>	7	6.6.1	The command <code>\getkeyans</code>	19
5.2	Keys for penalties	8	6.6.2	The command <code>\foreachkeyans</code>	19
5.3	Keys for spaces	8	6.6.3	The command <code>\printkeyans</code>	20
5.3.1	Vertical spaces	8	<b>7</b>	<b>Full examples</b>	<b>21</b>
5.3.2	Horizontal spaces	9	<b>8</b>	<b>Tagged PDF examples</b>	<b>24</b>
5.4	Keys for add code	10	<b>9</b>	<b>The way of non-enumerated lists</b>	<b>24</b>
5.5	Keys for start, series and resume	10	<b>10</b>	<b>References</b>	<b>26</b>
5.6	Keys for reset	11	<b>11</b>	<b>Change history</b>	<b>27</b>
5.6.1	The command <code>\resetenumext</code>	11	<b>12</b>	<b>Index of Documentation</b>	<b>28</b>
			<b>13</b>	<b>Implementation</b>	<b>30</b>
			<b>14</b>	<b>Index of Implementation</b>	<b>151</b>

## Motivation and acknowledgments

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

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

This package would not be possible without Phelype Oleinik who has collaborated and adapted a large part of the code and all  $\text{\LaTeX}$  team for their great work and to the different members of the  $\text{\TeX-SX}$  community who have provided great answers and ideas. Here a note of the main ones:

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

<sup>\*</sup>This file describes a documentation for v1.6, last revised 2025-06-21.

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

License and Requirements

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

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

1 Introduction

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

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

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

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

3. True False

(a)  $\alpha > \delta$

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

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

(b) Usually uses the package manager?

(c) Rate the following package and class

i. xsim-exam

ii. xsim

iii. exsheets

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

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

\* 

$(x - 1)^2$

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

\* 

$3(x + y + z)$

3. True False

(a)  $\alpha > \delta$ 

\* 

False

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

\* 

Very True!

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

\* 

Yes

(b) Usually uses the package manager?

\* 

Yes, dnf

(c) Rate the following package and class

i. xsim-exam

\* 

doesn’t exist for now :(

ii. xsim

\* 

very good

iii. exsheets

\* 

obsolete

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

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

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

1.  $(x - 1)^2$ 

⌘

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

⌘

3. (a) False

(b) Very True!

⌘

4. (a) Yes

⌘
- (b) Yes, dnf

⌘

(c) i. doesn’t exist for now :(

⌘

ii. very good

⌘

iii. obsolete

⌘

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

1. First type of questions

A) value

C) value

B) correct

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

D) I and III only

B) II only

E) I, II, and III

C) I and II only

★ 3. Third type of questions

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

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

A) value

D) value

B) value

E) value

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

A

A)

B


B)

A

C)

A

D)



E)

5. Question with image on right side:

A) value

B) value

C) value

D) correct

E) value

B

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

1. B)  $x = 5$

2. D)

3. C) some note
- ⌘ 4. E) A duck

⌘ 5. D) “other note”

⌘

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

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

1.1 Description and usage

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

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

This package can be used with `xelatex`, `lualatex`, `pdflatex` and the classical `latex`»`dvips`»`ps2pdf` and is present in  $\text{\TeX}$  Live and  $\text{MiK}\text{\TeX}$ , use the package manager to install. For manual installation, download `enumext.zip` and unzip it, run `luatex enumext.ins` and move all files to appropriate locations, then run `mktexlsr`. To produce the documentation run `arara enumext.dtx`.

<code>enumext.sty</code>	»	<code>TDS:tex/latex/enumext/</code>
<code>enumext.pdf</code>	»	<code>TDS:doc/latex/enumext/</code>
<code>README.md</code>	»	<code>TDS:doc/latex/enumext/</code>
<code>enumext.dtx</code>	»	<code>TDS:source/latex/enumext/</code>
<code>enumext.ins</code>	»	<code>TDS:source/latex/enumext/</code>

The package is loaded in the usual way:

```
\usepackage{enumext}
```

1.2 The concept of left margin

There is a direct relationship between the parameters `\leftmargin`, `\itemindent`, `\labelwidth` and `\labelsep` plus an “extra space” that makes it difficult to obtain the desired *horizontal spaces* in a `list` environment. Usually we don’t want the `list` to go beyond the left margin of the page, but since these four values are related, that causes a problem.

The `enumitem`[6] package adds the `\labelindent` parameter to solve some of these problems. A simplified representation of this in the figure 1.

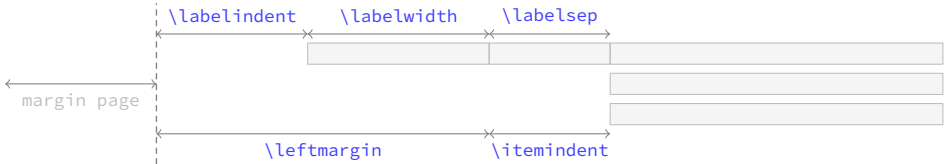


Figure 1: Representation of horizontal lengths in `enumitem`.

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

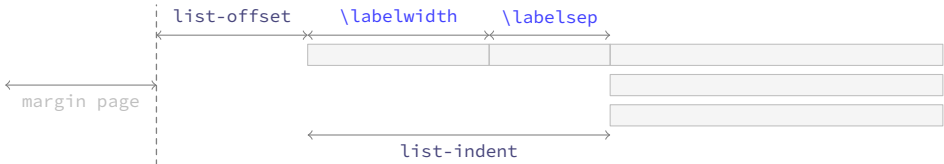


Figure 2: Representation of horizontal lengths concept in `enumext`.

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

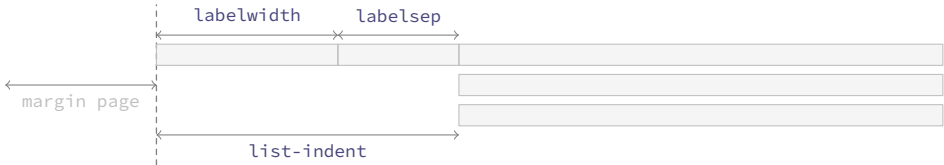


Figure 3: Default horizontal lengths `list-offset=0pt`, `list-indent=\labelwidth+\labelsep` in `enumext`.

### 1.3 User interface

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

#### 1.3.1 Public counters

The package `enumext` uses 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.

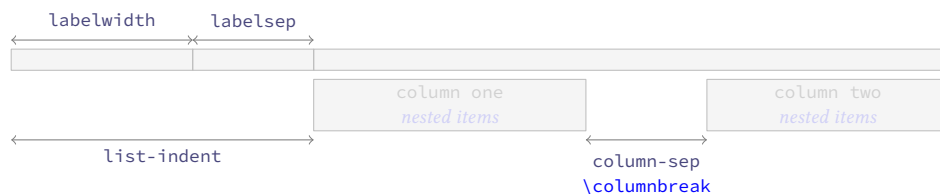


Figure 4: Representation of the two column output for a nested level in `enumext` environment.

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 §5.7).

- 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 §5.8).

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

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

#### 1.3.6 Support for \footnote

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

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

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

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

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

2 The environments provided

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

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

2.1 The environment enumext

The `enumext` is an environment that works in the same way as the standard `enumerate` environment provided by  $\text{\LaTeX}$ , `\item` and `\item[⟨custom⟩]` commands work in the usual way. The environment can be nested with at most “four levels” and the options can be configured globally using `\setenumext` command and locally using `[⟨key = val⟩]` in the environment.

Example with `columns=2`

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

2.2 The environment enumext\*

The `enumext*` is a *horizontal list environment* similar to the `shortenumberate` or `tasks` environments provided by the `shortlst`[16] and `tasks`[17] packages, `\item` and `\item[⟨custom⟩]` work as usual. The options can be configured globally using `\setenumext` command and locally using `[⟨key = val⟩]` in the environment.

Some considerations to take into account for this environment:

- The environment cannot be nested within itself or in the environment `keyans*`, but it can be nested within `enumext` and vice versa.
- Each “item content” in the environment is placed within a `minipage` environment whose *width* is stored in the dimension `\itemwidth` that NOT includes `labelwidth`, `labelsep`, only the *width of the content*.
- You cannot have floating environments like `figure` or `table` but `\footnote` with `hyperref` support is supported if the `footnotehyper` package is loaded (see §1.3.6 for full support).
- You cannot have any standard list environments like `itemize`, `enumerate`, `description`, `quote`, `quotation`, `verse`, `center`, `flushleft`, `flushright`, `verbatim`, `tabbing`, `trivlist`, `list` and all environments created with `\newtheorem`.

Example with `columns=2`

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

2.3 The command \item\*

```
\item* \item* [⟨symbol⟩] [⟨offset⟩]
```

The `\item*`, `\item* [⟨symbol⟩]` and `\item* [⟨symbol⟩] [⟨offset⟩]` works like the numbered `\item`, but placing a `⟨symbol⟩` to the “left” of the `⟨label⟩` separated from it by the `⟨offset⟩` set by the the *second optional argument*. The *starred argument* “\*” cannot be separated by spaces ‘ ’ from the command, i.e. `\item*` and the *first optional argument* does “NOT” support *verbatim content*. Can be configure with the keys `item-sym*` and `item-pos*` locally in the environment or globally using `\setenumext` command (§3).

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

2.3.1 Keys for \item\*

`item-sym*` = {<symbol>} default: \textborn  
Sets the *symbol* to be displayed in the “left” of the box containing the current <label> set by `labelwidth` key for `\item*` in `enumext` and `enumext*`. The *symbol* can be in *text* or *math* mode, for example `item-sym*={\star}`.  
  
`item-pos*` = {<rigid length>} default: by levels  
Sets the *offset* between the box containing the current <label> defined by `labelwidth` key and the <symbol> set by `item-sym*` key. The default values are set by `labelsep` key at each level. If positive values are passed it will *offset to the left* and if negative values are passed it will *offset to the right*.

2.4 The command \item in enumext\*

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

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

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

3 The command \setenumext

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

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

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

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

4 The command \setenumextmeta

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

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

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



## 5 The keyval system

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

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

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

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

### 5.1 Keys for label and ref

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

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

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

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

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

- This key is intended to give the basic structure with which the  $\langle label \rangle$  will be displayed, and the form in which it is used by standard “*label and ref*” and the “*internal label and ref*” system with the `save-ref` key. You cannot use commands with  $\langle label \rangle$  as an argument, for example `\emph{\langle \backslash alph* \rangle}` will return an error. For full customization of how  $\langle label \rangle$  is displayed use the `font`, `wrap-label` and/or `wrap-label*` keys.

`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 the `label` key. Internally sets the value of `\labelwidth` for the current level. The default values are calculated by means of the *width* of a box by setting a *value* to the current counter set by `label` key using ‘0’ for `\arabic*`, ‘M’ for `\Alph*`, ‘m’ for `\alph*`, ‘VIII’ for `\Roman*` and ‘viii’ for `\roman*`.

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

Sets the `labelwidth` key pass the  $\langle integer \rangle$  or converting the  $\langle string \rangle$  of the form `\Alph`, `\alph`, `\Roman` or `\roman` to a *value* for the current counter defined by `label` key, then calculating the *width* by means of a box. For example `widest={XXIII}` or `widest={23}` are equivalent. This key is useful when the default values of the `labelwidth` key are smaller than those actually used.

`font` = {  $\langle font commands \rangle$  } default: *empty*

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

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

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

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

Wraps the *current*  $\langle label \rangle$  defined by `label` key referenced by  $\{ \#1 \}$  after executing the `align` and `font` keys. The  $\{ \langle code \rangle \}$  must be passed between braces and this does not modify the value set by the `labelwidth` key and is applied *only* on `\item` and `\item*`. When using it in the `\setenumext` command it is necessary to use the *double* ‘ $\{ \# \#1 \}$ ’. For example `wrap-label={\fbox{\#1}}` or you can create a command:

```
\NewDocumentCommand \mywrap { s m }
{
  \IfBooleanTF{\#1}
  {
    {\textcolor{red}{\textbf{Q}}\textcolor{blue}{\textbf{.}}\textcolor{gray}{\#2}}
    {\textcolor{blue}{\textbf{Q}}\textcolor{red}{\textbf{.}}\textcolor{gray}{\#2}}
  }
}
```

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

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

Page breaks in the provided environments are controlled by the following three parameters, which work together to ensure they look good, avoiding unsightly page breaks that could distort the output.

`beginpenalty = {\integer}` default: *-51*

Set the *page breaking* penalty for breaking at the beginning of the `enumext`, `enumext*`, `keyans`, and `keyans*` environments. Internally sets the value of `\@beginparpenalty`.

`midpenalty = {\integer}` default: *-51*

Set the *page breaking* penalty for breaking between items of the `enumext`, `enumext*`, `keyans`, and `keyans*` environments. Internally sets the value of `\@itempenalty`.

`endpenalty = {\integer}` default: *-51*

Set the *page breaking* penalty for breaking at the end of the `enumext`, `enumext*`, `keyans`, and `keyans*` environments. Internally sets the value of `\@endparpenalty`.

- The values passed to these *keys* affect the nested environments in which they were set and cannot be reset. L<sup>A</sup>T<sub>E</sub>X default is `-\@lowpenalty`, that is, `-51`. Because it is negative, it somewhat encourages a page break at each spot. Change it with, e.g., `\@beginparpenalty=9999`; a value of `10000` prohibits a page break. Please, refer to your L<sup>A</sup>T<sub>E</sub>X or T<sub>E</sub>X manual about how penalties control page breaks.

## 5.3 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`.

### 5.3.1 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`  $\langle \text{value forbidden} \rangle$  default: *not used*  
This is a “meta-key” that does not receive an argument. Set `itemsep` and `parsep` equal to 0pt the entire level of environment.

`nosep`  $\langle \text{value forbidden} \rangle$  default: *not used*  
This is a “meta-key” that does not receive an argument. Sets all keys for vertical spacing equal to 0pt the entire level of environment.

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

- This key is provided as a way to work around this minor issue, but you should be aware that if for some reason you have the `itemindent` key set in the `enumext*` environment it will be lost and you will need to adjust it using the `list-offset` key in the `enumext` environment.

### Extra vertical spaces

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

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

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

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

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

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

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

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

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

### 5.3.2 Horizontal spaces

`list-offset` =  $\{ \langle \text{rigid length} \rangle \}$  default: 0pt

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

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

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

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

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

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

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

`rightmargin = {⟨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.

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

## 5.4 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” all calculations related to the *list parameters* in the environment and the *⟨keys⟩* sets by `[⟨key = val⟩]` have been performed, with the exception of the *⟨keys⟩* `start` and `start*`, that is, in the *second argument* of the list: `\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 the *⟨keys⟩* sets in `[⟨key = val⟩]` of the environment that is, “before” the arguments defining the list environment are executed: `{⟨code⟩}\begin{list}{⟨arg one⟩}{⟨arg two⟩}`.

`first = {⟨code⟩}` default: *not used*

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

- Keep in mind that the `{⟨code⟩}` set in this *⟨key⟩* will affect the entire “body” of the environment and therefore the inner levels of the list and the `keyans`, `keyans*` and `keyanspic` environments. It is recommended to set this *⟨key⟩* per level. In the `enumext*` and `keyans*` environments this *⟨key⟩* is executed “after” the `listparindent`, `parsep` and `itemindent` *⟨keys⟩* within the `minipage` environment in which the “item content” is placed.

`after = {⟨code⟩}` default: *not used*

Execute `{⟨code⟩}` “after” finishing the environment. The `{⟨code⟩}` must be passed between braces.

## 5.5 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 available only for the `enumext` and `enumext*` environments.

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

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

- For security reasons the `series` key will never save in `{⟨series name⟩}` the *⟨keys⟩* `series`, `resume`, `resume*`, `save-ans`, `save-key`, `start*` and `start`.

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

Sets the *start value* and *options* for the “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.

- 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*.

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

Sets the *start value* and *options* for the “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.

- 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.

## 5.6 Keys for reset

`reset` *⟨value forbidden⟩*

default: *not used*

Sets the *start value* and *options* for the “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.

`reset*` *⟨value forbidden⟩*

default: *not used*

Sets the *start value* and *options* for the “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.

### 5.6.1 The command `\resetenumext`

---

<code>\resetenumext</code>	<code>\resetenumext[⟨1⟩]{⟨some counter⟩}</code>	<code>\resetenumext[⟨4⟩]{⟨some counter⟩}</code>
	<code>\resetenumext[⟨2⟩]{⟨some counter⟩}</code>	<code>\resetenumext[⟨*⟩]{⟨some counter⟩}</code>
	<code>\resetenumext[⟨3⟩]{⟨some counter⟩}</code>	<code>\resetenumext*{⟨some counter⟩}</code>

---

The `\resetenumext` command “resets” the *⟨counters⟩* for the `enumext` and `enumext*` environments along with the *⟨internal values⟩* used by the keys `resume without value` and `resume*` according to the value of *⟨{some counter}⟩*. For example `\resetenumext{chapter}` will “reset” the numbering of “all levels” of the `enumext` environment for each execution of a “numbered” chapter.

The *optional argument* of the form `[1]`, `[2]`, `[3]`, `[4]` “reset” the values for levels 1, 2, 3 and 4 of the `enumext` environment, the form `[*]` “reset” the values for the `enumext*` environment. If is run *without* the *optional argument*, it will “reset” the values for “all levels” of the `enumext` environment.

The *starred argument* “\*” will “reset” the values for “all levels” of the `enumext` and `enumext*` environments.

## 5.7 Keys for multicol

`columns = {⟨integer⟩}`

default: 1

Set the *number of columns* to be used by the `multicol` environment within the environments `enumext` and `keyans`. The value must be a positive integer less than or equal to 10. In the `enumext*` and `keyans*` environments they correspond to the default number of columns (without joining) and internally adjust the value of `\itemwidth`.

`columns-sep = {⟨rigid length⟩}`

default: *by level*

Set the *space between columns* used by the `multicol` environment within the environments `enumext` and `keyans`. Internally sets the value of `\columnsep`, by default its value is equal to the sum of the values set in the keys `labelwidth` and `labelsep` of the current level. In the `enumext*` and `keyans*` environments they correspond to the *space between columns* (without joining) and internally adjust the value of `\itemwidth`.

## 5.8 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`.

### 5.8.1 The command `\miniright`

---

<code>\miniright</code>	<code>\begin{enumext}[mini-env={⟨rigid length⟩}]</code>	<i>⟨item's before⟩</i>	<code>\item \miniright</code>	<i>⟨content⟩</i>	<code>\end{enumext}</code>
	<code>\begin{enumext}[mini-env={⟨rigid length⟩}]</code>	<i>⟨item's before⟩</i>	<code>\item \miniright*</code>	<i>⟨content⟩</i>	<code>\end{enumext}</code>

---

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

The *starred argument* “\*” inhibits the use of `\centering` command i.e. the usual  $\TeX$  justification is maintained in the `minipage` on the “right side”.

### 5.8.2 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.

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

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

By executing the key `save-ans={⟨store name⟩}` the entire “*structure*” of the environment (excluding the *first level*) including the *optional argument* passed to the inner levels or the environment nested in it, along with the `⟨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* `{⟨store name⟩}` would be `nosep`, `columns=2`, but using the key `save-key={columns=3}` will overwrite and the “*stored key*” in the *sequence* `{⟨store name⟩}` are only `columns=3` ignoring all the others.

`save-sep = {⟨text symbol⟩}`

default: `{,}`

Sets the *text symbol* that will separate the current `⟨label⟩` 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* `{⟨store name⟩}` set by `save-ans` key. The `{⟨text symbol⟩}` must always be passed between braces, whitespace ‘`␣`’ is preserved within the braces and only affects the “*stored content*” and not what is displayed when using the `show-ans` or `show-pos` keys.

`no-store` `⟨value forbidden⟩`

default: *not used*



This is a “switch-key” that does not receive an argument and disables the “*storing content*” in the *sequence* and *prop list*  $\{\langle store name \rangle\}$  set by `save-ans` key at the entire level or a nested environment in which it runs. This key is intended for use in internal levels or nested `enumext` or `enumext*` environments in which you want to use `enumext` or `enumext*` but “without” using the `\anskey` command or use `anskey*` environment and “without” interfering with the `check-ans` key.

### 6.1.1 Keys for label and ref

`save-ref` =  $\{\langle true | false \rangle\}$

default: *false*

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

`mark-ref` =  $\{\langle symbol \rangle\}$

default: *\textreferencemark*

Sets the *symbol* that will be displayed by the `\printkeyans` command only if the `hyperref` package is detected and the `save-ref` key are active. This “*symbol*” is used as a “*link*” between the environment in which the `save-ans` key was used and the place where the command is executed.

### 6.1.2 Keys for wrap and marks

The `enumext` package provides a set of  $\langle keys \rangle$  to set and manipulate “*symbol marks*” associated with “*answers*” and how they are displayed and stored in the *sequence* and *prop list*.

The  $\langle keys \rangle$  available for the `\anskey` command and the `anskey*` environment can be passed “*only*” in the *optional argument* in the “*first level*” of the `enumext` or `enumext*` environment.

The  $\langle keys \rangle$  available for the `keyans` and `keyans*` environments can be passed locally in the *optional argument*, at the “*first level*” of the `enumext` or `enumext*` environment or via the `\setenumext` command with one minor difference, when  $\langle keys \rangle$  are passed through the “*first level*” of the `enumext` or `enumext*` environment they are set in “*both*” environments, but when they are passed using the `\setenumext` command they are set “*individually*” in each environment.

`show-ans` =  $\{\langle true | false \rangle\}$

default: *false*

Display the *symbol* set by the `mark-ans` key to the left of the *mandatory argument*  $\langle content \rangle$  passed to the `\anskey` command and  $\langle body \rangle$  for the `anskey*` environment using the `wrap-ans` key if set.

For `\item*` and `\anspic*` the `keyans`, `keyans*` and `keyanspic` environments it will display the *symbol* set by the `mark-ans*` key to the left of the current  $\langle label \rangle$  and *optional argument*. If the *optional argument* is present in `\item*` or `\anspic*` it will be shown using `wrap-opt` key.

### Keys for \anskey and anskey\*

`mark-ans` =  $\{\langle symbol \rangle\}$

default: *\textasteriskcentered*

Sets the *symbol* to be displayed in the left margin for `\anskey` command and `anskey*` environment when using the key `show-ans`. The “*symbol*” is placed in a box of width equal to the value of `labelwidth` at the current level, separated by the value of the key `mark-sep` and aligned by the value of the key `mark-pos`. This key is not affected by the keys `font` or `wrap-label` so if you want to apply *styling* you have to do it directly, for example: `mark-ans={\textcolor{red}{\textbf{\textasteriskcentered}}}`

`mark-pos` =  $\{\langle left | right | center \rangle\}$

default: *left*

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

`mark-sep` =  $\{\langle rigid length \rangle\}$

default: *labelsep*

Sets the *horizontal space* between the box containing the “*symbol*” defined by `mark-ans` key and the *mandatory argument*  $\langle content \rangle$  passed to the `\anskey` command and the *body* in `anskey*` environment.

`wrap-ans` =  $\{\langle code \{ \#1 \} more code \rangle\}$

default: *\fbox+\parbox{\#1}*

Wraps the *mandatory argument*  $\langle content \rangle$  passed to the `\anskey` and the  $\langle body \rangle$  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 how the *argument* or *body* is displayed 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 ‘ $\{ \# \#1 \}$ ’.



### Keys for keyans, keyans\* and keyanspic

- `mark-ans*` = {`<symbol>`} default: `\textasteriskcentered`  
 Sets the *symbol* to be displayed in the left margin for `\item*` and `\anspic*` for the `keyans`, `keyans*` and `keyanspic` environments when using the key `show-ans`. The “*symbol*” is placed in a box of width equal to the value of `labelwidth` of the environment in which it is executed, separated by the value of the key `mark-sep*` and aligned by the value of the key `mark-pos*`. This key is not affected by the keys `font` or `wrap-label` so if you want to apply *styling* you have to do it directly, for example: `mark-ans*={\textcolor{red}{\textbf{\textasteriskcentered}}}`.
- `mark-pos*` = {`<left | right | center>`} default: `left`  
 Sets the *aligned* of the “*symbol*” defined by `mark-ans*` key for the `keyans`, `keyans*` and `keyanspic` environments. The “*symbol*” is aligned in a box with the same dimensions of the label box defined by `labelwidth` key of the environment in which it is executed and separated by the value of the `mark-sep*` key.
- `mark-sep*` = {`<rigid length>`} default: `labelsep`  
 Sets the *horizontal space* between the box containing the “*symbol*” defined by `mark-ans*` key and the current `<label>` for `\item*` and `\anspic*` in the `keyans`, `keyans*` and `keyanspic` environments.
- `wrap-ans*` = {`<code> {#1} more code`} default: `not used`  
 Wraps the *current* `<label>` when using the `show-ans` key for `\item*` and `\anspic*` referenced by `{#1}` in the `keyans`, `keyans*` and `keyanspic` environments after executing the `align` and `font` keys. The `{<code>}` must be passed between braces and *only* affects how the `<label>` is displayed and NOT the “*stored label*” in the *sequence* and *prop list* `{<store name>}` set by `save-ans` key. This key overwrites the key `wrap-label` and if is passed using `\setenumext` it is necessary to use double `'{#1}'`. For example, if you want the `<label>` to be displayed in red when using `show-ans` you just set `wrap-ans*={\textcolor{red}{#1}}`.
- `wrap-opt` = {`<code> {#1} more code`} default: `[{#1}]`  
 Wraps the *optional argument* passed to the `\item*` and `\anspic*` referenced by `{#1}` in the `keyans`, `keyans*` and `keyanspic` environments when using the `show-ans` or `show-pos` keys. The `{<code>}` must be passed between braces and *only* affects the current *optional argument* and NOT the “*stored content*” in the *sequence* and *prop list* `{<store name>}` set by `save-ans` key. If this key is passed using `\setenumext` it is necessary to use double `'{#1}'`.

#### 6.1.3 Keys for debug and checking

- `show-pos` = {`<true | false>`} default: `false`  
 Displays the *position* occupied by the “*stored content*” by `\anskey`, `anskey*`, `\item*` and `\anspic*` in the *prop list* `{<store name>}` set by `save-ans` key. This position is used by the `\getkeyans` command and by the `\ref` command if the `save-ref` key is active.
- `check-ans` = {`<true | false>`} default: `false`  
 Enables the *checking answer* mechanism displaying an appropriate message on the terminal. This key works under the logic that each `\item` or `\item*` that does not open an inner level or nested environment contains “*only one answer*” or “*only one execution*” of the `\anskey` or `anskey*`. It is intended to be used in conjunction with the `no-store` key.

## 6.2 The command `\anskey`

---

`\anskey` `\anskey[<keys>]{<content>}`

---

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

If `save-ref` key are active and the `hyperref`[8] package is detected, `\hyperlink` and `\hypertarget` will be used, otherwise the usual “*label and ref*” system provided by  $\LaTeX$  will be used.

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

#### 6.2.1 Keys for `\anskey`

By default the *mandatory argument* `<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  $\langle content \rangle$  in the *sequence*  $\langle store name \rangle$  of the form  $\backslash item^* \langle content \rangle$ .

`item-sym*` =  $\langle symbol \rangle$

default: *not set*

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

`item-pos*` =  $\langle rigid length \rangle$

default: *not set*

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

### Example

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

★ 1. Text containing our instructions or questions.

\*

2. Text containing our instructions or questions.

(a) Question.

\*

3. Text containing our instructions or questions.

\*

4. Text containing our instructions or questions.

\*

## 6.3 The environment `anskey*`

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

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

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

The `anskey*` environment is implemented using the new “*collect code*” c-type argument part of  $\LaTeX$  release 2025-06-01[13].  $\backslash begin\{anskey^*\}$  and  $\backslash end\{anskey^*\}$  must be in different lines and should not appear within verbatim environments or commands. All  $\langle keys \rangle$  must be passed separated by commas and “without separation” of the start of the environment.

Comments “%” or “any character” after  $\backslash begin\{anskey^*\}$  or  $[\langle key = val \rangle]$  on the same line are NOT supported,  $\LaTeX$  will return an “error” message if this happens. In a similar way comments “%” or “any character” after  $\backslash end\{anskey^*\}$  on the same line  $\LaTeX$  will return a “warning” message.

### 6.3.1 Keys for `anskey*`

The `anskey*` environment uses the same  $\langle keys \rangle$  as the `\anskey` command next to the  $\langle keys \rangle$  `write-env`, `overwrite` and `force-eol`. The environment is available for all levels of the `enumext` environment and the `enumext*` environment, but it is disabled for the `keyans`, `keyans*` and `keyanspic` environments.

`write-env` =  $\langle file.ext \rangle$

default: *not used*

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

`overwrite` =  $\langle true | false \rangle$

default: *false*

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

`force-eol` =  $\langle true | false \rangle$

default: *false*

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

Example

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

  \begin{anskey*}[item-star]
    \first answer
  \end{anskey*}

  \item Text containing our instructions or questions.

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

  \item Text containing our instructions or questions.

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

  \item Text containing our instructions or questions.

  \begin{anskey*}
    \fourth answer
  \end{anskey*}
\end{enumext}
```

- ★ 5. Text containing our instructions or questions.

[5] First answer with verbatim
6. Text containing our instructions or questions.

(a) Question.

[6] second answer
7. Text containing our instructions or questions.

[7] third answer
8. Text containing our instructions or questions.

[8] fourth answer

6.4 The environments keyans and keyans\*

keyans	<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.

- 🔴

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

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

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

The keys `mark-ans*`, `mark-pos*`, `mark-sep*`, `save-sep`, `wrap-opt`, `wrap-ans*`, `show-ans` and `show-pos` are available for both environments.

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

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

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

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


Example

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

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

  \item Text containing a question and image.

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

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

6.5 The environment keyanspic

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

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

When the `keyanspic` environment is used *without keys* the `\label`s are centered *below* the *drawings or tabular* in a *single line* layout style.

A representation of the output can be seen in the figure 6.

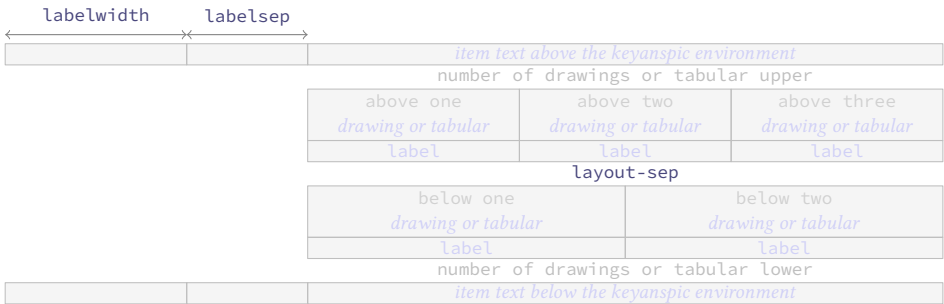


Figure 6: Representation of the `keyanspic` environment with `layout-sty={\langle 3, 2 \rangle}` in `enumext`.

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

### 6.5.1 Keys for keyanspic

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

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

`label-sep = {⟨rubber length | rigid length⟩}` default: *internal adjustment*

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

`layout-sty = {⟨n° upper , n° lower⟩}` default: *not set*

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

`layout-sep = {⟨rubber length | rigid length⟩}` default: *adjusted parsep from keyans*

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

`layout-top = {⟨rubber length | rigid length⟩}` default: *adjusted topsep from keyans*

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

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

### 6.5.2 The command `\anspic`

---

```
\anspic {⟨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=true,nosep]
  \item Question with images and labels below.

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

  \item Question with images and labels above.

  \begin{keyanspic}[label-pos=above, layout-sty={3,2},layout-sep=0.25cm]
    \anspic{\includegraphics[scale=0.15]{example-image-a}}
    \anspic{\includegraphics[scale=0.15]{example-image-b}}
    \anspic{\includegraphics[scale=0.15]{example-image-a}}
    \anspic{\includegraphics[scale=0.15]{example-image-a}}
    \anspic*[note]{\includegraphics[scale=0.15]{example-image-a}}
  \end{keyanspic}

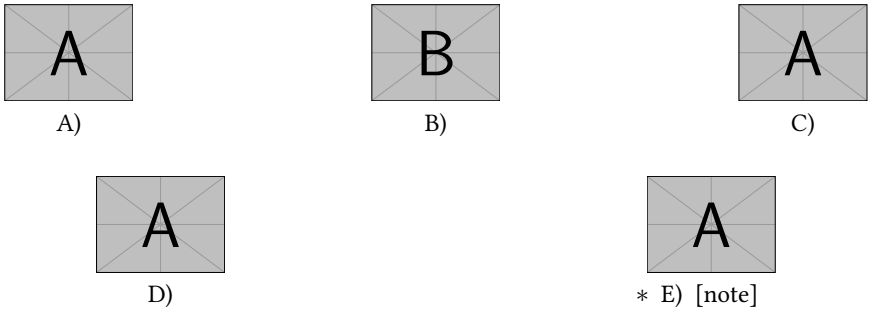
  \item Question with images and labels below on a single line.

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

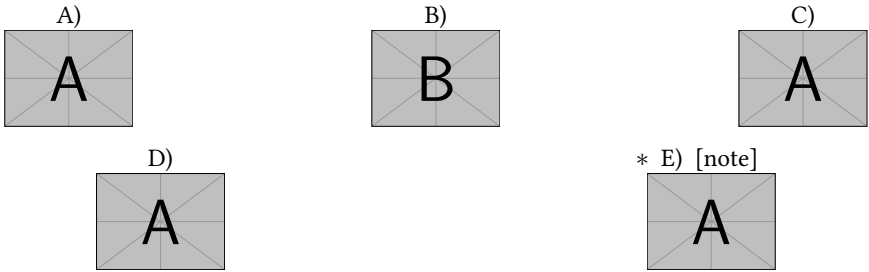
\end{enumext}
```

1. Question with images and labels below.

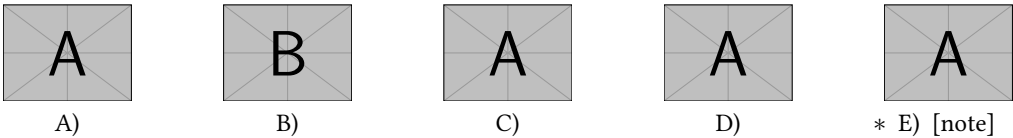




2. Question with images and labels above.



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



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

6.6 Printing stored content

6.6.1 The command `\getkeyans`

`\getkeyans` `\getkeyans{⟨store name : position⟩}`

The command `\getkeyans` prints the “stored content” in *prop list* `{⟨store name⟩}` defined by `save-ans` key in the `⟨position⟩` returned by the `show-pos` key.

The “stored content” can only be accessed *after* it is stored, if `{⟨store name⟩}` does not exist the command will return an error.

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

6.6.2 The command `\foreachkeyans`

`\foreachkeyans` `\foreachkeyans[⟨key = val⟩]{⟨store name⟩}`

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

Options for command

`sep = {⟨code⟩}` default: `{;}`

Establishes the *separation* between “each” `{⟨content⟩}` stored in *prop list* `{⟨store name⟩}`. For example, you can use `sep={\[\ 10pt]}` for vertical separation of stored contents.

`step = {⟨integer⟩}` default: 1

Sets the *step* (increment) applied to the value set by key `start` for “each” `{⟨content⟩}` stored in *prop list* `{⟨store name⟩}`. The value must be a *positive integer*.

`start = {⟨integer⟩}` default: 1

Sets the *position* of the *prop list* `{⟨store name⟩}` from which execution will start. The value must be a *positive integer*.

`stop = {⟨integer⟩}` default: 0

Sets the *position* of the *prop list* `{⟨store name⟩}` from which execution will finish. The value must be a *positive integer*.

`before = {⟨code⟩}` default: *empty*

Sets the  $\langle code \rangle$  that will be executed  $\langle before \rangle$  each  $\langle content \rangle$  stored in *prop list*  $\langle store name \rangle$ . The  $\langle code \rangle$  must be passed between braces.

`after =  $\langle code \rangle$`  default: *empty*

Sets the  $\langle code \rangle$  that will be executed  $\langle after \rangle$  each  $\langle content \rangle$  stored in *prop list*  $\langle store name \rangle$ . The  $\langle code \rangle$  must be passed between braces.

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

Wraps the  $\langle content \rangle$  stored in *prop list*  $\langle store name \rangle$  referenced by  $\langle \#1 \rangle$ . The  $\langle code \rangle$  must be passed between braces. For example `\foreachkeyans[wrapper= $\langle \backslash makebox[1em][l]{\langle \#1 \rangle} \rangle \langle store name \rangle$ ]`.

### 6.6.3 The command `\printkeyans`

---

```
\printkeyans  $\langle store name \rangle$ 
\printkeyans[ $\langle keys \rangle$ ] $\langle store name \rangle$ 
\printkeyans*[ $\langle keys \rangle$ ] $\langle store name \rangle$ 
```

---

The command `\printkeyans` prints “all stored content” in sequence  $\langle store name \rangle$  defined by `save-ans` key placing this inside the `enumext` or `enumext*` environment if the *starred argument* ‘ $\ast$ ’ is used.

The “stored content” can only be accessed *after* it is stored in the *sequence*, if  $\langle store name \rangle$  does not exist the command will return an error.

The *optional argument* allows managing the  $\langle keys \rangle$  in the “first level” of the environment in which the “stored content” of the *sequence*  $\langle store name \rangle$  will be printed, if the *starred argument* ‘ $\ast$ ’ 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*  $\langle store name \rangle$  the default values are the same as those established for the second, third and fourth levels plus the keys `nosep`, `first=\small`, `font=\small`. If the environment `enumext*` is saved within the *sequence*  $\langle store name \rangle$  it will have the same default values plus the keys `nosep`, `first=\small`, `font=\small`.

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

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

The default values for the “first level” of `\printkeyans` commands and `\printkeyans*` are established using `\setenumext[ $\langle print \rangle$ ,  $\langle i \rangle$ ] $\langle keys \rangle$`  and `\setenumext[ $\langle print \rangle$ ,  $\ast$ ] $\langle keys \rangle$` .

If we need to set the  $\langle keys \rangle$  for the environment `enumext` “saved” in the *sequence*  $\langle store name \rangle$  we will use `\setenumext[ $\langle print \rangle$ ,  $\langle level \rangle$ ] $\langle keys \rangle$`  and if we need to set the  $\langle keys \rangle$  for the environment `enumext*` “saved” in the *sequence*  $\langle store name \rangle$  we will use `\setenumext[ $\langle print \rangle$ ,  $\ast$ ] $\langle keys \rangle$` .

### Example

```
\begin{enumext}[save-ans=sample,columns=1,show-pos=true,nosep,save-ref=true]
  \item Factor  $3x+3y+3z$ . \anskey{ $3(x+y+z)$ }
  \item True False

  \begin{enumext}[nosep]
    \item \LaTeX2e is cool? \anskey{Very True!}
  \end{enumext}

  \item Related to Linux

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

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

\printkeyans{sample}
```

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

[1]

2. True False

(a) ~~TeX~~ze is cool?

[2]

3. Related to Linux

(a) You use linux?

[3]

(b) Rate the following package and class

i. `xsim`

[4]

ii. `exsheets`

[5]

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

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


7 Full examples

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

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

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

Example 1

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

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

☐ A 36 km/h.

☐ B 360 km/h.

☐ C 27,8 km/h.

☐ D  $3,60 \times 10^8$  km/h.

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

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

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

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

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

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

☐ A 36 km/h.

☐ B 360 km/h.

☐ C 27,8 km/h.

☐ D  $3,60 \times 10^8$  km/h.

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

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


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

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

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

1. B
2. A
3. B
4. A

Example 2

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

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

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

A 36 km/h.

✓ B 360 km/h.

C 27,8 km/h.

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

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

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

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

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

A 36 km/h.

✓ B 360 km/h.

C 27,8 km/h.

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

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

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

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


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

✖ 2. A

✖

3. B

✖ 4. A

✖
- Example 3
- A “simple multiple choice” test .
1. First type of questions

A value

B correct

C value

D value

2. Second type of questions

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

II.  $\alpha = \delta$

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

A I only

B II only

C I and II only

D I and III only

E I, II, and III

3. Third type of questions

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

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

A value

B value

C value

D value

E value

4. Question with image and label below:

A

A

B


B

A

C

A

D



E

5. Question with image on right side:

A value

B value

C value

D correct

E value

B

Test keys

1. B,  $x = 5$

✖ 4. E, A duck

✖

2. D


✖ 5. D, other note


✖


3. C, some note

✖


Example 4

A “simple worksheet” using ducks :) .

 Factor  $x^2 - 2x + 1$


 Factor  $3x + 3y + 3z$

The following questions need to be cuaqtified :)

 True False

(a)  $\alpha > \delta$

(b)  $\text{\LaTeX}$ 2e is cool?

 Related to Linux

(a) You use linux?

©2024–2025 by Pablo González L


22 / 167

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

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

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

Example 5

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

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

1. A)                                      2. C)                                      3. B)                                      4. D)

Example 6

Adapted from the response to Environment for enumerate environment .

- 8.5a, KSC 10. sample
- A sample
- ✓ B answer
- C sample
- D sample
- 9.5a, KSC 11. sample
- A sample
- B sample
- C sample
- ✓ D answer
3. sample
- A sample
- B answer
- C sample
- D sample
4. sample
- A sample
- B sample
- C sample
- D answer



10. B (8.5a, KSC)
11. D (9.5a, KSC)

12. B (10.5a, KSC)
13. D (11.5a, KSC)













## 8 Tagged PDF examples

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

To compile the tests with `lualatex-dev` the packages `multicol`, `unicode-math`, `geometry`, `graphicx`, `luamml` and `hyperref` are required along with the line:

```
\DocumentMetadata
{
  lang = en-US, pdfversion = 2.0, pdfstandard = ua-2, tagging=on,
}
```

◆ All examples have been checked using `veraPDF` together with `ngpdf`.

- The file `enumext-01.tex` contains the basic tests for the `enumext` and `enumext*` environments and the nesting between them plus the use of the `label`, `labelwidth`, `labelsep`, `ref`, `align` and `wrap-label` keys. Source file  and *tagged* PDF .
- The file `enumext-02.tex` contains the tests for the `enumext` and `enumext*` environments and the support for `minipage` and `multicol` environments using the keys `columns`, `columns-sep`, `mini-env`, `mini-right` and `\miniright` command. Source file  and *tagged* PDF .
- The file `enumext-03.tex` contains the tests for the `enumext` and `keyanspic` environments activated by the `save-ans` key together with the `save-sep` and `save-ref` keys and the `\printkeyans` command. Source file  and *tagged* PDF .
- The file `enumext-04.tex` contains the tests for the `\anskey` command and the `anskey*` environment activated by the `save-ans` key along with the `\getkeyans` and `\printkeyans` commands. Source file  and *tagged* PDF .
- The file `enumext-05.tex` contains the tests for the environments `keyans`, `keyans*` and `keyanspic` activated by the key `save-ans` together with the keys `no-store` and `show-ans` and the commands `\setenumext`, `\setenumextmeta`, `\printkeyans` and `\foreachkeyans`. Source file  and *tagged* PDF .
- The file `enumext-06.tex` contains the tests for the environments `enumext` and `enumext*` for *fake itemize* and *description*. Source file  and *tagged* PDF .

## 9 The way of non-enumerated lists

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

Here I leave as an example other uses of the `enumext` environment that can be helpful for specific purposes. The *trick* to generate these “fake environments” is set `label={}` or `label={\some}` and play with the `list-indent`, `list-offset`, `font` and `wrap-label` keys.

### Fake itemize environment

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

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

### Fake description environment

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

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

This is an entry *without* a label.

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

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

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

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

**SomeThing** A short one-line description.  
This is an entry *without* a label.  
**Something** A short *one-line* description text.  
**Something long** A much *longer* description text may take more than one line or more than one paragraph.  
Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.

- The small space at the beginning of the “*unlabeled entry*” corresponds to `\labelsep` and can be removed using `\hspace{-\labelsep}` at the beginning of the line.
- When *tagged* PDF is active the default `description` style is NOT available due to the redefinition of `\makeLabel` for the `align` key which uses `\makebox` in this case, meaning that `\item[⟨content⟩]` will not extend beyond `\labelwidth` which causes overlaps,

Description indented by label

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

```
\newlength{\descitemwd}  
\settowidth{\descitemwd}{\textbf{Something long}}  
  
and then use labelsep=4pt,labelwidth=\descitemwd,font=\bfseries.
```

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

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

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

If we add `align=right` it will look like this:

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

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

Description with multi-line labels

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

```
\NewDocumentCommand \labelbx { s +m }  
{%  
  \SuspendTagging{\parbox}%  
  \IfBooleanTF{#1}  
  {%  
    {\strut\smash{\parbox[t]{\labelwidth}{\raggedright{#2}}}}%  
    {\strut\smash{\parbox[t]{\labelwidth}{\raggedleft{#2}}}}%  
  }\ResumeTagging{\parbox}%  
}
```

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

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

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

## Final notes

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

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

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

### Why list environments?

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

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

### Why not random questions and other utilities

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

### Why has it taken so long?

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

## 10 References

- [1] HIRSCHHORN, PHILIP. “Using the exam document class”. Available from CTAN, <https://www.ctan.org/pkg/exam>, 2023.
- [2] NIEDERBERGER, CLEMENS. “xsim – eXercise Sheets IMproved”. Available from CTAN, <https://www.ctan.org/pkg/xsim>, 2023.
- [3] MITTELBACH, FRANK. “An environment for multicolumn output”. Available from CTAN, <https://www.ctan.org/pkg/multicol>, 2025.
- [4] GONZÁLEZ, PABLO. “scontents - Stores  $\text{\LaTeX}$  contents in memory or files”. Available from CTAN, <https://www.ctan.org/pkg/scontents>, 2025.
- [5] The  $\text{\LaTeX}$  Project. “enumerate – Enumerate with redefinable labels”. Available from CTAN, <https://www.ctan.org/pkg/enumerate>, 2025.
- [6] BEZOS, JAVIER. “Customizing lists with the enumitem package”. Available from CTAN, <https://www.ctan.org/pkg/enumitem>, 2025.
- [7] BERRY, KARL. “ $\text{\LaTeX}_{2\epsilon}$ : An Unofficial Reference Manual”. Available from CTAN, <https://ctan.org/pkg/latex2e-help-texinfo>, 2025.
- [8] The  $\text{\LaTeX}$  Project. “Extensive support for hypertext in  $\text{\LaTeX}$ ”. Available from CTAN, <https://www.ctan.org/pkg/hyperref>, 2025.
- [9] BURNOL, JEAN-FRANÇOIS. “The footnotehyper package”. Available from CTAN, <https://www.ctan.org/pkg/footnotehyper>, 2021.

- [10] The  $\text{\LaTeX}$  Project. “The expl3 package”. Available from CTAN, <https://www.ctan.org/pkg/l3kernel>, 2025.
- [11] The  $\text{\LaTeX}$  Project. “The  $\text{\LaTeX}$ 3 Interfaces”. Available from CTAN, <https://www.ctan.org/pkg/l3kernel>, 2025.
- [12] The  $\text{\LaTeX}$  Project. “The  $\text{\LaTeX}$ 2 $\epsilon$  sources”. Available from CTAN, <https://ctan.org/tex-archive/macros/latex/base>, 2025.
- [13] The  $\text{\LaTeX}$  Project. “ $\text{\LaTeX}$  News, Issue 41, June 2025”. Available from CTAN, <https://ctan.org/tex-archive/macros/latex/base>, 2025.
- [14] The  $\text{\LaTeX}$  Project. “ $\text{\LaTeX}$  for authors current version”. Available from CTAN, <https://ctan.org/pkg/latex-base>, 2025.
- [15] GUNDLACH, PATRICK. “The lua-visual-debug package”. Available from CTAN, <https://www.ctan.org/pkg/lua-visual-debug>, 2023.
- [16] LEMVIG, MOGENS. “The shortlst package”. Available from CTAN, <https://www.ctan.org/pkg/shortlst>, 1998.
- [17] NIEDERBERGER, CLEMENS. “tasks – Horizontally columned lists”. Available from CTAN, <https://www.ctan.org/pkg/tasks>, 2022.
- [18] FISCHER, ULRIKE. “tagpdf –  $\text{\LaTeX}$  kernel code for PDF tagging”. Available from CTAN, <https://www.ctan.org/pkg/tagpdf>, 2025.
- [19] The  $\text{\LaTeX}$  Project. “latex-lab –  $\text{\LaTeX}$  laboratory”. Available from CTAN, <https://www.ctan.org/pkg/latex-lab>, 2025.
- [20] MITTELBACH, FRANK. “ $\text{\LaTeX}$ ’s socket management”. Available from CTAN, <https://ctan.org/tex-archive/macros/latex/base>, 2025.

## 11 Change history

- v1.6 (ctan), 2025-06-21**
  - Add `\resetenumext`, `reset` and `reset*` keys.
  - The `resume`, `resume*` and `series` keys can now be set per level.
  - Fixed bad interaction between `\printkeyans` and the `resume`, `resume*` keys.
- v1.5 (ctan), 2025-06-11**
  - Replacing `\regex_match:` (deprecated) with `\regex_if_match:`.
  - Add keys `beginpenalty`, `midpenalty` and `endpenalty`.
- v1.4 (ctan), 2025-06-09**
  - Improved implementation of the `start` key for *tagged* PDF.
  - Improved implementation of the `ref` key.
  - Fixed the behavior of the `save-sep` key.
  - Fixed the behavior of the `resume*` key.
- v1.3 (ctan), 2025-06-01**
  - Removed dependency on the `scontents` package.
  - The `anskey*` environment has been rewritten using the new `c`-type argument.
- v1.2 (ctan), 2025-03-28**
  - Replace signature (prevent expansion for optional argument).
  - Solve Inconsistent local/global assignment.
- v1.1 (ctan), 2024-11-14**
  - Fixed implementation for `font` and `base-fix` keys.
  - Added new keys for symbol marks.
  - Update and improvements in the internal code.
  - Adjustments in the documentation.
- v1.0 (ctan), 2024-11-01**
  - First public release.

12 Index of Documentation

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	14
\columnbreak	4, 14	item-join	14
\columnsep	11	item-pos*	15
Commands provide by enumext:		item-star	14, 15
\anskey	12–15	item-sym*	15
\anspic	12–14, 17, 18	Keys for \foreachkeyans provide by enumext:	
\foreachkeyans	19	after	20
\getkeyans	14, 19	before	19
\item*	5–7, 12–14, 16, 17	sep	19
\item	5–7, 10, 11, 14, 16, 17	start	19
\miniright	11, 12	step	19
\printkeyans	6, 13, 20	stop	19
\resetenumext	11	wrapper	20
\setenumextmeta	6	Keys for \anskey* provide by enumext:	
\setenumext	5–7, 12–14, 16, 20	break-col	14
Counters defined by enumext:		force-eol	15
enumXiii	4	item-join	14
enumXii	4	item-pos*	15
enumXiv	4	item-star	14, 15
enumXi	4	item-sym*	15
enumXviii	4	overwrite	15
enumXvii	4	write-env	15
enumXvi	4	Keys for environments provide by enumext:	
enumXv	4	above*	9
E		above	9
Environments provide by enumext:		after	10
anskey*	12–15, 24	align	7, 14, 24, 25
enumext*	4–17, 20, 24	base-fix	9
enumext	4–17, 20, 24	before*	10
keyans*	4–16, 24	before	10
keyanspic	4, 7, 8, 10, 12–15, 17, 24	beginpenalty	8
keyans	4–18, 24	below*	9
Environments:		below	9
Verbatim	15	check-ans	13, 14
center	5	columns-sep	4, 11, 24
description	5, 24, 25	columns	4, 9, 11, 24
enumerate	1, 3, 5, 26	endpenalty	8
figure	5	first	10
flushleft	5	font	7, 13, 14
flushright	5	item-pos*	5, 6
itemize	5, 24	item-sym*	5, 6
list	3, 5, 10, 26	itemindent	9, 10
minipage	3–5, 8–12, 24, 26	itemsep	8, 9
multicols	3, 4, 11, 24	label-pos	18
quotation	5	label-sep	18
quote	5	labelsep	3–7, 9, 11, 24, 25
shortenenumerate	5	labelwidth	3, 4, 6, 7, 9, 11, 13, 14, 24, 25
tabbing	5	labelwith	5
table	5	label	7, 8, 10, 16, 17, 24, 25
tasks	5	labewdith	9
trivlist	5	layout-sep	18
verbatim	5	layout-sty	17, 18
verse	5	layout-top	18



list-indent	3, 9, 10
list-offset	3, 9, 25
listparindent	10
mark-ans*	13, 14, 16, 18
mark-ans	13
mark-pos*	14, 16, 18
mark-pos	13
mark-ref	13
mark-sep*	14, 16, 18
mark-sep	13
midpenalty	8
mini-env	4, 9, 11, 12, 24
mini-right*	7, 12
mini-right	7, 12, 24
mini-sep	4, 11, 12
mode-box	7
no-store	12, 14, 15, 24
noitemsep	9
nosep	9, 24
overwrite	15
parsep	8–10, 18
partopsep	8
ref	4, 8, 24
reset*	11
reset	11
resume*	7, 10–12
resume	7, 10–12
rightmargin	10
save-ans	4, 6, 10–20, 24
save-key	10, 12, 20
save-ref	4, 7, 13–15, 19, 24
save-sep	12, 16, 18, 24
series	7, 10–12
show-ans	12–14, 16, 18, 24
show-length	8
show-pos	12–14, 16, 18, 19
start*	10, 11
start	10, 11
topsep	8, 9, 18
widest	7
wrap-ans*	14, 16, 18
wrap-ans	13
wrap-label*	7, 25
wrap-label	7, 13, 14, 24, 25
wrap-opt	13, 14, 16, 18
write-env	15
<b>L</b>	
\label	4
Labels provide by enumext:	
\Alph*	7, 8, 16
\Roman*	7, 8
\alph*	7, 8
\arabic*	7, 8
\roman*	7, 8
\labelsep	3, 7
\labelwidth	3, 7
\linewidth	11
\listparindent	10
<b>P</b>	
Packages:	
enumerate	26
enumext	1–5, 7, 13, 17, 24, 26
enumitem	3, 4, 25, 26
fancyvrb	15
footnotehyper	5
geometry	24
graphicx	24
hyperref	4, 5, 13–15, 24, 26
l3keys	7
l3prop	26
l3seq	26
luamml	24
multicol	1, 2, 4, 24, 26
scontents	27
shortlst	5
tasks	5
task	6
unicode-math	24
xsim	2
\parsep	8
\partopsep	8
<b>R</b>	
\raggedcolumns	4
\ref	4
\rightmargin	10
<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}[2025-06-01]
```

Now declare the `enumext` package.

```
4 \ProvidesExplPackage {enumext} {2025-06-21} {1.6} {Enumerate exercise sheets}
```

Finally check if the `multicol` package are loaded, if not we load it.

```
5 \hook_gput_code:nnn {begindocument} {enumext}
6 {
7   \IfPackageLoadedTF { multicol }
8   {
9     \msg_info:nnn { enumext } { package-load } { multicol }
10  }
11  {
12    \msg_info:nnn { enumext } { package-not-load } { multicol }
13    \RequirePackage{multicol}[2025-05-25]
14  }
15 }
```

### 13.4 Definition of variables

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

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

```
\__enumext_level_int
\__enumext_level_h_int
\__enumext_anskey_level_int
\__enumext_keyans_level_int
\__enumext_keyans_level_h_int
\__enumext_keyans_pic_level_int

16 \int_new:N \__enumext_level_int
17 \int_new:N \__enumext_level_h_int
18 \int_new:N \__enumext_anskey_level_int
19 \int_new:N \__enumext_keyans_level_int
20 \int_new:N \__enumext_keyans_level_h_int
21 \int_new:N \__enumext_keyans_pic_level_int
```

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

```

\l__enumext_starred_bool
\g__enumext_starred_bool
  \l_enumext_starred_first_bool
\l__enumext_standar_bool
\g__enumext_standar_bool
  \l_enumext_standar_first_bool
\l__enumext_keyans_env_bool
\g__enumext_start_line_tl
\g__enumext_envir_name_tl
\l__enumext_envir_name_tl

```

Internal variables used by functions `\__enumext_is_not_nested:`, `\__enumext_is_on_first_level:` and `\__enumext_keyans_name_and_start:` (§13.5.1).

```

22 \bool_new:N \l__enumext_starred_bool
23 \bool_new:N \g__enumext_starred_bool
24 \bool_new:N \l__enumext_starred_first_bool
25 \bool_new:N \l__enumext_standar_bool
26 \bool_new:N \g__enumext_standar_bool
27 \bool_new:N \l__enumext_standar_first_bool
28 \bool_new:N \l__enumext_keyans_env_bool
29 \tl_new:N \g__enumext_start_line_tl
30 \tl_new:N \g__enumext_envir_name_tl
31 \tl_new:N \l__enumext_envir_name_tl

```

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

```

\l__enumext_counter_i_tl
\l__enumext_counter_ii_tl
\l__enumext_counter_iii_tl
\l__enumext_counter_iv_tl
\l__enumext_counter_v_tl
\l__enumext_counter_vi_tl
\l__enumext_counter_vii_tl
\l__enumext_counter_viii_tl

```

Variables to store the “*name of the counters*” `enumXi`, `enumXii`, `enumXiii` and `enumXiv` for `enumext` environment, `enumXv` for `keyans` environment and `enumXvi` for the `keyanspic` environment. The counters `enumXvii` and `enumXviii` are used by `enumext*` and `keyans*` environments.

The initial values of these variables are set by the function `\__enumext_define_counter:Nn` (§13.11) and then modified by the function `\__enumext_label_style:Nnn` used by `label` key (§13.14).

```

32 \cs_set_protected:Npn \__enumext_tmp:n #1
33 {
34   \tl_new:c { l__enumext_counter_#1_tl }
35 }
36 \clist_map_inline:nn { i, ii, iii, iv, v, vi, vii, viii } { \__enumext_tmp:n {#1} }

```

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

```

\l__enumext_ref_key_arg_tl
\l__enumext_ref_the_count_tl
\l__enumext_the_counter_X_tl
  \l__enumext_renew_counter_X_tl

```

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

```

37 \tl_new:N \l__enumext_ref_key_arg_tl
38 \tl_new:N \l__enumext_ref_the_count_tl
39 \cs_set_protected:Npn \__enumext_tmp:n #1
40 {
41   \tl_new:c { l__enumext_renew_counter_#1_tl }
42   \tl_new:c { l__enumext_the_counter_#1_tl }
43   \tl_set:ce { l__enumext_the_counter_#1_tl } { \exp_not:c { theenumX#1 } }
44 }
45 \clist_map_inline:nn { i, ii, iii, iv, v, vi, vii, viii } { \__enumext_tmp:n {#1} }

```

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

```

\l__enumext_series_name_tl
\l__enumext_resume_X_bool
\g__enumext_resume_X_int
  \g__enumext_not_key_series_X_tl
\g__enumext_series_name_X_tl

```

Internal variables used by `resume`, `resume*` and `series` keys (§13.26).

```

46 \tl_new:N \l__enumext_series_name_tl
47 \cs_set_protected:Npn \__enumext_tmp:n #1
48 {
49   \bool_new:c { l__enumext_resume_#1_bool }
50   \int_new:c { g__enumext_resume_#1_int }
51   \tl_new:c { g__enumext_not_key_series_#1_tl }
52   \tl_new:c { l__enumext_series_name_#1_tl }
53 }
54 \clist_map_inline:nn { i, ii, iii, iv, vii } { \__enumext_tmp:n {#1} }

```

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

```

\l__enumext_current_widest_dim
\g__enumext_counter_styles_tl
\g__enumext_widest_label_tl
  \l__enumext_label_width_by_box

```

The variable `\l__enumext_current_widest_dim` stores the current label width, the variable `\g__enumext_counter_styles_tl` stores the default *label style* and the variable `\g__enumext_widest_label_tl` the label width. These variables are used by `widest` (§13.15) and `label` (§13.13) keys.

```

55 \dim_new:N \l__enumext_current_widest_dim
56 \tl_new:N \g__enumext_counter_styles_tl
57 \tl_new:N \g__enumext_widest_label_tl
58 \box_new:N \l__enumext_label_width_by_box

```

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

```
\l__enumext_leftmargin_tmp_X_bool
\l__enumext_leftmargin_tmp_X_dim
\l__enumext_leftmargin_X_dim
\l__enumext_itemindent_X_dim
```

The boolean variable `\l__enumext_leftmargin_tmp_X_bool` and the dimensional variable `\l__enumext_leftmargin_tmp_X_dim` are used by the `list-indent` key (§13.19). The variables `\l__enumext_leftmargin_X_dim` and `\l__enumext_itemindent_X_dim` are used and set by the function `\__enumext_calc_hspace:NNNNNNNNNN` (§13.40.1).

```
59 \cs_set_protected:Npn \__enumext_tmp:n #1
60 {
61   \bool_new:c { \l__enumext_leftmargin_tmp_#1_bool }
62   \dim_new:c { \l__enumext_leftmargin_tmp_#1_dim }
63   \dim_new:c { \l__enumext_leftmargin_#1_dim }
64   \dim_new:c { \l__enumext_itemindent_#1_dim }
65 }
66 \clist_map_inline:nn { i, ii, iii, iv, v, vi, vii, viii } { \__enumext_tmp:n {#1} }
```

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

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

Internal variables used by `columns` key (§13.23) and `align` key (§13.13).

```
67 \cs_set_protected:Npn \__enumext_tmp:n #1
68 {
69   \skip_new:c { \l__enumext_multicols_above_#1_skip }
70   \skip_new:c { \l__enumext_multicols_below_#1_skip }
71   \skip_new:c { \g__enumext_multicols_right_#1_skip }
72   \str_new:c { \l__enumext_align_label_pos_#1_str }
73 }
74 \clist_map_inline:nn { i, ii, iii, iv, v } { \__enumext_tmp:n {#1} }
```

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

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

Internal variables used by `\miniright` command (§13.24.4) and the keys `mini-right`, `mini-right*`, `mini-env` and `mini-sep` (§13.22, §13.24).

```
75 \int_new:N \g__enumext_minipage_stat_int
76 \skip_new:N \l__enumext_minipage_temp_skip
77 \skip_new:N \l__enumext_minipage_left_skip
78 \skip_new:N \l__enumext_minipage_right_skip
79 \skip_new:N \l__enumext_minipage_after_skip
80 \skip_new:N \g__enumext_minipage_right_skip
81 \skip_new:N \g__enumext_minipage_after_skip
82 \cs_set_protected:Npn \__enumext_tmp:n #1
83 {
84   \dim_new:c { \l__enumext_minipage_left_#1_dim }
85   \bool_new:c { \l__enumext_minipage_active_#1_bool }
86 }
87 \clist_map_inline:nn { i, ii, iii, iv, v, vii, viii } { \__enumext_tmp:n {#1} }
```

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

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

The bool vars `\l__enumext_wrap_label_X_bool` and `\l__enumext_wrap_label_opt_X_bool` are used by `wrap-label` and `wrap-label*` keys (§13.13), the integer `\l__enumext_start_X_int` are used by the `start` and `start*` keys (§13.15), the token list `\l__enumext_fake_item_indent_X_tl` is used by `itemindent` key (§13.19.1), the variables `\l__enumext_label_fill_left_X_tl` and `\l__enumext_label_fill_right_X_tl` are used by the `align` key (§13.13). The boolean vars `\l__enumext_vspace_a_star_X_bool`, `\l__enumext_vspace_b_star_X_bool` are used by `above`, `above*`, `below` and `below*` keys (§13.21).

```
88 \cs_set_protected:Npn \__enumext_tmp:n #1
89 {
90   \bool_new:c { \l__enumext_wrap_label_#1_bool }
91   \bool_new:c { \l__enumext_wrap_label_opt_#1_bool }
92   \int_new:c { \l__enumext_start_#1_int }
93   \tl_new:c { \l__enumext_fake_item_indent_#1_tl }
94   \tl_new:c { \l__enumext_label_fill_left_#1_tl }
95   \tl_new:c { \l__enumext_label_fill_right_#1_tl }
96   \bool_new:c { \l__enumext_vspace_a_star_#1_bool }
97   \bool_new:c { \l__enumext_vspace_b_star_#1_bool }
98 }
99 \clist_map_inline:nn { i, ii, iii, iv, v, vii, viii } { \__enumext_tmp:n {#1} }
```

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

```

\l__enumext_store_active_bool
\l__enumext_store_name_tl
\g__enumext_store_name_tl
\l__enumext_store_current_label_tl
\l__enumext_store_current_opt_arg_tl

```

The variable `\l__enumext_store_active_bool` setting by `save-ans` key (§13.28.1) 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 variables `\l__enumext_store_current_label_tl` and `\l__enumext_store_current_opt_arg_tl` save the *current label* and *optional argument* of `\item*` (§13.39) and `\anspic*` (§13.44.2) for the `keyans`, `keyans*` and `keyanspic` environments.

```

100 \bool_new:N \l__enumext_store_active_bool
101 \tl_new:N \l__enumext_store_name_tl
102 \tl_new:N \g__enumext_store_name_tl
103 \tl_new:N \l__enumext_store_current_label_tl
104 \tl_new:N \l__enumext_store_current_opt_arg_tl

```

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

```

\l__enumext_store_anskey_arg_tl
\l__enumext_store_anskey_env_tl
\l__enumext_write_anskey_env_bool
\l__enumext_write_anskey_env_file_name_tl
\l__enumext_write_anskey_env_file_iow

```

The variable `\l__enumext_store_anskey_arg_tl` save the *argument* of `\anskey` (§13.32) and the variables `\l__enumext_store_anskey_env_tl` save the  $\langle body\rangle$  of the environment `anskey*` (§13.33).

The variables `\l__enumext_write_anskey_env_bool`, `\l__enumext_write_anskey_env_file_name_tl` and `\l__enumext_write_anskey_env_file_iow` they are used by the `write-env` and `overwrite` keys in the `anskey*` environment implementation.

```

105 \tl_new:N \l__enumext_store_anskey_arg_tl
106 \tl_new:N \l__enumext_store_anskey_env_tl
107 \bool_new:N \l__enumext_write_anskey_env_bool
108 \tl_new:N \l__enumext_write_anskey_env_file_name_tl
109 \iow_new:N \l__enumext_write_anskey_env_file_iow

```

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

```

\c__enumext_anskey_env_hidden_space_str

```

The `\c__enumext_anskey_env_hidden_space_str` is a constant *string* to used to hide the  $\langle forced\ space\rangle$  added by T<sub>E</sub>X when recording content in a macro. This *string* contains the *reserved phrase* “ $\%^{\wedge\wedge}\text{Aenumextheol}\%$ ” which is added to the end of the argument stored in *sequence* and *prop list* when the key `force-eol` is false.

```

110 \str_const:Nc \c__enumext_anskey_env_hidden_space_str
111 { \c_percent_str \c_circumflex_str \c_circumflex_str A enumextheol \c_percent_str }

```

(End of definition for `\c__enumext_anskey_env_hidden_space_str`.)

```

\l__enumext_setkey_tmpa_tl
\l__enumext_setkey_tmpb_tl
\l__enumext_setkey_tmpa_int
\l__enumext_setkey_tmpa_seq
\l__enumext_setkey_tmpb_seq

```

Internal variables used by the command `\setenumext` (§13.50).

```

112 \tl_new:N \l__enumext_setkey_tmpa_tl
113 \tl_new:N \l__enumext_setkey_tmpb_tl
114 \int_new:N \l__enumext_setkey_tmpa_int
115 \seq_new:N \l__enumext_setkey_tmpa_seq
116 \seq_new:N \l__enumext_setkey_tmpb_seq

```

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

```

\l__enumext_meta_path_tl
\l__enumext_foreach_print_seq
\l__enumext_foreach_name_prop_tl
\l__enumext_foreach_default_keys_tl

```

Internal variables used by the `\printkeyans` command (§13.49) and `\foreachkeyans` command (§13.52).

```

117 \tl_new:N \l__enumext_meta_path_tl
118 \seq_new:N \l__enumext_foreach_print_seq
119 \tl_new:N \l__enumext_foreach_name_prop_tl
120 \tl_new:N \l__enumext_foreach_default_keys_tl

```

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

```

\l__enumext_print_keyans_starred_tl
\l__enumext_print_keyans_star_bool
\l__enumext_print_keyans_cmd_bool
\l__enumext_mark_position_str
\l__enumext_mark_position_v_str
\l__enumext_mark_position_viii_str
\l__enumext_mark_sep_tmpa_dim
\l__enumext_mark_sep_tmpb_dim
\l__enumext_show_pos_tmp_int
\g__enumext_item_symbol_aux_tl
\l__enumext_print_keyans_X_tl
\l__enumext_store_save_key_X_tl
\l__enumext_store_save_key_X_bool
\l__enumext_store_upper_level_X_bool

```

Internal variables used by command `\printkeyans` (§13.49), `show-pos`, `show-ans`, `mark-pos`, `mark-sep` keys (§13.29), `item-sym*` key (§13.37), `save-key` key (§13.29.3) and “*storing structure*”.

```

121 \tl_new:N \l__enumext_print_keyans_starred_tl
122 \bool_new:N \l__enumext_print_keyans_star_bool
123 \bool_new:N \l__enumext_print_keyans_cmd_bool
124 \str_new:N \l__enumext_mark_position_str
125 \str_new:N \l__enumext_mark_position_v_str
126 \str_new:N \l__enumext_mark_position_viii_str
127 \dim_new:N \l__enumext_mark_sep_tmpa_dim
128 \dim_new:N \l__enumext_mark_sep_tmpb_dim
129 \int_new:N \l__enumext_show_pos_tmp_int
130 \tl_new:N \g__enumext_item_symbol_aux_tl
131 \cs_set_protected:Npn \l__enumext_tmp:n #1
132 {
133   \tl_new:c { l__enumext_print_keyans_#1_tl }

```

```

134      \tl_new:c { \__enumext_store_save_key_#1_tl      }
135      \bool_new:c { \__enumext_store_save_key_#1_bool  }
136      \bool_new:c { \__enumext_store_upper_level_#1_bool }
137    }
138    \clist_map_inline:nn { i, ii, iii, iv, vii } { \__enumext_tmp:n {#1} }

```

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

Internal variables used by `keyanspic` environment and `\anspic` command (§13.44.1).

```

139 \seq_new:N \__enumext_anspic_args_seq
140 \dim_new:N \__enumext_anspic_mini_width_dim
141 \int_new:N \__enumext_anspic_above_int
142 \int_new:N \__enumext_anspic_below_int
143 \bool_new:N \__enumext_anspic_label_above_bool
144 \str_new:N \__enumext_anspic_mini_pos_str
145 \box_new:N \__enumext_anspic_label_box
146 \box_new:N \__enumext_anspic_body_box
147 \dim_new:N \__enumext_anspic_label_htdp_dim
148 \dim_new:N \__enumext_anspic_body_htdp_dim

```

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

Internal variables used by “*internal check answer*” mechanism (§13.28.3) used by the `check-ans`, `no-store`, `wrap-ans*` keys and check for starred commands `\item*` in `keyans` and `keyans*` environments and `\anspic*` in `keyanspic` environment.

```

149 \bool_new:N \__enumext_check_answers_bool
150 \bool_new:N \g__enumext_check_ans_key_bool
151 \tl_new:N \__enumext_check_start_line_env_tl
152 \bool_new:N \__enumext_item_wrap_key_bool
153 \int_new:N \g__enumext_check_starred_cmd_int
154 \int_new:N \g__enumext_item_anskey_int
155 \int_new:N \g__enumext_item_number_int
156 \bool_new:N \__enumext_item_number_bool
157 \int_new:N \g__enumext_item_answer_diff_int

```

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

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

```

158 \bool_new:N \__enumext_hyperref_bool
159 \bool_new:N \__enumext_footnotes_key_bool

```

(End of definition for `\__enumext_hyperref_bool` and `\__enumext_footnotes_key_bool`.)

Internal variables used by `save-ref` key (§13.29). The variables `\__enumext_label_copy_X_tl` correspond to temporary copies of the *labels* defined by level on which operations will be performed.

The variables `\__enumext_newlabel_arg_one_tl` and `\__enumext_newlabel_arg_two_tl` will be used to form the arguments passed to the function `\__enumext_newlabel:nn` (§13.7) and the variable `\__enumext_write_aux_file_tl` will be in charge of executing the writing code in the `.aux` file.

```

160 \tl_new:N \__enumext_newlabel_arg_one_tl
161 \tl_new:N \__enumext_newlabel_arg_two_tl
162 \tl_new:N \__enumext_write_aux_file_tl
163 \cs_set_protected:Npn \__enumext_tmp:n #1
164 {
165   \tl_new:c { \__enumext_label_copy_#1_tl }
166 }
167 \clist_map_inline:nn { i, ii, iii, iv, v, vi, vii, viii } { \__enumext_tmp:n {#1} }

```

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

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

```

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

```

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



```

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

```

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

```

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 `\l__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
\seq_use:NV

```

Non-standard kernel variants used by the `\printkeyans` command (§13.49) and `\foreachkeyans` command (§13.52).

```

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_scan_tokens:n
```

The functions `\tl_rescan:n` and `\tl_set_rescan:Nnn` provided by `expl3` doesn't fit the needs of this package because it does not allow catcode changes inside the argument, so verbatim stuff used inside one of `anskey*` environment will not work. Here we create a private copy of `\tex_scantokens:D` which will serve our purposes. See the answer by Ulrich Diez in [How do use {<setup> in \tl\\_set\\_rescan:Nnn to replace \scantokens?](#).

```
202 \cs_new_protected:Npn \__enumext_scan_tokens:n #1 { \tex_scantokens:D {#1} }
```

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

```
\__enumext_at_begin_document:n
```

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

```

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

```

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

```

\__enumext_after_env:nn
\__enumext_before_env:nn

```

A internal “hook” functions for execute code `mini-right` and `mini-right*` keys outside the `enumext*` and `keyans*` environments and print check-ans outside the `enumext` and `enumext*` environments.

```

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

```

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

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

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

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

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

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

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

`\__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.

```
225 \cs_new:Npn \__enumext_show_length:nnn #1 #2 #3
226 {
227   *~#2
228   \prg_replicate:nn { 14 - \str_count:n {#2} } {~}
229   =~\use:c { #1_use:c } { \__enumext_#2_#3_#1 } \\
230 }
```

(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.

```
231 \cs_new_protected:Nn \__enumext_unskip_unkern:
232 {
233   \int_case:nnT { \lastnodetype }
234   {
235     { 11 }{ \unskip }
236     { 12 }{ \unkern }
237   }
238 }
```

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

### 13.5.1 Utilities for environments and levels

`\__enumext_is_not_nested:` The function `\__enumext_is_not_nested:` set the variables `\g__enumext_standar_bool` and `\g__enumext_starred_bool` to “true” only if the environments `enumext` and `enumext*` are NOT nested in each other and save the environment name in `\l__enumext_envir_name_tl`.  
`\__enumext_is_on_first_level:`

```
239 \cs_new_protected:Nn \__enumext_is_not_nested:
240 {
241   \str_case:en { \@currenvir }
242   {
243     {enumext}
244     {
245       \tl_set:Nn \l__enumext_envir_name_tl { enumext }
246       \bool_lazy_and:nnT
247       { \bool_not_p:n { \g__enumext_standar_bool } }
248       { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
249       {
250         \bool_gset_true:N \g__enumext_standar_bool
251       }
252     }
253     {enumext*}
254     {
255       \tl_set:Nn \l__enumext_envir_name_tl { enumext* }
256       \bool_lazy_and:nnT
257       { \bool_not_p:n { \g__enumext_starred_bool } }
258       { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
```

```

259         {
260             \bool_gset_true:N \g__enumext_starred_bool
261         }
262     }
263 }
264 }

```

The function `\__enumext_is_on_first_level:` will set the variables `\l__enumext_standar_first_bool` (§13.28.1), `\l__enumext_starred_first_bool` (§13.28.1) to “true” only if the environment is not nested and we are in the “first level” of it. We will also save the *start line number* of each environment in the variable `\g__enumext_start_line_tl` and the *name* of each environment in the variable `\g__enumext_envir_name_tl` to use in messages related to the `check-ans` key and `.log` file.

```

265 \cs_new_protected:Nn \__enumext_is_on_first_level:
266 {
267     \bool_lazy_all:nT
268     {
269         { \bool_if_p:N \g__enumext_standar_bool }
270         { \int_compare_p:nNn { \l__enumext_level_int } = { 1 } }
271         { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
272     }
273     {
274         \bool_set_true:N \l__enumext_standar_first_bool
275         \tl_gset:Nn \g__enumext_envir_name_tl { enumext }
276         \tl_gset:Nn \g__enumext_start_line_tl
277             {
278                 on~line~\exp_not:V \inputlineno
279             }
280     }
281     \bool_lazy_all:nT
282     {
283         { \bool_if_p:N \g__enumext_starred_bool }
284         { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
285         { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
286     }
287     {
288         \bool_set_true:N \l__enumext_starred_first_bool
289         \tl_gset:Nn \g__enumext_envir_name_tl { enumext* }
290         \tl_gset:Nn \g__enumext_start_line_tl
291             {
292                 on~line~\exp_not:V \inputlineno
293             }
294     }
295 }

```

(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.

```

296 \cs_new_protected:Nn \__enumext_keyans_name_and_start:
297 {
298     \str_case:en { \@currentenvir }
299     {
300         {keyans}
301         {
302             \tl_set:Nn \l__enumext_envir_name_tl { keyans }
303             \tl_set:Nn \l__enumext_check_start_line_env_tl
304                 {
305                     in~'keyans'~start~on~line~\exp_not:V \inputlineno
306                 }
307         }
308         {keyans*}
309         {
310             \tl_set:Nn \l__enumext_envir_name_tl { keyans* }
311             \tl_set:Nn \l__enumext_check_start_line_env_tl
312                 {
313                     in~'keyans*'~start~on~line~\exp_not:V \inputlineno
314                 }
315         }
316         {keyanspic}
317         {

```

```

318         \tl_set:Nn \l__enumext_envir_name_tl { keyanspic }
319         \tl_set:Nc \l__enumext_check_start_line_env_tl
320             {
321                 in~'keyanspic'~start~on~line~\exp_not:V \inputlineno
322             }
323     }
324 }
325 }

```

(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.

```

326 \cs_new_protected:Nn \__enumext_reset_global_vars:
327 {
328     \__enumext_reset_global_int:
329     \__enumext_reset_global_bool:
330     \__enumext_reset_global_tl:
331 }
332 \cs_new_protected:Nn \__enumext_reset_global_int:
333 {
334     \int_gzero:N \g__enumext_item_number_int
335     \int_gzero:N \g__enumext_item_anskey_int
336     \int_gzero:N \g__enumext_item_answer_diff_int
337 }
338 \cs_new_protected:Nn \__enumext_reset_global_bool:
339 {
340     \bool_gset_false:N \g__enumext_check_ans_key_bool
341     \bool_gset_false:N \g__enumext_standar_bool
342     \bool_gset_false:N \g__enumext_starred_bool
343 }
344 \cs_new_protected:Nn \__enumext_reset_global_tl:
345 {
346     \tl_gclear:N \g__enumext_store_name_tl
347     \tl_gclear:N \g__enumext_start_line_tl
348     \tl_gclear:N \g__enumext_envir_name_tl
349 }

```

(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.

```

350 \cs_new_protected:Nn \__enumext_log_global_vars:
351 {
352     \msg_log:nneeee { enumext } { prop-seq-int-hook }
353     { \g__enumext_store_name_tl }
354     { \prop_count:c { g__enumext_ \g__enumext_store_name_tl _prop } }
355     { \seq_count:c { g__enumext_ \g__enumext_store_name_tl _seq } }
356     { \int_use:c { g__enumext_resume_ \g__enumext_store_name_tl _int } }
357 }

```

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.

```

358 \cs_new_protected:Nn \__enumext_log_answer_vars:
359 {
360     \msg_log:nneee { enumext } { item-answer-hook }
361     { \int_use:N \g__enumext_item_number_int }
362     { \int_use:N \g__enumext_item_anskey_int }
363     { \int_eval:n { \g__enumext_item_number_int - \g__enumext_item_anskey_int } }
364 }

```

(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`[19]).

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

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

```
365 \__enumext_at_begin_document:n
366 {
367   \cs_new_eq:NN \__enumext_start_list:nn \list
368   \cs_new_eq:NN \__enumext_stop_list: \endlist
369   \NewCommandCopy \__enumext_item_std:w \item
370 }
```

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

```
371 \__enumext_at_begin_document:n
372 {
373   \cs_new_eq:NN \__enumext_minipage:w \minipage
374   \cs_new_eq:NN \__enumext_endminipage: \endminipage
375 }
```

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

### 13.7 Compatibility with hyperref and footnotehyper

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

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

```
376 \hook_gput_code:nnn { begindocument } { enumext } { \__enumext_after_hyperref: }
377 \hook_gset_rule:nnnn { begindocument } { enumext } { after } { hyperref }
```

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

```
378 \cs_new_protected:Nn \__enumext_after_hyperref:
379 {
380   \IfPackageLoadedT { hyperref }
381   {
382     \msg_info:nnn { enumext } { package-load } { hyperref }
383     \bool_set_true:N \l__enumext_hyperref_bool
384     \IfHyperBoolean{hyperfootnotes}
385     {
386       \bool_set_true:N \l__enumext_footnotes_key_bool
387     }
388     { }
389   }
```

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`.

```
390   \bool_if:NT \l__enumext_footnotes_key_bool
391   {
392     \IfPackageLoadedTF { footnotehyper }
393     {
394       \msg_info:nnn { enumext } { package-load } { footnotehyper }
395     }
396     {
397       \bool_set_false:N \l__enumext_footnotes_key_bool
```

```

398     }
399 }

```

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.

```

400 \bool_if:NTF \l__enumext_hyperref_bool
401 {
402   \cs_new_eq:NN \__enumext_hypertarget:nn \hypertarget
403   \cs_new_eq:NN \__enumext_phantomsection: \phantomsection
404 }
405 {
406   \cs_new_eq:NN \__enumext_hypertarget:nn \use_none:nn
407   \cs_new_eq:NN \__enumext_phantomsection: \prg_do_nothing:
408 }
409 }

```

(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.

```

410 \cs_new_protected:Npn \__enumext_newlabel:nn #1 #2
411 {
412   \protected@write \@auxout { }
413   {
414     \token_to_str:N \newlabel {#1}
415     {
416       {#2}
417       \bool_if:NT \l__enumext_hyperref_bool
418       { { \thepage } {#2} {#1} }
419       { }
420     }
421   }
422   \__enumext_hypertarget:nn {#1} { }
423   \__enumext_phantomsection:
424 }

```

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

### 13.8 Internal redefining `\footnote` command

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

`\__enumext_footnotetext:nn`  
`\__enumext_renew_footnote:`  
`\__enumext_print_footnote:`  
`\__enumext_renew_footnote_mini:`  
`\__enumext_print_footnote_mini:`

Redefinition of the `\footnote` command using `\footnotetext` and `\footnotemark` for the `mini-env` key in the `enumext` and `keyans` environments.

```

425 \cs_new_protected:Nn \__enumext_footnotetext:nn
426 {
427   \footnotetext[#1]{#2}
428 }
429 \cs_new_protected:Nn \__enumext_renew_footnote:
430 {
431   \RenewDocumentCommand \footnote { o +m }
432   {
433     \tl_if_novalue:nTF {##1}
434     {
435       \stepcounter{footnote}
436       \int_gset_eq:Nc \g__enumext_footnote_standar_int { c@footnote }
437     }
438     {
439       \int_gset:Nn \g__enumext_footnote_standar_int { ##1 }
440     }
441     \footnotemark [ \g__enumext_footnote_standar_int ]
442     \seq_gput_right:Nn \g__enumext_footnote_standar_arg_seq { ##2 }
443     \seq_gput_right:NV
444     \g__enumext_footnote_standar_int_seq \g__enumext_footnote_standar_int

```



```

445     }
446   }
447   \cs_new_protected:Nn \__enumext_print_footnote:
448   {
449     \seq_if_empty:NF \g__enumext_footnote_standar_int_seq
450     {
451       \seq_map_pairwise_function:NNN
452       \g__enumext_footnote_standar_int_seq
453       \g__enumext_footnote_standar_arg_seq
454       \__enumext_footnotetext:nn
455     }
456     \seq_gclear:N \g__enumext_footnote_standar_arg_seq
457     \seq_gclear:N \g__enumext_footnote_standar_int_seq
458   }

```

The `enumext*` and `keyans*` environments are implemented using `minipage` so we must also redefine `\footnote` to keep these numbering as if it were part of the document.

```

459   \cs_new_protected:Nn \__enumext_renew_footnote_mini:
460   {
461     \RenewDocumentCommand \footnote { o +m }
462     {
463       \tl_if_novalue:nTF {##1}
464       {
465         \stepcounter{footnote}
466         \int_gset_eq:Nc \g__enumext_footnote_starred_int { c@footnote }
467       }
468       {
469         \int_gset:Nn \g__enumext_footnote_starred_int { ##1 }
470       }
471       \footnotemark [ \g__enumext_footnote_starred_int ]
472       \seq_gput_right:Nn \g__enumext_footnote_starred_arg_seq { ##2 }
473       \seq_gput_right:NV
474       \g__enumext_footnote_starred_int_seq \g__enumext_footnote_starred_int
475     }
476   }
477   \cs_new_protected:Nn \__enumext_print_footnote_mini:
478   {
479     \seq_if_empty:NF \g__enumext_footnote_starred_int_seq
480     {
481       \seq_map_pairwise_function:NNN
482       \g__enumext_footnote_starred_int_seq
483       \g__enumext_footnote_starred_arg_seq
484       \__enumext_footnotetext:nn
485     }
486     \seq_gclear:N \g__enumext_footnote_starred_arg_seq
487     \seq_gclear:N \g__enumext_footnote_starred_int_seq
488   }

```

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

`\__enumext_renew_footnote_standar:`  
`\__enumext_print_footnote_standar:`  
`\__enumext_renew_footnote_starred:`  
`\__enumext_print_footnote_starred:`

We encapsulate the redefinition of `\footnote` to pass it to internal `__enumext_mini_page` environment used by the `mini-env` key in the `enumext` and `keyans` environments. We will run the redefinition when `tagged` PDF is active or when the `footnotehyper` package is not loaded.

```

489   \cs_new_protected:Nn \__enumext_renew_footnote_standar:
490   {
491     \bool_if:NT \g__enumext_standar_bool
492     {
493       \IfDocumentMetadataTF
494       {
495         \__enumext_renew_footnote:
496       }
497       {
498         \bool_if:NF \l__enumext_footnotes_key_bool
499         {
500           \__enumext_renew_footnote:
501         }
502       }
503     }
504   }
505   \cs_new_protected:Nn \__enumext_print_footnote_standar:
506   {

```

```

507 \bool_if:NT \g__enumext_standar_bool
508 {
509   \IfDocumentMetadataTF
510   {
511     \__enumext_print_footnote:
512   }
513   {
514     \bool_if:NF \l__enumext_footnotes_key_bool
515     {
516       \__enumext_print_footnote:
517     }
518   }
519 }
520 }

```

We encapsulate the redefinition of `\footnote` to pass it to the `enumext*` and `keyans*` environments. We will run the redefinition when *tagged* PDF is active or when the `footnotehyper` package is not loaded.

```

521 \cs_new_protected:Nn \__enumext_renew_footnote_starred:
522 {
523   \IfDocumentMetadataTF
524   {
525     \__enumext_renew_footnote_mini:
526   }
527   {
528     \bool_if:NF \l__enumext_footnotes_key_bool
529     {
530       \__enumext_renew_footnote_mini:
531     }
532   }
533 }
534 \cs_new_protected:Nn \__enumext_print_footnote_starred:
535 {
536   \IfDocumentMetadataTF
537   {
538     \__enumext_print_footnote_mini:
539   }
540   {
541     \bool_if:NF \l__enumext_footnotes_key_bool
542     {
543       \__enumext_print_footnote_mini:
544     }
545   }
546 }

```

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

```

547 \__enumext_after_env:nn { enumext* }
548 {
549   \__enumext_print_footnote_starred:
550 }
551 \__enumext_after_env:nn { keyans* }
552 {
553   \__enumext_print_footnote_starred:
554 }

```

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

### 13.9 The internal minipage environment

```

\__enumext_internal_mini_page:
__enumext_mini_env*

```

The function `\__enumext_internal_mini_page:` creates a internal `\__enumext_mini_page` environment (*custom version* of `minipage`) setting the `\if@minipage` switch to “false” to allow spaces at the “above” of the environment, plus we will add `\skip_vertical:N \c_zero_skip` to maintain alignment on “top” in the first part and `\skip_vertical:N \c_zero_skip` in the second part to allow spaces “below”. This environment will be used internally by the `mini-env` key, it is NOT documented in the user interface and is for internal use only. Within this environment we redefine `\footnote` to make them look the same as if they were elsewhere in the document. This function is passed to the function `\__enumext_safe_exec:` in the `enumext` environment definition (§13.41) and `\__enumext_safe_exec_vii:` in the `enumext*` environment definition (§13.46)

```

555 \cs_new_protected:Nn \__enumext_internal_mini_page:
556 {
557   \int_compare:nNnT { \l__enumext_level_int } = { 0 }
558   {

```

```

559     \DeclareDocumentEnvironment{__enumext_mini_page}{ m }
560     {
561         \__enumext_renew_footnote_standar:
562         \__enumext_minipage:w [ t ] { ##1 }
563         \legacy_if_gset_false:n { @minipage }
564         \skip_vertical:N \c_zero_skip
565     }
566     {
567         \skip_vertical:N \c_zero_skip
568         \__enumext_endminipage:
569         \__enumext_print_footnote_standar:
570     }
571 }
572 }

```

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

### 13.10 Definition of public dimension

The package `enumext` only provides a single public dimension `\itemwidth` and is intended for user convenience only and is not for internal use as such. This dimension is set in all environments and is only used by the `wrap-ans` key at its default value.

```

573 \dim_zero_new:N \itemwidth

```

### 13.11 Definition of counters

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.

```

enumXi
enumXii
enumXiii
enumXiv
enumXv
enumXvi
enumXvii
enumXviii
574 \cs_new_protected:Npn \__enumext_define_counter:Nn #1 #2
575 {
576     \cs_if_exist:cTF { c@ #2 }
577     { \msg_fatal:nnn { enumext } { counters }{ #2 } }
578     {
579         \tl_set:Nn #1 { #2 }
580         \newcounter { #2 }
581     }
582 }

```

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.

```

583 \__enumext_define_counter:Nn \__enumext_counter_i_tl { enumXi }
584 \__enumext_define_counter:Nn \__enumext_counter_ii_tl { enumXii }
585 \__enumext_define_counter:Nn \__enumext_counter_iii_tl { enumXiii }
586 \__enumext_define_counter:Nn \__enumext_counter_iv_tl { enumXiv }
587 \__enumext_define_counter:Nn \__enumext_counter_v_tl { enumXv }
588 \__enumext_define_counter:Nn \__enumext_counter_vi_tl { enumXvi }
589 \__enumext_define_counter:Nn \__enumext_counter_vii_tl { enumXvii }
590 \__enumext_define_counter:Nn \__enumext_counter_viii_tl { enumXviii }

```

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

### 13.12 Definition of labels

This part of the code is inspired by the `enumitem` package. The idea is to be able to access the counters using `\arabic*`, `\Alph*`, `\alph*`, `\Roman*` and `\roman*` to use them in the `label` key.

- 🔗 Direct support for this is provided since L<sup>A</sup>T<sub>E</sub>X release 2025-06-01[13], but we will keep the original implementation so as not to hinder the internal “*label and ref*” system.

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.

```

591 \cs_new_protected:Npn \__enumext_register_default_label_wd:Nn #1 #2
592 {
593     \tl_const:cn { c__enumext_widest_ \cs_to_str:N #1 _tl } {#2}
594     \tl_gput_right:Nn \g__enumext_counter_styles_tl {#1}
595 }
596 \__enumext_register_default_label_wd:Nn \arabic { 0 }
597 \__enumext_register_default_label_wd:Nn \Alph { M }

```

```

598 \__enumext_register_default_label_wd:Nn \alph { m }
599 \__enumext_register_default_label_wd:Nn \Roman { VIII }
600 \__enumext_register_default_label_wd:Nn \roman { viii }

```

(End of definition for \\_\_enumext\_register\_default\_label\_wd: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.

```

601 \cs_new_protected:Npn \__enumext_label_width_by_box:Nn #1 #2
602 {
603   \hbox_set:Nn \l__enumext_label_width_by_box {#2}
604   \dim_set:Nn #1 { \box_wd:N \l__enumext_label_width_by_box }
605 }
606 \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.

```

607 \cs_new_protected:Npn \__enumext_label_style:Nnn #1 #2 #3
608 {
609   \tl_clear_new:N #1
610   \tl_put_right:Ne #1 { \tl_trim_spaces:n {#3} }
611   \tl_gset_eq:NN \g__enumext_widest_label_tl #1
612   \tl_map_inline:Nn \g__enumext_counter_styles_tl
613   {
614     \tl_replace_all:Nne #1 { ##1* } { \exp_not:N ##1 {#2} }
615     \tl_greplace_all:Nne \g__enumext_widest_label_tl { ##1* }
616     { \tl_use:c { c__enumext_widest_ \cs_to_str:N ##1 _tl } }
617   }
618   \__enumext_label_width_by_box:Nn \l__enumext_current_widest_dim
619   { \tl_use:N \g__enumext_widest_label_tl }
620   \tl_set_eq:cN { the #2 } #1
621 }
622 \cs_generate_variant:Nn \__enumext_label_style:Nnn { cvn }

```

(End of definition for \\_\_enumext\_label\_style:Nnn.)

### 13.13 Setting keys associated with label

When *tagged* PDF is active \makelabel is redefined using \makebox to work correctly (§13.36). 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.

```

623 \cs_set_protected:Npn \__enumext_tmp:n #1
624 {
625   \keys_define:nn { enumext / #1 }
626   {
627     mode-box .bool_set:N = \l__enumext_mode_box_bool,
628     mode-box .initial:n = false,
629     mode-box .value_forbidden:n = true,
630   }
631 }
632 \clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }

```

(End of definition for mode-box.)

```

font
labelsep
labelwidth
wrap-label
wrap-label*

```

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

```

633 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
634 {
635   \keys_define:nn { enumext / #1 }
636   {
637     font .tl_set:c = { l__enumext_label_font_style_#2_tl },
638     font .value_required:n = true,
639     labelsep .dim_set:c = { l__enumext_labelsep_#2_dim },
640     labelsep .initial:n = {0.3333em},

```

```

641     labelsep .value_required:n = true,
642     labelwidth .dim_set:c = { l__enumext_labelwidth_#2_dim },
643     labelwidth .value_required:n = true,
644     wrap-label .cs_set_protected:cp = { __enumext_wrapper_label_#2:n } ##1,
645     wrap-label .initial:n = {##1},
646     wrap-label .value_required:n = true,
647     wrap-label* .code:n = {
648         \bool_set_true:c { l__enumext_wrap_label_opt_#2_bool }
649         \keys_set:nn { enumext / #1 } { wrap-label = {##1} }
650     },
651     wrap-label* .value_required:n = true,
652 }
653 }
654 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

(End of definition for font and others.)

**align** The `align` key is implemented differently for “starred” and “non starred” environments. For compatibility with *tagged* PDF we must set `\l__enumext_align_label_pos_X_str`.

```

655 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
656 {
657     \keys_define:nn { enumext / #1 }
658     {
659         align .choice:,
660         align / left .code:n =
661             {
662                 \tl_clear:c { l__enumext_label_fill_left_#2_tl }
663                 \tl_set:cn { l__enumext_label_fill_right_#2_tl } { \hfill }
664                 \str_set:cn { l__enumext_align_label_pos_#2_str } { l }
665             },
666         align / right .code:n =
667             {
668                 \tl_set:cn { l__enumext_label_fill_left_#2_tl } { \hfill }
669                 \tl_clear:c { l__enumext_label_fill_right_#2_tl }
670                 \str_set:cn { l__enumext_align_label_pos_#2_str } { r }
671             },
672         align / center .code:n =
673             {
674                 \tl_set:cn { l__enumext_label_fill_left_#2_tl } { \hfill }
675                 \tl_set:cn { l__enumext_label_fill_right_#2_tl } { \hfill }
676                 \str_set:cn { l__enumext_align_label_pos_#2_str } { c }
677             },
678         align / unknown .code:n =
679             \msg_error:nnee { enumext } { unknown-choice }
680             { align } { left,~right,~ center } { \exp_not:n {##1} },
681         align .initial:n = left,
682         align .value_required:n = true,
683     }
684 }
685 \clist_map_inline:nn
686 {
687     {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {keyans}{v}
688 }
689 { \__enumext_tmp:nn #1 }
690 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
691 {
692     \keys_define:nn { enumext / #1 }
693     {
694         align .choice:,
695         align / left .code:n = \str_set:cn { l__enumext_align_label_#2_str } { l },
696         align / right .code:n = \str_set:cn { l__enumext_align_label_#2_str } { r },
697         align / center .code:n = \str_set:cn { l__enumext_align_label_#2_str } { c },
698         align / unknown .code:n =
699             \msg_error:nnee { enumext } { unknown-choice }
700             { align } { left,~right,~ center } { \exp_not:n {##1} },
701         align .initial:n = left,
702         align .value_required:n = true,
703     }
704 }
705 \clist_map_inline:nn { {enumext*}{vii}, {keyans*}{viii} } { \__enumext_tmp:nn #1 }

```

(End of definition for align.)

### 13.14 Setting label and ref keys

The implementation of the keys `label` and `ref` are part of the core of the package `enumext`, here the default values for  $\langle label \rangle$ , the value of the variables  $\backslash\_\_enumext\_label\_X\_tl$ , the default values for  $\backslash labelwidth$  and the “*label and ref*” system.

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

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

```

label
ref
\__enumext_label_i_tl
\__enumext_label_ii_tl
\__enumext_label_iii_tl
\__enumext_label_iv_tl
706 \cs_set_protected:Npn \__enumext_tmp:nnn #1 #2 #3
707 {
708   \keys_define:nn { enumext / #1 }
709   {
710     label .code:n = {
711       \__enumext_label_style:cvn { \__enumext_label_#2_tl }
712       { \__enumext_counter_#2_tl } {##1}
713       \dim_set_eq:cN { \__enumext_labelwidth_#2_dim }
714       \__enumext_current_widest_dim
715     },
716     label .initial:n = #3,
717     label .value_required:n = true,
718     ref .code:n = \__enumext_standar_ref:n {##1},
719     ref .value_required:n = true,
720   }
721 }
722 \__enumext_tmp:nnn { level-1 } { i } { \arabic*. }
723 \__enumext_tmp:nnn { level-2 } { ii } { (\alph*. ) }
724 \__enumext_tmp:nnn { level-3 } { iii } { \roman*. }
725 \__enumext_tmp:nnn { level-4 } { iv } { \Alph*. }
```

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

$\backslash\_\_enumext\_standar\_ref:n$   
 $\backslash\_\_enumext\_standar\_ref:$

The  $\backslash\_\_enumext\_standar\_ref:n$  function will first pass the key *argument* `ref` to the variable  $\backslash\_\_enumext\_ref\_key\_arg\_tl$  and analyze its state, if it is not *empty* it will set a copy of of the *current counter style* save in  $\backslash\_\_enumext\_the\_counter\_X\_tl$  to  $\backslash\_\_enumext\_ref\_the\_count\_tl$  and then set the variable  $\backslash\_\_enumext\_renew\_counter\_X\_tl$  which will modify  $\backslash theenumX$ .

```

726 \cs_new_protected:Npn \__enumext_standar_ref:n #1
727 {
728   \tl_set:Nn \__enumext_ref_key_arg_tl {#1}
729   \tl_if_empty:NTF \__enumext_ref_key_arg_tl
730   {
731     \msg_error:nnn { enumext } { key-ref-empty } { enumext }
732   }
733   {
734     \tl_set_eq:Nc \__enumext_ref_the_count_tl
735     {
736       \__enumext_the_counter_ \__enumext_level: _tl
737     }
738     \tl_set:ce { \__enumext_renew_counter_ \__enumext_level: _tl }
739     {
740       \exp_not:N \renewcommand { \exp_not:V \__enumext_ref_the_count_tl }
741       { \exp_not:V \__enumext_ref_key_arg_tl }
742     }
743   }
744 }
```

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

```

745 \cs_new_protected:Npn \__enumext_standar_ref:
746 {
747   \tl_if_empty:cF { \__enumext_renew_counter_ \__enumext_level: _tl }
748   {
749     \tl_use:c { \__enumext_renew_counter_ \__enumext_level: _tl }
750   }
751 }
```

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



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

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

```

\l__enumext_label_vii_tl 752 \cs_set_protected:Npn \l__enumext_tmp:nnn #1 #2 #3
\l__enumext_label_viii_tl 753 {
754   \keys_define:nn { enumext / #1 }
755   {
756     label .code:n = {
757       \__enumext_label_style:cvn { \l__enumext_label_#2_tl }
758       { \l__enumext_counter_#2_tl } {##1}
759       \dim_set_eq:cN { \l__enumext_labelwidth_#2_dim }
760       \l__enumext_current_widest_dim
761     },
762     label .initial:n = #3,
763     label .value_required:n = true,
764     ref .code:n = \l__enumext_starred_ref:n {##1},
765     ref .value_required:n = true,
766   }
767 }
768 \l__enumext_tmp:nnn { enumext* } { vii } { \arabic*.}
769 \l__enumext_tmp:nnn { keyans* } { viii } { \Alph*.}

```

(End of definition for label and others.)

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

```

770 \cs_new_protected:Npn \l__enumext_starred_ref:n #1
771 {
772   \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
773   \int_compare:nNnT { \l__enumext_level_h_int } = { 1 }
774   {
775     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
776     {
777       \msg_error:nnn { enumext } { key-ref-empty } { enumext* }
778     }
779     {
780       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_vii_tl
781       \tl_set:Ne \l__enumext_renew_counter_vii_tl
782       {
783         \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V
784       }
785     }
786   }
787   \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
788   {
789     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
790     {
791       \msg_error:nnn { enumext } { key-ref-empty } { keyans* }
792     }
793     {
794       \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_viii_tl
795       \tl_set:Ne \l__enumext_renew_counter_viii_tl
796       {
797         \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V
798       }
799     }
800   }
801 }

```

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.

```

802 \cs_new_protected:Nn \l__enumext_starred_ref:
803 {
804   \int_compare:nNnT { \l__enumext_level_h_int } = { 1 }
805   {
806     \tl_if_empty:NF \l__enumext_renew_counter_vii_tl
807     {
808       \tl_use:N \l__enumext_renew_counter_vii_tl
809     }
810   }
811   \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
812   {

```

```

813         \tl_if_empty:NF \l__enumext_renew_counter_viii_tl
814         {
815             \tl_use:N \l__enumext_renew_counter_viii_tl
816         }
817     }
818 }

```

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

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

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

```

\__enumext_label_v_tl
\__enumext_label_vi_tl
819 \keys_define:nn { enumext / keyans }
820 {
821     label .code:n = {
822         \__enumext_label_style:cnv { \__enumext_label_v_tl }
823         { \__enumext_counter_v_tl } {#1}
824         \__enumext_label_style:cnv { \__enumext_label_vi_tl }
825         { \__enumext_counter_vi_tl } {#1}
826         \dim_set_eq:NN
827         \__enumext_labelwidth_v_dim \__enumext_current_widest_dim
828     },
829     label .initial:n = \Alph*,
830     label .value_required:n = true,
831     ref .code:n = \__enumext_keyans_ref:n {#1},
832     ref .value_required:n = true,
833 }

```

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

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

```

\__enumext_keyans_ref:n
\__enumext_keyans_ref:
834 \cs_new_protected:Npn \__enumext_keyans_ref:n #1
835 {
836     \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
837     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
838     {
839         \msg_error:nnn { enumext } { key-ref-empty } { keyans }
840     }
841     {
842         \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_v_tl
843         \tl_put_right:Ne \l__enumext_renew_counter_v_tl
844         {
845             \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V \l__
846         }
847     }
848 }

```

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

```

849 \cs_new_protected:Nn \__enumext_keyans_ref:
850 {
851     \tl_if_empty:NF \l__enumext_renew_counter_v_tl
852     {
853         \tl_use:N \l__enumext_renew_counter_v_tl
854     }
855 }

```

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

### 13.15 Setting `start`, `start*` and `widest` keys

The function `\__enumext_start_from:NNn` used by `start` and `start*` keys take three arguments:

```

\__enumext_start_from:ccn #1: \l__enumext_label_X_tl
\__enumext_start_from:cce #2: \l__enumext_start_X_int
\__enumext_start_from:cce #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.

```

856 \cs_new_protected:Npn \__enumext_start_from:NNn #1 #2 #3
857 {

```

```

858     \__enumext_if_is_int:nTF { #3 }
859     {
860         \int_set:Nn #2 {#3}
861     }
862     {
863         \regex_if_match:nVT { \c{Alph} | \c{alph} } {#1}
864         { \int_set:Nn #2 { \int_from_alph:n {#3} } }
865         \regex_if_match:nVT { \c{Roman} | \c{roman} } {#1}
866         { \int_set:Nn #2 { \int_from_roman:n {#3} } }
867     }
868 }
869 \cs_generate_variant:Nn \__enumext_start_from:NNn { ccn, cce }

```

(End of definition for \\_\_enumext\_start\_from:NNn.)

```

\__enumext_widest_from:nNNn
\__enumext_widest_from:nccn

```

The function \\_\_enumext\_widest\_from:nNNn used by the `widest` key take four arguments:

**#1:** The counter associated with the environment level

**#2:** \l\_\_enumext\_label\_X\_tl

**#3:** \l\_\_enumext\_labelwidth\_X\_dim

**#4:** *<integer or string>*

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

```

870 \cs_new_protected:Npn \__enumext_widest_from:nNNn #1 #2 #3 #4
871 {
872     \__enumext_if_is_int:nTF {#4}
873     {
874         \setcounter{enumX#1} { #4 }
875     }
876     {
877         \regex_if_match:nVT { \c{Alph} | \c{alph} } {#2}
878         { \setcounter{enumX#1} { \int_from_alph:n {#4} } }
879         \regex_if_match:nVT { \c{Roman} | \c{roman} } {#2}
880         { \setcounter{enumX#1} { \int_from_roman:n {#4} } }
881     }
882     \__enumext_label_width_by_box:cv
883     { \__enumext_labelwidth_#1_dim } { \__enumext_label_#1_tl }
884 }
885 \cs_generate_variant:Nn \__enumext_widest_from:nNNn { nccn }

```

(End of definition for \\_\_enumext\_widest\_from:nNNn.)

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

```

start
start*
widest
886 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
887 {
888     \keys_define:nn { enumext / #1 }
889     {
890         start* .code:n = {
891             \__enumext_start_from:ccn
892             { \__enumext_label_#2_tl }
893             { \__enumext_start_#2_int } {##1}
894         },
895         start* .value_required:n = true,
896         start .code:n = {
897             \__enumext_start_from:cce
898             { \__enumext_label_#2_tl }
899             { \__enumext_start_#2_int } { \int_eval:n {##1} }
900         },
901         start .initial:n = 1,
902         start .value_required:n = true,
903         widest .code:n = {
904             \__enumext_widest_from:nccn {#2}
905             { \__enumext_label_#2_tl }
906             { \__enumext_labelwidth_#2_dim } {##1}
907         },
908         widest .value_required:n = true,
909     }
910 }
911 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

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

### 13.16 Setting keys for penaltys

`beginpenalty`  
`midpenalty`  
`endpenalty`

The three parameters `\@beginparpenalty`, `\@itempenalty` and `\@endparpenalty` work together to ensure that list environments look good, avoiding unsightly page breaks that can break the flow of the `list`, so it's a good idea to have a `(keys)` to access these.

```

912 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
913 {
914   \keys_define:nn { enumext / #1 }
915   {
916     beginpenalty .int_set:c = { l__enumext_beginparpenalty_#2_int },
917     beginpenalty .initial:n = -51,
918     beginpenalty .value_required:n = true,
919     midpenalty .int_set:c = { l__enumext_itempenalty_#2_int },
920     midpenalty .initial:n = -51,
921     midpenalty .value_required:n = true,
922     endpenalty .int_set:c = { l__enumext_endparpenalty_#2_int },
923     endpenalty .initial:n = -51,
924     endpenalty .value_required:n = true,
925   }
926 }
927 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

(End of definition for `beginpenalty`, `midpenalty`, and `endpenalty`.)

### 13.17 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.

```

928 \cs_set_protected:Npn \__enumext_tmp:nnnnnn #1 #2 #3 #4 #5 #6
929 {
930   \keys_define:nn { enumext / #1 }
931   {
932     topsep .skip_set:c = { l__enumext_topsep_#2_skip },
933     topsep .initial:n = {#3},
934     topsep .value_required:n = true,
935     partopsep .skip_set:c = { l__enumext_partopsep_#2_skip },
936     partopsep .initial:n = {#4},
937     partopsep .value_required:n = true,
938     parsep .skip_set:c = { l__enumext_parsep_#2_skip },
939     parsep .initial:n = {#5},
940     parsep .value_required:n = true,
941     itemsep .skip_set:c = { l__enumext_itemsep_#2_skip },
942     itemsep .initial:n = {#6},
943     itemsep .value_required:n = true,
944     noitemsep .meta:n = { itemsep = 0pt, parsep = 0pt },
945     noitemsep .value_forbidden:n = true,
946     nosepp .meta:n = {
947       itemsep = 0pt, parsep = 0pt,
948       topsep = 0pt, partopsep = 0pt,
949     },
950     nosepp .value_forbidden:n = true,
951   }
952 }

```

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

```

953 \__enumext_tmp:nnnnnn { level-1 } { i } { 8.0pt plus 2.0pt minus 4.0pt }
954 { 2.0pt plus 1.0pt minus 1.0pt } { 4.0pt plus 2.0pt minus 1.0pt }
955 { 4.0pt plus 2.0pt minus 1.0pt }
956 \__enumext_tmp:nnnnnn { level-2 } { ii } { 4.0pt plus 2.0pt minus 1.0pt }
957 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
958 { 2.0pt plus 1.0pt minus 1.0pt }
959 \__enumext_tmp:nnnnnn { level-3 } { iii } { 2.0pt plus 1.0pt minus 1.0pt }
960 { 1.0pt minus 1.0pt } { 0pt } { 2.0pt plus 1.0pt minus 1.0pt }
961 \__enumext_tmp:nnnnnn { level-4 } { iv } { 2.0pt plus 1.0pt minus 1.0pt }
962 { 1.0pt minus 1.0pt } { 0pt } { 2.0pt plus 1.0pt minus 1.0pt }
963 \__enumext_tmp:nnnnnn { keyans } { v } { 4.0pt plus 2.0pt minus 1.0pt }
964 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
965 { 2.0pt plus 1.0pt minus 1.0pt }
966 \__enumext_tmp:nnnnnn { enumext* } { vii } { 8.0pt plus 2.0pt minus 4.0pt }
967 { 2.0pt plus 1.0pt minus 1.0pt } { 4.0pt plus 2.0pt minus 1.0pt }

```

```

968 { 4.0pt plus 2.0pt minus 1.0pt }
969 \__enumext_tmp:nnnnn { keyans* } { viii } { 4.0pt plus 2.0pt minus 1.0pt }
970 { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
971 { 2.0pt plus 1.0pt minus 1.0pt }

```

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

### 13.18 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:
972 \keys_define:nn { enumext / level-1 }
973 {
974   base-fix .bool_set:N = \l__enumext_base_line_fix_bool,
975   base-fix .initial:n = false,
976   base-fix .value_forbidden:n = true,
977 }

```

The function `\__enumext_nested_base_line_fix:` passed to the `\__enumext_parse_keys:n` function in the definition of the `enumext` environment (§13.41) will be responsible for applying the *baseline correction* and adjusting the *keys* for the `enumext` environment and the `\printkeyans` with *starred argument* ‘\*’ (§13.49).

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.

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

```

978 \cs_new_protected:Nn \__enumext_nested_base_line_fix:
979 {
980   \bool_lazy_all:nT
981   {
982     { \bool_if_p:N \l__enumext_starred_first_bool }
983     { \bool_if_p:N \l__enumext_base_line_fix_bool }
984     { \bool_not_p:n { \l__enumext_print_keyans_star_bool } }
985   }
986   {
987     \mode_leave_vertical:
988     \vspace { -\dim_eval:n { \baselineskip + \parsep } }
989     \keys_set:nn { enumext / level-1 }
990     {
991       topsep = 0pt, above = 0pt, above* = 0pt,
992     }
993   }

```

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`.

```

994 \bool_lazy_and:nnT
995 { \bool_if_p:N \l__enumext_starred_first_bool }
996 { \bool_if_p:N \l__enumext_print_keyans_star_bool }
997 {
998   \mode_leave_vertical:
999   \skip_vertical:n { -\baselineskip }
1000   \skip_vertical:N \c_zero_skip
1001   \keys_set:nn { enumext / level-1 }
1002   {
1003     topsep = 0pt, above = 0pt, above* = 0pt,
1004   }
1005 }
1006 \bool_set_false:N \l__enumext_base_line_fix_bool
1007 }

```

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

### 13.19 Setting keys for horizontal spaces

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

```

1008 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1009 {
1010   \keys_define:nn { enumext / #1 }
1011   {
1012     itemindent .dim_set:c = { l__enumext_fake_item_indent_#2_dim },
1013     itemindent .value_required:n = true,
1014     rightmargin .dim_set:c = { l__enumext_rightmargin_#2_dim },
1015     rightmargin .value_required:n = true,
1016     listparindent .dim_set:c = { l__enumext_listparindent_#2_dim },
1017     listparindent .value_required:n = true,
1018     list-offset .dim_set:c = { l__enumext_listoffset_#2_dim },
1019     list-offset .value_required:n = true,
1020     list-indent .code:n =
1021       \bool_set_true:c { l__enumext_leftmargin_tmp_#2_bool }
1022       \dim_set:cn { l__enumext_leftmargin_tmp_#2_dim } {##1},
1023     list-indent .value_required:n = true,
1024   }
1025 }
1026 \clist_map_inline:nn
1027 {
1028   {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {keyans}{v}
1029 }
1030 { \__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.

```

1031 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1032 {
1033   \keys_define:nn { enumext / #1 }
1034   {
1035     itemindent .dim_set:c = { l__enumext_fake_item_indent_#2_dim },
1036     itemindent .value_required:n = true,
1037     rightmargin .dim_set:c = { l__enumext_rightmargin_#2_dim },
1038     rightmargin .value_required:n = true,
1039     listparindent .dim_set:c = { l__enumext_listparindent_#2_dim },
1040     listparindent .value_required:n = true,
1041     list-offset .dim_set:c = { l__enumext_listoffset_#2_dim },
1042     list-offset .value_required:n = true,
1043     list-indent .meta:n = { list-offset = ##1 },
1044     list-indent .value_required:n = true,
1045   }
1046 }
1047 \clist_map_inline:nn
1048 {
1049   {enumext*}{vii}, {keyans*}{viii}
1050 }
1051 { \__enumext_tmp:nn #1 }

```

#### 13.19.1 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.

```

1052 \cs_set_protected:Nn \__enumext_fake_item_indent:
1053 {
1054   \dim_compare:nNnT
1055     { \dim_use:c { l__enumext_fake_item_indent_ \__enumext_level: _dim } }
1056     >
1057     { \c_zero_dim }
1058   {
1059     \tl_set:ce { l__enumext_fake_item_indent_ \__enumext_level: _tl }
1060     {
1061       \exp_not:N \mode_leave_vertical:
1062       \exp_not:n { \skip_horizontal:n }
1063       { \dim_use:c { l__enumext_fake_item_indent_ \__enumext_level: _dim } }

```



```

1064         \exp_not:N \ignorespaces
1065     }
1066 }
1067 }
1068 \cs_set_protected:Nn \__enumext_keyans_fake_item_indent:
1069 {
1070     \dim_compare:nNnT
1071     { \l__enumext_fake_item_indent_v_dim } > { \c_zero_dim }
1072     {
1073         \tl_set:Nc \l__enumext_fake_item_indent_v_tl
1074         {
1075             \exp_not:N \mode_leave_vertical:
1076             \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_v_dim
1077             \exp_not:N \ignorespaces
1078         }
1079     }
1080 }
1081 \cs_set_protected:Nn \__enumext_fake_item_indent_vii:
1082 {
1083     \dim_compare:nNnT
1084     { \l__enumext_fake_item_indent_vii_dim } > { \c_zero_dim }
1085     {
1086         \tl_set:Nc \l__enumext_fake_item_indent_vii_tl
1087         {
1088             \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_vii_dim
1089             \exp_not:N \ignorespaces
1090         }
1091     }
1092 }
1093 \cs_set_protected:Nn \__enumext_fake_item_indent_viii:
1094 {
1095     \dim_compare:nNnT
1096     { \l__enumext_fake_item_indent_viii_dim } > { \c_zero_dim }
1097     {
1098         \tl_set:Nc \l__enumext_fake_item_indent_viii_tl
1099         {
1100             \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_viii_dim
1101             \exp_not:N \ignorespaces
1102         }
1103     }
1104 }

```

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

### 13.20 Setting show-length key

show-length

Define and set `show-length` key for `enumext`, `enumext*`, `keyans` and `keyans*` environments. The function sets the boolean variable `\l__enumext_show_length_X_bool` used in the definition of all environments to “true” and calls the function `\__enumext_show_length:nnn` which prints all the values of the “vertical” and “horizontal” parameters calculated and used.

```

1105 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1106 {
1107     \keys_define:nn { enumext / #1 }
1108     {
1109         show-length .bool_set:c = { \l__enumext_show_length_#2_bool },
1110         show-length .initial:n = false,
1111     }
1112 }
1113 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

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

### 13.21 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.

```

1114 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1115 {
1116     \keys_define:nn { enumext / #1 }
1117     {
1118         before .tl_set:c = { \l__enumext_before_no_starred_key_#2_tl },
1119         before .value_required:n = true,

```

```

1120     before* .tl_set:c = { l__enumext_before_starred_key_#2_tl },
1121     before* .value_required:n = true,
1122     after .tl_set:c = { l__enumext_after_stop_list_#2_tl },
1123     after .value_required:n = true,
1124     first .tl_set:c = { l__enumext_after_list_args_#2_tl },
1125     first .value_required:n = true,
1126   }
1127 }
1128 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

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

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

The function `\__enumext_before_args_exec:` executes the `{⟨code⟩}` set by the *before\** key “before” the `enumext` environment is started. The `{⟨code⟩}` is executed “without” knowing any definition of the `{⟨arg two⟩}` of the list: `{⟨code⟩}\list{⟨arg one⟩}{⟨arg two⟩}`.

```

1129 \cs_new_protected:Nn \__enumext_before_args_exec:
1130 {
1131   \tl_use:c { l__enumext_before_starred_key_ \__enumext_level: _tl }
1132 }

```

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⟩}`

```

1133 \cs_new_protected:Nn \__enumext_before_keys_exec:
1134 {
1135   \tl_use:c { l__enumext_before_no_starred_key_ \__enumext_level: _tl }
1136 }

```

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

```

1137 \cs_new_protected:Nn \__enumext_after_stop_list:
1138 {
1139   \tl_use:c { l__enumext_after_stop_list_ \__enumext_level: _tl }
1140 }

```

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.`

```

1141 \cs_new_protected:Nn \__enumext_after_args_exec:
1142 {
1143   \tl_use:c { l__enumext_after_list_args_ \__enumext_level: _tl }
1144 }

```

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

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

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

```

\__enumext_before_args_exec_v:
\__enumext_before_keys_exec_v:
\__enumext_after_stop_list_v:
\__enumext_after_args_exec_v:
1145 \cs_new_protected:Nn \__enumext_before_args_exec_v:
1146 {
1147   \tl_use:N \l__enumext_before_starred_key_v_tl
1148 }
1149 \cs_new_protected:Nn \__enumext_before_keys_exec_v:
1150 {
1151   \tl_use:N \l__enumext_before_no_starred_key_v_tl
1152 }
1153 \cs_new_protected:Nn \__enumext_after_stop_list_v:
1154 {
1155   \tl_use:N \l__enumext_after_stop_list_v_tl
1156 }
1157 \cs_new_protected:Nn \__enumext_after_args_exec_v:
1158 {
1159   \tl_use:N \l__enumext_after_list_args_v_tl
1160 }

```

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

### 13.21.3 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.

```
1161 \cs_new_protected:Nn \__enumext_before_args_exec_vii:
1162 {
1163   \tl_use:N \l__enumext_before_starred_key_vii_tl
1164 }
1165 \cs_new_protected:Nn \__enumext_before_args_exec_viii:
1166 {
1167   \tl_use:N \l__enumext_before_starred_key_viii_tl
1168 }
1169 \cs_new_protected:Nn \__enumext_before_keys_exec_vii:
1170 {
1171   \tl_use:N \l__enumext_before_no_starred_key_vii_tl
1172 }
1173 \cs_new_protected:Nn \__enumext_before_keys_exec_viii:
1174 {
1175   \tl_use:N \l__enumext_before_no_starred_key_viii_tl
1176 }
1177 \cs_new_protected:Nn \__enumext_after_stop_list_vii:
1178 {
1179   \tl_use:N \l__enumext_after_stop_list_vii_tl
1180 }
1181 \cs_new_protected:Nn \__enumext_after_stop_list_viii:
1182 {
1183   \tl_use:N \l__enumext_after_stop_list_viii_tl
1184 }
1185 \cs_new_protected:Nn \__enumext_after_args_exec_vii:
1186 {
1187   \tl_use:N \l__enumext_after_list_args_vii_tl
1188 }
1189 \cs_new_protected:Nn \__enumext_after_args_exec_viii:
1190 {
1191   \tl_use:N \l__enumext_after_list_args_viii_tl
1192 }
```

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

### 13.22 Setting keys for multicol 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.

```
1193 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1194 {
1195   \keys_define:nn { enumext / #1 }
1196   {
1197     mini-env .dim_set:c = { l__enumext_minipage_right_#2_dim },
1198     mini-env .value_required:n = true,
1199     mini-sep .dim_set:c = { l__enumext_minipage_hsep_#2_dim },
1200     mini-sep .initial:n = 0.3333em,
1201     mini-sep .value_required:n = true,
1202     columns-sep .dim_set:c = { l__enumext_columns_sep_#2_dim },
1203     columns-sep .value_required:n = true,
1204     columns .int_set:c = { l__enumext_columns_#2_int },
1205     columns .initial:n = 1,
1206     columns .value_required:n = true,
1207   }
1208 }
1209 \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.

```
1210 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1211 {
1212   \keys_define:nn { enumext / #1 }
1213   {
1214     mini-right .tl_gset:c = { g__enumext_miniright_code_#2_tl },
1215     mini-right .value_required:n = true,
1216     mini-right* .code:n = {
```

```

1217         \bool_gset_true:c { g__enumext_minipage_center_#2_bool }
1218         \keys_set:nn { enumext / #1 } { mini-right = {##1} }
1219     },
1220     mini-right* .value_required:n = true,
1221 }
1222 }
1223 \clist_map_inline:nn { {enumext*}{vii}, {keyans*}{viii} } { \__enumext_tmp:nn #1 }

```

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

### 13.23 Adjustment of vertical spaces for multicol

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

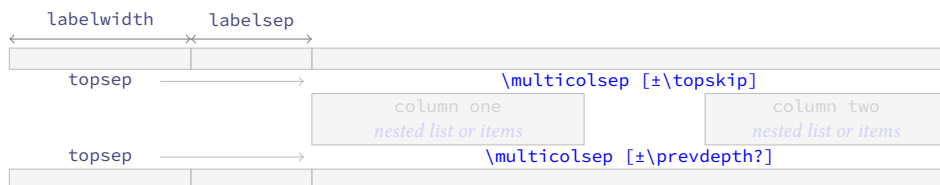


Figure 7: Representation of the vertical space in `multicol` for a nested level.

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

I should make it clear that the implementation here is a “*bit questionable*”. At first glance doing `\multicolsep=\topsep` seemed right, but the results were not always as expected. An almost *imperceptible* detail is that in some cases the `\itemsep` values 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.

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

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

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

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

```

1224 \cs_new_protected:Nn \__enumext_multi_set_vskip:
1225 {
1226     \skip_set:cn { l__enumext_multicol_above_ \__enumext_level: _skip }
1227     {
1228         \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip }
1229     }
1230     \skip_set:cn { l__enumext_multicol_below_ \__enumext_level: _skip }
1231     {
1232         \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip }
1233     }
1234     \__enumext_add_pre_parsep:
1235 }

```

(End of definition for `\__enumext_multi_set_vskip:`)

`\__enumext_add_pre_parsep:` The function `\__enumext_add_pre_parsep:` “*adjusted*” the value of `\l__enumext_multicol_above_X_skip` detecting the value of `\parsep` from the previous level. This is necessary since `\parsep` from the previous level affects the *vertical spaces*.

```

1236 \cs_new_protected:Nn \__enumext_add_pre_parsep:
1237 {
1238     \int_case:nn { \l__enumext_level_int }
1239     {
1240         { 2 }{
1241             \skip_if_eq:nnF { \l__enumext_parsep_i_skip } { \c_zero_skip }
1242             {
1243                 \skip_add:Nn \l__enumext_multicol_above_ii_skip
1244                 {
1245                     \l__enumext_parsep_i_skip
1246                 }
1247             }
1248         }
1249     }

```

```

1249     { 3 }{
1250         \skip_if_eq:nnF { \l__enumext_parsep_ii_skip } { \c_zero_skip }
1251         {
1252             \skip_add:Nn \l__enumext_multicols_above_iii_skip
1253             {
1254                 \l__enumext_parsep_ii_skip
1255             }
1256         }
1257     }
1258     { 4 }{
1259         \skip_if_eq:nnF { \l__enumext_parsep_iii_skip } { \c_zero_skip }
1260         {
1261             \skip_add:Nn \l__enumext_multicols_above_iv_skip
1262             {
1263                 \l__enumext_parsep_iii_skip
1264             }
1265         }
1266     }
1267 }
1268 }

```

(End of definition for `\__enumext_add_pre_parsep:`)

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

```

1269 \cs_new_protected:Nn \__enumext_multi_addvspace:
1270 {
1271     \__enumext_multi_set_vskip:
1272     \mode_if_vertical:T
1273     {
1274         \skip_add:cn { \l__enumext_multicols_above_ \__enumext_level: _skip }
1275         {
1276             \skip_use:c { \l__enumext_partopsep_ \__enumext_level: _skip }
1277         }
1278         \skip_add:cn { \l__enumext_multicols_below_ \__enumext_level: _skip }
1279         {
1280             \skip_use:c { \l__enumext_partopsep_ \__enumext_level: _skip }
1281         }
1282     }
1283     \par\nopagebreak
1284     \addvspace{ \skip_use:c { \l__enumext_multicols_above_ \__enumext_level: _skip } }
1285 }

```

(End of definition for `\__enumext_multi_addvspace:`)

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

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

`\__enumext_keyans_multi_addvspace:`

```

1286 \cs_new_protected:Nn \__enumext_keyans_multi_set_vskip:
1287 {
1288     \skip_set:Nn \l__enumext_multicols_above_v_skip
1289     {
1290         \l__enumext_topsep_v_skip
1291     }
1292     \skip_set:Nn \l__enumext_multicols_below_v_skip
1293     {
1294         \l__enumext_topsep_v_skip
1295     }
1296 }
1297 \cs_new_protected:Nn \__enumext_keyans_multi_addvspace:
1298 {
1299     \__enumext_keyans_multi_set_vskip:
1300     \mode_if_vertical:T
1301     {
1302         \skip_add:Nn \l__enumext_multicols_above_v_skip
1303         {
1304             \skip_use:N \l__enumext_partopsep_v_skip
1305         }
1306         \skip_add:Nn \l__enumext_multicols_below_v_skip

```

```

1307     {
1308         \skip_use:N \l__enumext_partopsep_v_skip
1309     }
1310 }
1311 \par\nopagebreak
1312 \addvspace{ \l__enumext_multicols_above_v_skip }
1313 }

```

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

### 13.24 Adjustment of vertical spaces for minipage

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



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

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

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

- Again I must make clear that the implementation here is a “bit questionable”, but hunting the spaces (glue) produced by the `minipage` environment is quite complicated, even more if `multicols` it is nested. The setting of the values was more “trial and error” (approx to `\strutbox`), using the help of the `lua-visual-debug`[15] package, again my attempts to find the correct values using `\showoutput` and `\showboxdepth` absolutely failed.

#### 13.24.1 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  $\TeX$  is in *vertical mode* and we will add `\partopsep`, followed by that we set the value of `\l__enumext_minipage_after_skip`.

```

1314 \cs_new_protected:Nn \__enumext_minipage_set_skip:
1315 {
1316     \skip_set:Nn \l__enumext_minipage_right_skip
1317     {
1318         \skip_use:c { \l__enumext_topsep_ \__enumext_level: _skip }
1319     }
1320     \mode_if_vertical:T
1321     {
1322         \skip_add:Nn \l__enumext_minipage_right_skip
1323         {
1324             \skip_use:c { \l__enumext_partopsep_ \__enumext_level: _skip }
1325         }
1326     }
1327     \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:`.

```

1328     \skip_set_eq:cN
1329     { \l__enumext_multicols_above_ \__enumext_level: _skip } \l__enumext_minipage_right_skip
1330     \skip_set_eq:cN
1331     { \l__enumext_multicols_below_ \__enumext_level: _skip } \l__enumext_minipage_right_skip
1332     \__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`.

```

1333     \int_compare:nNnT
1334     { \int_use:c { \l__enumext_columns_ \__enumext_level: _int } } > { 1 }
1335     {
1336         \skip_zero:N \topskip

```



```

1337     \skip_set_eq:Nc \multicolsep { \l__enumext_multicols_above_ \l__enumext_level: _skip }
1338   }
1339 }

```

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

```

1340 \cs_new_protected:Nn \l__enumext_minipage_add_space:
1341 {
1342   \l__enumext_minipage_set_skip:
1343   \l__enumext_unskip_unkern:
1344   \mode_if_vertical:TF
1345   {
1346     \nopagebreak\nointerlineskip
1347   }
1348   {
1349     \par\nopagebreak\nointerlineskip
1350     \skip_zero:c { \l__enumext_partopsep_ \l__enumext_level: _skip }
1351   }
1352   \int_compare:nNnTF
1353   { \int_use:c { \l__enumext_columns_ \l__enumext_level: _int } } > { 1 }
1354   {
1355     \addvspace{ 0.445\box_ht:N \strutbox }
1356   }
1357   {
1358     \addvspace{ 0.250\box_ht:N \strutbox }
1359   }
1360 }

```

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

`\l__enumext_pre_itemsep_skip:`

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

```

1361 \cs_new_protected:Nn \l__enumext_pre_itemsep_skip:
1362 {
1363   \int_case:nn { \l__enumext_level_int }
1364   {
1365     { 2 }{
1366       \skip_if_eq:nnTF
1367       { \l__enumext_itemsep_i_skip } { \l__enumext_minipage_after_skip }
1368       {
1369         \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1370         \skip_set:Nn \l__enumext_multicols_below_ii_skip { 0.350\box_ht:N \strutbox }
1371       }
1372       {
1373         \dim_compare:nNnT
1374         { \l__enumext_itemsep_i_skip } < { \l__enumext_minipage_after_skip }
1375         {
1376           \skip_sub:Nn
1377           \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1378           \skip_sub:Nn
1379           \l__enumext_multicols_below_ii_skip { \l__enumext_itemsep_i_skip }
1380           \skip_add:Nn
1381           \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1382           \skip_add:Nn
1383           \l__enumext_multicols_below_ii_skip { 0.350\box_ht:N \strutbox }
1384         }
1385         \dim_compare:nNnT
1386         { \l__enumext_itemsep_i_skip } > { \l__enumext_minipage_after_skip }
1387         {
1388           \skip_set:Nn \l__enumext_minipage_temp_skip
1389           {
1390             \l__enumext_itemsep_i_skip - \l__enumext_minipage_after_skip
1391           }
1392           \skip_sub:Nn
1393           \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1394           \skip_sub:Nn
1395           \l__enumext_multicols_below_ii_skip { \l__enumext_itemsep_i_skip }

```

```

1396         \skip_add:Nn
1397         \l__enumext_minipage_after_skip
1398         { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1399     \skip_add:Nn
1400     \l__enumext_multicols_below_ii_skip
1401     { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1402 }
1403 }
1404 }
1405 { 3 }{
1406     \skip_if_eq:nnTF
1407     { \l__enumext_itemsep_ii_skip } { \c_zero_skip }
1408     {
1409         \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1410         \skip_set:Nn \l__enumext_multicols_below_iii_skip { 0.350\box_ht:N \strutbox }
1411     }
1412     {
1413         \dim_compare:nNnT
1414         { \l__enumext_itemsep_ii_skip } < { \l__enumext_minipage_after_skip }
1415         {
1416             \skip_sub:Nn
1417             \l__enumext_minipage_after_skip { \l__enumext_itemsep_ii_skip }
1418             \skip_sub:Nn
1419             \l__enumext_multicols_below_iii_skip { \l__enumext_itemsep_ii_skip }
1420             \skip_add:Nn
1421             \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1422             \skip_add:Nn
1423             \l__enumext_multicols_below_iii_skip { 0.350\box_ht:N \strutbox }
1424         }
1425         \dim_compare:nNnT
1426         { \l__enumext_itemsep_ii_skip } > { \l__enumext_minipage_after_skip }
1427         {
1428             \skip_set:Nn \l__enumext_minipage_temp_skip
1429             {
1430                 \l__enumext_itemsep_ii_skip - \l__enumext_minipage_after_skip
1431             }
1432             \skip_sub:Nn
1433             \l__enumext_minipage_after_skip { \l__enumext_itemsep_ii_skip }
1434             \skip_sub:Nn
1435             \l__enumext_multicols_below_iii_skip { \l__enumext_itemsep_ii_skip }
1436             \skip_add:Nn
1437             \l__enumext_minipage_after_skip
1438             { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1439             \skip_add:Nn
1440             \l__enumext_multicols_below_iii_skip
1441             { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1442         }
1443     }
1444 }
1445 { 4 }{
1446     \skip_if_eq:nnTF { \l__enumext_itemsep_iii_skip } { \c_zero_skip }
1447     {
1448         \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1449         \skip_set:Nn \l__enumext_multicols_below_iv_skip { 0.350\box_ht:N \strutbox }
1450     }
1451     {
1452         \dim_compare:nNnT
1453         { \l__enumext_itemsep_iii_skip } < { \l__enumext_minipage_after_skip }
1454         {
1455             \skip_sub:Nn
1456             \l__enumext_minipage_after_skip { \l__enumext_itemsep_iii_skip }
1457             \skip_sub:Nn
1458             \l__enumext_multicols_below_iv_skip { \l__enumext_itemsep_iii_skip }
1459             \skip_add:Nn
1460             \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1461             \skip_add:Nn
1462             \l__enumext_multicols_below_iv_skip { 0.350\box_ht:N \strutbox }
1463         }
1464         \dim_compare:nNnT
1465         { \l__enumext_itemsep_iii_skip } > { \l__enumext_minipage_after_skip }
1466         {

```

```

1467         \skip_set:Nn \l__enumext_minipage_temp_skip
1468         {
1469             \l__enumext_itemsep_iii_skip - \l__enumext_minipage_after_skip
1470         }
1471     \skip_sub:Nn
1472     \l__enumext_minipage_after_skip { \l__enumext_itemsep_iii_skip }
1473 \skip_sub:Nn
1474 \l__enumext_multicols_below_iv_skip { \l__enumext_itemsep_iii_skip }
1475 \skip_add:Nn
1476 \l__enumext_minipage_after_skip
1477 { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1478 \skip_add:Nn
1479 \l__enumext_multicols_below_iv_skip
1480 { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1481 }
1482 }
1483 }
1484 }
1485 }

```

(End of definition for `\__enumext_pre_itemsep_skip:`)

### 13.24.2 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`.

```

1486 \cs_new_protected:Nn \__enumext_keyans_minipage_set_skip:
1487 {
1488     \skip_zero:N \l__enumext_minipage_after_skip
1489     \skip_zero:N \l__enumext_minipage_left_skip
1490     \skip_zero:N \l__enumext_minipage_right_skip
1491     \skip_set:Nn \l__enumext_minipage_right_skip
1492     {
1493         \l__enumext_topsep_v_skip
1494     }
1495     \mode_if_vertical:T
1496     {
1497         \skip_add:Nn \l__enumext_minipage_right_skip
1498         {
1499             \l__enumext_partopsep_v_skip
1500         }
1501     }
1502     \skip_set_eq:NN \l__enumext_minipage_after_skip \l__enumext_minipage_right_skip
1503     \skip_set_eq:NN \l__enumext_multicols_above_v_skip \l__enumext_minipage_right_skip
1504     \skip_set_eq:NN \l__enumext_multicols_below_v_skip \l__enumext_minipage_right_skip
1505     \__enumext_keyans_pre_itemsep_skip:
1506     \int_compare:nNnT { \l__enumext_columns_v_int } > { 1 }
1507     {
1508         \skip_zero:N \topskip
1509         \skip_set_eq:NN \multicolsep \l__enumext_minipage_right_skip
1510     }
1511 }
1512 \cs_new_protected:Nn \__enumext_keyans_minipage_add_space:
1513 {
1514     \__enumext_keyans_minipage_set_skip:
1515     \__enumext_unskip_unkern:
1516     \mode_if_vertical:TF
1517     {
1518         \nopagebreak\nointerlineskip
1519     }
1520     {
1521         \par\nopagebreak\nointerlineskip
1522         \skip_zero:N \l__enumext_partopsep_v_skip
1523     }
1524     \int_compare:nNnTF { \l__enumext_columns_v_int } > { 1 }
1525     {
1526         \addvspace{ 0.445\box_ht:N \strutbox }
1527     }
1528     {
1529         \addvspace{ 0.250\box_ht:N \strutbox }
1530     }

```

```

1531 }
1532 \cs_new_protected:Nn \__enumext_keyans_pre_itemsep_skip:
1533 {
1534   \skip_if_eq:nnTF
1535   { \l__enumext_itemsep_i_skip } { \l__enumext_minipage_after_skip }
1536   {
1537     \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1538     \skip_set:Nn \l__enumext_multicols_below_v_skip { 0.350\box_ht:N \strutbox }
1539   }
1540   {
1541     \dim_compare:nNnT
1542     { \l__enumext_itemsep_i_skip } < { \l__enumext_minipage_after_skip }
1543     {
1544       \skip_sub:Nn \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1545       \skip_sub:Nn \l__enumext_multicols_below_v_skip { \l__enumext_itemsep_i_skip }
1546       \skip_add:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
1547       \skip_add:Nn \l__enumext_multicols_below_v_skip { 0.350\box_ht:N \strutbox }
1548     }
1549     \dim_compare:nNnT
1550     { \l__enumext_itemsep_i_skip } > { \l__enumext_minipage_after_skip }
1551     {
1552       \skip_set:Nn \l__enumext_minipage_temp_skip
1553       {
1554         \l__enumext_itemsep_i_skip - \l__enumext_minipage_after_skip
1555       }
1556       \skip_sub:Nn \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
1557       \skip_sub:Nn \l__enumext_multicols_below_v_skip { \l__enumext_itemsep_i_skip }
1558       \skip_add:Nn \l__enumext_minipage_after_skip
1559       { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1560       \skip_add:Nn \l__enumext_multicols_below_v_skip
1561       { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
1562     }
1563   }
1564 }

```

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

### 13.24.3 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*`.

```

1565 \cs_new_protected:Nn \__enumext_mini_set_vskip_vii:
1566 {
1567   \skip_zero_new:N \l__enumext_minipage_left_skip
1568   \skip_gzero_new:N \g__enumext_minipage_right_skip
1569   \skip_gzero_new:N \g__enumext_minipage_after_skip
1570   \skip_if_eq:nnTF { \l__enumext_topsep_vii_skip } { \c_zero_skip }
1571   {
1572     \skip_set:Nn \l__enumext_minipage_left_skip { 0.5\box_dp:N \strutbox }
1573     \skip_gset:Nn \g__enumext_minipage_right_skip { 0.325\box_dp:N \strutbox }
1574   }
1575   {
1576     \skip_set:Nn \l__enumext_minipage_left_skip { 0.5875\box_dp:N \strutbox }
1577     \skip_gset:Nn \g__enumext_minipage_right_skip
1578     {
1579       \l__enumext_topsep_vii_skip
1580     }
1581     \skip_gset:Nn \g__enumext_minipage_after_skip
1582     {
1583       0.325\box_dp:N \strutbox + \l__enumext_topsep_vii_skip
1584     }
1585   }
1586 }
1587 \cs_new_protected:Nn \__enumext_mini_set_vskip_viii:
1588 {
1589   \skip_zero_new:N \l__enumext_minipage_after_skip
1590   \skip_zero_new:N \l__enumext_minipage_left_skip
1591   \skip_zero_new:N \l__enumext_minipage_right_skip
1592   \skip_if_eq:nnTF { \l__enumext_topsep_viii_skip } { \c_zero_skip }
1593   {

```

```

1594     \skip_set:Nn \l__enumext_minipage_left_skip
1595     {
1596         0.5\box_dp:N \strutbox
1597     }
1598     \skip_set:Nn \l__enumext_minipage_right_skip
1599     {
1600         \l__enumext_partopsep_viii_skip
1601     }
1602     \skip_set:Nn \l__enumext_minipage_after_skip
1603     {
1604         1.6\box_dp:N \strutbox
1605     }
1606 }
1607 {
1608     \skip_set:Nn \l__enumext_minipage_left_skip
1609     {
1610         0.5875\box_dp:N \strutbox
1611     }
1612     \skip_set:Nn \l__enumext_minipage_right_skip
1613     {
1614         \l__enumext_topsep_viii_skip
1615     }
1616     \skip_set:Nn \l__enumext_minipage_after_skip
1617     {
1618         0.325\box_dp:N \strutbox + \l__enumext_topsep_viii_skip
1619     }
1620 }
1621 }

```

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

`\__enumext_mini_addvspace_vii:`  
`\__enumext_mini_addvspace_viii:`

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

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

```

1622 \cs_new_protected:Nn \__enumext_mini_addvspace_vii:
1623 {
1624     \__enumext_mini_set_vskip_vii:
1625     \par\nopagebreak
1626     \addvspace { \l__enumext_minipage_left_skip }
1627 }
1628 \cs_new_protected:Nn \__enumext_mini_addvspace_viii:
1629 {
1630     \__enumext_mini_set_vskip_viii:
1631     \par\nopagebreak
1632     \addvspace { \l__enumext_minipage_left_skip }
1633 }

```

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

#### 13.24.4 The command `\miniright`

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

`\miniright`

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

```

1634 \NewDocumentCommand \miniright { s }
1635 {
1636     \int_compare:nNnT { \l__enumext_keyans_pic_level_int } = { 1 }
1637     {
1638         \msg_error:nnn { enumext } { wrong-miniright-place }
1639     }
1640     % outside
1641     \bool_lazy_and:nnT
1642     { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }

```

```

1643     { \int_compare:p:nNn { \l__enumext_level_h_int } = { 0 } }
1644     {
1645       \msg_error:nnn { enumext } { wrong-miniright-place }
1646     }
1647     % starred env
1648     \bool_lazy_and:nnT
1649     { \bool_if_p:N \g__enumext_starred_bool }
1650     { \bool_not_p:n { \l__enumext_standar_bool } }
1651     {
1652       \msg_error:nnn { enumext } { wrong-miniright-starred }
1653     }
1654     % exec
1655     \int_compare:nNnTF { \l__enumext_keyans_level_int } = { 1 }
1656     {
1657       \__enumext_keyans_mini_right_cmd:n {#1}
1658     }
1659     { \__enumext_mini_right_cmd:n {#1} }
1660   }

```

(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.

```

1661 \cs_new_protected:Npn \__enumext_mini_right_cmd:n #1
1662 {
1663   \dim_compare:nNnTF
1664   { \dim_use:c { \l__enumext_minipage_right_ \__enumext_level: _dim } } > { \c_zero_dim }
1665   {
1666     \__enumext_multicols_stop:
1667     \int_compare:nNnT
1668     { \int_use:c { \l__enumext_columns_ \__enumext_level: _int } } = { 1 }
1669     {
1670       \par\addvspace{ \l__enumext_minipage_after_skip }
1671     }
1672     \end__enumext_mini_page
1673     \hfill
1674     \__enumext_mini_page{ \dim_use:c { \l__enumext_minipage_right_ \__enumext_level: _dim } }
1675     \par\nointerlineskip
1676     \addvspace { \l__enumext_minipage_right_skip }
1677     \bool_if:nF {#1}
1678     {
1679       \centering
1680     }
1681     \int_gzero:N \g__enumext_minipage_stat_int
1682   }
1683   { \msg_error:nnn { enumext } { wrong-miniright-use } }
1684   % paranoia
1685   \RenewDocumentCommand \miniright { s }
1686   {
1687     \msg_error:nn { enumext } { many-miniright-used }
1688   }
1689 }

```

(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.

```

1690 \cs_new_protected:Npn \__enumext_keyans_mini_right_cmd:n #1
1691 {
1692   \dim_compare:nNnTF { \l__enumext_minipage_right_v_dim } > { \c_zero_dim }
1693   {
1694     \__enumext_keyans_multicols_stop:
1695     \int_compare:nNnT { \l__enumext_columns_v_int } = { 1 }
1696     {
1697       \par\addvspace{ \l__enumext_minipage_after_skip }
1698     }

```



```

1699     \end__enumext_mini_page
1700     \hfill
1701     \__enumext_mini_page{ \__enumext_minipage_right_v_dim }
1702     \par\nointerlineskip
1703     \addvspace { \__enumext_minipage_right_skip }
1704     \bool_if:nF {#1}
1705     {
1706         \centering
1707     }
1708     \int_gzero:N \g__enumext_minipage_stat_int
1709 }
1710 { \msg_error:nnn { enumext } { wrong-miniright-use } }
1711 % paranoia
1712 \RenewDocumentCommand \miniright { s }
1713 {
1714     \msg_error:nn { enumext } { many-miniright-used }
1715 }
1716 }

```

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

### 13.25 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.

```

1717 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
1718 {
1719     \keys_define:nn { enumext / #1 }
1720     {
1721         above .skip_set:c = { \__enumext_vspace_above_#2_skip },
1722         above .value_required:n = true,
1723         above* .code:n      = \bool_set_true:c { \__enumext_vspace_a_star_#2_bool }
1724                             \keys_set:nn { enumext / #1 } { above = {##1} },
1725         above* .value_required:n = true,
1726         below .skip_set:c = { \__enumext_vspace_below_#2_skip },
1727         below .value_required:n = true,
1728         below* .code:n      = \bool_set_true:c { \__enumext_vspace_b_star_#2_bool }
1729                             \keys_set:nn { enumext / #1 } { below = {##1} },
1730         below* .value_required:n = true,
1731     }
1732 }
1733 \clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }

```

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

#### 13.25.1 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.

```

1734 \cs_new_protected:Nn \__enumext_vspace_above:
1735 {
1736     \skip_if_eq:nnF
1737     { \skip_use:c { \__enumext_vspace_above_ \__enumext_level: _skip } } { \c_zero_skip }
1738     {
1739         \bool_if:cTF { \__enumext_vspace_a_star_ \__enumext_level: _bool }
1740         {
1741             \vspace*{ \skip_use:c { \__enumext_vspace_above_ \__enumext_level: _skip } }
1742         }
1743         {
1744             \vspace { \skip_use:c { \__enumext_vspace_above_ \__enumext_level: _skip } }
1745         }
1746     }
1747 }

```

(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.

```

1748 \cs_new_protected:Nn \__enumext_vspace_below:
1749 {
1750   \skip_if_eq:nnF
1751   { \skip_use:c { l__enumext_vspace_below_ \__enumext_level: _skip } } { \c_zero_skip }
1752   {
1753     \bool_if:cTF { l__enumext_vspace_b_star_ \__enumext_level: _bool }
1754     {
1755       \vspace*{ \skip_use:c { l__enumext_vspace_below_ \__enumext_level: _skip } }
1756     }
1757     {
1758       \vspace { \skip_use:c { l__enumext_vspace_below_ \__enumext_level: _skip } }
1759     }
1760   }
1761 }

```

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

### 13.25.2 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.

```

1762 \cs_new_protected:Nn \__enumext_vspace_above_v:
1763 {
1764   \skip_if_eq:nnF { \l__enumext_vspace_above_v_skip } { \c_zero_skip }
1765   {
1766     \bool_if:NTF \l__enumext_vspace_a_star_v_bool
1767     {
1768       \vspace*{ \l__enumext_vspace_above_v_skip }
1769     }
1770     { \vspace { \l__enumext_vspace_above_v_skip } }
1771   }
1772 }

```

(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.

```

1773 \cs_new_protected:Nn \__enumext_vspace_below_v:
1774 {
1775   \skip_if_eq:nnF { \l__enumext_vspace_below_v_skip } { \c_zero_skip }
1776   {
1777     \bool_if:NTF \l__enumext_vspace_b_star_v_bool
1778     {
1779       \vspace*{ \l__enumext_vspace_below_v_skip }
1780     }
1781     { \vspace { \l__enumext_vspace_below_v_skip } }
1782   }
1783 }

```

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

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

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

`\__enumext_vspace_above_viii:`

```

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

```

```

1799         \bool_if:NTF \l__enumext_vspace_a_star_viii_bool
1800         {
1801             \vspace*{ \l__enumext_vspace_above_viii_skip }
1802         }
1803         { \vspace { \l__enumext_vspace_above_viii_skip } }
1804     }
1805 }

```

(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.

```

1806 \cs_new_protected:Nn \__enumext_vspace_below_vii:
1807 {
1808     \skip_if_eq:nnF { \l__enumext_vspace_below_vii_skip } { \c_zero_skip }
1809     {
1810         \bool_if:NTF \l__enumext_vspace_b_star_vii_bool
1811         {
1812             \vspace*{ \l__enumext_vspace_below_vii_skip }
1813         }
1814         { \vspace { \l__enumext_vspace_below_vii_skip } }
1815     }
1816 }
1817 \cs_new_protected:Nn \__enumext_vspace_below_viii:
1818 {
1819     \skip_if_eq:nnF { \l__enumext_vspace_below_viii_skip } { \c_zero_skip }
1820     {
1821         \bool_if:NTF \l__enumext_vspace_b_star_viii_bool
1822         {
1823             \vspace*{ \l__enumext_vspace_below_viii_skip }
1824         }
1825         { \vspace { \l__enumext_vspace_below_viii_skip } }
1826     }
1827 }

```

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

### 13.26 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 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*` for the “all levels” of `enumext` and `enumext*`. Here we do not need to make sure that `\printkeyans` is not running otherwise the startup value of the environments would be increased when using `resume` or `resume*` keys.

```

1828 \cs_set_protected:Npn \__enumext_tmp:n #1
1829 {
1830     \keys_define:nn { enumext / #1 }
1831     {
1832         series .str_set:N = \l__enumext_series_name_str,
1833         series .value_required:n = true,
1834         resume* .code:n = {
1835             \bool_if:NF \l__enumext_print_keyans_cmd_bool
1836             {
1837                 \__enumext_resume_star:
1838             }
1839         },
1840         resume* .value_forbidden:n = true,
1841     }
1842 }
1843 \clist_map_inline:nn {level-1, level-2, level-3, level-4, enumext*} { \__enumext_tmp:n {#1} }
1844 \cs_set_protected:Npn \__enumext_tmp:n #1
1845 {
1846     \keys_define:nn { enumext / #1 }
1847     {
1848         resume .code:n = {
1849             \bool_if:NF \l__enumext_print_keyans_cmd_bool
1850             {
1851                 \__enumext_resume_series:n {##1}

```

```

1852         }
1853     },
1854 }
1855 }
1856 \clist_map_inline:nn {level-1, level-2, level-3, level-4} { \__enumext_tmp:n {#1} }
1857 \keys_define:nn { enumext / enumext* }
1858 {
1859     resume .code:n = {
1860         \bool_if:NF \__enumext_print_keyans_cmd_bool
1861         {
1862             \__enumext_resume_series_vii:n {#1}
1863         }
1864     },
1865 }

```

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

### 13.26.1 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
1866 \cs_new:Npn \__enumext_filter_series:n #1
1867 {
1868     \use:e
1869     {
1870         \keyval_parse:NNn
1871         \__enumext_filter_series_key:n
1872         \__enumext_filter_series_pair:nn {#1}
1873     }
1874 }

```

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.

```

1875 \cs_new:Npn \__enumext_filter_series_key:n #1
1876 {
1877     \str_case:nnF {#1}
1878     {
1879         { resume } {} { resume* } {} { base-fix } {}
1880     }
1881     { , { \exp_not:n {#1} } }
1882 }

```

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.

```

1883 \cs_new:Npn \__enumext_filter_series_pair:nn #1#2
1884 {
1885     \str_case:nnF {#1}
1886     {
1887         { series } {} { resume } {} { start } {}
1888         { start* } {} { save-ans } {} { save-key } {}
1889     }
1890     { , { \exp_not:n {#1} } = { \exp_not:n {#2} } }
1891 }

```

(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_X_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_X_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 (§13.41) and to the function `\__enumext_parse_keys_vii:n` in the `enumext*` environment definition (§13.46).

```

1892 \cs_new_protected:Npn \__enumext_parse_series:n #1
1893 {
1894     \str_if_empty:NTF \l__enumext_series_name_str
1895     {
1896         \int_compare:nNnT { \l__enumext_level_int } > { 0 }

```

```

1897     {
1898         \bool_if:cF { \__enumext_resume_ \__enumext_level: _bool }
1899         {
1900             \__enumext_resume_last:n {#1}
1901         }
1902     }
1903     \int_compare:nNnT { \__enumext_level_h_int } = { 1 }
1904     {
1905         \bool_if:NF \__enumext_resume_vii_bool
1906         {
1907             \__enumext_resume_last:n {#1}
1908         }
1909     }
1910 }
1911 {
1912     \int_compare:nNnT { \__enumext_level_int } > { 0 }
1913     {
1914         \tl_gclear_new:c { g__enumext_series_ \__enumext_series_name_str _ \__enumext_level:
1915         \tl_gset:ce
1916             { g__enumext_series_ \__enumext_series_name_str _ \__enumext_level: _tl }
1917             { \__enumext_filter_series:n {#1} }
1918         \int_if_exist:cF { g__enumext_series_ \__enumext_series_name_str _ \__enumext_level:
1919             {
1920                 \int_new:c { g__enumext_series_ \__enumext_series_name_str _ \__enumext_level: _
1921             }
1922         }
1923         \int_compare:nNnT { \__enumext_level_h_int } = { 1 }
1924         {
1925             \tl_gclear_new:c { g__enumext_series_ \__enumext_series_name_str _vii_tl }
1926             \tl_gset:ce
1927                 { g__enumext_series_ \__enumext_series_name_str _vii_tl }
1928                 { \__enumext_filter_series:n {#1} }
1929             \int_if_exist:cF { g__enumext_series_ \__enumext_series_name_str _vii_int }
1930                 {
1931                     \int_new:c { g__enumext_series_ \__enumext_series_name_str _vii_int }
1932                 }
1933         }
1934     }
1935 }

```

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_series_X_tl` for the **enumext** environment and in the variable `\g__enumext_series_vii_tl` for the **enumext\*** environment.

```

1936 \cs_new_protected:Npn \__enumext_resume_last:n #1
1937 {
1938     \int_compare:nNnT { \__enumext_level_int } > { 0 }
1939     {
1940         \tl_gclear:c { g__enumext_not_key_series_ \__enumext_level: _tl }
1941         \tl_gset:ce
1942             { g__enumext_not_key_series_ \__enumext_level: _tl } { \__enumext_filter_series:n {#1} }
1943     }
1944     \int_compare:nNnT { \__enumext_level_h_int } = { 1 }
1945     {
1946         \tl_gclear:N \g__enumext_not_key_series_vii_tl
1947         \tl_gset:Ne \g__enumext_not_key_series_vii_tl { \__enumext_filter_series:n {#1} }
1948     }
1949 }

```

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

### 13.26.2 Internal function to save counter value

```

\__enumext_standar_save_counter:
\__enumext_standar_save_counter_aux:
\__enumext_starred_save_counter:
\__enumext_starred_save_counter_aux:

```

The `\__enumext_standar_save_counter:` and `\__enumext_starred_save_counter:` functions 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_X_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 `\__enumext_series_name_str` and `\__enumext_series_name_tl` contain the same *{⟨series name⟩}* but are executed at different moments, the integer variable with `\__enumext_series_name_str` sets the value when execute *series*=*{⟨series name⟩}* and the integer variable with `\__enumext_series_name_tl` sets the subsequent

values when use `resume={(series name)}`. This function is passed to the `enumext` environment definition (§13.41) and the `enumext*` environment definition (§13.46).

```

1950 \cs_new_protected:Nn \__enumext_standar_save_counter:
1951 {
1952   \bool_if:NTF \g__enumext_standar_bool % enumext NOT nested
1953   {
1954     \__enumext_standar_save_counter_aux:
1955     \int_compare:nNnT { \l__enumext_level_int } = { 1 }
1956     {
1957       \int_if_exist:cT { g__enumext_resume_ \l__enumext_store_name_tl _int }
1958       {
1959         \int_gset_eq:cN
1960         { g__enumext_resume_ \l__enumext_store_name_tl _int } \value{enumXi}
1961       }
1962     }
1963   }
1964   {
1965     \__enumext_standar_save_counter_aux:
1966   }
1967 }
1968 \cs_new_protected:Nn \__enumext_standar_save_counter_aux:
1969 {
1970   \str_if_empty:NF \l__enumext_series_name_str
1971   {
1972     \int_gset_eq:cc
1973     { g__enumext_series_ \l__enumext_series_name_str _ \__enumext_level: _int } { c@enumX \__enumext_level: }
1974   }
1975   \tl_if_empty:NTF \l__enumext_series_name_tl
1976   {
1977     \str_if_empty:NT \l__enumext_series_name_str
1978     {
1979       \tl_if_empty:NT \l__enumext_store_name_tl
1980       {
1981         \int_gset_eq:cc
1982         { g__enumext_resume_ \__enumext_level: _int } { c@enumX \__enumext_level: }
1983       }
1984     }
1985   }
1986   {
1987     \int_if_exist:cT { g__enumext_series_ \l__enumext_series_name_tl _ \__enumext_level: _int }
1988     {
1989       \int_gset_eq:cc
1990       { g__enumext_series_ \l__enumext_series_name_tl _ \__enumext_level: _int } { c@enumX \__enumext_level: }
1991     }
1992   }
1993 }
1994 \cs_new_protected:Nn \__enumext_starred_save_counter:
1995 {
1996   \bool_if:NTF \g__enumext_starred_bool % enumext* NOT nested
1997   {
1998     \__enumext_starred_save_counter_aux:
1999     \int_if_exist:cT { g__enumext_resume_ \l__enumext_store_name_tl _int }
2000     {
2001       \int_gset_eq:cN
2002       { g__enumext_resume_ \l__enumext_store_name_tl _int } \value{enumXvii}
2003     }
2004   }
2005   {
2006     \__enumext_starred_save_counter_aux:
2007   }
2008 }
2009 \cs_new_protected:Nn \__enumext_starred_save_counter_aux:
2010 {
2011   \str_if_empty:NF \l__enumext_series_name_str
2012   {
2013     \int_gset_eq:cN
2014     { g__enumext_series_ \l__enumext_series_name_str _vii_int } \value{enumXvii}
2015   }
2016   \tl_if_empty:NTF \l__enumext_series_name_tl
2017   {
2018     \str_if_empty:NT \l__enumext_series_name_str

```



```

2019         {
2020             \tl_if_empty:NT \l__enumext_store_name_tl
2021             {
2022                 \int_gset_eq:NN \g__enumext_resume_vii_int \value{enumXvii}
2023             }
2024         }
2025     }
2026     {
2027         \int_if_exist:cT { g__enumext_series_ \l__enumext_series_name_tl _vii_int }
2028         {
2029             \int_gset_eq:cN
2030             { g__enumext_series_ \l__enumext_series_name_tl _vii_int } \value{enumXvii}
2031         }
2032     }
2033 }

```

(End of definition for \\_\_enumext\_standar\_save\_counter: and others.)

### 13.26.3 Internal functions for resume key

```

\__enumext_resume_series:n
\__enumext_resume_series_vii:n

```

The functions `\__enumext_resume_series:n` and `\__enumext_resume_series_vii: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:n` 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.

```

2034 \cs_new_protected:Npn \__enumext_resume_series:n #1
2035 {
2036     \int_compare:nNnT { \l__enumext_level_int } > { 0 }
2037     {
2038         \tl_if_empty:nTF {#1}
2039         {
2040             \__enumext_resume_counter:n { }
2041         }
2042         {
2043             \tl_if_exist:cTF { g__enumext_series_ \tl_to_str:n {#1} _ \__enumext_level: _tl }
2044             {
2045                 \__enumext_resume_counter:n {#1}
2046                 \exp_args:Ne \keys_set:nv { enumext / level-\int_use:N \l__enumext_level_int }
2047                 { g__enumext_series_ \tl_to_str:n {#1} _ \__enumext_level: _tl }
2048             }
2049             {
2050                 \msg_error:nnn { enumext } { unknown-series-standar } {#1}
2051             }
2052         }
2053     }
2054 }
2055 \cs_new_protected:Npn \__enumext_resume_series_vii:n #1
2056 {
2057     \int_compare:nNnT { \l__enumext_level_h_int } = { 1 }
2058     {
2059         \tl_if_empty:nTF {#1}
2060         {
2061             \__enumext_resume_counter:n { }
2062         }
2063         {
2064             \tl_if_exist:cTF { g__enumext_series_ \tl_to_str:n {#1} _vii_tl }
2065             {
2066                 \__enumext_resume_counter:n {#1}
2067                 \keys_set:nv { enumext / enumext* }
2068                 { g__enumext_series_ \tl_to_str:n {#1} _vii_tl }
2069             }
2070             {
2071                 \msg_error:nnn { enumext } { unknown-series-starred } {#1}
2072             }
2073         }
2074     }
2075 }

```

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

```

\__enumext_resume_counter:n
\__enumext_resume_counter:
\__enumext_resume_counter_series:

```

The function `\__enumext_resume_counter:n` will set the variable `\l__enumext_resume_X_bool` to true and pass the value of the key `resume` to the variable `\l__enumext_series_name_tl` which will contain

the `{(series name)}`. If the variable `\l__enumext_series_name_tl` is empty, that is, we are passing the key `resume without value`, we will execute the function `\__enumext_resume_counter`: otherwise, when we pass `resume={ (series name) }` we will execute the function `\__enumext_resume_counter_series`:

```

2076 \cs_new_protected:Npn \__enumext_resume_counter:n #1
2077 {
2078   \int_compare:nNtT { \l__enumext_level_int } > { 0 }
2079   {
2080     \bool_set_true:c { l__enumext_resume_ \__enumext_level: _bool }
2081     \tl_clear:N \l__enumext_series_name_tl
2082     \tl_set:Nn \l__enumext_series_name_tl {#1}
2083     \tl_if_empty:NTF \l__enumext_series_name_tl
2084     {
2085       \__enumext_resume_counter:
2086     }
2087     {
2088       \__enumext_resume_counter_series:
2089     }
2090   }
2091   \int_compare:nNtT { \l__enumext_level_h_int } = { 1 }
2092   {
2093     \bool_set_true:N \l__enumext_resume_vii_bool
2094     \tl_clear:N \l__enumext_series_name_tl
2095     \tl_set:Nn \l__enumext_series_name_tl {#1}
2096     \tl_if_empty:NTF \l__enumext_series_name_tl
2097     {
2098       \__enumext_resume_counter:
2099     }
2100     {
2101       \__enumext_resume_counter_series:
2102     }
2103   }
2104 }

```

The `\__enumext_resume_counter`: function is executed when the `resume` key is used *without value*, only the counters for the “levels” of the environments will be set. If the `save-ans` key is active it will set the counter according to the value of the integer variable created by that key.

```

2105 \cs_new_protected:Nn \__enumext_resume_counter:
2106 {
2107   \cs_set:Npn \__enumext_tmp:n ##1
2108   {
2109     \exp_args:Ne \int_set:cn { l__enumext_start_ \int_to_roman:n {##1} _int }
2110     {
2111       \int_use:c { g__enumext_resume_ \int_to_roman:n {##1} _int } + 1
2112     }
2113   }
2114   \int_compare:nNtT { \l__enumext_level_int } > { 0 }
2115   {
2116     \bool_lazy_and:nnTF
2117     { \bool_if_p:N \l__enumext_standar_first_bool }
2118     { \bool_if_p:N \l__enumext_store_active_bool }
2119     {
2120       \int_set:Nn \l__enumext_start_i_int
2121       {
2122         \int_use:c { g__enumext_resume_ \l__enumext_store_name_tl _int } + 1
2123       }
2124       \int_step_function:nnN { 2 } { \l__enumext_level_int } \__enumext_tmp:n
2125     }
2126     {
2127       \int_step_function:nnN { 1 } { \l__enumext_level_int } \__enumext_tmp:n
2128     }
2129   }
2130   \int_compare:nNtT { \l__enumext_level_h_int } = { 1 }
2131   {
2132     \bool_lazy_and:nnTF
2133     { \bool_if_p:N \l__enumext_starred_first_bool }
2134     { \bool_if_p:N \l__enumext_store_active_bool }
2135     {
2136       \int_set:Nn \l__enumext_start_vii_int
2137       {
2138         \int_use:c { g__enumext_resume_ \l__enumext_store_name_tl _int } + 1
2139       }

```

```

2140     }
2141     {
2142         \int_set:Nn \l__enumext_start_vii_int { \g__enumext_resume_vii_int + 1 }
2143     }
2144 }
2145 }

```

The function `\__enumext_resume_counter_series:` will be executed when the `resume={⟨series name⟩}` key is active, setting the counters for the “current level” of the environments according to the value of the integer variables created by the `series` key. If the `save-ans` key is active it will set the counter according to the value of the integer variable created by that key.

```

2146 \cs_new_protected:Nn \__enumext_resume_counter_series:
2147 {
2148     \cs_set:Npn \__enumext_tmp:n ##1
2149     {
2150         \int_if_exist:cT { g__enumext_series_ \l__enumext_series_name_tl _ \int_to_roman:n {##1} }
2151         {
2152             \exp_args:Ne \int_set:cn { l__enumext_start_ \int_to_roman:n {##1} _int }
2153             {
2154                 \int_use:c { g__enumext_series_ \l__enumext_series_name_tl _ \int_to_roman:n {##1} }
2155             }
2156         }
2157     }
2158     \int_compare:nNnT { \l__enumext_level_int } > { 0 }
2159     {
2160         \bool_lazy_and:nnTF
2161         { \bool_if_p:N \l__enumext_standar_first_bool }
2162         { \bool_if_p:N \l__enumext_store_active_bool }
2163         {
2164             \int_set:Nn \l__enumext_start_i_int
2165             {
2166                 \int_use:c { g__enumext_resume_ \l__enumext_store_name_tl _int } + 1
2167             }
2168             \int_step_function:nnN { 2 } { \l__enumext_level_int } \l__enumext_tmp:n
2169         }
2170         {
2171             \int_step_function:nnN { 1 } { \l__enumext_level_int } \l__enumext_tmp:n
2172         }
2173     }
2174     \int_compare:nNnT { \l__enumext_level_h_int } = { 1 }
2175     {
2176         \bool_lazy_and:nnTF
2177         { \bool_if_p:N \l__enumext_starred_first_bool }
2178         { \bool_if_p:N \l__enumext_store_active_bool }
2179         {
2180             \int_set:Nn \l__enumext_start_vii_int
2181             {
2182                 \int_use:c { g__enumext_resume_ \l__enumext_store_name_tl _int } + 1
2183             }
2184         }
2185         {
2186             \int_set:Nn \l__enumext_start_vii_int
2187             {
2188                 \int_use:c { g__enumext_series_ \l__enumext_series_name_tl _vii_int } + 1
2189             }
2190         }
2191     }
2192 }

```

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

### 13.26.4 Internal function for resume\* key

`\__enumext_resume_star:`

The function `\__enumext_resume_star:` 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 and `⟨keys⟩` 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.

```

2193 \cs_new_protected:Nn \__enumext_resume_star:
2194 {
2195     \cs_set:Npn \__enumext_tmp:n ##1
2196     {

```

```

2197         \tl_if_empty:cF { g__enumext_not_key_series_ \int_to_roman:n {##1} _tl }
2198         {
2199             \__enumext_resume_counter:n { }
2200             \exp_args:Ne \keys_set:nv
2201             { enumext / level-\int_use:N \l__enumext_level_int }
2202             { g__enumext_not_key_series_ \int_to_roman:n {##1} _tl }
2203         }
2204     }
2205     \int_compare:nNnT { \l__enumext_level_int } > { 0 }
2206     {
2207         \int_step_function:nnN { 1 } { \l__enumext_level_int } \__enumext_tmp:n
2208     }
2209     \int_compare:nNnT { \l__enumext_level_h_int } = { 1 }
2210     {
2211         \tl_if_empty:NF \g__enumext_not_key_series_vii_tl
2212         {
2213             \__enumext_resume_counter:n { }
2214             \keys_set:nV { enumext / enumext* } \g__enumext_not_key_series_vii_tl
2215         }
2216     }
2217 }

```

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

### 13.27 The \resetenumext, reset and reset\* keys

```

\resetenumext
\__enumext_standard_reset:nn
\__enumext_reset_count_resume:nn
\__enumext_reset_count_resume:en
\__enumext_reset_count_resume_all:n
\__enumext_reset_count_resume_levels:n
\__enumext_starred_reset:n
2218 \NewDocumentCommand \resetenumext { s o m }
2219 {
2220     \bool_if:nTF {#1}
2221     {
2222         \__enumext_reset_count_resume_all:n {#3}
2223     }
2224     {
2225         \tl_if_novalue:nTF {#2}
2226         {
2227             \__enumext_reset_count_resume_levels:n {#3}
2228         }
2229         {
2230             \str_if_eq:nnTF {#2} { * }
2231             { \__enumext_starred_reset:n {#3} }
2232             {
2233                 \bool_lazy_and:nnTF
2234                 { \int_compare_p:nNn {#2} > 0 }
2235                 { \int_compare_p:nNn {#2} < 5 }
2236                 { \__enumext_standard_reset:nn {#2} {#3} }
2237                 {
2238                     \msg_error:nne { enumext } { out-of-range } { \int_eval:n {#2} }
2239                 }
2240             }
2241         }
2242     }
2243 }
2244 \cs_new_protected:Npn \__enumext_standard_reset:nn #1
2245 {
2246     \__enumext_reset_count_resume:en { \int_to_roman:n {#1} }
2247 }
2248 \cs_new_protected:Npn \__enumext_reset_count_resume:nn #1 #2
2249 {
2250     \counterwithin*{enumX#1}{#2}
2251     \int_gzero:c { g__enumext_resume_ #1 _int }
2252 }
2253 \cs_generate_variant:Nn \__enumext_reset_count_resume:nn { e }
2254 \cs_new_protected:Npn \__enumext_reset_count_resume_all:n #1
2255 {
2256     \clist_map_inline:nn { i,ii,iii,iv,vii }
2257     {
2258         \__enumext_reset_count_resume:nn { ##1 } { #1 }
2259     }
2260 }
2261 \cs_new_protected:Npn \__enumext_reset_count_resume_levels:n #1
2262 {

```

```

2263     \clist_map_inline:nn { i,ii,iii,iv }
2264     {
2265         \__enumext_reset_count_resume:nn { ##1 } { #1 }
2266     }
2267 }
2268 \cs_new_protected:Npn \__enumext_starred_reset:n #1
2269 {
2270     \__enumext_reset_count_resume:nn { vii } { #1 }
2271 }

```

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

### 13.28 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.

#### 13.28.1 Setting save-ans key

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

```

2272 \cs_set_protected:Npn \__enumext_tmp:n #1
2273 {
2274     \keys_define:nn { enumext / #1 }
2275     {
2276         save-ans .code:n = \__enumext_storing_set:n {##1},
2277         save-ans .value_required:n = true,
2278     }
2279 }
2280 \clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }

```

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

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

```

\__enumext_start_save_ans_msg:
\__enumext_stop_save_ans_msg:

```

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

```

2281 \cs_new_protected:Nn \__enumext_start_save_ans_msg:
2282 {
2283     \msg_term:nnVV { enumext } { save-ans-log }
2284     \g__enumext_envir_name_tl \l__enumext_store_name_tl
2285 }
2286 \cs_new_protected:Nn \__enumext_stop_save_ans_msg:
2287 {
2288     \msg_term:nnVV { enumext } { save-ans-log-hook }
2289     \g__enumext_envir_name_tl \g__enumext_store_name_tl
2290 }

```

(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  $\langle \textit{store name} \rangle$  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.

```

2291 \cs_new_protected:Npn \__enumext_storing_set:n #1
2292 {
2293     \tl_set:Ne \l__enumext_store_name_tl {#1}
2294     \tl_if_empty:NTF \l__enumext_store_name_tl
2295     {
2296         \bool_lazy_or:nnT
2297         { \l__enumext_standar_first_bool } { \l__enumext_starred_first_bool }
2298         {
2299             \msg_error:nnV { enumext } { save-ans-empty } \g__enumext_envir_name_tl
2300         }
2301     }
2302     {
2303         \bool_lazy_or:nnT
2304         { \l__enumext_standar_first_bool } { \l__enumext_starred_first_bool }
2305         {
2306             \__enumext_start_save_ans_msg:

```

```

2307         \__enumext_storing_exec:
2308     }
2309 }
2310 }

```

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

```

2311 \cs_new_protected:Nn \__enumext_storing_exec:
2312 {
2313     \bool_set_true:N \l__enumext_store_active_bool
2314     \bool_set_true:N \l__enumext_check_answers_bool
2315     \tl_gset:NV \g__enumext_store_name_tl \l__enumext_store_name_tl

```

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

```

2316     \prop_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _prop }
2317     {
2318         \msg_log:nnV { enumext } { store-prop } \l__enumext_store_name_tl
2319         \prop_new:c { g__enumext_ \l__enumext_store_name_tl _prop }
2320     }
2321     \seq_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _seq }
2322     {
2323         \msg_log:nnV { enumext } { store-seq } \l__enumext_store_name_tl
2324         \seq_new:c { g__enumext_ \l__enumext_store_name_tl _seq }
2325     }
2326     \int_if_exist:cF { g__enumext_resume_ \l__enumext_store_name_tl _int }
2327     {
2328         \msg_log:nnV { enumext } { store-int } \l__enumext_store_name_tl
2329         \int_new:c { g__enumext_resume_ \l__enumext_store_name_tl _int }
2330     }
2331 }

```

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

### 13.28.3 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.



### 13.28.4 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 2332 \cs_set_protected:Npn \__enumext_tmp:n #1
no-store 2333 {
2334   \keys_define:nn { enumext / #1 }
2335   {
2336     check-ans .bool_set:N = \__enumext_check_ans_key_bool,
2337     check-ans .initial:n = false,
2338     check-ans .value_required:n = true,
2339     no-store .code:n = {
2340       \bool_set_false:N \__enumext_check_answers_bool
2341       \bool_set_false:N \__enumext_check_ans_key_bool
2342     },
2343     no-store .value_forbidden:n = true,
2344   }
2345 }
2346 \clist_map_inline:nn
2347 {
2348   level-1, level-2, level-3, level-4, enumext*
2349 }
2350 { \__enumext_tmp:n {#1} }
```

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

### 13.28.5 Set-up check answer mechanism

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

```

2351 \cs_new_protected:Nn \__enumext_check_ans_active:
2352 {
2353   \tl_if_empty:NF \__enumext_store_name_tl
2354   {
2355     \bool_if:NT \__enumext_check_answers_bool
2356     {
2357       \__enumext_check_ans_level:
2358     }
2359   }
2360 }
```

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

```

2361 \cs_new_protected:Nn \__enumext_check_ans_level:
2362 {
2363   \int_case:nn { \__enumext_level_int }
2364   {
2365     { 1 }{
2366       \bool_lazy_all:nT
2367       {
2368         { \bool_if_p:N \g__enumext_starred_bool }
2369         { \int_compare_p:nNn { \__enumext_level_h_int } = { 1 } }
2370       }
2371       {
2372         \int_gdecr:N \g__enumext_item_number_int
2373         \bool_set_false:N \__enumext_item_number_bool
2374       }
2375     }
2376     { 2 }{
2377       \int_gdecr:N \g__enumext_item_number_int
2378       \bool_set_false:N \__enumext_item_number_bool
2379     }
2380     { 3 }{
2381       \int_gdecr:N \g__enumext_item_number_int
2382       \bool_set_false:N \__enumext_item_number_bool
2383     }
2384     { 4 }{
2385       \int_gdecr:N \g__enumext_item_number_int
2386       \bool_set_false:N \__enumext_item_number_bool
```

```

2387         }
2388     }

```

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.

```

2389     \int_case:nn { \l__enumext_level_h_int }
2390     {
2391         { 1 }{
2392             \bool_lazy_all:nT
2393             {
2394                 { \bool_if_p:N \g__enumext_standar_bool }
2395                 { \int_compare_p:nNn { \l__enumext_level_int } = { 1 } }
2396             }
2397             {
2398                 \int_gdecr:N \g__enumext_item_number_int
2399                 \bool_set_false:N \l__enumext_item_number_bool
2400             }
2401         }
2402     }
2403 }

```

(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.

```

2404 \cs_new_protected:Nn \__enumext_check_ans_key_hook:
2405 {
2406     \bool_lazy_and:nnT
2407     { \bool_if_p:N \l__enumext_check_ans_key_bool }
2408     { \bool_if_p:N \g__enumext_standar_bool }
2409     {
2410         \bool_gset_true:N \g__enumext_check_ans_key_bool
2411     }
2412     \bool_lazy_and:nnT
2413     { \bool_if_p:N \l__enumext_check_ans_key_bool }
2414     { \bool_if_p:N \g__enumext_starred_bool }
2415     {
2416         \bool_gset_true:N \g__enumext_check_ans_key_bool
2417     }
2418 }

```

(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:`.

```

2419 \cs_new_protected:Nn \__enumext_item_answer_diff:
2420 {
2421     \int_gset:Nn \g__enumext_item_answer_diff_int
2422     {
2423         \int_sign:n { \g__enumext_item_number_int - \g__enumext_item_anskey_int }
2424     }
2425 }

```

(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:`.

```

2426 \cs_new_protected:Nn \__enumext_check_ans_show:
2427 {
2428     \int_case:nn { \g__enumext_item_answer_diff_int }
2429     {
2430         { -1 }{ \__enumext_check_ans_msg_less: }
2431         { 0 }{ \__enumext_check_ans_msg_same_ok: }
2432         { 1 }{ \__enumext_check_ans_msg_greater: }
2433     }
2434 }

```

```

2435 \cs_new_protected:Nn \__enumext_check_ans_msg_less:
2436 {
2437   \msg_warning:nneee { enumext } { item-less-answer } { \g__enumext_store_name_tl }
2438   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2439 }
2440 \cs_new_protected:Nn \__enumext_check_ans_msg_same_ok:
2441 {
2442   \msg_term:nneee { enumext } { items-same-answer } { \g__enumext_store_name_tl }
2443   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2444 }
2445 \cs_new_protected:Nn \__enumext_check_ans_msg_greater:
2446 {
2447   \msg_warning:nneee { enumext } { item-greater-answer } { \g__enumext_store_name_tl }
2448   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2449 }

```

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

```

\__enumext_check_ans_log:
\__enumext_check_ans_log_msg_less:
\__enumext_check_ans_log_msg_same_ok:
\__enumext_check_ans_log_msg_greater:

```

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:`.

```

2450 \cs_new_protected:Nn \__enumext_check_ans_log:
2451 {
2452   \int_case:nn { \g__enumext_item_answer_diff_int }
2453   {
2454     { -1 } { \__enumext_check_ans_log_msg_less: }
2455     { 0 } { \__enumext_check_ans_log_msg_same_ok: }
2456     { 1 } { \__enumext_check_ans_log_msg_greater: }
2457   }
2458 }
2459 \cs_new_protected:Nn \__enumext_check_ans_log_msg_less:
2460 {
2461   \msg_log:nneee { enumext } { item-less-answer } { \g__enumext_store_name_tl }
2462   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2463 }
2464 \cs_new_protected:Nn \__enumext_check_ans_log_msg_same_ok:
2465 {
2466   \msg_log:nneee { enumext } { items-same-answer } { \g__enumext_store_name_tl }
2467   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2468 }
2469 \cs_new_protected:Nn \__enumext_check_ans_log_msg_greater:
2470 {
2471   \msg_log:nneee { enumext } { item-greater-answer } { \g__enumext_store_name_tl }
2472   { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
2473 }

```

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

### 13.28.6 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.

```

2474 \cs_new_protected:Npn \__enumext_check_starred_cmd:n #1
2475 {
2476   \int_compare:nNnT
2477   { \g__enumext_check_starred_cmd_int } = { 0 }
2478   {
2479     \msg_warning:nnnV
2480     { enumext } { missing-starred } { #1 } \l__enumext_check_start_line_env_tl
2481   }
2482   \int_compare:nNnT
2483   { \g__enumext_check_starred_cmd_int } > { 1 }
2484   {
2485     \msg_warning:nnnV
2486     { enumext } { many-starred } { #1 } \l__enumext_check_start_line_env_tl
2487   }
2488   \int_gzero:N \g__enumext_check_starred_cmd_int
2489   \tl_clear:N \l__enumext_check_start_line_env_tl
2490 }

```

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

## 13.29 Keys and functions associated with storage

### 13.29.1 Keys for marks, wrap and show

The `enumext` package provides a set of *keys* for manipulating “symbol marks” associated with “answers” and how they are displayed and stored in the *sequence* and *prop list* as well as an internal “label and ref” system.

```

mark-ans*  For the keyans and keyans* environments we will only add the keys mark-ans*, mark-pos*, mark-sep*,
mark-pos*  wrap-ans*, wrap-opt, save-sep, show-ans and show-pos.
mark-sep*
wrap-ans*  2491 \cs_set_protected:Npn \__enumext_tmp:nn #1 #2
           2492 {
           2493   \keys_define:nn { enumext / #1 }
           2494   {
           2495     mark-ans* .tl_set:c = { \__enumext_mark_answer_sym_#2_tl },
           2496     mark-ans* .initial:n = \textasteriskcentered,
           2497     mark-ans* .value_required:n = true,
           2498     mark-pos* .choice:,
           2499     mark-pos* / left .code:n = \str_set:cn { \__enumext_mark_position_#2_str } { l },
           2500     mark-pos* / right .code:n = \str_set:cn { \__enumext_mark_position_#2_str } { r },
           2501     mark-pos* / center .code:n = \str_set:cn { \__enumext_mark_position_#2_str } { c },
           2502     mark-pos* / unknown .code:n =
           2503       \msg_error:nnee { enumext } { unknown-choice }
           2504       { mark-pos } { left,~right,~center } { \exp_not:n {##1} },
           2505     mark-pos* .initial:n = right,
           2506     mark-pos* .value_required:n = true,
           2507     mark-sep* .dim_set:c = { \__enumext_mark_sym_sep_#2_dim },
           2508     mark-sep* .value_required:n = true,
           2509     wrap-ans* .cs_set_protected:cp = { __enumext_keyans_wrapper_item_#2:n } ##1,
           2510     wrap-ans* .value_required:n = true,
           2511     wrap-opt .cs_set_protected:cp = { __enumext_keyans_wrapper_opt_#2:n } ##1,
           2512     wrap-opt .initial:n = [{##1}],
           2513     wrap-opt .value_required:n = true,
           2514     save-sep .tl_set:c = { \__enumext_store_keyans_item_opt_sep_#2_tl },
           2515     save-sep .initial:n = {,~},
           2516     save-sep .value_required:n = true,
           2517     show-ans .bool_set:N = \__enumext_show_answer_bool,
           2518     show-ans .initial:n = false,
           2519     show-ans .value_required:n = true,
           2520     show-pos .bool_set:N = \__enumext_show_position_bool,
           2521     show-pos .initial:n = false,
           2522     show-pos .value_required:n = true,
           2523   }
           2524 }
           2525 \clist_map_inline:nn { {keyans}{v}, {keyans*}{viii} } { \__enumext_tmp:nn #1 }

```

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

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

```

mark-ans*  2526 \cs_set_protected:Npn \__enumext_tmp:n #1
mark-pos*  2527 {
mark-sep*  2528   \keys_define:nn { enumext / #1 }
wrap-ans*  2529   {
mark-ans*  2530     mark-ref .tl_set:N = \__enumext_mark_ref_sym_tl,
mark-pos*  2531     mark-ref .initial:n = \textreferencemark,
mark-sep*  2532     mark-ref .value_required:n = true,
wrap-ans*  2533     save-ref .bool_set:N = \__enumext_store_ref_key_bool,
           2534     save-ref .initial:n = false,
           2535     save-ref .value_required:n = true,
           2536     show-ans .bool_set:N = \__enumext_show_answer_bool,
           2537     show-ans .initial:n = false,
           2538     show-ans .value_required:n = true,
           2539     show-pos .bool_set:N = \__enumext_show_position_bool,
           2540     show-pos .initial:n = false,
           2541     show-pos .value_required:n = true,
           2542     mark-ans .tl_set:N = \__enumext_mark_answer_sym_tl,
           2543     mark-ans .initial:n = \textasteriskcentered,
           2544     mark-ans .value_required:n = true,
           2545     mark-sep .dim_set:N = \__enumext_mark_sym_sep_dim,
           2546     mark-sep .value_required:n = true,

```

```

2547 mark-pos .choice:,
2548 mark-pos / left .code:n = \str_set:Nn \l__enumext_mark_position_str { l },
2549 mark-pos / right .code:n = \str_set:Nn \l__enumext_mark_position_str { r },
2550 mark-pos / center .code:n = \str_set:Nn \l__enumext_mark_position_str { c },
2551 mark-pos / unknown .code:n =
2552 \msg_error:nneee { enumext } { unknown-choice }
2553 { mark-pos } { left,~right,~center } { \exp_not:n {##1} },
2554 mark-pos .initial:n = right,
2555 mark-pos .value_required:n = true,
2556
2557 wrap-ans .cs_set_protected:Np = \__enumext_anskey_wrapper:n ##1,
2558 wrap-ans .initial:n =
2559 {
2560 \fbox{\parbox[t]{\dimeval{\itemwidth -2\fboxsep -2\fboxrule}}{##1}}
2561 },
2562 wrap-ans .value_required:n = true,
2563 mark-ans* .code:n = {
2564 \keys_set:nn { enumext / keyans } { mark-ans* = {##1} }
2565 \keys_set:nn { enumext / keyans* } { mark-ans* = {##1} }
2566 },
2567 mark-ans* .value_required:n = true,
2568 mark-pos* .code:n = {
2569 \keys_set:nn { enumext / keyans } { mark-pos* = {##1} }
2570 \keys_set:nn { enumext / keyans* } { mark-pos* = {##1} }
2571 },
2572 mark-pos* .value_required:n = true,
2573 mark-sep* .code:n = {
2574 \keys_set:nn { enumext / keyans } { mark-sep* = {##1} }
2575 \keys_set:nn { enumext / keyans* } { mark-sep* = {##1} }
2576 },
2577 mark-sep* .value_required:n = true,
2578 wrap-ans* .code:n = {
2579 \keys_set:nn { enumext / keyans } { wrap-ans* = {##1} }
2580 \keys_set:nn { enumext / keyans* } { wrap-ans* = {##1} }
2581 },
2582 wrap-ans* .value_required:n = true,
2583 wrap-opt .code:n = {
2584 \keys_set:nn { enumext / keyans } { wrap-opt = {##1} }
2585 \keys_set:nn { enumext / keyans* } { wrap-opt = {##1} }
2586 },
2587 wrap-opt .value_required:n = true,
2588 save-sep .code:n = {
2589 \keys_set:nn { enumext / keyans } { save-sep = {##1} }
2590 \keys_set:nn { enumext / keyans* } { save-sep = {##1} }
2591 },
2592 save-sep .value_required:n = true,
2593 }
2594 }
2595 \clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }

```

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

### 13.29.2 Storing structure of the environments

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

```

\__enumext_store_active_keys:n
\__enumext_store_active_keys_vii:n

```

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

```

2596 \cs_new_protected:Npn \__enumext_store_active_keys:n #1
2597 {
2598 \bool_if:cF { \l__enumext_store_save_key_ \__enumext_level: _bool }
2599 {
2600 \tl_clear:c { \l__enumext_store_save_key_ \__enumext_level: _tl }
2601 \tl_set:ce
2602 { \l__enumext_store_save_key_ \__enumext_level: _tl }
2603 { \__enumext_filter_save_key:n {#1} }

```

```

2604     }
2605 }
2606 \cs_new_protected:Npn \__enumext_store_active_keys_vii:n #1
2607 {
2608     \bool_if:NF \l__enumext_store_save_key_vii_bool
2609     {
2610         \tl_clear:N \l__enumext_store_save_key_vii_tl
2611         \tl_set:Nx \l__enumext_store_save_key_vii_tl { \__enumext_filter_save_key:n {#1} }
2612     }
2613 }

```

(End of definition for \\_\_enumext\_store\_active\_keys:n and \\_\_enumext\_store\_active\_keys\_vii:n.)

### 13.29.3 Setting save-key key

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

save-key

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

```

2614 \cs_set_protected:Npn \__enumext_tmp:n #1
2615 {
2616     \keys_define:nn { enumext / enumext* }
2617     {
2618         save-key .code:n = \__enumext_parse_save_key_vii:n {##1},
2619         save-key .value_required:n = true,
2620     }
2621     \keys_define:nn { enumext / #1 }
2622     {
2623         save-key .code:n = \__enumext_parse_save_key:n {##1},
2624         save-key .value_required:n = true,
2625     }
2626 }
2627 \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*`.

```

2628 \cs_new_protected:Npn \__enumext_parse_save_key:n #1
2629 {
2630     \bool_set_true:c { l__enumext_store_save_key_ \__enumext_level: _bool }
2631     \tl_clear:c { l__enumext_store_save_key_ \__enumext_level: _tl }
2632     \tl_set:ce
2633     { l__enumext_store_save_key_ \__enumext_level: _tl }
2634     { \__enumext_filter_save_key:n {#1} }
2635 }
2636 \cs_new_protected:Npn \__enumext_parse_save_key_vii:n #1
2637 {
2638     \bool_set_true:N \l__enumext_store_save_key_vii_bool
2639     \tl_clear:N \l__enumext_store_save_key_vii_tl
2640     \tl_set:Nx \l__enumext_store_save_key_vii_tl { \__enumext_filter_save_key:n {#1} }
2641 }

```

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

### 13.29.4 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.

```

2642 \cs_new:Npn \__enumext_filter_save_key:n #1
2643 {
2644     \use:e
2645     {
2646         \keyval_parse:NNn
2647         \__enumext_filter_save_key_key:n
2648         \__enumext_filter_save_key_pair:nn {#1}
2649     }
2650 }

```

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.

```

2651 \cs_new:Npn \__enumext_filter_save_key_key:n #1
2652 {
2653   \str_case:nnF {#1}
2654   {
2655     { resume } {} { resume* } {} { no-store } {} { base-fix } {}
2656   }
2657   { , { \exp_not:n {#1} } }
2658 }

```

The function `\__enumext_filter_save_key_pair:nn` will be responsible for “*filtering keys*” that are passed “*with value*” by excluding the `series`, `resume`, `save-ans`, `save-ref`, `save-key`, `check-ans`, `show-ans`, `save-pos`, `mark-ans`, `mark-pos`, `mark-sep`, `wrap-ans`, `mark-ans*`, `mark-pos*`, `mark-sep*`, `wrap-ans*`, `wrap-opt`, `save-sep`, `mark-ref`, `mini-env`, `mini-sep`, `mini-right` and `mini-right*` keys.

```

2659 \cs_new:Npn \__enumext_filter_save_key_pair:nn #1#2
2660 {
2661   \str_case:nnF {#1}
2662   {
2663     { series } {} { resume } {} { save-ans } {} { save-ref } {}
2664     { save-key } {} { check-ans } {} { show-ans } {} { show-pos } {}
2665     { mark-ans } {} { mark-pos } {} { mark-sep } {} { wrap-ans } {}
2666     { mark-ans* } {} { mark-pos* } {} { mark-sep* } {} { wrap-ans* } {}
2667     { wrap-opt } {} { save-sep } {} { mark-ref } {} { mini-env } {}
2668     { mini-sep } {} { mini-right } {} { mini-right* } {}
2669   }
2670   { , { \exp_not:n {#1} } } = { \exp_not:n {#2} } }
2671 }

```

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

### 13.29.5 Function for storing content in prop list

`\__enumext_store_addto_prop:n`  
`\__enumext_store_addto_prop:V`

The function `\__enumext_store_addto_prop:n` stores the  $\{\langle content \rangle\}$  in *prop list* defined by `save-ans` key. The “*stored content*” is retrieved by means of the `\getkeyans` command.

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

```

2672 \cs_new_protected:Npn \__enumext_store_addto_prop:n #1
2673 {
2674   \prop_gput_if_not_in:cen { g__enumext_ \l__enumext_store_name_tl _prop }
2675   {
2676     \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } + 1 }
2677   }
2678   { #1 }
2679 }
2680 \cs_generate_variant:Nn \__enumext_store_addto_prop:n { V }

```

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

### 13.29.6 Function for storing content in sequence

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

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

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

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

```

2681 \cs_new_protected:Npn \__enumext_store_addto_seq:n #1
2682 {
2683   \seq_gput_right:cn { g__enumext_ \l__enumext_store_name_tl _seq } { #1 }
2684 }
2685 \cs_generate_variant:Nn \__enumext_store_addto_seq:n { v, V }

```

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



### 13.29.7 Functions for storing structure in the sequence

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

```

2686 \cs_new_protected:Nn \__enumext_store_level_open:
2687 {
2688   \bool_if:NT \l__enumext_check_answers_bool
2689   {
2690     \tl_if_empty:cTF { l__enumext_store_save_key_ \__enumext_level: _tl }
2691     {
2692       \__enumext_store_addto_seq:n
2693       {
2694         \item \begin{enumext}
2695       }
2696     }
2697     {
2698       \tl_put_left:cn { l__enumext_store_save_key_ \__enumext_level: _tl }
2699       {
2700         \item \begin{enumext} [
2701         ]
2702       }
2703       \tl_put_right:cn { l__enumext_store_save_key_ \__enumext_level: _tl }
2704       {
2705         ]
2706       }
2707       \__enumext_store_addto_seq:v { l__enumext_store_save_key_ \__enumext_level: _tl }
2708     }
2709   }
2710 \cs_new_protected:Nn \__enumext_store_level_close:
2711 {
2712   \bool_if:NT \l__enumext_check_answers_bool
2713   {
2714     \__enumext_store_addto_seq:n { \end{enumext} }
2715   }
2716 }

```

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

The “*storing structure*” is handled by the functions `\__enumext_store_level_open_vii:` and `\__enumext_store_level_close_vii:` which are executed in the `enumext*` environment.

```

2717 \cs_new_protected:Nn \__enumext_store_level_open_vii:
2718 {
2719   \bool_if:NT \l__enumext_check_answers_bool
2720   {
2721     \tl_if_empty:NTF \l__enumext_store_save_key_vii_tl
2722     {
2723       \__enumext_store_addto_seq:n
2724       {
2725         \item \begin{enumext*}
2726       }
2727     }
2728     {
2729       \tl_put_left:Nn \l__enumext_store_save_key_vii_tl
2730       {
2731         \item \begin{enumext*}[
2732         ]
2733       }
2734       \tl_put_right:Nn \l__enumext_store_save_key_vii_tl
2735       {
2736         ]
2737       }
2738       \__enumext_store_addto_seq:V \l__enumext_store_save_key_vii_tl
2739     }
2740   }
2741 \cs_new_protected:Nn \__enumext_store_level_close_vii:
2742 {
2743   \bool_if:NT \l__enumext_check_answers_bool
2744   {
2745     \__enumext_store_addto_seq:n { \end{enumext*} }
2746   }
2747 }

```

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

### 13.29.8 Function for show marks and position

`\__enumext_print_keyans_box:NN`  
`\__enumext_print_keyans_box:cc`

The function `\__enumext_print_keyans_box:NN` print a box in the left margin with `\l__enumext_mark_answer_sym_tl` used by the `wrap-ans`, `show-ans` and `show-pos` keys. The function takes two arguments:

#1: `\l__enumext_labelwidth_X_dim`  
 #2: `\l__enumext_labelsep_X_dim`

```
2748 \cs_new_protected:Nn \__enumext_print_keyans_box:NN
2749 {
2750   \mode_leave_vertical:
2751   \skip_horizontal:n { -\dim_use:N #2 }
2752   \hbox_overlap_left:n
2753   {
2754     \makebox[ \dim_use:N #1 ][ \l__enumext_mark_position_str ]
2755     {
2756       \tl_use:N \l__enumext_mark_answer_sym_tl
2757     }
2758   }
2759   \skip_horizontal:n { \dim_use:N #2 }
2760 }
2761 \cs_generate_variant:Nn \__enumext_print_keyans_box:NN { cc }
```

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

### 13.30 The internal label and ref

The function `\__enumext_store_internal_ref:` handles the “*internal label and ref*” system used by the `save-ref` and `mark-ref` keys for `\anskey` will allow to execute `\ref{⟨store name : position⟩}` and will return `1.(a).i.A`.

`\__enumext_store_internal_ref:`

First we will remove the dots “.” from the current `⟨labels⟩`, we do not want to get double dots in our references, then we will place this in the variable `\l__enumext_newlabel_arg_two_tl`.

```
2762 \cs_new_protected:Nn \__enumext_store_internal_ref:
2763 {
2764   \cs_set_protected:Npn \__enumext_tmp:n ##1
2765   {
2766     \tl_set_eq:cc { \l__enumext_label_copy_##1_tl } { \l__enumext_label_##1_tl }
2767     \tl_reverse:c { \l__enumext_label_copy_##1_tl }
2768     \tl_remove_once:cn { \l__enumext_label_copy_##1_tl } { . }
2769     \tl_reverse:c { \l__enumext_label_copy_##1_tl }
2770   }
2771   \clist_map_inline:nn { i, ii, iii, iv, vii } { \__enumext_tmp:n {##1} }
2772   \cs_set:Npn \__enumext_tmp:n ##1
2773   { . \tl_use:c { \l__enumext_label_copy_ \int_to_roman:n {##1} _tl } }
```

Here we need to analyse the cases where the environment is started with `enumext*` and if `\anskey` or `anskey*` is running alone in it or if it is running in a nested `enumext` environment within the starting environment.

```
2774   \bool_lazy_all:nT
2775   {
2776     { \bool_if_p:N \g__enumext_starred_bool }
2777     { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
2778   }
2779   {
2780     \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2781     { \tl_use:N \l__enumext_label_copy_vii_tl }
2782   }
2783   \bool_lazy_all:nT
2784   {
2785     { \bool_not_p:n { \g__enumext_standar_bool } }
2786     { \bool_if_p:N \l__enumext_standar_bool }
2787     { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } }
2788   }
2789   {
2790     \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2791     {
2792       \tl_use:N \l__enumext_label_copy_vii_tl
2793       \int_step_function:nnN { 1 } { \l__enumext_level_int } \__enumext_tmp:n
2794     }
2795   }
```

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.

```

2796 \bool_lazy_all:nT
2797 {
2798   { \bool_if_p:N \g__enumext_standar_bool }
2799   { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } }
2800   { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
2801 }
2802 {
2803   \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2804   {
2805     \tl_use:N \l__enumext_label_copy_i_tl
2806     \int_step_function:nnN { 2 } { \l__enumext_level_int } \l__enumext_tmp:n
2807   }
2808 }
2809 \cs_set:Npn \l__enumext_tmp:n ##1
2810 { \tl_use:c { l__enumext_label_copy_ \int_to_roman:n {##1} _tl } . }
2811 \bool_lazy_all:nT
2812 {
2813   { \bool_if_p:N \g__enumext_standar_bool }
2814   { \bool_if_p:N \l__enumext_starred_bool }
2815   { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } }
2816 }
2817 {
2818   \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2819   {
2820     \int_step_function:nnN { 1 } { \l__enumext_level_int } \l__enumext_tmp:n
2821     \tl_use:N \l__enumext_label_copy_vii_tl
2822   }
2823 }

```

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

```

2824 \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
2825 {
2826   \l__enumext_store_name_tl \c_colon_str
2827   \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } }
2828 }

```

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

```

2829 \tl_put_right:Ne \l__enumext_write_aux_file_tl
2830 {
2831   \l__enumext_newlabel:nn
2832   { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2833   { \l__enumext_newlabel_arg_two_tl }
2834 }
2835 \l__enumext_write_aux_file_tl
2836 }

```

(End of definition for `\l__enumext_store_internal_ref:`)

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

`\l__enumext_store_anskey_arg:n`

The internal function `\l__enumext_store_anskey_arg:n` first we pass the  $\langle \textit{argument} \rangle$  to the *prop list*, then checks the state of the variable `\l__enumext_store_ref_key_bool` handled by the *save-ref* key and will call the function `\l__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*”  $\langle \textit{argument} \rangle$ .

```

2837 \cs_new_protected:Npn \l__enumext_store_anskey_arg:n #1
2838 {
2839   \int_gincr:N \g__enumext_item_anskey_int
2840   \l__enumext_store_addto_prop:n {#1}
2841   \bool_if:NT \l__enumext_store_ref_key_bool
2842   {
2843     \l__enumext_store_internal_ref:
2844   }
2845   \l__enumext_anskey_show_wrap_left:n { #1 }

```

Now we start processing the  $\llbracket \textit{key} = \textit{val} \rrbracket$  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`.

```

2846 \tl_clear:N \l__enumext_store_anskey_arg_tl

```

```

2847 \bool_lazy_and:nnT
2848 { \bool_if_p:N \l__enumext_store_columns_break_bool }
2849 { \bool_not_p:n { \l__enumext_starred_bool } }
2850 {
2851   \tl_put_left:Nn \l__enumext_store_anskey_arg_tl { \columnbreak }
2852 }
2853 \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 (*number*) to `\l__enumext_store_anskey_arg_tl`.

```

2854 \bool_lazy_and:nnT
2855 { \bool_not_p:n { \l__enumext_starred_bool } }
2856 { \int_compare_p:nNn { \l__enumext_store_item_join_int } > { 1 } }
2857 {
2858   \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2859   {
2860     ( \exp_not:V \l__enumext_store_item_join_int )
2861   }
2862 }

```

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*`.

```

2863 \bool_if:NTF \l__enumext_store_item_star_bool
2864 {
2865   \tl_put_right:Nn \l__enumext_store_anskey_arg_tl { * }
2866   \tl_if_empty:NF \l__enumext_store_item_symbol_tl
2867   {
2868     \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2869     {
2870       [ \exp_not:V \l__enumext_store_item_symbol_tl ]
2871     }
2872   }
2873   \dim_compare:nT
2874   {
2875     \l__enumext_store_item_symbol_sep_dim != \c_zero_dim
2876   }
2877   {
2878     \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2879     {
2880       [ \exp_not:V \l__enumext_store_item_symbol_sep_dim ]
2881     }
2882   }
2883   \tl_put_right:Nn \l__enumext_store_anskey_arg_tl {#1}
2884 }
2885 {
2886   \tl_put_right:Nn \l__enumext_store_anskey_arg_tl {#1}
2887 }

```

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*.

```

2888 \bool_lazy_and:nnT
2889 { \bool_if_p:N \l__enumext_store_ref_key_bool }
2890 { \bool_if_p:N \l__enumext_hyperref_bool }
2891 {
2892   \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
2893   {
2894     \hfill \exp_not:N \hyperlink { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2895     { \exp_not:V \l__enumext_mark_ref_sym_tl }
2896   }
2897 }
2898 \__enumext_store_addto_seq:V \l__enumext_store_anskey_arg_tl
2899 }

```

(End of definition for `\__enumext_store_anskey_arg:n`)

`\__enumext_anskey_show_wrap_arg:n`

The function `\__enumext_anskey_show_wrap_arg:n` “wraps” the  $\langle argument \rangle$  passed to `\anskey` and the  $\langle body \rangle$  for `anskey*` when using the `wrap-ans` and `wrap-sep` keys.

```

2900 \cs_new_protected:Npn \__enumext_anskey_show_wrap_arg:n #1
2901 {
2902   \par
2903   \bool_if:NTF \l__enumext_starred_bool
2904   {

```

```

2905     \dim_compare:nNnT { \l__enumext_mark_sym_sep_dim } = { \c_zero_dim }
2906     {
2907         \dim_set:Nn \l__enumext_mark_sym_sep_dim { \l__enumext_labelsep_vii_dim }
2908     }
2909     \__enumext_print_keyans_box:NN
2910     \l__enumext_labelwidth_vii_dim \l__enumext_mark_sym_sep_dim
2911 }
2912 {
2913     \dim_compare:nNnT { \l__enumext_mark_sym_sep_dim } = { \c_zero_dim }
2914     {
2915         \dim_set:Nn \l__enumext_mark_sym_sep_dim
2916         {
2917             \dim_use:c { \l__enumext_labelsep_ \__enumext_level: _dim }
2918         }
2919     }
2920     \__enumext_print_keyans_box:cc
2921     { \l__enumext_labelwidth_ \__enumext_level: _dim } { \l__enumext_mark_sym_sep_dim }
2922 }
2923 \__enumext_anskey_wrapper:n { #1 }
2924 }

```

(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.

```

2925 \cs_new_protected:Npn \__enumext_anskey_show_wrap_left:n #1
2926 {
2927     \bool_if:NT \l__enumext_show_answer_bool
2928     {
2929         \__enumext_anskey_show_wrap_arg:n { #1 }
2930     }
2931     \bool_if:NT \l__enumext_show_position_bool
2932     {
2933         \tl_set:Ne \l__enumext_mark_answer_sym_tl
2934         {
2935             \group_begin:
2936             \exp_not:N \normalfont
2937             \exp_not:N \footnotesize [ \int_eval:n
2938             {
2939                 \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
2940             }
2941             ]
2942             \group_end:
2943         }
2944         \__enumext_anskey_show_wrap_arg:n { #1 }
2945     }
2946 }

```

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

### 13.32 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[\langle key = val \rangle]{\langle content \rangle}`.

`break-col`  
`item-join`  
`item-star`  
`item-sym*`  
`item-pos*`  
`unknown`

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

```

2947 \keys_define:nn { enumext / anskey }
2948 {
2949     break-col .bool_set:N = \l__enumext_store_columns_break_bool,
2950     break-col .default:n = true,
2951     break-col .value_forbidden:n = true,
2952     item-join .int_set:N = \l__enumext_store_item_join_int,
2953     item-join .value_required:n = true,
2954     item-star .bool_set:N = \l__enumext_store_item_star_bool,
2955     item-star .default:n = true,
2956     item-star .value_forbidden:n = true,
2957     item-sym* .tl_set:N = \l__enumext_store_item_symbol_tl,

```

`\__enumext_anskey_unknown:n`  
`\__enumext_anskey_unknown:nn`

```

2958     item-sym* .value_required:n = true,
2959     item-pos* .dim_set:N = \l__enumext_store_item_symbol_sep_dim,
2960     item-pos* .value_required:n = true,
2961     unknown .code:n = { \l__enumext_anskey_unknown:n {#1} },
2962 }

```

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

```

2963 \cs_new_protected:Npn \l__enumext_anskey_unknown:n #1
2964 {
2965   \exp_args:NV \l__enumext_anskey_unknown:nn \l_keys_key_str {#1}
2966 }
2967 \cs_new_protected:Npn \l__enumext_anskey_unknown:nn #1 #2
2968 {
2969   \tl_if_blank:nTF {#2}
2970   {
2971     \msg_error:nnn { enumext } { anskey-cmd-key-unknown } {#1}
2972   }
2973   {
2974     \msg_error:nnnn { enumext } { anskey-cmd-key-value-unknown } {#1} {#2}
2975   }
2976 }

```

(End of definition for *break-col* and others.)

- The `\anskey` command will only be present when using the `save-ans` key in `enumext` and `enumext*` environments, otherwise it will return an error.

**\anskey** We will first call the function `\l__enumext_anskey_safe_outer:` to be sure where we execute the command, then we will check the state of the variable `\l__enumext_check_answers_bool` set by the key `no-store`, if is true we will increment `\g__enumext_item_anskey_int` for the internal “*check answer*” system and execute the function `\l__enumext_anskey_safe_inner:n` to ensure that the command is not nested and that the argument is not empty, finally search the `[⟨key = val⟩]` and call the function `\l__enumext_store_anskey_arg:n`.

```

2977 \NewDocumentCommand \anskey { o +m }
2978 {
2979   \l__enumext_anskey_safe_outer:
2980   \group_begin:
2981     \bool_if:NT \l__enumext_check_answers_bool
2982     {
2983       \tl_if_novalue:nF {#1}
2984       {
2985         \keys_set:nn { enumext / anskey } {#1}
2986       }
2987       \tl_if_blank:nTF {#2}
2988       {
2989         \msg_error:nn { enumext } { anskey-empty-arg }
2990       }
2991       {
2992         \l__enumext_anskey_safe_inner:
2993         \l__enumext_store_anskey_arg:n {#2}
2994       }
2995     }
2996   \group_end:
2997 }

```

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

### 13.32.1 Internal functions for the command

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

`\l__enumext_anskey_safe_inner:`

```

2998 \cs_new_protected:Nn \l__enumext_anskey_safe_outer:
2999 {
3000   \bool_if:NF \l__enumext_store_active_bool
3001   {
3002     \msg_error:nnnn { enumext } { anskey-wrong-place } { anskey } { enumext }
3003   }
3004   \int_compare:nNt { \l__enumext_keyans_level_int } = { 1 }
3005   {
3006     \msg_error:nnnn { enumext } { command-wrong-place } { anskey } { keyans }
3007   }
3008   \int_compare:nNt { \l__enumext_keyans_level_h_int } = { 1 }

```

```

3009     {
3010         \msg_error:nnnn { enumext } { command-wrong-place }{ anskey }{ keyans* }
3011     }
3012     \int_compare:nNnT { \l__enumext_keyans_pic_level_int } = { 1 }
3013     {
3014         \msg_error:nnnn { enumext } { command-wrong-place }{ anskey }{ keyanspic }
3015     }
3016 }

```

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.

```

3017 \cs_new_protected:Nn \__enumext_anskey_safe_inner:
3018 {
3019     \int_incr:N \l__enumext_anskey_level_int
3020     \int_compare:nNnT { \l__enumext_anskey_level_int } > { 1 }
3021     {
3022         \msg_error:nn { enumext } { anskey-nested }
3023     }
3024     \bool_if:NF \l__enumext_item_number_bool
3025     {
3026         \msg_error:nn { enumext } { anskey-unnumber-item }
3027     }
3028     \mode_if_math:T
3029     {
3030         \msg_error:nne { enumext } { anskey-math-mode } { \c_backslash_str anskey }
3031     }
3032 }

```

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

### 13.33 The environment `anskey*`

The original implementation of the `anskey*` environment used non-public functions from the `scontents`[4] package, which was not the best approach. Fortunately L<sup>A</sup>T<sub>E</sub>X release 2025-06-01 implemented the new `c`-type argument in the `\lcmd`[13], with which we can record the *(body)* of the environment in *verbatim mode* and, together with `\scantokens` do the work as the original implementation.

First we add the same keys from the `\anskey` command along with the `force-eol`, `write-env` and `overwrite` keys that were in the original implementation that used the `scontents` support package for these.

```

break-col 3033 \keys_define:nn { enumext / anskey* }
item-join 3034 {
item-star 3035     break-col .bool_set:N = \l__enumext_store_columns_break_bool,
item-sym* 3036     break-col .default:n = true,
item-pos* 3037     break-col .value_forbidden:n = true,
force-eol 3038     item-join .int_set:N = \l__enumext_store_item_join_int,
write-env 3039     item-join .value_required:n = true,
overwrite 3040     item-star .bool_set:N = \l__enumext_store_item_star_bool,
unknown   3041     item-star .default:n = true,
           3042     item-star .value_forbidden:n = true,
           3043     item-sym* .tl_set:N = \l__enumext_store_item_symbol_tl,
           3044     item-sym* .value_required:n = true,
           3045     item-pos* .dim_set:N = \l__enumext_store_item_symbol_sep_dim,
           3046     item-pos* .value_required:n = true,
           3047     force-eol .bool_set:N = \l__enumext_anskey_env_force_eol_bool,
           3048     force-eol .initial:n = false,
           3049     force-eol .default:n = true,
           3050     write-env .code:n = {
3051         \bool_set_true:N \l__enumext_write_anskey_env_bool
3052         \tl_set:Nn \l__enumext_write_anskey_env_file_name_tl {#1}
3053     },
           3054     write-env .value_required:n = true,
           3055     overwrite .bool_set:N = \l__enumext_anskey_env_overwrite_bool,
           3056     overwrite .initial:n = false,
           3057     overwrite .default:n = true,
           3058     unknown .code:n = { \l__enumext_anskey_env_unknown:n {#1} },
3059 }

```

(End of definition for `break-col` and others.)

```

\__enumext_anskey_env_unknown:n
\__enumext_anskey_env_unknown:nn

```

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`.



```

3060 \cs_new_protected:Npn \__enumext_anskey_env_unknown:n #1
3061 {
3062   \exp_args:NV \__enumext_anskey_env_unknown:nn \l_keys_key_str {#1}
3063 }
3064 \cs_new_protected:Npn \__enumext_anskey_env_unknown:nn #1#2
3065 {
3066   \tl_if_blank:nTF {#2}
3067   {
3068     \msg_error:nnn { enumext } { anskey-env-key-unknown } {#1}
3069   }
3070   {
3071     \msg_error:nnnn { enumext } { anskey-env-key-value-unknown } {#1} {#2}
3072   }
3073 }

```

(End of definition for \\_\_enumext\_anskey\_env\_unknown:n and \\_\_enumext\_anskey\_env\_unknown:nn.)

```

\__enumext_anskey_env_file_if_writable:n
\__enumext_anskey_env_file_if_writable:nT
\__enumext_anskey_env_file_if_writable:nF
\__enumext_anskey_env_file_if_writable:nTF

```

The conditional function \\_\_enumext\_anskey\_env\_file\_if\_writable:n used by the `write-env` and `overwrite` keys in the `anskey*` environment to determine whether the output file is written or overwritten.

```

3074 \prg_new_protected_conditional:Npnn \__enumext_anskey_env_file_if_writable:n #1 { T, F, TF }
3075 {
3076   \bool_if:NTF \l__enumext_write_anskey_env_bool
3077   {
3078     \file_if_exist:nTF {#1}
3079     {
3080       \bool_if:NTF \l__enumext_anskey_env_overwrite_bool
3081       {
3082         \msg_warning:nne { enumext } { overwrite-file } {#1}
3083         \prg_return_true:
3084       }
3085       {
3086         \msg_warning:nne { enumext } { not-writing } {#1}
3087         \prg_return_false:
3088       }
3089     }
3090     {
3091       \msg_warning:nne { enumext } { writing-file } {#1}
3092       \prg_return_true:
3093     }
3094   }
3095   { \prg_return_false: }
3096 }

```

The \\_\_enumext\_anskey\_env\_file\_write:nn function is used by the `write-env` key in the `anskey*` environment to write the output file with the `⟨body⟩` of the environment.

```

3097 \cs_new_protected:Npn \__enumext_anskey_env_file_write:nn #1#2
3098 {
3099   \__enumext_anskey_env_file_if_writable:nT {#1}
3100   {
3101     \iow_open:Nn \l__enumext_write_anskey_env_file_iow {#1}
3102     \iow_now:Nn \l__enumext_write_anskey_env_file_iow {#2}
3103     \iow_close:N \l__enumext_write_anskey_env_file_iow
3104   }
3105 }
3106 \cs_generate_variant:Nn \__enumext_anskey_env_file_write:nn { VV }

```

(End of definition for \\_\_enumext\_anskey\_env\_file\_if\_writable:n and others.)

**anskey\*** First, we'll call the function \\_\_enumext\_anskey\_env\_safe\_outer: to make sure where we're running the environment, then, we'll check the state of the variable \l\_\_enumext\_check\_answers\_bool set by the key `no-store`. If it's true, we'll look for `[⟨key = val⟩]` and verify that the `argument` `c` `⟨body⟩` is not empty. Finally, we'll run the internal check function \\_\_enumext\_anskey\_env\_safe\_inner:n and call the function \\_\_enumext\_store\_anskey\_arg:n.

```

3107 \NewDocumentEnvironment{anskey*}{ o c }
3108 {
3109   \__enumext_anskey_env_safe_outer:
3110   \bool_if:NT \l__enumext_check_answers_bool
3111   {
3112     \tl_if_novalue:nF {#1}
3113     {
3114       \keys_set:nn { enumext / anskey* } {#1}

```

```

3115     }
3116     \tl_if_blank:nTF {#2}
3117     {
3118         \msg_error:nn { enumext } { anskey-empty-arg }
3119     }
3120     {
3121         \__enumext_anskey_env_safe_inner:
3122         \__enumext_store_anskey_env:n {#2}
3123     }
3124 }
3125 } { }

```

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

### 13.33.1 Internal functions for the environment

`\__enumext_anskey_env_safe_outer:` The function `\__enumext_store_anskey_safe_outer:` will return the appropriate messages when `anskey*` is executed outside the environment in which the `save-ans` key was activated or within the `keyans`, `keyans*` or `keyanspic` environments.

```

3126 \cs_new_protected:Nn \__enumext_anskey_env_safe_outer:
3127 {
3128     \bool_if:NF \l__enumext_store_active_bool
3129     {
3130         \msg_error:nnn { enumext } { anskey-env-error } { anskey* }
3131     }
3132     \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
3133     {
3134         \msg_error:nnn { enumext } { anskey-env-wrong } { keyans }
3135     }
3136     \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
3137     {
3138         \msg_error:nnn { enumext } { anskey-env-wrong } { keyans* }
3139     }
3140     \int_compare:nNnT { \l__enumext_keyans_pic_level_int } = { 1 }
3141     {
3142         \msg_error:nnn { enumext } { anskey-env-wrong } { keyanspic }
3143     }
3144 }

```

The function `\__enumext_anskey_env_safe_inner:` will first check if preceded by a not numbered `\item` or if it is in *math mode* returning the appropriate messages.

```

3145 \cs_new_protected:Nn \__enumext_anskey_env_safe_inner:
3146 {
3147     \bool_if:NF \l__enumext_item_number_bool
3148     {
3149         \msg_error:nn { enumext } { anskey-unnumber-item }
3150     }
3151     \mode_if_math:T
3152     {
3153         \msg_error:nnn { enumext } { anskey-math-mode } { anskey* }
3154     }
3155 }

```

The `\__enumext_store_anskey_env:n` function will first pass the argument `c` (*body*) to the variable `\l__enumext_store_anskey_env_tl` and replace the macro `\obeyedline` with `^^J` and then execute the `write-env` and `overwrite` keys, check the state of the variable `\l__enumext_anskey_env_force_eol_bool` managed by the `force-eol` key and we will add `\c__enumext_anskey_env_hidden_space_str` if necessary. Finally we will use `\exp_args:Ne` on the `\__enumext_store_anskey_arg:n` to expand the `\__enumext_scan_tokens:n` function which rescans the `\l__enumext_store_anskey_env_tl` variable before processing it.

```

3156 \cs_new_protected:Npn \__enumext_store_anskey_env:n #1
3157 {
3158     \tl_set:Nn \l__enumext_store_anskey_env_tl {#1}
3159     \RenewDocumentCommand \obeyedline { } { \iow_char:N ^^J }
3160     \tl_replace_all:Nee \l__enumext_store_anskey_env_tl { \obeyedline } { \iow_char:N ^^J }
3161     \__enumext_anskey_env_file_write:VV
3162     \l__enumext_write_anskey_env_file_name_tl \l__enumext_store_anskey_env_tl
3163     \bool_if:NF \l__enumext_anskey_env_force_eol_bool
3164     {
3165         \tl_put_right:Ne \l__enumext_store_anskey_env_tl
3166         {
3167             \c__enumext_anskey_env_hidden_space_str

```

```

3168     }
3169   }
3170   \exp_args:Ne
3171   \__enumext_store_anskey_arg:n
3172   {
3173     \__enumext_scan_tokens:n { \__enumext_store_anskey_env_tl }
3174   }
3175 }

```

Since `\obeyedline` can be redefined by the user, for example to `\mbox{} \par`, it is necessary to redefine it to `^^\` in order to use `\tl_replace_all`:Nee otherwise it returns an error.

(End of definition for `\__enumext_anskey_env_safe_outer:`, `\__enumext_anskey_env_safe_inner:`, and `\__enumext_store_anskey_env:n`.)

### 13.34 Executing check-ans system and write .log

`\__enumext_execute_after_env:`

The `\__enumext_execute_after_env:` function will first return the appropriate message for the end of the environment in which the `save-ans` key is being executed, then call the `\__enumext_item_answer_diff:` function and then will write the values of the global variables used to the `.log` file. If the key `check-ans` is active it will execute the function `\__enumext_check_ans_show:` and show the result in the terminal, otherwise it will execute the function `\__enumext_check_ans_log:` and write the results in the `.log` file and finally we execute the function `\__enumext_reset_global_vars:` returning the used variables to their original state.

```

3176 \cs_new_protected:Nn \__enumext_execute_after_env:
3177 {
3178   \int_compare:nNnT { \__enumext_level_int } = { 0 }
3179   {
3180     \tl_if_empty:NF \g__enumext_store_name_tl
3181     {
3182       \__enumext_stop_save_ans_msg:
3183       \__enumext_item_answer_diff:
3184       \__enumext_log_global_vars:
3185       \__enumext_log_answer_vars:
3186       \bool_if:NTF \g__enumext_check_ans_key_bool
3187       {
3188         \__enumext_check_ans_show:
3189       }
3190       { \__enumext_check_ans_log: }
3191     }
3192     \__enumext_reset_global_vars:
3193   }
3194 }

```

This function is passed to the function `\__enumext_after_env:n` for the environments `enumext` (§13.41) and `enumext*` (§13.46) and it is executed only when the environments are not nested or at some level of these..

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

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

#### 13.35.1 Storing content in prop list

`\__enumext_keyans_addto_prop:n`

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

```

3195 \cs_new_protected:Npn \__enumext_keyans_addto_prop:n #1
3196 {
3197   \tl_clear:N \__enumext_store_current_label_tl
3198   \int_compare:nNnTF { \__enumext_keyans_pic_level_int } = { 1 }
3199   {
3200     \tl_put_right:Ne \__enumext_store_current_label_tl { \__enumext_label_vi_tl }
3201   }
3202   {
3203     \tl_put_right:Ne \__enumext_store_current_label_tl { \__enumext_label_v_tl }
3204   }

```

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

```

3205   \tl_if_novalue:NF { #1 }
3206   {
3207     \tl_if_empty:NF \__enumext_store_keyans_item_opt_sep_v_tl
3208     {

```

```

3209         \tl_put_right:NV \l__enumext_store_current_label_tl \l__enumext_store_keyans_item_opt.
3210     }
3211     \tl_put_right:Nn \l__enumext_store_current_label_tl { #1 }
3212 }
3213 \__enumext_store_addto_prop:V \l__enumext_store_current_label_tl
3214 }

```

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

### 13.35.2 The save-ref key for keyans, keyans\* and keyanspic

The “*internal label and ref*” system for the `keyans`, `keyans*` and `keyanspic` environments has *slight differences* with the one implemented for `\anskey` basically because in this environments the interest is in the current `<label>` for `\item*` and `\anspic*` with the `<contents>` of the *optional argument*. The mechanism defined here will allow to execute `\ref{<store name: position>}` and will return 1. (A).

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

```

3215 \cs_new_protected:Nn \__enumext_keyans_store_ref:
3216 {
3217     \bool_if:NT \l__enumext_store_ref_key_bool
3218     {
3219         \cs_set_protected:Npn \__enumext_tmp:n ##1
3220         {
3221             \tl_set_eq:cc { l__enumext_label_copy_##1_tl } { l__enumext_label_##1_tl }
3222             \tl_reverse:c { l__enumext_label_copy_##1_tl }
3223             \tl_remove_once:cn { l__enumext_label_copy_##1_tl } { . }
3224             \tl_reverse:c { l__enumext_label_copy_##1_tl }
3225         }
3226         \clist_map_inline:nn { i, v, vi, vii, viii } { \__enumext_tmp:n {##1} }
3227         \__enumext_keyans_store_ref_aux_i:
3228     }
3229 }

```

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

```

3230 \cs_new_protected:Nn \__enumext_keyans_store_ref_aux_i:
3231 {
3232     \bool_if:NT \g__enumext_starred_bool
3233     {
3234         \tl_set_eq:NN \l__enumext_label_copy_i_tl \l__enumext_label_copy_vii_tl
3235     }
3236     \int_compare:nNnT { \l__enumext_keyans_pic_level_int } = { 1 }
3237     {
3238         \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
3239         { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_vi_tl }
3240     }
3241     \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
3242     {
3243         \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
3244         { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_v_tl }
3245     }
3246     \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
3247     {
3248         \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
3249         { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_viii_tl }
3250     }
3251     \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
3252     {
3253         \l__enumext_store_name_tl \c_colon_str
3254         \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } }
3255     }
3256     \__enumext_keyans_store_ref_aux_ii:
3257 }

```

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.

```

3258 \cs_new_protected:Nn \__enumext_keyans_store_ref_aux_ii:
3259 {
3260     \tl_put_right:Ne \l__enumext_write_aux_file_tl

```

```

3261     {
3262         \__enumext_newlabel:nn
3263         { \exp_not:V \l__enumext_newlabel_arg_one_tl }
3264         { \l__enumext_newlabel_arg_two_tl }
3265     }
3266     \l__enumext_write_aux_file_tl
3267 }

```

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

### 13.35.3 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.

```

3268 \cs_new_protected:Npn \__enumext_keyans_addto_seq:n #1
3269 {
3270     \tl_clear:N \l__enumext_store_current_label_tl
3271     \int_compare:nNnTF { \l__enumext_keyans_pic_level_int } = { 1 }
3272     {
3273         \tl_put_right:Ne \l__enumext_store_current_label_tl { \item \l__enumext_label_vi_tl }
3274     }
3275     {
3276         \tl_put_right:Ne \l__enumext_store_current_label_tl { \item \l__enumext_label_v_tl }
3277     }
3278     \tl_if_novalue:nF { #1 }
3279     {
3280         \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_v_tl
3281         {
3282             \tl_put_right:NV \l__enumext_store_current_label_tl \l__enumext_store_keyans_item_opt_sep_v_tl
3283         }
3284         \tl_put_right:Nn \l__enumext_store_current_label_tl { #1 }
3285     }
3286     \__enumext_keyans_addto_seq_link:
3287 }

```

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.

```

3288 \cs_new_protected:Nn \__enumext_keyans_addto_seq_link:
3289 {
3290     \bool_lazy_and:nnT
3291     { \bool_if_p:N \l__enumext_store_ref_key_bool }
3292     { \bool_if_p:N \l__enumext_hyperref_bool }
3293     {
3294         \tl_put_right:Ne \l__enumext_store_current_label_tl
3295         {
3296             \hfill \exp_not:N \hyperlink
3297             {
3298                 \exp_not:V \l__enumext_newlabel_arg_one_tl
3299             }
3300             { \exp_not:V \l__enumext_mark_ref_sym_tl }
3301         }
3302     }
3303     \__enumext_store_addto_seq:V \l__enumext_store_current_label_tl
3304     \bool_if:NT \l__enumext_check_answers_bool
3305     {
3306         \int_gincr:N \g__enumext_item_anskey_int
3307     }
3308 }

```

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

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

The function `\__enumext_keyans_save_item_opt:n` will save the optional argument of `\item*` and `\anspic*` in the variable `\l__enumext_store_current_opt_arg_tl`.

```
\__enumext_keyans_save_item_opt:n
\__enumext_keyans_show_item_opt:
\__enumext_keyans_show_item_opt_viii:
```

```
3309 \cs_new_protected:Npn \__enumext_keyans_save_item_opt:n #1
3310 {
3311   \tl_if_novalue:nF { #1 }
3312   {
3313     \tl_set:Nn \l__enumext_store_current_opt_arg_tl { #1 }
3314   }
3315 }
```

The function `\__enumext_keyans_show_item_opt:` will print the optional arguments of `\item*` and `\anspic*` when the `show-ans` or `show-pos` keys are set next to the key `wrap-opt` in `keyans` and `keyanspic` environments.

```
3316 \cs_new_protected:Nn \__enumext_keyans_show_item_opt:
3317 {
3318   \tl_if_empty:NF \l__enumext_store_current_opt_arg_tl
3319   {
3320     \bool_lazy_or:nnT
3321     { \bool_if_p:N \l__enumext_show_answer_bool }
3322     { \bool_if_p:N \l__enumext_show_position_bool }
3323     {
3324       \__enumext_keyans_wrapper_opt_v:n
3325       { \l__enumext_store_current_opt_arg_tl } \c_space_tl
3326     }
3327   }
3328 }
```

The function `\__enumext_keyans_show_item_opt_viii:` will print the optional argument of `\item*` when the `show-ans` or `show-pos` keys are set next to the key `wrap-opt` in `keyans*` environment.

```
3329 \cs_new_protected:Nn \__enumext_keyans_show_item_opt_viii:
3330 {
3331   \tl_if_empty:NF \l__enumext_store_current_opt_arg_tl
3332   {
3333     \bool_lazy_or:nnT
3334     { \bool_if_p:N \l__enumext_show_answer_bool }
3335     { \bool_if_p:N \l__enumext_show_position_bool }
3336     {
3337       \__enumext_keyans_wrapper_opt_viii:n
3338       { \l__enumext_store_current_opt_arg_tl } \c_space_tl
3339     }
3340   }
3341 }
```

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

```
\__enumext_keyans_pos_mark_set:
\__enumext_keyans_show_ans:
\__enumext_keyans_show_pos:
```

The function `\__enumext_keyans_pos_mark_set:` adjusts the horizontal spaces for the `mark-sep*` key taking into account the value of the `align` key and the width of `\label`.

```
3342 \cs_new_protected:Nn \__enumext_keyans_pos_mark_set:
3343 {
3344   \__enumext_label_width_by_box:Nn
3345   \l__enumext_mark_sep_tmpa_dim { \l__enumext_label_v_tl }
3346   \str_case:Vn \l__enumext_align_label_pos_v_str
3347   {
3348     { l }
3349     {
3350       \dim_set:Nn \l__enumext_mark_sep_tmpb_dim { \c_zero_dim }
3351     }
3352     { r }
3353     {
3354       \dim_set:Nn \l__enumext_mark_sep_tmpb_dim
3355       { \l__enumext_labelwidth_v_dim - \l__enumext_mark_sep_tmpa_dim }
3356     }
3357     { c }
3358     {
3359       \dim_set:Nn \l__enumext_mark_sep_tmpb_dim
3360       { 0.5\l__enumext_labelwidth_v_dim - 0.5\l__enumext_mark_sep_tmpa_dim }
3361     }
3362   }
```

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

```

3363 \dim_compare:nNtT { \l__enumext_mark_sym_sep_v_dim } = { \c_zero_dim }
3364 {
3365   \dim_set:Nn \l__enumext_mark_sym_sep_v_dim { \l__enumext_labelsep_v_dim }
3366 }
3367 \tl_set_eq:NN \l__enumext_mark_answer_sym_tl \l__enumext_mark_answer_sym_v_tl
3368 \dim_add:Nn \l__enumext_mark_sym_sep_v_dim { \l__enumext_mark_sep_tmpb_dim }
3369 \str_set_eq:NN \l__enumext_mark_position_str \l__enumext_mark_position_v_str
3370 }

```

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

```

3371 \cs_new_protected:Nn \__enumext_keyans_show_ans:
3372 {
3373   \bool_lazy_all:nT
3374   {
3375     { \bool_if_p:N \l__enumext_show_answer_bool }
3376     { \bool_if_p:N \l__enumext_item_wrap_key_bool }
3377   }
3378   {
3379     \__enumext_keyans_pos_mark_set:
3380     \__enumext_print_keyans_box:NN
3381     \l__enumext_labelwidth_v_dim \l__enumext_mark_sym_sep_v_dim
3382   }
3383 }

```

The function `\__enumext_keyans_show_pos:` will print the  $\langle position \rangle$  of the stored content in *prop list*. Need add `1` to `\g__enumext_⟨store name⟩_prop` for `keyans` environment.

```

3384 \cs_new_protected:Nn \__enumext_keyans_show_pos:
3385 {
3386   \int_compare:nNtF { \l__enumext_keyans_level_int } = { 1 }
3387   {
3388     \int_incr:N \l__enumext_show_pos_tmp_int
3389   }
3390   {
3391     \int_zero:N \l__enumext_show_pos_tmp_int
3392   }
3393   \bool_lazy_all:nT
3394   {
3395     { \bool_if_p:N \l__enumext_show_position_bool }
3396     { \bool_if_p:N \l__enumext_item_wrap_key_bool }
3397   }
3398   {
3399     \tl_set:Nc \l__enumext_mark_answer_sym_v_tl
3400     {
3401       \group_begin:
3402       \exp_not:N \normalfont
3403       \exp_not:N \footnotesize [ \int_eval:n
3404       {
3405         \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
3406         + \l__enumext_show_pos_tmp_int
3407       }
3408       ]
3409       \group_end:
3410     }
3411     \__enumext_keyans_pos_mark_set:
3412     \__enumext_print_keyans_box:NN
3413     \l__enumext_labelwidth_v_dim \l__enumext_mark_sym_sep_v_dim
3414   }
3415 }

```

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

### 13.36 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`.

```

3416 \cs_new_protected:Npn \__enumext_default_item:n #1
3417 {
3418   \tl_if_novalue:nTF {#1}
3419   {
3420     \bool_if:NT \l__enumext_check_answers_bool
3421     {
3422       \int_gincr:N \g__enumext_item_number_int
3423       \bool_set_true:N \l__enumext_item_number_bool
3424     }
3425     \bool_set_true:c { l__enumext_wrap_label_ \__enumext_level: _bool }
3426     \__enumext_item_std:w \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
3427   }
3428   {
3429     \bool_set_eq:cc
3430     { l__enumext_wrap_label_ \__enumext_level: _bool }
3431     { l__enumext_wrap_label_opt_ \__enumext_level: _bool }
3432     \__enumext_item_std:w [#1] \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
3433   }
3434 }

```

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

`\__enumext_item_starred_exec:nn`  
`\__enumext_item_starred_exec:`

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

**#1:** `\l__enumext_item_symbol_X_tl`  
**#2:** `\l__enumext_item_symbol_sep_X_dim`

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

```

3435 \cs_new_protected:Npn \__enumext_item_starred_exec:nn #1 #2
3436 {
3437   \tl_if_novalue:nTF {#1}
3438   {
3439     \tl_gset_eq:Nc
3440     \g__enumext_item_symbol_aux_tl { l__enumext_item_symbol_ \__enumext_level: _tl }
3441   }
3442   {
3443     \tl_gset:Nn \g__enumext_item_symbol_aux_tl {#1}
3444   }
3445   \tl_if_novalue:nTF {#2}
3446   {
3447     \dim_set_eq:cc
3448     { l__enumext_item_symbol_sep_ \__enumext_level: _dim }
3449     { l__enumext_labelsep_ \__enumext_level: _dim }
3450   }
3451   {
3452     \dim_set:cn { l__enumext_item_symbol_sep_ \__enumext_level: _dim } {#2}
3453   }
3454   \bool_if:NT \l__enumext_check_answers_bool
3455   {
3456     \int_gincr:N \g__enumext_item_number_int
3457     \bool_set_true:N \l__enumext_item_number_bool
3458   }
3459   \bool_set_true:c { l__enumext_wrap_label_ \__enumext_level: _bool }

```

```

3460   \__enumext_item_std:w \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
3461 }

```

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

```

3462 \cs_new_protected:Nn \__enumext_item_starred_exec:
3463 {
3464   \tl_if_empty:cF { l__enumext_item_symbol_ \__enumext_level: _tl }
3465   {
3466     \mode_leave_vertical:
3467     \skip_horizontal:n { -\dim_use:c { l__enumext_item_symbol_sep_ \__enumext_level: _dim } }
3468     \hbox_overlap_left:n { \g__enumext_item_symbol_aux_tl }
3469     \skip_horizontal:n { \dim_use:c { l__enumext_item_symbol_sep_ \__enumext_level: _dim } }
3470   }
3471 }

```

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

`\__enumext_redefine_item:` The function `\__enumext_redefine_item:` will redefine the `\item` command in the `enumext` environment adding `\item*`. This function are passed to `\__enumext_list_arg_two_X:` used in the definition of the `enumext` environment (§13.41).

```

3472 \cs_new_protected:Nn \__enumext_redefine_item:
3473 {
3474   \RenewDocumentCommand \item { s o o }
3475   {
3476     \bool_if:nTF {##1}
3477     {
3478       \__enumext_item_starred_exec:nn {##2} {##3}
3479     }
3480     { \__enumext_default_item:n {##2} }
3481   }
3482 }

```

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

`\__enumext_make_label:` The function `\__enumext_make_label:` redefine `\makelabel` for the keys `mode-box`, `align`, `font`, `wrap-label`, `wrap-label*` and `\item*` for `enumext` environment. This function are passed to `\__enumext_list_arg_two_X:` used in the definition of the `enumext` environment (§13.41).

```

3483 \cs_new_protected:Nn \__enumext_make_label:
3484 {
3485   \IfDocumentMetadataTF
3486   {
3487     \__enumext_make_label_box:
3488   }
3489   {
3490     \bool_if:NTF \l__enumext_mode_box_bool
3491     {
3492       \__enumext_make_label_box:
3493     }
3494     {
3495       \__enumext_make_label_std:
3496     }
3497   }
3498 }

```

Standard definition when `\DocumentMetadata` is not active.

```

3499 \cs_new_protected:Nn \__enumext_make_label_std:
3500 {
3501   \RenewDocumentCommand \makelabel { m }
3502   {
3503     \tl_use:c { l__enumext_label_fill_left_ \__enumext_level: _tl }
3504     \__enumext_item_starred_exec:
3505     \tl_use:c { l__enumext_label_font_style_ \__enumext_level: _tl }
3506     \bool_if:cTF { l__enumext_wrap_label_ \__enumext_level: _bool }
3507     {
3508       \use:c { __enumext_wrapper_label_ \__enumext_level: :n } { ##1 }
3509     }
3510     { ##1 }
3511     \tl_use:c { l__enumext_label_fill_right_ \__enumext_level: _tl }
3512     \tl_gclear:N \g__enumext_item_symbol_aux_tl
3513   }
3514 }

```



```

3559             \__enumext_keyans_unknown_keys:n {##1}
3560         },
3561     }
3562 }
3563 \clist_map_inline:nn { keyans, keyans*, keyanspic } { \__enumext_tmp:n {#1} }

```

Internal functions for handling `unknown` key.

```

3564 \cs_new_protected:Npn \__enumext_keyans_unknown_keys:n #1
3565 {
3566     \exp_args:NV \__enumext_keyans_unknown_keys:nn \l_keys_key_str {#1}
3567 }
3568 \cs_new_protected:Npn \__enumext_keyans_unknown_keys:nn #1#2
3569 {
3570     \tl_if_blank:nTF {#2}
3571     {
3572         \msg_error:nne { enumext } { keyans-unknown-key } {#1}
3573     }
3574     {
3575         \msg_error:nnee { enumext } { keyans-unknown-key-value } {#1} {#2}
3576     }
3577 }

```

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

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

`unknown`

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

```

\__enumext_starred_unknown_keys:n
\__enumext_starred_unknown_keys:nn
3578 \keys_define:nn { enumext / enumext* }
3579 {
3580     unknown .code:n = { \__enumext_starred_unknown_keys:n {#1} },
3581 }

```

Internal functions for handling `unknown` key.

```

3582 \cs_new_protected:Npn \__enumext_starred_unknown_keys:n #1
3583 {
3584     \exp_args:NV \__enumext_starred_unknown_keys:nn \l_keys_key_str {#1}
3585 }
3586 \cs_new_protected:Npn \__enumext_starred_unknown_keys:nn #1#2
3587 {
3588     \tl_if_blank:nTF {#2}
3589     {
3590         \msg_error:nnn { enumext } { starred-unknown-key } {#1}
3591     }
3592     {
3593         \msg_error:nnnn { enumext } { starred-unknown-key-value } {#1} {#2}
3594     }
3595 }

```

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

### 13.38.3 Handling unknown keys for `enumext`

`unknown`

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

```

\__enumext_standar_unknown_keys:n
\__enumext_standar_unknown_keys:nn
3596 \cs_set_protected:Npn \__enumext_tmp:n #1
3597 {
3598     \keys_define:nn { enumext / #1 }
3599     {
3600         unknown .code:n = { \__enumext_standar_unknown_keys:n {##1} },
3601     }
3602 }
3603 \clist_map_inline:nn { level-1, level-2, level-3, level-4 } { \__enumext_tmp:n {#1} }

```

Internal functions for handling `unknown` key.

```

3604 \cs_new_protected:Npn \__enumext_standar_unknown_keys:n #1
3605 {
3606     \exp_args:NV \__enumext_standar_unknown_keys:nn \l_keys_key_str {#1}
3607 }
3608 \cs_new_protected:Npn \__enumext_standar_unknown_keys:nn #1#2
3609 {
3610     \tl_if_blank:nTF {#2}
3611     {
3612         \msg_error:nnn { enumext } { standar-unknown-key } {#1}
3613     }
3614     {

```

```

3615         \msg_error:nnnn { enumext } { standar-unknown-key-value } {#1} {#2}
3616     }
3617 }

```

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

### 13.39 Redefining `\item` and `\makeLabel` in `keyans`

The `\item` and `\item[⟨custom⟩]` commands work in the usual way in `keyans`, but the `\item*` and `\item*[⟨content⟩]` commands *store* the current `⟨label⟩` next to the `⟨content⟩` if it is present in the *sequence* and *prop list* defined by `save-ans` key.

`__enumext_keyans_default_item:n`

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

```

3618 \cs_new_protected:Npn __enumext_keyans_default_item:n #1
3619 {
3620     \tl_if_novalue:nTF { #1 }
3621     {
3622         \bool_set_true:N \__enumext_wrap_label_v_bool
3623         \__enumext_item_std:w \tl_use:N \__enumext_fake_item_indent_v_tl
3624     }
3625     {
3626         \bool_set_eq:NN \__enumext_wrap_label_v_bool \__enumext_wrap_label_opt_v_bool
3627         \__enumext_item_std:w {#1} \tl_use:N \__enumext_fake_item_indent_v_tl
3628     }
3629 }

```

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

`__enumext_keyans_starred_item:n`

The function `__enumext_keyans_starred_item:n` will take as argument `#1` the *optional argument* `[⟨content⟩]` passed to `\item*` and save it via the `__enumext_keyans_save_item_opt:n` function, then activate the `wrap-label` key, execute `\item` using `__enumext_item_std:w`, the `itemindent` key and print the *optional argument* using the `__enumext_keyans_show_item_opt:` function handled by the `wrap-opt` key.

```

3630 \cs_new_protected:Npn __enumext_keyans_starred_item:n #1
3631 {
3632     __enumext_keyans_save_item_opt:n { #1 }
3633     \bool_set_true:N \__enumext_wrap_label_v_bool
3634     \__enumext_item_std:w \tl_use:N \__enumext_fake_item_indent_v_tl
3635     __enumext_keyans_show_item_opt:

```

Now *store* the current `⟨label⟩` first in the *prop list* (including the *optional argument*), run the internal “*label and ref*” system if the `save-ref` key is active, then *store* in the *sequence* and finally increments `\g__enumext_check_starred_cmd_int` for internal check system.

```

3636     __enumext_keyans_addto_prop:n { #1 }
3637     __enumext_keyans_store_ref:
3638     __enumext_keyans_addto_seq:n { #1 }
3639     \int_gincr:N \g__enumext_check_starred_cmd_int
3640 }

```

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

`\item*`  
`__enumext_keyans_redefine_item:`

The function `__enumext_keyans_redefine_item:` is responsible for adding the *starred argument* and *optional argument* by the `__enumext_list_arg_two_v:` function in the definition of the `keyans` environment. Here we will set to true the variable `\__enumext_item_wrap_key_bool` used by the `wrap-ans*` key only when `\item*` is executed and additionally we need to use `\peek_remove_spaces:n` to avoid an unwanted space when using `\item*` together with the `itemindent` key. This function are passed to `__enumext_list_arg_two_v:` used in the definition of the `keyans` environment (§13.40).

```

3641 \cs_new_protected:Nn __enumext_keyans_redefine_item:
3642 {
3643     \RenewDocumentCommand \item { s o }
3644     {
3645         \bool_if:nTF {##1}
3646         {
3647             \bool_set_true:N \__enumext_item_wrap_key_bool % wrap-ans*
3648             \peek_remove_spaces:n
3649             {
3650                 __enumext_keyans_starred_item:n {##2}
3651             }
3652         }
3653         {
3654             \bool_set_false:N \__enumext_item_wrap_key_bool

```

```

3655         \__enumext_keyans_default_item:n {##2}
3656     }
3657 }
3658 }

```

(End of definition for `\item*` and `\__enumext_keyans_redefine_item:`. This function is documented on page 17.)

```

\__enumext_keyans_make_label:
\__enumext_keyans_wrapper_label:n
\__enumext_keyans_make_label_std:
\__enumext_keyans_make_label_box:

```

The function `\__enumext_keyans_make_label:` redefine `\makeLabel` for the keys `mode-box`, `align`, `font`, `wrap-label`, `wrap-label*`, `wrap-ans*` and `\item*` for `keyans` environment. This function are passed to `\__enumext_list_arg_two_v:` used in the definition of the `keyans` environment (§13.40).

```

3659 \cs_new_protected:Nn \__enumext_keyans_make_label:
3660 {
3661     \IfDocumentMetadataTF
3662     {
3663         \__enumext_keyans_make_label_box:
3664     }
3665     {
3666         \bool_if:NTF \l__enumext_mode_box_bool
3667         {
3668             \__enumext_keyans_make_label_box:
3669         }
3670         {
3671             \__enumext_keyans_make_label_std:
3672         }
3673     }
3674 }

```

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

```

3675 \cs_new_protected:Npn \__enumext_keyans_wrapper_label:n #1
3676 {
3677     \bool_lazy_all:nT
3678     {
3679         { \bool_if_p:N \l__enumext_wrap_label_v_bool }
3680         { \bool_if_p:N \l__enumext_show_answer_bool }
3681         { \bool_if_p:N \l__enumext_item_wrap_key_bool }
3682         { \cs_if_exist_p:N \__enumext_keyans_wrapper_item_v:n }
3683     }
3684     {
3685         \cs_set_eq:NN \__enumext_wrapper_label_v:n \__enumext_keyans_wrapper_item_v:n
3686     }
3687     \bool_if:NTF \l__enumext_wrap_label_v_bool
3688     {
3689         \__enumext_wrapper_label_v:n { #1 }
3690     }
3691     { #1 }
3692 }

```

Standard definition when `\DocumentMetadata` is not active.

```

3693 \cs_new_protected:Nn \__enumext_keyans_make_label_std:
3694 {
3695     \RenewDocumentCommand \makeLabel { m }
3696     {
3697         \tl_use:N \l__enumext_label_fill_left_v_tl
3698         \__enumext_keyans_show_ans:
3699         \__enumext_keyans_show_pos:
3700         \tl_use:N \l__enumext_label_font_style_v_tl
3701         \__enumext_keyans_wrapper_label:n { ##1 }
3702         \tl_use:N \l__enumext_label_fill_right_v_tl
3703     }
3704 }

```

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

```

3705 \cs_new_protected:Nn \__enumext_keyans_make_label_box:
3706 {
3707     \RenewDocumentCommand \makeLabel { m }
3708     {
3709         \strut\smash
3710         {
3711             \makebox[ \l__enumext_labelwidth_v_dim ][ \l__enumext_align_label_pos_v_str ]
3712             {
3713                 \__enumext_keyans_show_ans:

```

```

3714         \__enumext_keyans_show_pos:
3715         \tl_use:N \l__enumext_label_font_style_v_tl
3716         \__enumext_keyans_wrapper_label:n { ##1 }
3717     }
3718 }
3719 }
3720 }

```

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

### 13.40 Second argument of the lists

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

Here we will implement the `\__enumext_list_arg_two_X:` function, which will be responsible for setting all the list parameters, the counter, the redefinition of `\item`, `\makelabel` along with the keys `ref`, `itemindent` and `show-length`.

- In the functions `\__enumext_list_arg_two_X:` we will implement the “counter” for the environments, but we do NOT set the “start value” for it to be compatible with *tagged* PDF that should be done later.

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

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

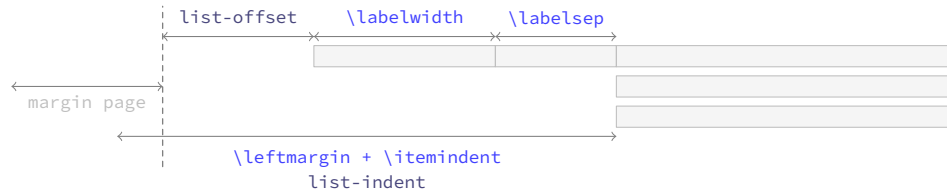


Figure 9: Representation of standard horizontal lengths in `list` environment.

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

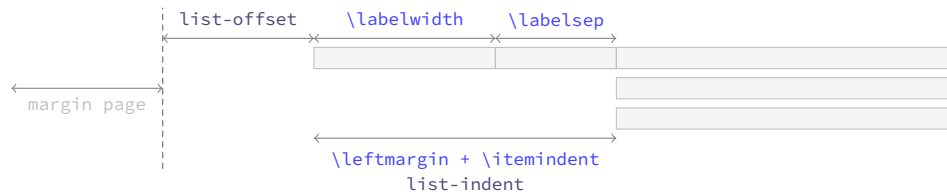


Figure 10: Representation of horizontal lengths concept in list in `enumext`.

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

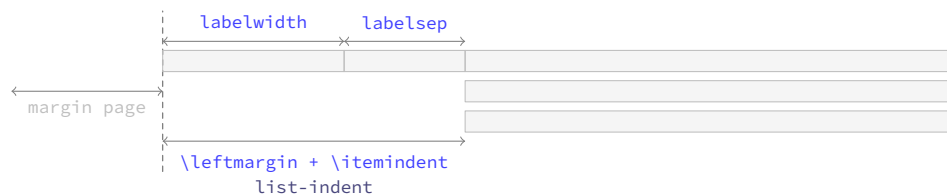


Figure 11: Default horizontal lengths in `enumext`.

```

\__enumext_calc_hspace:NNNNNN
\__enumext_calc_hspace:cccccc

```

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

```

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

```

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

```

3721 \cs_new_protected:Npn \__enumext_calc_hspace:NNNNNN #1 #2 #3 #4 #5 #6 #7
3722 {
3723   \dim_compare:nNt { #1 } < { \c_zero_dim }
3724   {
3725     \msg_warning:nnnV { enumext } { width-non-positive } { labelwidth } { #1 }

```



```

3726     \dim_set:Nn #1 { \dim_abs:n { #1 } }
3727   }
3728   \dim_compare:nNnT { #2 } < { \c_zero_dim }
3729   {
3730     \msg_warning:nnnV { enumext } { width-negative }{ labelsep }{ #2 }
3731     \dim_set:Nn #2 { \dim_abs:n { #2 } }
3732   }

```

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

```

3733   \bool_if:NF #7 { \dim_set:Nn #4 { #1 + #2 } }

```

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

```

3734   \dim_compare:nNnTF { #4 } < { \c_zero_dim }
3735   {
3736     \dim_set:Nn #6 { #1 + #2 - #4 }
3737     \dim_set:Nn #5 { #1 + #2 + #3 - #6 }
3738   }
3739   {
3740     \dim_compare:nNnT { #4 } = { #1 + #2 }
3741     { \dim_set:Nn #6 { \c_zero_dim } }
3742     \dim_compare:nNnT { #4 } < { #1 + #2 }
3743     { \dim_set:Nn #6 { #1 + #2 - #4 } }
3744     \dim_compare:nNnT { #4 } > { #1 + #2 }
3745     {
3746       \dim_set:Nn #6 { -#1 - #2 + #4 }
3747       \dim_set:Nn #6 { #6*-1 }
3748     }
3749     \dim_set:Nn #5 { #1 + #2 + #3 - #6 }
3750   }
3751 }
3752 \cs_generate_variant:Nn \__enumext_calc_hspace:NNNNNNN { ccccccc }

```

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

### 13.40.2 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:
3753 \cs_set_protected:Npn \__enumext_tmp:n #1
3754 {
3755   \cs_new_protected:cpn { __enumext_list_arg_two_#1: }
3756   {
3757     \__enumext_calc_hspace:ccccccc
3758     { \__enumext_labelwidth_#1_dim } { \__enumext_labelsep_#1_dim }
3759     { \__enumext_listoffset_#1_dim } { \__enumext_leftmargin_tmp_#1_dim }
3760     { \__enumext_leftmargin_#1_dim } { \__enumext_itemindent_#1_dim }
3761     { \__enumext_leftmargin_tmp_#1_bool }
3762     \clist_map_inline:nn
3763     { labelsep, labelwidth, itemindent, leftmargin, rightmargin, listparindent }
3764     { \dim_set_eq:cc {####1} { \__enumext_####1_#1_dim } }
3765     \clist_map_inline:nn { topsep, parsep, partopsep, itemsep }
3766     { \skip_set_eq:cc {####1} { \__enumext_####1_#1_skip } }
3767     \clist_map_inline:nn { beginparpenalty, itempenalty, endparpenalty }
3768     { \int_set_eq:cc {@####1} { \__enumext_####1_#1_int } }
3769     \usecounter { enumX#1 }
3770     \str_if_eq:nnTF {#1} { v }
3771     {
3772       \__enumext_keyans_redefine_item:
3773       \__enumext_keyans_make_label:
3774       \__enumext_keyans_ref:
3775       \__enumext_keyans_fake_item_indent:
3776       \bool_if:cT { \__enumext_show_length_#1_bool }
3777       {
3778         \msg_term:nnnn { enumext } { list-lengths-not-nested } { v } { keyans }
3779       }
3780     }
3781     {
3782       \__enumext_redefine_item:
3783       \__enumext_make_label:
3784       \__enumext_standar_ref:
3785       \__enumext_fake_item_indent:
3786       \bool_if:cT { \__enumext_show_length_#1_bool }

```

```

3787         {
3788             \msg_term:nne { enumext } { list-lengths } {#1}
3789             { \int_use:N \l__enumext_level_int }
3790         }
3791     }
3792 }
3793 }
3794 \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:
\__enumext_list_arg_two_viii:

```

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

```

3795 \cs_set_protected:Npn \__enumext_tmp:n #1
3796 {
3797     \cs_new_protected:cpn { __enumext_list_arg_two_#1: }
3798     {
3799         \bool_set_true:c { \__enumext_leftmargin_tmp_#1_bool }
3800         \dim_zero:c { \__enumext_leftmargin_tmp_#1_dim }
3801         \__enumext_calc_hspace:ccccc
3802         { \__enumext_labelwidth_#1_dim } { \__enumext_labelsep_#1_dim }
3803         { \__enumext_listoffset_#1_dim } { \__enumext_leftmargin_tmp_#1_dim }
3804         { \__enumext_leftmargin_#1_dim } { \__enumext_itemindent_#1_dim }
3805         { \__enumext_leftmargin_tmp_#1_bool }
3806         \clist_map_inline:nn
3807         { labelsep, labelwidth, itemindent, leftmargin, rightmargin, listparindent }
3808         { \dim_set_eq:cc {####1} { \__enumext_####1_#1_dim } }
3809         \clist_map_inline:nn { topsep, parsep, partopsep, itemsep }
3810         { \skip_set_eq:cc {####1} { \__enumext_####1_#1_skip } }
3811         \clist_map_inline:nn { beginparpenalty, itempenalty, endparpenalty }
3812         { \int_set_eq:cc {@####1} { \__enumext_####1_#1_int } }
3813         \skip_set_eq:Nc \parsep { \__enumext_itemsep_#1_skip }
3814         \skip_zero:N \partopsep
3815         \usecounter { enumX#1 }
3816         \__enumext_starred_ref:
3817         \str_if_eq:nnTF {#1} { vii }
3818         {
3819             \__enumext_fake_item_indent_vii:
3820             \bool_if:cT { \__enumext_show_length_vii_bool }
3821             { \msg_term:nnnn { enumext } { list-lengths-not-nested } { vii } { enumext* } }
3822         }
3823         {
3824             \__enumext_fake_item_indent_viii:
3825             \bool_if:cT { \__enumext_show_length_#1_bool }
3826             { \msg_term:nnnn { enumext } { list-lengths-not-nested } { #1 } { keyans* } }
3827         }
3828     }
3829 }
3830 \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:`.)

### 13.41 The environment `enumext`

```
\__enumext_safe_exec:
```

The `\__enumext_safe_exec:` function first call the function `\__enumext_is_not_nested:` which sets `\g__enumext_standar_bool` to “true” if we are NOT nested within `enumext*`, then call the function `\__enumext_internal_mini_page:` to create the environment `__enumext_mini_page`, we will increment `\l__enumext_level_int` to restrict nesting of the environment, set `\l__enumext_standar_bool` to “true” and finally call the function `\__enumext_is_on_first_level:` which sets `\l__enumext_standar_first_bool` to “true” only if the environment is NOT nested and we are at the “first level”.

```

3831 \cs_new_protected:Nn \__enumext_safe_exec:
3832 {
3833     \__enumext_is_not_nested:
3834     \__enumext_internal_mini_page:
3835     \int_incr:N \l__enumext_level_int
3836     \int_compare:nNnT { \l__enumext_level_int } > { 4 }
3837     { \msg_fatal:nn { enumext } { list-too-deep } }
3838     \bool_set_true:N \l__enumext_standar_bool
3839     \bool_set_false:N \l__enumext_starred_bool

```

```

3840     \__enumext_is_on_first_level:
3841 }

```

(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\_name\_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.

```

3842 \cs_new_protected:Npn \__enumext_parse_keys:n #1
3843 {
3844     \tl_if_novalue:nF {#1}
3845     {
3846         \str_clear:N \l__enumext_series_name_str
3847         \int_compare:nNnTF { \l__enumext_level_int } = { 1 }
3848         {
3849             \keys_set:nn { enumext / level-1 } {#1}
3850             \bool_if:NF \l__enumext_print_keyans_cmd_bool
3851             {
3852                 \__enumext_parse_series:n {#1}
3853             }
3854             \__enumext_nested_base_line_fix:
3855         }
3856         {
3857             \exp_args:Ne \keys_set:nn
3858             { enumext / level-\int_use:N \l__enumext_level_int } {#1}
3859             \bool_if:NF \l__enumext_print_keyans_cmd_bool
3860             {
3861                 \__enumext_parse_series:n {#1}
3862             }
3863         }
3864         \__enumext_store_active_keys:n {#1}
3865     }
3866 }

```

(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\*.

```

3867 \cs_new_protected:Npn \__enumext_start_store_level:
3868 {
3869     \bool_lazy_all:nT
3870     {
3871         { \bool_if_p:N \l__enumext_store_active_bool }
3872         { \bool_not_p:n { \l__enumext_keyans_env_bool } }
3873         { \bool_if_p:N \g__enumext_standar_bool }
3874     }
3875     {
3876         \int_compare:nNnT { \l__enumext_level_int } > { 1 }
3877         {
3878             \bool_set_true:c { l__enumext_store_upper_level_ \__enumext_level: _bool }
3879             \__enumext_store_level_open:
3880         }
3881     }

```

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

```

3882     \bool_lazy_all:nT
3883     {
3884         { \bool_if_p:N \l__enumext_store_active_bool }
3885         { \bool_not_p:n { \l__enumext_keyans_env_bool } }
3886         { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
3887     }
3888     {
3889         \int_compare:nNnT { \l__enumext_level_int } > { 0 }
3890         {
3891             \bool_set_true:c { l__enumext_store_upper_level_ \__enumext_level: _bool }
3892             \__enumext_store_level_open:
3893         }
3894     }
3895 }

```

(End of definition for `\__enumext_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*`.

```

3896 \cs_new_protected:Nn \__enumext_stop_store_level:
3897 {
3898   \bool_if:cT { \__enumext_store_upper_level_ \__enumext_level: _bool }
3899   {
3900     \__enumext_store_level_close:
3901   }
3902 }
```

(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=0pt` and set the value of `\multicolsep` equal to zero and leave `\columnseprule` equal to zero for inner levels.

```

3903 \cs_new_protected:Nn \__enumext_multicols_start:
3904 {
3905   \int_compare:nNt
3906   { \int_use:c { \__enumext_columns_ \__enumext_level: _int } } > { 1 }
3907   {
3908     \dim_compare:nNt
3909     { \dim_use:c { \__enumext_columns_sep_ \__enumext_level: _dim } } = { \c_zero_dim }
3910     {
3911       \dim_set:cn { \__enumext_columns_sep_ \__enumext_level: _dim }
3912       {
3913         ( \dim_use:c { \__enumext_labelwidth_ \__enumext_level: _dim }
3914         + \dim_use:c { \__enumext_labelsep_ \__enumext_level: _dim }
3915         ) / \int_use:c { \__enumext_columns_ \__enumext_level: _int }
3916         - \dim_use:c { \__enumext_listoffset_ \__enumext_level: _dim }
3917       }
3918     }
3919     \dim_set_eq:Nc \columnsep { \__enumext_columns_sep_ \__enumext_level: _dim }
3920     \int_compare:nNt { \__enumext_level_int } > { 1 }
3921     {
3922       \dim_zero:N \columnseprule
3923     }
3924 }
```

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.

```

3924 \bool_if:cF { \__enumext_minipage_active_ \__enumext_level: _bool }
3925 {
3926   \skip_zero:N \multicolsep
3927   \__enumext_multi_addvspace:
3928 }
3929 \raggedcolumns
3930 \begin{multicols}{ \int_use:c { \__enumext_columns_ \__enumext_level: _int } }
3931 }
3932 }
```

(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:`.

```

3933 \cs_new_protected:Nn \__enumext_multicols_stop:
3934 {
3935   \int_compare:nNtF
3936   { \int_use:c { \__enumext_columns_ \__enumext_level: _int } } > { 1 }
3937   {
3938     \__enumext_stop_list:
3939     \__enumext_stop_store_level:
3940     \end{multicols}
3941     \__enumext_unskip_unkern:
3942     \__enumext_unskip_unkern:
3943     \par\addvspace{ \skip_use:c { \__enumext_multicols_below_ \__enumext_level: _skip } }
3944   }
3945   {
3946     \__enumext_stop_list:
3947     \__enumext_stop_store_level:
3948   }
3949 }
```

```

3948     }
3949 }

```

(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.

```

3950 \cs_new_protected:Nn \__enumext_before_list:
3951 {
3952   \__enumext_vspace_above:
3953   \__enumext_before_args_exec:
3954   \__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.

```

3955   \dim_compare:nNtT
3956   { \dim_use:c { \l__enumext_minipage_right_ \__enumext_level: _dim } } > { \c_zero_dim }
3957   {
3958     \dim_set:cn { \l__enumext_minipage_left_ \__enumext_level: _dim }
3959     {
3960       \linewidth
3961       - \dim_use:c { \l__enumext_minipage_right_ \__enumext_level: _dim }
3962       - \dim_use:c { \l__enumext_minipage_hsep_ \__enumext_level: _dim }
3963     }

```

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.

```

3964     \bool_set_true:c { \l__enumext_minipage_active_ \__enumext_level: _bool }
3965     \int_gincr:N \g__enumext_minipage_stat_int
3966     \__enumext_minipage_add_space:
3967     \noindent
3968     \__enumext_mini_page{ \dim_use:c { \l__enumext_minipage_left_ \__enumext_level: _dim } }
3969   }
3970   \__enumext_multicols_start:
3971 }

```

(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.

```

3972 \cs_new_protected:Nn \__enumext_second_part:
3973 {
3974   \bool_if:cTF { \l__enumext_minipage_active_ \__enumext_level: _bool }
3975   {
3976     \int_compare:nNtT { \g__enumext_minipage_stat_int } = { 1 }
3977     {
3978       \msg_warning:nn { enumext } { missing-miniright }
3979       \miniright
3980     }
3981     \int_gzero:N \g__enumext_minipage_stat_int
3982     \__enumext_unskip_unkern: % remove topsep + [partopsep]
3983     \end__enumext_mini_page
3984   }
3985   {
3986     \__enumext_multicols_stop:
3987   }

```

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.

```

3988 \__enumext_after_stop_list:
3989 \__enumext_check_ans_key_hook:
3990 \__enumext_vspace_below:
3991 \bool_set_false:N \l__enumext_standar_bool
3992 \bool_if:NF \l__enumext_print_keyans_cmd_bool
3993 {
3994   \__enumext_standar_save_counter:
3995 }
3996 }

```

(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.

```

3997 \cs_new_protected:Nn \__enumext_set_item_width:
3998 {
3999   \dim_set:Nn \itemwidth { \linewidth }
4000   \dim_compare:nT
4001   {
4002     \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim } != \c_zero_dim
4003   }
4004   {
4005     \dim_sub:Nn \itemwidth
4006     {
4007       \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim }
4008     }
4009   }
4010 }

```

(End of definition for `\__enumext_set_item_width`.)

`\__enumext_start_counter`: For compatibility with *tagged* PDF and since we are using legacy code for the implementation, we must set the initial value of the counters after the second argument to the list environment and before the first execution of `\item`, i.e. `\begin{list}{\langle arg one \rangle}{\langle arg two \rangle}\setcounter{enumX}`.

- This is described in [processing order of legacy setup code in the block templates](#) and we will apply the workaround provided by Frank Mittelbach.

```

4011 \cs_new_protected:Nn \__enumext_start_counter:
4012 {
4013   \setcounter { enumX \__enumext_level: }
4014   {
4015     \int_eval:n { \int_use:c { l__enumext_start_ \__enumext_level: _int } - 1 }
4016   }
4017 }

```

(End of definition for `\__enumext_start_counter`.)

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

```

4018 \NewDocumentEnvironment{enumext}{0}{ }
4019 {
4020   \__enumext_safe_exec:
4021   \__enumext_parse_keys:n {#1}
4022   \__enumext_before_list:
4023   \__enumext_start_store_level:
4024   \__enumext_start_list:nn
4025   { \tl_use:c { l__enumext_label_ \__enumext_level: _tl } }
4026   {
4027     \use:c { __enumext_list_arg_two_ \__enumext_level: : }
4028     \__enumext_before_keys_exec:
4029   }
4030   \__enumext_start_counter:
4031   \__enumext_set_item_width:
4032   \__enumext_after_args_exec:
4033 }
4034 {
4035   \__enumext_second_part:
4036 }

```

(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`.

```
4037 \__enumext_after_env:nn {enumext}
4038 {
4039   \__enumext_execute_after_env:
4040 }
```

### 13.42 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.

```
4041 \cs_new_protected:Nn \__enumext_keyans_safe_exec:
4042 {
4043   \bool_if:NF \__enumext_store_active_bool
4044   {
4045     \msg_error:nnnn { enumext } { wrong-place } { keyans } { save-ans }
4046   }
4047   \int_incr:N \__enumext_keyans_level_int
4048   \bool_set_true:N \__enumext_keyans_env_bool
4049   \__enumext_keyans_name_and_start:
4050   % Set false for interfering with enumext nested in keyans (yes, its possible and crayze)
4051   \bool_set_false:N \__enumext_store_active_bool
4052   \int_compare:nNnT { \__enumext_keyans_level_int } > { 1 }
4053   {
4054     \msg_error:nn { enumext } { keyans-nested }
4055   }
4056   \int_compare:nNnT { \__enumext_level_int } > { 1 }
4057   {
4058     \msg_error:nn { enumext } { keyans-wrong-level }
4059   }
4060 }
```

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

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

```
4061 \cs_new_protected:Npn \__enumext_keyans_parse_keys:n #1
4062 {
4063   \keys_set:nn { enumext / keyans } {#1}
4064 }
```

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

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

```
4065 \cs_new_protected:Nn \__enumext_before_list_v:
4066 {
4067   \__enumext_vspace_above_v:
4068   \__enumext_before_args_exec_v:
4069   \dim_compare:nNnT { \__enumext_minipage_right_v_dim } > { \c_zero_dim }
4070   {
4071     \dim_set:Nn \__enumext_minipage_left_v_dim
4072     {
4073       \linewidth - \__enumext_minipage_right_v_dim - \__enumext_minipage_hsep_v_dim
4074     }
4075     \bool_set_true:N \__enumext_minipage_active_v_bool
4076     \int_gincr:N \g__enumext_minipage_stat_int
4077     \__enumext_keyans_minipage_add_space:
4078     \__enumext_mini_page{ \__enumext_minipage_left_v_dim }
4079   }
4080   \__enumext_keyans_multicols_start:
4081 }
4082 \cs_new_protected:Nn \__enumext_keyans_multicols_start:
4083 {
4084   \int_compare:nNnT { \__enumext_columns_v_int } > { 1 }
4085   {
4086     \dim_compare:nNnT { \__enumext_columns_sep_v_dim } = { \c_zero_dim }
```



```

4087     {
4088         \dim_set:Nn \l__enumext_columns_sep_v_dim
4089         {
4090             (
4091                 \l__enumext_labelwidth_v_dim + \l__enumext_labelsep_v_dim
4092             ) / \l__enumext_columns_v_int
4093             - \l__enumext_listoffset_v_dim
4094         }
4095     }
4096     \dim_set_eq:Nn \columnsep \l__enumext_columns_sep_v_dim
4097     \dim_zero:N \columnseprule % no rule here
4098     \bool_if:NF \l__enumext_minipage_active_v_bool
4099     {
4100         \skip_zero:N \multicolsep
4101         \__enumext_keyans_multi_addvspace:
4102     }
4103     \raggedcolumns
4104     \begin{multicols}{ \l__enumext_columns_v_int }
4105 }
4106 }
4107 \cs_new_protected:Nn \__enumext_keyans_multicols_stop:
4108 {
4109     \int_compare:nNnTF { \l__enumext_columns_v_int } > { 1 }
4110     {
4111         \__enumext_stop_list:
4112         \end{multicols}
4113         \__enumext_unskip_unkern:
4114         \__enumext_unskip_unkern:
4115         \par\addvspace{ \l__enumext_multicols_below_v_skip }
4116     }
4117     {
4118         \__enumext_stop_list:
4119     }
4120 }
4121 \cs_new_protected:Nn \__enumext_second_part_v:
4122 {
4123     \bool_if:NTF \l__enumext_minipage_active_v_bool
4124     {
4125         \int_compare:nNnT { \g__enumext_minipage_stat_int } = { 1 }
4126         {
4127             \msg_warning:nn { enumext } { missing-miniright }
4128             \miniright
4129         }
4130         \int_gzero:N \g__enumext_minipage_stat_int
4131         \__enumext_unskip_unkern: % remove \topsep + [\partopsep]
4132         \end__enumext_mini_page
4133         \par\addvspace{ \l__enumext_minipage_after_skip }
4134     }
4135     {
4136         \__enumext_keyans_multicols_stop:
4137     }
4138     \bool_set_false:N \l__enumext_keyans_env_bool
4139     \__enumext_after_stop_list_v:
4140     \__enumext_vspace_below_v:
4141 }

```

(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.

```

4142 \cs_new_protected:Nn \__enumext_keyans_set_item_width:
4143 {
4144     \dim_set:Nn \itemwidth { \linewidth }
4145     \dim_compare:nT
4146     {
4147         \l__enumext_listoffset_v_dim != \c_zero_dim
4148     }
4149     {
4150         \dim_sub:Nn \itemwidth { \l__enumext_listoffset_v_dim }
4151     }
4152 }

```

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

`\__enumext_keyans_start_counter:` For compatibility with *tagged* PDF and since we are using legacy code for the implementation, we must set the initial value of the counters after the second argument to the list environment and before the first execution of `\item`, i.e. `\begin{list}{⟨arg one⟩}{⟨arg two⟩}\setcounter{enumX}`.

```
4153 \cs_new_protected:Nn \__enumext_keyans_start_counter:
4154 {
4155   \setcounter { enumXv } { \int_eval:n { \int_use:c { l__enumext_start_v_int } - 1 } }
4156 }
```

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

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

```
4157 \NewDocumentEnvironment{keyans}{0}{ }
4158 {
4159   \__enumext_keyans_safe_exec:
4160   \__enumext_keyans_parse_keys:n {#1}
4161   \__enumext_before_list_v:
4162   \__enumext_start_list:nn
4163   { \tl_use:N \l__enumext_label_v_tl }
4164   {
4165     \__enumext_list_arg_two_v:
4166     \__enumext_before_keys_exec_v:
4167   }
4168   \__enumext_keyans_start_counter:
4169   \__enumext_keyans_set_item_width:
4170   \__enumext_after_args_exec_v:
4171 }
4172 {
4173   \__enumext_check_starred_cmd:n { item }
4174   \__enumext_second_part_v:
4175 }
```

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

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

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

To maintain a correct `list` structure when `\DocumentMetadata` is active, it is necessary to do some things manually using `tagpdf`[18] and `ltsockets`[20]. 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`.](#)

#### 13.43.1 Socket for tagging support in `enumext*` and `keyans*`

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

```
stop-start-tags
stop-list-tags
\__enumext_start_list_tag:n
\__enumext_stop_start_list_tag:
\__enumext_stop_list_tag:n
4176 \socket_new:nn {tagsupport/\__enumext/starred}{1}
4177 \socket_new_plugin:nnn {tagsupport/\__enumext/starred} {start-list-tags}
4178 {
4179   \tag_resume:n {#1}
4180   \tag_mc_end_push:
4181   \tag_struct_begin:n {tag=LI}
4182   \tag_struct_begin:n {tag=Lbl}
4183   \tag_mc_begin:n {tag=Lbl}
4184 }
4185 \socket_new_plugin:nnn {tagsupport/\__enumext/starred} {stop-start-tags}
4186 {
4187   \tag_mc_end:
4188   \tag_struct_end:n {tag=Lbl}
4189   \tag_struct_begin:n {tag=LBody}
4190   \tag_struct_begin:n {tag=text-unit}
4191   \tag_struct_begin:n {tag=text}
4192 }
4193 \socket_new_plugin:nnn {tagsupport/\__enumext/starred} {stop-list-tags}
4194 {
4195   \tag_struct_end:n {tag=text}
4196   \tag_struct_end:n {tag=text-unit}
4197   \tag_struct_end:n {tag=LBody}
4198   \tag_struct_end:n {tag=LI}
```

```

4199     \tag_mc_begin_pop:n {}
4200     \tag_suspend:n {#1}
4201 }

```

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

```

4202 \cs_new_protected_nopar:Npn \__enumext_start_list_tag:n #1
4203 {
4204     \IfDocumentMetadataT
4205     {
4206         \socket_assign_plug:nn {tagsupport/__enumext/starred} {start-list-tags}
4207         \socket_use:nn {tagsupport/__enumext/starred} {#1}
4208     }
4209 }
4210 \cs_new_protected_nopar:Nn \__enumext_stop_start_list_tag:
4211 {
4212     \IfDocumentMetadataT
4213     {
4214         \socket_assign_plug:nn {tagsupport/__enumext/starred} {stop-start-tags}
4215         \socket_use:nn {tagsupport/__enumext/starred} { }
4216     }
4217 }
4218 \cs_new_protected_nopar:Npn \__enumext_stop_list_tag:n #1
4219 {
4220     \IfDocumentMetadataT
4221     {
4222         \socket_assign_plug:nn {tagsupport/__enumext/starred} {stop-list-tags}
4223         \socket_use:nn {tagsupport/__enumext/starred} {#1}
4224     }
4225 }

```

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

### 13.43.2 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:

```

```

4226 \socket_new:nn {tagsupport/__enumext/keyanspic}{ 0 }
4227 \socket_new_plug:nnn {tagsupport/__enumext/keyanspic} {start-list-tags}
4228 {
4229     \tag_resume:n {keyanspic}
4230     \tag_mc_end_push:
4231         \tag_struct_begin:n {tag=LI}
4232         \tag_struct_begin:n {tag=Lbl}
4233         \tag_mc_begin:n {tag=Lbl}
4234 }
4235 \socket_new_plug:nnn {tagsupport/__enumext/keyanspic} {stop-start-tags}
4236 {
4237     \tag_mc_end:
4238     \tag_struct_end:n {tag=Lbl}
4239     \tag_struct_begin:n {tag=LBody}
4240     \tag_struct_begin:n {tag=text-unit}
4241     \tag_struct_begin:n {tag=text}
4242     \tag_mc_begin:n {tag=text}
4243 }
4244 \socket_new_plug:nnn {tagsupport/__enumext/keyanspic} {stop-list-tags}
4245 {
4246     \tag_mc_end:
4247     \tag_struct_end:n {tag=text}
4248     \tag_struct_end:n {tag=text-unit}
4249     \tag_struct_end:n {tag=LBody}
4250     \tag_struct_end:n {tag=LI}
4251     \tag_mc_begin_pop:n {}
4252     \tag_suspend:n {keyanspic}
4253 }

```

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

```

4254 \cs_new_protected_nopar:Nn \__enumext_anspic_start_list_tag:
4255 {
4256     \IfDocumentMetadataT
4257     {
4258         \socket_assign_plug:nn {tagsupport/__enumext/keyanspic} {start-list-tags}
4259         \socket_use:n {tagsupport/__enumext/keyanspic}
4260     }
4261 }

```

```

4262 \cs_new_protected_nopar:Nn \__enumext_anspic_stop_start_list_tag:
4263 {
4264   \IfDocumentMetadataT
4265   {
4266     \socket_assign_plug:nn {tagsupport/__enumext/keyanspic} {stop-start-tags}
4267     \socket_use:n {tagsupport/__enumext/keyanspic}
4268   }
4269 }
4270 \cs_new_protected_nopar:Nn \__enumext_anspic_stop_list_tag:
4271 {
4272   \IfDocumentMetadataT
4273   {
4274     \socket_assign_plug:nn {tagsupport/__enumext/keyanspic} {stop-list-tags}
4275     \socket_use:n {tagsupport/__enumext/keyanspic}
4276   }
4277 }

```

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

### 13.44 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.

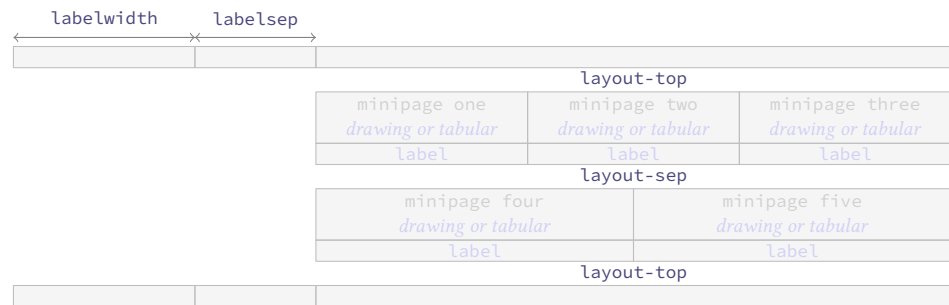


Figure 12: Representation of the `keyanspic` spacing in `enumext`.

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?](#).

#### 13.44.1 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`.

```

4278 \keys_define:nn { enumext / keyanspic }
4279 {
4280   label-pos .choice:,
4281   label-pos / above .code:n =
4282     \bool_set_true:N \l__enumext_anspic_label_above_bool
4283     \str_set:Nn \l__enumext_anspic_mini_pos_str { t },
4284   label-pos / below .code:n =
4285     \bool_set_false:N \l__enumext_anspic_label_above_bool
4286     \str_set:Nn \l__enumext_anspic_mini_pos_str { b },
4287   label-pos / unknown .code:n =
4288     \msg_error:nnee { enumext } { unknown-choice }
4289     { label-pos } { above,~ below } { \exp_not:n {#1} },
4290   label-pos .initial:n = below,
4291   label-pos .value_required:n = true,
4292   label-sep .skip_set:N = \l__enumext_anspic_label_sep_skip,
4293   label-sep .value_required:n = true,
4294   layout-sty .tl_set:N = \l__enumext_anspic_layout_style_tl,
4295   layout-sty .value_required:n = true,
4296   layout-sep .code:n = \keys_set:nn { enumext / keyans } { parsep = #1 },

```

```

4297 layout-sep .value_required:n = true,
4298 layout-top .code:n          = \keys_set:nn { enumext / keyans } { topsep = #1 },
4299 layout-top .value_required:n = true,
4300 mark-ans   .code:n          = \keys_set:nn { enumext / keyans } { mark-ans = #1 },
4301 mark-ans   .value_required:n = true,
4302 mark-pos   .code:n          = \keys_set:nn { enumext / keyans } { mark-pos = #1 },
4303 mark-pos   .value_required:n = true,
4304 mark-sep   .code:n          = \keys_set:nn { enumext / keyans } { mark-sep = #1 },
4305 mark-sep   .value_required:n = true,
4306 save-sep   .code:n          = \keys_set:nn { enumext / keyans } { save-sep = #1 },
4307 save-sep   .value_required:n = true,
4308 wrap-opt   .code:n          = \keys_set:nn { enumext / keyans } { wrap-opt = #1 },
4309 wrap-opt   .value_required:n = true,
4310 wrap-ans*  .code:n          = \keys_set:nn { enumext / keyans } { wrap-ans* = #1 },
4311 wrap-ans*  .value_required:n = true,
4312 show-ans   .code:n          = \keys_set:nn { enumext / keyans } { show-ans = #1 },
4313 show-ans   .value_required:n = true,
4314 show-pos   .code:n          = \keys_set:nn { enumext / keyans } { show-pos = #1 },
4315 show-pos   .value_required:n = true,
4316 unknown    .code:n          = {
4317                                     \tl_set:Nn \l__enumext_envir_name_tl { keyanspic }
4318                                     \__enumext_keyans_unknown_keys:n {#1}
4319                                 },
4320 }

```

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

```

\__enumext_keyans_pic_safe_exec:
\__enumext_keyans_pic_parse_keys:n
\__enumext_keyans_pic_skip_abs:N
\__enumext_keyans_pic_arg_two:

```

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

```

4321 \cs_new_protected:Nn \__enumext_keyans_pic_safe_exec:
4322 {
4323   \int_incr:N \l__enumext_keyans_pic_level_int
4324   \int_compare:nNtT { \l__enumext_keyans_pic_level_int } > { 1 }
4325   {
4326     \msg_error:nn { enumext } { keyanspic-nested }
4327   }
4328   \__enumext_keyans_name_and_start:
4329 }

```

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

```

4330 \cs_new_protected:Npn \__enumext_keyans_pic_parse_keys:n #1
4331 {
4332   \tl_if_novalue:nF {#1}
4333   {
4334     \keys_set:nn { enumext / keyanspic } {#1}
4335   }
4336 }

```

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

```

4337 \cs_new_protected:Npn \__enumext_keyans_pic_skip_abs:N #1
4338 {
4339   \dim_compare:nNtT { #1 } < { \c_zero_dim }
4340   {
4341     \skip_set:Nn #1 { -#1 }
4342   }
4343 }

```

The `\__enumext_keyans_pic_arg_two:` function will be used in the *second argument* of the `list` environment that defines the `keyanspic` environment, with this we will take the configuration of the “spaces” and the keys `label`, `wrap-label`, `parsep` and `topsep` from the `keyans` environment. The first thing we need to do is set the boolean variable `\l__enumext_leftmargin_tmp_v_bool` handled by the `list-indent` key to “false”, then copy the definition of the second list argument from the `keyans` environment definition and make sure that `\parsep` does not have a negative value.

```

4344 \cs_new_protected:Npn \__enumext_keyans_pic_arg_two:
4345 {
4346   \bool_set_false:N \l__enumext_leftmargin_tmp_v_bool
4347   \__enumext_list_arg_two_v:
4348   \__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*.

```

4349   \bool_if:NF \l__enumext_anspic_label_above_bool
4350   {
4351     \stepcounter { enumXv }
4352     \hbox_set:Nn \l__enumext_anspic_label_box { \l__enumext_label_v_tl }
4353     \dim_set:Nn \l__enumext_anspic_label_htdp_dim
4354     {
4355       \box_ht_plus_dp:N \l__enumext_anspic_label_box
4356     }
4357     \skip_add:Nn \parsep
4358     {
4359       \l__enumext_anspic_label_htdp_dim
4360       + \box_dp:N \strutbox
4361       + \l__enumext_anspic_label_sep_skip
4362     }
4363   }

```

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.

```

4364   \dim_add:Nn \leftmargin { -\l__enumext_labelwidth_v_dim - \l__enumext_labelsep_v_dim }
4365   \ignorespaces
4366   \skip_add:Nn \topsep { 0.5\box_dp:N \strutbox }
4367   \dim_zero:N \listparindent
4368   \skip_zero:N \partopsep
4369   \skip_zero:N \itemsep
4370 }

```

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

**keyanspic** Now we define the environment `keyanspic`. For compatibility with *tagged* PDF we must use the `\begin{list}` form and a lot of conditional code using `\IfDocumentMetadataTF`. We will first stop the code for automatic *tagged* PDF for `list` environments, redefine `\item` so that it cannot be used, and stop the code for automatic *tagged* PDF for the `keyanspic` environment.

```

4371 \NewDocumentEnvironment{keyanspic}{o }
4372 {
4373   \__enumext_keyans_pic_safe_exec:
4374   \__enumext_keyans_pic_parse_keys:n {#1}
4375   \begin{list} { } { \__enumext_keyans_pic_arg_two: }
4376   \IfDocumentMetadataT
4377   {
4378     \tag_suspend:n {list}
4379   }
4380   \item[] \scan_stop:
4381   \RenewDocumentCommand \item {}
4382   {
4383     \msg_error:nn { enumext } { keyanspic-item-cmd }
4384   }
4385   \IfDocumentMetadataT
4386   {
4387     \tag_resume:n {keyanspic}
4388     \tag_tool:n {para/tagging=false}
4389     \tag_suspend:n {keyanspic}
4390   }
4391 }

```

In the second part of the environment definition we will manually place our code for *tagged* PDF and execute the command `\anspic` using the `\__enumext_anspic_exec`: function.

```

4392 {
4393   \IfDocumentMetadataT
4394   {
4395     \tag_resume:n {keyanspic}
4396     \tag_mc_end_push:
4397     \tag_struct_begin:n {tag=L,attribute=enumerate}
4398   }
4399   \__enumext_anspic_exec:
4400   \IfDocumentMetadataT
4401   {
4402     \tag_suspend:n {keyanspic}
4403   }

```

```

4404 \end{list}
4405 \IfDocumentMetadataT
4406 {
4407   \tag_struct_end:n {tag=L}
4408   \tag_mc_begin_pop:n {}
4409   \tag_struct_end:n {tag=L}
4410   \tag_mc_begin_pop:n {}
4411 }

```

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

```

4412 \__enumext_check_starred_cmd:n { anspic }
4413 \setcounter { enumXvi } { 0 }
4414 \bool_if:NTF \__enumext_anspic_label_above_bool
4415 {
4416   \par\addvspace{ 0.5\box_dp:N \strutbox }
4417 }
4418 {
4419   \par
4420   \addvspace
4421   {
4422     \dim_eval:n
4423     {
4424       \__enumext_anspic_label_htdp_dim + \box_ht_plus_dp:N \strutbox
4425       + \__enumext_anspic_label_sep_skip + \__enumext_topsep_v_skip
4426     }
4427   }
4428 }
4429 }

```

(End of definition for `keyanspic`. This function is documented on page 17.)

### 13.44.2 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 `\__enumext_anspic_args_seq` which is processed by the `keyanspic` environment.

```

4430 \NewDocumentCommand \anspic { s o +m }
4431 {
4432   \bool_if:NF \__enumext_store_active_bool
4433   {
4434     \msg_error:nnnn { enumext } { wrong-place } { keyanspic } { save-ans }
4435   }
4436   \int_compare:nNt { \__enumext_level_int } > { 1 }
4437   {
4438     \msg_error:nn { enumext } { keyanspic-wrong-level }
4439   }
4440   \int_compare:nNt { \__enumext_keyans_level_int } = { 1 }
4441   {
4442     \msg_error:nnnn { enumext } { command-wrong-place } { anspic } { keyans }
4443   }
4444   \seq_put_right:Nn \__enumext_anspic_args_seq
4445   {
4446     \__enumext_anspic_args:nnn { #1 } { #2 } { #3 }
4447   }
4448 }

```

The `\__enumext_anspic_body_dim:n` function will set the value of `\__enumext_anspic_body_htdp_dim` equal to the “height plus depth” of the *mandatory argument* if the key `label-pos` is set “below”.

```

4449 \cs_new_protected:Npn \__enumext_anspic_body_dim:n #1
4450 {
4451   \bool_if:NF \__enumext_anspic_label_above_bool
4452   {

```



```

4453 \IfDocumentMetadataT
4454 {
4455   \tag_suspend:n {keyanspic}
4456 }
4457 \vbox_set:Nn \l__enumext_anspic_body_box { #1 }
4458 \dim_set:Nn \l__enumext_anspic_body_htdp_dim
4459 {
4460   \box_ht_plus_dp:N \l__enumext_anspic_body_box
4461 }
4462 \IfDocumentMetadataT
4463 {
4464   \tag_resume:n {keyanspic}
4465 }
4466 }
4467 }

```

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

```

4468 \cs_new_protected:Npn \__enumext_anspic_label:nn #1 #2
4469 {
4470   \makebox[ \l__enumext_anspic_mini_width_dim ][ c ]
4471   {
4472     \bool_if:NTF { #1 }
4473     {
4474       \bool_set_true:N \l__enumext_item_wrap_key_bool
4475       \bool_set_true:N \l__enumext_wrap_label_v_bool
4476       \__enumext_keyans_save_item_opt:n { #2 }
4477       \__enumext_keyans_addto_prop:n { #2 }
4478       \__enumext_keyans_store_ref:
4479       \__enumext_keyans_addto_seq:n { #2 }
4480       \int_gincr:N \g__enumext_check_starred_cmd_int
4481       \__enumext_keyans_show_ans:
4482       \__enumext_keyans_show_pos:
4483       \makebox[ \l__enumext_labelwidth_v_dim ][ c ]
4484       {
4485         \tl_use:N \l__enumext_label_font_style_v_tl
4486         \__enumext_keyans_wrapper_label:n { \l__enumext_label_vi_tl }
4487       }
4488       \skip_horizontal:n { \l__enumext_labelsep_v_dim }
4489       \__enumext_keyans_show_item_opt:
4490     }
4491     {
4492       \bool_set_false:N \l__enumext_item_wrap_key_bool
4493       \tl_use:N \l__enumext_label_font_style_v_tl
4494       \__enumext_wrapper_label_v:n { \l__enumext_label_vi_tl }
4495     }
4496   }
4497 }

```

The function `\__enumext_anspic_label_pos:nnn` will be in charge of handling the “counter” and the position of the *label*, set by `label-pos` key which will have the same configuration as the `keyans` environment.

```

4498 \cs_new_protected:Npn \__enumext_anspic_label_pos:nnn #1 #2 #3
4499 {
4500   \stepcounter { enumXvi }
4501   \__enumext_anspic_body_dim:n { #3 }
4502   \bool_if:NTF \l__enumext_anspic_label_above_bool
4503   {
4504     \__enumext_anspic_label:nn { #1 } { #2 }
4505   }
4506   {
4507     \raisebox
4508     {
4509       -\dim_eval:n
4510       {
4511         \l__enumext_anspic_label_htdp_dim
4512         + \l__enumext_anspic_body_htdp_dim
4513         + \box_dp:N \strutbox
4514         + \l__enumext_anspic_label_sep_skip
4515       }
4516     }
4517     [ opt ] [ opt ]

```

```

4518         {
4519             \__enumext_anspic_label:nn { #1 } { #2 }
4520         }
4521     }
4522 }
4523 %

```

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.

```

4524 \cs_new_protected:Nn \__enumext_anspic_args:nnn
4525 {
4526     \__enumext_anspic_start_list_tag:
4527     \__enumext_anspic_label_pos:nnn { #1 } { #2 } { #3 }
4528     \__enumext_anspic_stop_start_list_tag:
4529     \bool_if:NTF \l__enumext_anspic_label_above_bool
4530     {
4531         \\[\l__enumext_anspic_label_sep_skip] #3
4532     }
4533     {
4534         \\ #3
4535     }
4536     \__enumext_anspic_stop_list_tag:
4537 }

```

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`.

```

4538 \cs_new_protected:Nn \__enumext_anspic_print:n
4539 {
4540     \clist_map_function:nN { #1 } \__enumext_anspic_row:n
4541 }
4542 \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.

```

4543 \cs_new_protected:Nn \__enumext_anspic_row:n
4544 {
4545     \dim_set:Nn \l__enumext_anspic_mini_width_dim { \linewidth / #1 }
4546     \int_set:Nn \l__enumext_anspic_above_int { \l__enumext_anspic_below_int }
4547     \int_set:Nn \l__enumext_anspic_below_int { \l__enumext_anspic_above_int + #1 }
4548     \int_step_inline:nnn
4549     { \l__enumext_anspic_above_int + 1 }
4550     { \l__enumext_anspic_below_int }
4551     {
4552         \IfDocumentMetadataT
4553         {
4554             \tag_suspend:n {minipage}
4555         }
4556         \begin{minipage}[ \l__enumext_anspic_mini_pos_str ]{ \l__enumext_anspic_mini_width_dim }
4557             \centering
4558             \seq_item:Nn \l__enumext_anspic_args_seq { ##1 }
4559         \end{minipage}
4560         \IfDocumentMetadataT
4561         {
4562             \tag_resume:n {minipage}
4563         }
4564     }
4565     \par
4566 }

```

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*.

```

4567 \cs_new_protected:Nn \__enumext_anspic_exec:
4568 {
4569     \tl_if_empty:NTF \l__enumext_anspic_layout_style_tl
4570     {
4571         \__enumext_anspic_print:e { \seq_count:N \l__enumext_anspic_args_seq }
4572     }
4573     {
4574         \__enumext_anspic_print:V \l__enumext_anspic_layout_style_tl
4575     }
4576 }

```

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

### 13.45 The horizontal environments

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

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

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

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

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

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

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

#### 13.45.1 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:
```

```
4577 \cs_new_protected:Nn \__enumext_starred_columns_set_vii:  
4578 {  
4579   \dim_compare:nNnT { \__enumext_columns_sep_vii_dim } = { \c_zero_dim }  
4580   {  
4581     \dim_set:Nn \__enumext_columns_sep_vii_dim  
4582     {  
4583       ( \__enumext_labelwidth_vii_dim + \__enumext_labelsep_vii_dim )  
4584       / \__enumext_columns_vii_int  
4585     }  
4586   }  
4587   \int_set:Nn \__enumext_tmpa_vii_int { \__enumext_columns_vii_int - 1 }  
4588   \dim_set:Nn \__enumext_item_width_vii_dim  
4589   {  
4590     ( \linewidth - \__enumext_columns_sep_vii_dim * \__enumext_tmpa_vii_int )  
4591     / \__enumext_columns_vii_int  
4592     - \__enumext_labelwidth_vii_dim  
4593     - \__enumext_labelsep_vii_dim  
4594   }  
4595 }
```

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

```
4595 \dim_compare:nNnT { \__enumext_rightmargin_vii_dim } > { \c_zero_dim }  
4596 {  
4597   \dim_sub:Nn \__enumext_item_width_vii_dim  
4598   {  
4599     ( \__enumext_rightmargin_vii_dim * \__enumext_tmpa_vii_int )  
4600     / \__enumext_columns_vii_int  
4601   }  
4602   \dim_add:Nn \__enumext_columns_sep_vii_dim  
4603   {  
4604     \__enumext_rightmargin_vii_dim  
4605   }  
4606 }  
4607 }
```

Same implementation for the `keyans*` environment.

```
4608 \cs_new_protected:Nn \__enumext_starred_columns_set_viii:  
4609 {  
4610   \dim_compare:nNnT { \__enumext_columns_sep_viii_dim } = { \c_zero_dim }  
4611   {  
4612     \dim_set:Nn \__enumext_columns_sep_viii_dim  
4613     {  
4614       ( \__enumext_labelwidth_viii_dim + \__enumext_labelsep_viii_dim )  
4615       / \__enumext_columns_viii_int  
4616     }  
4617   }  
4618 }
```

```

4616     }
4617   }
4618   \int_set:Nn \l__enumext_tmpa_viii_int { \l__enumext_columns_viii_int - 1 }
4619   \dim_set:Nn \l__enumext_item_width_viii_dim
4620   {
4621     ( \linewidth - \l__enumext_columns_sep_viii_dim * \l__enumext_tmpa_viii_int )
4622     / \l__enumext_columns_viii_int
4623     - \l__enumext_labelwidth_viii_dim
4624     - \l__enumext_labelsep_viii_dim
4625   }
4626   \dim_compare:nNnT { \l__enumext_rightmargin_viii_dim } > { \c_zero_dim }
4627   {
4628     \dim_sub:Nn \l__enumext_item_width_viii_dim
4629     {
4630       ( \l__enumext_rightmargin_viii_dim * \l__enumext_tmpa_vii_int )
4631       / \l__enumext_columns_viii_int
4632     }
4633     \dim_add:Nn \l__enumext_columns_sep_viii_dim
4634     {
4635       \l__enumext_rightmargin_viii_dim
4636     }
4637   }
4638 }

```

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

### 13.45.2 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.

```

4639 \cs_new_protected:Npn \__enumext_starred_joined_item_vii:n #1
4640 {
4641   \int_set:Nn \l__enumext_joined_item_vii_int {#1}
4642   \int_compare:nNnT { \l__enumext_joined_item_vii_int } > { \l__enumext_columns_vii_int }
4643   {
4644     \msg_warning:nnee { enumext } { item-joined }
4645     { \int_use:N \l__enumext_joined_item_vii_int }
4646     { \int_use:N \l__enumext_columns_vii_int }
4647     \int_set:Nn \l__enumext_joined_item_vii_int
4648     {
4649       \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1
4650     }
4651   }
4652   \int_compare:nNnT
4653   { \l__enumext_joined_item_vii_int }
4654   >
4655   { \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1 }
4656   {
4657     \msg_warning:nnee { enumext } { item-joined-columns }
4658     { \int_use:N \l__enumext_joined_item_vii_int }
4659     {
4660       \int_eval:n
4661       { \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1 }
4662     }
4663     \int_set:Nn \l__enumext_joined_item_vii_int
4664     {
4665       \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1
4666     }
4667   }
4668   \int_compare:nNnTF { \l__enumext_joined_item_vii_int } > { 1 }
4669   {
4670     \int_set_eq:NN \l__enumext_joined_item_aux_vii_int \l__enumext_joined_item_vii_int
4671     \int_decr:N \l__enumext_joined_item_aux_vii_int
4672     \int_add:Nn \l__enumext_item_column_pos_vii_int { \l__enumext_joined_item_aux_vii_int }
4673     \int_gadd:Nn \g__enumext_item_count_all_vii_int { \l__enumext_joined_item_aux_vii_int }
4674     \dim_set:Nn \l__enumext_joined_width_vii_dim
4675     {
4676       \l__enumext_item_width_vii_dim * \l__enumext_joined_item_vii_int
4677       + ( \l__enumext_labelwidth_vii_dim + \l__enumext_labelsep_vii_dim
4678         + \l__enumext_columns_sep_vii_dim
4679         ) * \l__enumext_joined_item_aux_vii_int

```

```

4680     }
4681     \dim_set_eq:NN \itemwidth \l__enumext_joined_width_vii_dim
4682   }
4683   {
4684     \dim_set_eq:NN \l__enumext_joined_width_vii_dim \l__enumext_item_width_vii_dim
4685     \dim_set_eq:NN \itemwidth \l__enumext_item_width_vii_dim
4686   }
4687 }

```

Same implementation for the `keyans*` environment.

```

4688 \cs_new_protected:Npn \__enumext_starred_joined_item_viii:n #1
4689 {
4690   \int_set:Nn \l__enumext_joined_item_viii_int {#1}
4691   \int_compare:nNnT { \l__enumext_joined_item_viii_int } > { \l__enumext_columns_viii_int }
4692   {
4693     \msg_warning:nnee { enumext } { item-joined }
4694     { \int_use:N \l__enumext_joined_item_viii_int }
4695     { \int_use:N \l__enumext_columns_viii_int }
4696     \int_set:Nn \l__enumext_joined_item_viii_int
4697     {
4698       \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1
4699     }
4700   }
4701   \int_compare:nNnT
4702   { \l__enumext_joined_item_viii_int }
4703   >
4704   { \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1 }
4705   {
4706     \msg_warning:nnee { enumext } { item-joined-columns }
4707     { \int_use:N \l__enumext_joined_item_viii_int }
4708     {
4709       \int_eval:n
4710       { \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1 }
4711     }
4712     \int_set:Nn \l__enumext_joined_item_viii_int
4713     {
4714       \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1
4715     }
4716   }
4717   \int_compare:nNnTF { \l__enumext_joined_item_viii_int } > { 1 }
4718   {
4719     \int_set_eq:NN \l__enumext_joined_item_aux_viii_int \l__enumext_joined_item_viii_int
4720     \int_decr:N \l__enumext_joined_item_aux_viii_int
4721     \int_add:Nn \l__enumext_item_column_pos_viii_int { \l__enumext_joined_item_aux_viii_int }
4722     \int_gadd:Nn \g__enumext_item_count_all_viii_int { \l__enumext_joined_item_aux_viii_int }
4723     \dim_set:Nn \l__enumext_joined_width_viii_dim
4724     {
4725       \l__enumext_item_width_viii_dim * \l__enumext_joined_item_viii_int
4726       + ( \l__enumext_labelwidth_viii_dim + \l__enumext_labelsep_viii_dim
4727         + \l__enumext_columns_sep_viii_dim
4728         ) * \l__enumext_joined_item_aux_viii_int
4729     }
4730     \dim_set_eq:NN \itemwidth \l__enumext_joined_width_viii_dim
4731   }
4732   {
4733     \dim_set_eq:NN \l__enumext_joined_width_viii_dim \l__enumext_item_width_viii_dim
4734     \dim_set_eq:NN \itemwidth \l__enumext_item_width_viii_dim
4735   }
4736 }

```

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

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

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

```

4737 \cs_new_protected:Nn \__enumext_start_mini_vii:
4738 {
4739   \dim_compare:nNnT { \l__enumext_minipage_right_vii_dim } > { \c_zero_dim }
4740   {

```

```

4741 \dim_set:Nn \l__enumext_minipage_left_vii_dim
4742 {
4743   \linewidth
4744   - \l__enumext_minipage_right_vii_dim
4745   - \l__enumext_minipage_hsep_vii_dim
4746 }
4747 \bool_set_true:N \l__enumext_minipage_active_vii_bool
4748 \dim_gset_eq:NN
4749   \g__enumext_minipage_right_vii_dim
4750   \l__enumext_minipage_right_vii_dim
4751 \__enumext_mini_addvspace_vii:
4752 \nointerlineskip\noindent
4753 \__enumext_mini_page{ \l__enumext_minipage_left_vii_dim }
4754 }
4755 }

```

The function `\__enumext_stop_mini_vii:` closes the `\__enumext_mini_page` environment on the “*left side*”, applies `\hfill` and set the variable `\g__enumext_minipage_active_vii_bool` to “*true*” which will be used in the function `\__enumext_after_env:nn` to execute the `minipage` on the “*right side*”. At this point we will execute the `\__enumext_stop_list:` and `\__enumext_stop_store_level_vii:` functions stopping the `list` environment and the level saving mechanism for storage in *sequence* of the `\anskey` command and `anskey*` environment. This function is passed to the `\__enumext_after_list_vii:` function in the second part of the `enumext*` environment definition (§13.46).

```

4756 \cs_new_protected:Nn \__enumext_stop_mini_vii:
4757 {
4758   \bool_if:NTF \l__enumext_minipage_active_vii_bool
4759   {
4760     \__enumext_stop_list:
4761     \__enumext_stop_store_level_vii:
4762     \IfDocumentMetadataT { \tag_resume:n {enumext*} }
4763     \end__enumext_mini_page
4764     \hfill
4765     \bool_gset_true:N \g__enumext_minipage_active_vii_bool
4766   }
4767   {
4768     \__enumext_stop_list:
4769     \__enumext_stop_store_level_vii:
4770   }
4771 }

```

(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.

```

4772 \__enumext_after_env:nn {enumext*}
4773 {
4774   \bool_if:NT \g__enumext_minipage_active_vii_bool
4775   {
4776     \__enumext_minipage:w [ t ] { \g__enumext_minipage_right_vii_dim }
4777     \legacy_if_gset_false:n { @minipage }
4778     \skip_vertical:N \c_zero_skip
4779     \par\addvspace { \g__enumext_minipage_right_skip }
4780     \bool_if:NF \g__enumext_minipage_center_vii_bool
4781     {
4782       \tl_put_left:Nn \g__enumext_miniright_code_vii_tl
4783       {
4784         \centering
4785       }
4786     }
4787     \vbox_set_top:Nn \l__enumext_miniright_code_vii_box
4788     {
4789       \tl_use:N \g__enumext_miniright_code_vii_tl
4790     }
4791     \box_use_drop:N \l__enumext_miniright_code_vii_box
4792     \skip_vertical:N \c_zero_skip
4793     \__enumext_endminipage:
4794     \par\addvspace{ \g__enumext_minipage_after_skip }
4795   }
4796   \bool_gset_false:N \g__enumext_minipage_active_vii_bool
4797   \bool_gset_true:N \g__enumext_minipage_center_vii_bool

```

```

4798 \tl_gclear:N \g__enumext_miniright_code_vii_tl
4799 \dim_gzero:N \g__enumext_minipage_right_vii_dim
4800 \bool_gset_false:N \g__enumext_starred_bool
4801 }

```

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

`\__enumext_stop_mini_viii:`

```

4802 \cs_new_protected:Nn \__enumext_start_mini_viii:
4803 {
4804   \dim_compare:nNnT { \l__enumext_minipage_right_viii_dim } > { \c_zero_dim }
4805   {
4806     \dim_set:Nn \l__enumext_minipage_left_viii_dim
4807     {
4808       \linewidth
4809       - \l__enumext_minipage_right_viii_dim
4810       - \l__enumext_minipage_hsep_viii_dim
4811     }
4812     \bool_set_true:N \l__enumext_minipage_active_viii_bool
4813     \dim_gset_eq:NN
4814     \g__enumext_minipage_right_viii_dim
4815     \l__enumext_minipage_right_viii_dim
4816     \__enumext_mini_addvspace_viii:
4817     \nointerlineskip\noindent
4818     \__enumext_mini_page{ \l__enumext_minipage_left_viii_dim }
4819   }
4820 }
4821 \cs_new_protected:Nn \__enumext_stop_mini_viii:
4822 {
4823   \bool_if:NTF \l__enumext_minipage_active_viii_bool
4824   {
4825     \__enumext_stop_list:
4826     \IfDocumentMetadataTF { \tag_resume:n {keyans*} } { }
4827     \end__enumext_mini_page
4828     \hfill
4829     \bool_gset_true:N \g__enumext_minipage_active_viii_bool
4830   }
4831   {
4832     \__enumext_stop_list:
4833   }
4834 }
4835 \__enumext_after_env:nn {keyans*}
4836 {
4837   \bool_if:NT \g__enumext_minipage_active_viii_bool
4838   {
4839     \__enumext_mini_page{ \g__enumext_minipage_right_viii_dim }
4840     \par\addvspace { \g__enumext_minipage_right_skip }
4841     \bool_if:NF \g__enumext_minipage_center_viii_bool
4842     {
4843       \tl_put_left:Nn \g__enumext_miniright_code_viii_tl
4844       {
4845         \centering
4846       }
4847     }
4848     \vbox_set_top:Nn \l__enumext_miniright_code_viii_box
4849     {
4850       \tl_use:N \g__enumext_miniright_code_viii_tl
4851     }
4852     \box_use_drop:N \l__enumext_miniright_code_viii_box
4853     \end__enumext_mini_page
4854     \par\addvspace{ \g__enumext_minipage_after_skip }
4855   }
4856   \bool_gset_false:N \g__enumext_minipage_active_viii_bool
4857   \bool_gset_true:N \g__enumext_minipage_center_viii_bool
4858   \tl_gclear:N \g__enumext_miniright_code_viii_tl
4859   \dim_gzero:N \g__enumext_minipage_right_viii_dim
4860 }

```

(End of definition for `\__enumext_start_mini_viii:` and `\__enumext_stop_mini_viii:`)



### 13.46 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.

```

4861 \NewDocumentEnvironment{enumext*}{o}{
4862   {
4863     \__enumext_safe_exec_vii:
4864     \__enumext_parse_keys_vii:n {#1}
4865     \__enumext_before_list_vii:
4866     \__enumext_start_store_level_vii:
4867     \__enumext_start_list:nn { }
4868     {
4869       \__enumext_list_arg_two_vii:
4870       \__enumext_before_keys_exec_vii:
4871     }
4872     \setcounter { enumXvii } { \int_eval:n { \int_use:c { \__enumext_start_vii_int } - 1 } }
4873     \IfDocumentMetadataT { \tag_suspend:n {enumext*} }
4874     \__enumext_starred_columns_set_vii:
4875     \item[] \scan_stop:
4876     \cs_set_eq:NN \__enumext_stop_item_tmp_vii: \__enumext_first_item_tmp_vii:
4877     \cs_set_eq:NN \item \__enumext_start_item_tmp_vii:
4878     \ignorespaces
4879   }
4880   {
4881     \IfDocumentMetadataT { \tag_struct_end:n {tag=text-unit} }
4882     \__enumext_stop_item_tmp_vii:
4883     \__enumext_remove_extra_parsep_vii:
4884     \__enumext_after_list_vii:
4885   }

```

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

`\__enumext_safe_exec_vii:` We will first call the function `\__enumext_is_not_nested:` which sets `\g__enumext_starred_bool` to true if we are NOT nested within `enumext`, then call the function `\__enumext_internal_mini_page:` to create the environment `__enumext_mini_page`, we will increment `\l__enumext_level_h_int` to restrict nesting of the environment, set `\l__enumext_starred_bool` to true and finally call the function `\__enumext_is_on_first_level:` which sets `\l__enumext_starred_first_bool` to true if we are not nested, allowing the “storage system” to be used.

```

4886 \cs_new_protected:Nn \__enumext_safe_exec_vii:
4887   {
4888     \__enumext_is_not_nested:
4889     \__enumext_internal_mini_page:
4890     \int_incr:N \l__enumext_level_h_int
4891     \int_compare:nNtT { \l__enumext_level_h_int } > { 1 }
4892     {
4893       \msg_error:nn { enumext } { nested }
4894     }
4895     \int_compare:nNtT { \l__enumext_keyans_level_h_int } = { 1 }
4896     {
4897       \msg_error:nnn { enumext } { nested-horizontal } { keyans*}
4898     }
4899     \bool_set_true:N \l__enumext_starred_bool
4900     \bool_set_false:N \l__enumext_standar_bool
4901     \__enumext_is_on_first_level:
4902   }

```

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

`\__enumext_parse_keys_vii:n` First we will clear the variable `\l__enumext_series_name_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.

```

4903 \cs_new_protected:Npn \__enumext_parse_keys_vii:n #1
4904   {
4905     \tl_if_novalue:nF {#1}
4906     {

```

```

4907     \str_clear:N \l__enumext_series_name_str
4908     \keys_set:nn { enumext / enumext* } {#1}
4909     \bool_if:NF \l__enumext_print_keyans_cmd_bool
4910     {
4911         \__enumext_parse_series:n {#1}
4912     }
4913     \__enumext_store_active_keys_vii:n {#1}
4914 }
4915 }

```

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

`\__enumext_before_list_vii:` The function `\__enumext_before_list_vii:` first calls the function `\__enumext_vspace_above_vii:` used by the keys `above` and `above*`, then calls the function `\__enumext_check_ans_active:` for the check answer mechanism and finally calls the functions `\__enumext_before_args_exec:` and `\__enumext_start_mini_vii:` used by the keys `before*`, `mini-env`, `mini-right` and `mini-right*`.

```

4916 \cs_new_protected:Nn \__enumext_before_list_vii:
4917 {
4918     \__enumext_vspace_above_vii:
4919     \__enumext_check_ans_active:
4920     \__enumext_before_args_exec_vii:
4921     \__enumext_start_mini_vii:
4922 }

```

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

```

4923 \cs_new_protected:Nn \__enumext_after_list_vii:
4924 {
4925     \__enumext_stop_mini_vii:
4926     \__enumext_after_stop_list_vii:
4927     \__enumext_check_ans_key_hook:
4928     \__enumext_vspace_below_vii:
4929     \bool_set_false:N \l__enumext_starred_bool
4930     \bool_if:NF \l__enumext_print_keyans_cmd_bool
4931     {
4932         \__enumext_starred_save_counter:
4933     }
4934 }

```

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

`\__enumext_start_store_level_vii:` and `\__enumext_stop_store_level_vii:` functions activate the “storing structure” mechanism in *sequence* for `\anskey` command and `anskey*` environment if `enumext*` are nested in `enumext`.

```

4935 \cs_new_protected:Nn \__enumext_start_store_level_vii:
4936 {
4937     \bool_if:NT \l__enumext_store_active_bool
4938     {
4939         \int_compare:nNnT { \l__enumext_level_int } > { 0 }
4940         {
4941             \__enumext_store_level_open_vii:
4942         }
4943     }
4944 }
4945 \cs_new_protected:Nn \__enumext_stop_store_level_vii:
4946 {
4947     \bool_if:NT \l__enumext_store_active_bool
4948     {
4949         \int_compare:nNnT { \l__enumext_level_int } > { 0 }
4950         {
4951             \__enumext_store_level_close_vii:
4952         }
4953     }
4954 }

```

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

### 13.46.1 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.

```
4955 \cs_new_protected_nopar:Nn \__enumext_first_item_tmp_vii:
4956 {
4957   \skip_horizontal:n
4958   {
4959     -\__enumext_labelwidth_vii_dim - \__enumext_labelsep_vii_dim
4960   }
4961   \ignorespaces
4962 }
```

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

`\__enumext_start_item_tmp_vii:`

`\__enumext_item_peek_args_vii:`

`\__enumext_joined_item_vii:w`

`\__enumext_standar_item_vii:w`

`\__enumext_starred_item_vii:w`

First we will call the function `\__enumext_stop_item_tmp_vii:` that we will redefine later, we will increment the value of `\__enumext_item_column_pos_vii_int` that will count the item’s by rows and the value of `\g__enumext_item_count_all_vii_int` that will count the total of item’s in the environment. After that we will call the function `\__enumext_item_peek_args_vii:` that will handle the arguments passed to `\item`.

`\__enumext_starred_item_vii_aux_i:w`

`\__enumext_starred_item_vii_aux_ii:w`

`\__enumext_starred_item_vii_aux_iii:w`

```
4963 \cs_new_protected_nopar:Nn \__enumext_start_item_tmp_vii:
4964 {
4965   \__enumext_stop_item_tmp_vii:
4966   \int_incr:N \__enumext_item_column_pos_vii_int
4967   \int_gincr:N \g__enumext_item_count_all_vii_int
4968   \__enumext_item_peek_args_vii:
4969 }
```

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).

```
4970 \cs_new_protected:Nn \__enumext_item_peek_args_vii:
4971 {
4972   \peek_meaning:NTF (
4973     { \__enumext_joined_item_vii:w }
4974     { \__enumext_joined_item_vii:w (1) }
4975   }
```

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`.

```
4976 \cs_new_protected:Npn \__enumext_joined_item_vii:w (#1)
4977 {
4978   \__enumext_starred_joined_item_vii:n {#1}
4979   \peek_meaning_remove:NTF *
4980   { \__enumext_starred_item_vii:w }
4981   { \__enumext_standar_item_vii:w }
4982 }
```

The function `\__enumext_standar_item_vii:w` will first look for the argument “[”, if present it will set the state of the variable `\__enumext_wrap_label_opt_vii_bool` equal to the state of the variable `\l__enumext_wrap_label_opt_vii_bool` handled by the key `wrap-label*` and finally execute the *non-enumerated* version `\item[<custom>]` by means of the function `\__enumext_start_item_vii:w`, otherwise we will set the value of the variable `\__enumext_wrap_label_vii_bool` handled by the `wrap-label` key to true and set the switch `\if@noitemarg` to true to execute the enumerated version of `\item` by means of the function `\__enumext_start_item_vii:w [ \__enumext_label_vii_tl ]`.

```
4983 \cs_new_protected:Npn \__enumext_standar_item_vii:w
4984 {
4985   \bool_set_false:N \__enumext_item_starred_vii_bool
4986   \peek_meaning:NTF [
4987     {
4988       \bool_set_eq:NN \__enumext_wrap_label_vii_bool \__enumext_wrap_label_opt_vii_bool
4989       \__enumext_start_item_vii:w
4990     }
4991     {
4992       \bool_set_true:N \__enumext_wrap_label_vii_bool
4993       \legacy_if_set_true:n { @noitemarg }
4994       \__enumext_start_item_vii:w [ \__enumext_label_vii_tl ] \ignorespaces
4995     }
4996   }
```

```

4995     }
4996 }

```

The function `\__enumext_starred_item_vii:w` together with the specified auxiliary functions `aux_i:w`, `aux_ii:w`, and `aux_iii:w` execute `\item*`, `\item*[\langle symbol \rangle]` and `\item*[\langle symbol \rangle][\langle offset \rangle]`.

```

4997 \cs_new_protected:Npn \__enumext_starred_item_vii:w
4998 {
4999   \bool_set_true:N \l__enumext_item_starred_vii_bool
5000   \bool_set_true:N \l__enumext_wrap_label_vii_bool
5001   \peek_meaning:NTF [
5002     { \__enumext_starred_item_vii_aux_i:w }
5003     { \__enumext_starred_item_vii_aux_ii:w }
5004   }
5005   \cs_new_protected:Npn \__enumext_starred_item_vii_aux_i:w [#1]
5006   {
5007     \tl_gset:Nn \g__enumext_item_symbol_aux_vii_tl {#1}
5008     \__enumext_starred_item_vii_aux_ii:w
5009   }
5010   \cs_new_protected:Npn \__enumext_starred_item_vii_aux_ii:w
5011   {
5012     \peek_meaning:NTF [
5013       { \__enumext_starred_item_vii_aux_iii:w }
5014       {
5015         \dim_set_eq:NN \l__enumext_item_symbol_sep_vii_dim \l__enumext_labelsep_vii_dim
5016         \legacy_if_set_true:n { @noitemarg }
5017         \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ] \ignorespaces
5018       }
5019     }
5020     \cs_new_protected:Npn \__enumext_starred_item_vii_aux_iii:w [#1]
5021     {
5022       \dim_set:Nn \l__enumext_item_symbol_sep_vii_dim {#1}
5023       \legacy_if_set_true:n { @noitemarg }
5024       \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ] \ignorespaces
5025     }

```

(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`

```

5026 \cs_new_protected_nopar:Npn \__enumext_fake_make_label_vii:n #1
5027 {
5028   \legacy_if:nT { @noitemarg }
5029   {
5030     \legacy_if_set_false:n { @noitemarg }
5031     \legacy_if:nT { @nmbrrlist }
5032     {
5033       \IfDocumentMetadataT
5034       {
5035         \bool_if:NT \l__enumext_hyperref_bool
5036         {
5037           \legacy_if_set_true:n { @hyper@item }
5038         }
5039       }
5040       \refstepcounter{enumXvii}
5041       \bool_if:NT \l__enumext_check_answers_bool
5042       {
5043         \int_gincr:N \g__enumext_item_number_int
5044         \bool_set_true:N \l__enumext_item_number_bool
5045       }
5046     }
5047   }

```

```

5048 \bool_if:NT \l__enumext_item_starred_vii_bool
5049 {
5050   \tl_if_blank:VT \g__enumext_item_symbol_aux_vii_tl
5051   {
5052     \tl_gset_eq:NN
5053     \g__enumext_item_symbol_aux_vii_tl \l__enumext_item_symbol_vii_tl
5054   }
5055   \mode_leave_vertical:
5056   \skip_horizontal:n { -\l__enumext_item_symbol_sep_vii_dim }
5057   \hbox_overlap_left:n { \g__enumext_item_symbol_aux_vii_tl }
5058   \skip_horizontal:N \l__enumext_item_symbol_sep_vii_dim
5059   \tl_gclear:N \g__enumext_item_symbol_aux_vii_tl
5060 }
5061 \makebox[ \l__enumext_labelwidth_vii_dim ][ \l__enumext_align_label_vii_str ]
5062 {
5063   \tl_use:N \l__enumext_label_font_style_vii_tl
5064   \bool_if:NTF \l__enumext_wrap_label_vii_bool
5065   {
5066     \__enumext_wrapper_label_vii:n {#1}
5067   }
5068   { #1 }
5069 }
5070 \skip_horizontal:N \l__enumext_labelsep_vii_dim \ignorespaces
5071 }

```

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

### 13.46.2 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`.

```

5072 \cs_new_protected_nopar:Npn \__enumext_start_item_vii:w [#1]
5073 {
5074   \cs_set_eq:NN \__enumext_stop_item_tmp_vii: \__enumext_stop_item_vii:
5075   \hbox_set_to_wd:Nnw \l__enumext_item_text_vii_box
5076   {
5077     \l__enumext_joined_width_vii_dim
5078     + \l__enumext_labelwidth_vii_dim
5079     + \l__enumext_labelsep_vii_dim
5080   }

```

Redefine the `\footnote` command.

```
5081 \__enumext_renew_footnote_starred:
```

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

```

5082 \__enumext_start_list_tag:n {enumext*}
5083 \__enumext_fake_make_label_vii:n {#1}
5084 \__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.

```

5085 \__enumext_minipage:w [ t ]{ \l__enumext_joined_width_vii_dim }
5086 \dim_set_eq:NN \parindent \l__enumext_listparindent_vii_dim
5087 \skip_set_eq:NN \parskip \l__enumext_parsep_vii_skip
5088 \__enumext_unskip_unkern:
5089 \__enumext_unskip_unkern:
5090 \skip_horizontal:n { -\l__enumext_listparindent_vii_dim } \ignorespaces
5091 \tl_use:N \l__enumext_fake_item_indent_vii_tl
5092 \tl_use:N \l__enumext_after_list_args_vii_tl
5093 }

```

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*.

```
5094 \cs_new_protected_nopar:Nn \__enumext_stop_item_vii:
5095 {
5096     \__enumext_endminipage:
5097     \__enumext_stop_list_tag:n {enumext*}
5098     \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*.

```
5099     \int_set:Nn \hbadness { 10000 }
5100     \box_use_drop:N \l__enumext_item_text_vii_box
```

Finally apply the *vertical space* between rows set by `itemsep` key passed to `\parsep` using `\par\noindent` and *horizontal space* between columns set by `columns-sep` key using `\skip_horizontal:N`.

```
5101     \int_compare:nNnTF
5102     { \l__enumext_item_column_pos_vii_int } = { \l__enumext_columns_vii_int }
5103     {
5104         \par\noindent
5105         \int_zero:N \l__enumext_item_column_pos_vii_int
5106     }
5107     {
5108         \skip_horizontal:N \l__enumext_columns_sep_vii_dim
5109     }
5110 }
```

(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)*.

```
5111 \cs_new_protected:Nn \__enumext_remove_extra_parsep_vii:
5112 {
5113     \int_compare:nNnT
5114     {
5115         \int_mod:nn
5116         { \g__enumext_item_count_all_vii_int } { \l__enumext_columns_vii_int }
5117     }
5118     =
5119     { 0 }
5120     {
5121         \para_end:
5122         \skip_vertical:n { -\l__enumext_itemsep_vii_skip }
5123         \skip_vertical:N \c_zero_skip
5124         \int_gzero:N \g__enumext_item_count_all_vii_int
5125     }
5126 }
```

(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`.

```
5127 \__enumext_after_env:nn {enumext*}
5128 {
5129     \__enumext_execute_after_env:
5130 }
```

### 13.47 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.

```
5131 \NewDocumentEnvironment{keyans*}{ o }
5132 {
5133     \__enumext_safe_exec_viii:
5134     \__enumext_parse_keys_viii:n {#1}
5135     \__enumext_before_list_viii:
5136     \__enumext_start_list:nn { }
5137     {
5138         \__enumext_list_arg_two_viii:
5139         \__enumext_before_keys_exec_viii:
5140     }
```

```

5141 \setcounter { enumXviii } { \int_eval:n { \int_use:c { l__enumext_start_viii_int } - 1 } }
5142 \IfDocumentMetadataT { \tag_suspend:n {keyans*} }
5143 \__enumext_starred_columns_set_viii:
5144 \item[] \scan_stop:
5145 \cs_set_eq:NN \__enumext_stop_item_tmp_viii: \__enumext_first_item_tmp_viii:
5146 \cs_set_eq:NN \item \__enumext_start_item_tmp_viii:
5147 \ignorespaces
5148 }
5149 {
5150 \IfDocumentMetadataT { \tag_struct_end:n {tag=text-unit} }
5151 \__enumext_stop_item_tmp_viii:
5152 \__enumext_remove_extra_parsep_viii:
5153 \__enumext_check_starred_cmd:n { item }
5154 \__enumext_after_list_viii:
5155 }

```

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

`\__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.

```

5156 \cs_new_protected:Nn \__enumext_safe_exec_viii:
5157 {
5158 \bool_if:NF \l__enumext_store_active_bool
5159 {
5160 \msg_error:nnnn { enumext } { wrong-place } { keyans* } { save-ans }
5161 }
5162 \int_incr:N \l__enumext_keyans_level_h_int
5163 \int_compare:nNnT { \l__enumext_keyans_level_h_int } > { 1 }
5164 {
5165 \msg_error:nn { enumext } { nested }
5166 }
5167 \__enumext_keyans_name_and_start:
5168 \bool_if:NT \l__enumext_starred_bool
5169 {
5170 \msg_error:nnn { enumext } { nested-horizontal } { enumext* }
5171 }
5172 \bool_set_true:N \l__enumext_starred_bool
5173 % Set false for interfering with enumext nested in keyans* (yes, its possible and crayze)
5174 \bool_set_false:N \l__enumext_store_active_bool
5175 \int_compare:nNnT { \l__enumext_level_int } > { 1 }
5176 {
5177 \msg_error:nn { enumext } { keyans-wrong-level }
5178 }
5179 }

```

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

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

```

5180 \cs_new_protected:Npn \__enumext_parse_keys_viii:n #1
5181 {
5182 \tl_if_no_value:nF {#1}
5183 {
5184 \keys_set:nn { enumext / keyans* } {#1}
5185 }
5186 }

```

(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`.

```

5187 \cs_new_protected:Nn \__enumext_before_list_viii:
5188 {
5189 \__enumext_vspace_above_viii:
5190 \__enumext_before_args_exec_viii:
5191 \__enumext_start_mini_viii:
5192 }

```



(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.

```
5193 \cs_new_protected:Nn \__enumext_after_list_viii:
5194 {
5195     \__enumext_stop_mini_viii:
5196     \__enumext_after_stop_list_viii:
5197     \__enumext_vspace_below_viii:
5198 }
```

(End of definition for `\__enumext_after_list_viii:`)

### 13.47.1 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.

```
5199 \cs_new_protected_nopar:Nn \__enumext_first_item_tmp_viii:
5200 {
5201     \skip_horizontal:n
5202     {
5203         -\__enumext_labelwidth_viii_dim - \__enumext_labelsep_viii_dim
5204     }
5205     \ignorespaces
5206 }
```

(End of definition for `\__enumext_first_item_tmp_viii:`)

`\__enumext_start_item_tmp_viii:` First we will call the function `\__enumext_stop_item_tmp_viii:` that we will redefine later, we will increment the value of `\__enumext_item_column_pos_viii_int` that will count the item’s by rows and `\__enumext_item_peek_args_viii:` that will handle the arguments passed to `\item`.  
`\__enumext_item_peek_args_viii:` increment the value of `\g__enumext_item_count_all_viii_int` that will count the total of item’s in the environment.  
`\__enumext_joined_item_viii:w` After that we will call the function `\__enumext_item_peek_args_viii:` that will handle the arguments passed to `\item`.  
`\__enumext_standar_item_viii:w`

```
5207 \cs_new_protected_nopar:Nn \__enumext_start_item_tmp_viii:
5208 {
5209     \__enumext_stop_item_tmp_viii:
5210     \int_incr:N \__enumext_item_column_pos_viii_int
5211     \int_gincr:N \g__enumext_item_count_all_viii_int
5212     \__enumext_item_peek_args_viii:
5213 }
```

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).

```
5214 \cs_new_protected:Nn \__enumext_item_peek_args_viii:
5215 {
5216     \peek_meaning:NTF (
5217         { \__enumext_joined_item_viii:w }
5218         { \__enumext_joined_item_viii:w (1) }
5219 }
```

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`.

```
5220 \cs_new_protected:Npn \__enumext_joined_item_viii:w (#1)
5221 {
5222     \__enumext_starred_joined_item_viii:n {#1}
5223     \peek_meaning_remove:NTF *
5224     { \__enumext_starred_item_viii:w }
5225     { \__enumext_standar_item_viii:w }
5226 }
```

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 ]`.

```

5227 \cs_new_protected:Npn \__enumext_standar_item_viii:w
5228 {
5229   \bool_set_false:N \l__enumext_item_starred_viii_bool
5230   \bool_set_false:N \l__enumext_item_wrap_key_bool
5231   \peek_meaning:NTF [
5232     {
5233       \bool_set_eq:NN \l__enumext_wrap_label_viii_bool \l__enumext_wrap_label_opt_viii_bool
5234       \__enumext_start_item_viii:w
5235     }
5236     {
5237       \bool_set_true:N \l__enumext_wrap_label_viii_bool
5238       \legacy_if_set_true:n { @noitemarg }
5239       \__enumext_start_item_viii:w [ \l__enumext_label_viii_tl ] \ignorespaces
5240     }
5241   }

```

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

```

\__enumext_starred_item_viii:w
\__enumext_starred_item_viii_aux_i:w
\__enumext_starred_item_viii_aux_ii:w
\__enumext_keyans_starred_item_star:

```

The function `\__enumext_starred_item_viii:w` together with the specified auxiliary functions `aux_i:w` and `aux_ii:w` execute `\item*` and `\item*[⟨content⟩]`.

```

5242 \cs_new_protected:Npn \__enumext_starred_item_viii:w
5243 {
5244   \bool_set_true:N \l__enumext_item_starred_viii_bool
5245   \bool_set_true:N \l__enumext_item_wrap_key_bool
5246   \bool_set_true:N \l__enumext_wrap_label_viii_bool
5247   \peek_meaning:NTF [
5248     { \__enumext_starred_item_viii_aux_i:w }
5249     { \__enumext_starred_item_viii_aux_ii:w }
5250   }

```

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`.

```

5251 \cs_new_protected:Npn \__enumext_starred_item_viii_aux_i:w [#1]
5252 {
5253   \tl_clear:N \l__enumext_store_current_label_tl
5254   \tl_if_no_value:nF { #1 }
5255   {
5256     \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_viii_tl
5257     {
5258       \tl_put_right:NV \l__enumext_store_current_label_tl \l__enumext_store_keyans_item_opt_sep_viii_tl
5259       \tl_put_right:Nn \l__enumext_store_current_label_tl { #1 }
5260     }
5261     \tl_set:Nn \l__enumext_store_current_opt_arg_tl { #1 }
5262   }
5263   \__enumext_starred_item_viii_aux_ii:w
5264 }
5265 \cs_new_protected:Npn \__enumext_starred_item_viii_aux_ii:w
5266 {
5267   \legacy_if_set_true:n { @noitemarg }
5268   \__enumext_start_item_viii:w [ \l__enumext_label_viii_tl ] \ignorespaces
5269 }

```

The function `\__enumext_keyans_starred_item_star:` will be in charge of storing the current `⟨label⟩` for `\item*` followed by the `[⟨content⟩]` for `\item*[⟨content⟩]` if present in the *sequence* and *prop list* set by the `save-ans` key. In this same function the keys `show-ans`, `show-pos`, `mark-sep` and `save-ref` are implemented.

```

5270 \cs_new_protected:Nn \__enumext_keyans_starred_item_star:
5271 {
5272   \tl_put_left:Ne \l__enumext_store_current_label_tl { \l__enumext_label_viii_tl }
5273   \__enumext_store_addto_prop:V \l__enumext_store_current_label_tl
5274   \__enumext_keyans_store_ref:
5275   \tl_put_left:Nn \l__enumext_store_current_label_tl { \item }

```

```

5276 \__enumext_keyans_addto_seq_link:
5277 \int_gincr:N \g__enumext_check_starred_cmd_int
5278 \dim_compare:nNtT { \l__enumext_mark_sym_sep_viii_dim } = { \c_zero_dim }
5279 {
5280   \dim_set:Nn \l__enumext_mark_sym_sep_viii_dim { \l__enumext_labelsep_viii_dim }
5281 }
5282 \bool_if:NT \l__enumext_show_answer_bool
5283 {
5284   \tl_set_eq:NN \l__enumext_mark_answer_sym_tl \l__enumext_mark_answer_sym_viii_tl
5285   \str_set_eq:NN \l__enumext_mark_position_str \l__enumext_mark_position_viii_str
5286   \__enumext_print_keyans_box:NN
5287   \l__enumext_labelwidth_viii_dim \l__enumext_mark_sym_sep_viii_dim
5288 }
5289 \bool_if:NT \l__enumext_show_position_bool
5290 {
5291   \tl_set:Nx \l__enumext_mark_answer_sym_tl
5292   {
5293     \group_begin:
5294     \exp_not:N \normalfont
5295     \exp_not:N \footnotesize [ \int_eval:n
5296       {
5297         \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
5298       }
5299     ]
5300     \group_end:
5301   }
5302   \str_set_eq:NN \l__enumext_mark_position_str \l__enumext_mark_position_viii_str
5303   \__enumext_print_keyans_box:NN
5304   \l__enumext_labelwidth_viii_dim \l__enumext_mark_sym_sep_viii_dim
5305 }
5306 }

```

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

```

\__enumext_keyans_wrapper_label_viii:n
\__enumext_fake_make_label_viii:n

```

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

```

5307 \cs_new_protected:Npn \__enumext_keyans_wrapper_label_viii:n #1
5308 {
5309   \bool_lazy_all:nT
5310   {
5311     { \bool_if_p:N \l__enumext_wrap_label_viii_bool }
5312     { \bool_if_p:N \l__enumext_show_answer_bool }
5313     { \bool_if_p:N \l__enumext_item_wrap_key_bool }
5314     { \cs_if_exist_p:N \__enumext_keyans_wrapper_item_viii:n }
5315   }
5316   {
5317     \cs_set_eq:NN
5318     \__enumext_wrapper_label_viii:n \__enumext_keyans_wrapper_item_viii:n
5319   }
5320   \bool_if:NTF \l__enumext_wrap_label_viii_bool
5321   {
5322     \__enumext_wrapper_label_viii:n {#1}
5323   }
5324   { #1 }
5325 }
5326 \cs_new_protected_nopar:Npn \__enumext_fake_make_label_viii:n #1
5327 {
5328   \legacy_if:nT { @noitemarg }
5329   {
5330     \legacy_if_set_false:n { @noitemarg }
5331     \legacy_if:nT { @nmbrrlist }
5332     {
5333       \refstepcounter{enumXviii}
5334     }
5335   }
5336   \bool_if:NT \l__enumext_item_starred_viii_bool
5337   {
5338     \__enumext_keyans_starred_item_star:
5339   }
5340   \makebox[ \l__enumext_labelwidth_viii_dim ][ \l__enumext_align_label_viii_str ]
5341   {
5342     \tl_use:N \l__enumext_label_font_style_viii_tl

```

```

5343     \__enumext_keyans_wrapper_label_viii:n {#1}
5344   }
5345   \skip_horizontal:N \__enumext_labelsep_viii_dim \ignorespaces
5346 }

```

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

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

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

```

\__enumext_start_item_viii:w
\__enumext_stop_item_viii:
5347 \cs_new_protected_nopar:Npn \__enumext_start_item_viii:w [#1]
5348 {
5349   \cs_set_eq:NN \__enumext_stop_item_tmp_viii: \__enumext_stop_item_viii:
5350   \hbox_set_to_wd:Nnw \__enumext_item_text_viii_box
5351   {
5352     \__enumext_joined_width_viii_dim
5353     + \__enumext_labelwidth_viii_dim
5354     + \__enumext_labelsep_viii_dim
5355   }
5356   \__enumext_renew_footnote_starred:
5357   \__enumext_start_list_tag:n {keyans*}
5358   \__enumext_fake_make_label_viii:n {#1}
5359   \__enumext_stop_start_list_tag:
5360   \__enumext_minipage:w [ t ]{ \__enumext_joined_width_viii_dim }
5361   \dim_set_eq:NN \parindent \__enumext_listparindent_viii_dim
5362   \skip_set_eq:NN \parskip \__enumext_parsep_viii_skip
5363   \__enumext_unskip_unkern:
5364   \__enumext_unskip_unkern:
5365   \skip_horizontal:n { -\__enumext_listparindent_viii_dim } \ignorespaces
5366   \tl_use:N \__enumext_fake_item_indent_viii_tl
5367   \bool_if:NT \__enumext_item_starred_viii_bool
5368   {
5369     \__enumext_keyans_show_item_opt_viii:
5370   }
5371   \tl_use:N \__enumext_after_list_args_viii_tl
5372 }
5373 \cs_new_protected_nopar:Nn \__enumext_stop_item_viii:
5374 {
5375   \__enumext_endminipage:
5376   \__enumext_stop_list_tag:n {keyans*}
5377   \hbox_set_end:
5378   \int_set:Nn \hbadness { 10000 }
5379   \box_use_drop:N \__enumext_item_text_viii_box
5380   \int_compare:nNnTF
5381   { \__enumext_item_column_pos_viii_int } = { \__enumext_columns_viii_int }
5382   {
5383     \par\noindent
5384     \int_zero:N \__enumext_item_column_pos_viii_int
5385   }
5386   {
5387     \skip_horizontal:N \__enumext_columns_sep_viii_dim
5388   }
5389 }

```

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

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

```

5390 \cs_new_protected:Nn \__enumext_remove_extra_parsep_viii:
5391 {
5392   \int_compare:nNnT
5393   {
5394     \int_mod:nn
5395     { \g__enumext_item_count_all_viii_int }
5396     { \__enumext_columns_viii_int }
5397   }
5398   =
5399   { 0 }
5400   {
5401     \para_end:
5402     \skip_vertical:n { -\__enumext_itemsep_viii_skip }
5403     \skip_vertical:N \c_zero_skip
5404     \int_gzero:N \g__enumext_item_count_all_viii_int

```

```

5405     }
5406 }

```

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

### 13.48 The command `\getkeyans`

`\getkeyans` The `\getkeyans` command takes a *mandatory argument* of the form `{⟨store name : position⟩}`. Retrieve a “single content” stored by `\anskey`, `\anspic*` and `\item*` and `anskey*` from *prop list* defined by `save-ans` key.

```

5407 \NewDocumentCommand \getkeyans { m }
5408 {
5409   \exp_args:Ne \__enumext_getkeyans_aux:n
5410   { \tl_to_str:e { \text_expand:n {#1} } }
5411 }

```

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

```

5412 \cs_new_protected:Npn \__enumext_getkeyans_aux:n #1
5413 {
5414   \str_if_in:nnTF {#1} { : }
5415   {
5416     \use:e
5417     {
5418       \cs_set:Npn \exp_not:N \__enumext_tmp:w ##1 \c_colon_str ##2 \scan_stop:
5419       { {##1} {##2} }
5420     }
5421     \exp_after:wN \__enumext_getkeyans:nn \__enumext_tmp:w #1 \scan_stop:
5422   }
5423   { \msg_error:nnn { enumext } { missing-colon } {#1} }
5424 }

```

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*.

```

5425 \cs_new_protected:Npn \__enumext_getkeyans:nn #1 #2
5426 {
5427   \prop_if_exist:cTF { g__enumext_#1_prop }
5428   {
5429     \prop_item:cn { g__enumext_#1_prop } {#2}
5430   }
5431   {
5432     \msg_error:nnn { enumext } { undefined-storage-anskey } {#1}
5433   }
5434 }

```

(End of definition for `\getkeyans`, `\__enumext_getkeyans_aux:n`, and `\__enumext_getkeyans:nn`. This function is documented on page 19.)

### 13.49 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⟩]`.

```

5435 \keys_define:nn { enumext / print }
5436 {
5437   print* .code:n      = \keys_precompile:neN { enumext / enumext* }
5438               { \__enumext_filter_save_key:n {#1} }
5439               \l__enumext_print_keyans_starred_tl, % starred cmd
5440   print* .initial:n   = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
5441               rightmargin=0pt, listparindent=0pt, nosepl, label=\arabic*,
5442               columns=2, first=\small, font=\small },
5443   print-1 .code:n     = \keys_precompile:neN { enumext / level-1 }
5444               { \__enumext_filter_save_key:n {#1} }
5445               \l__enumext_print_keyans_i_tl,
5446   print-1 .initial:n  = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,

```

```

5447             rightmargin=0pt, listparindent=0pt, nosep, label=\arabic*.,
5448             columns=2, first=\small, font=\small },
5449     print-2 .code:n    = \keys_precompile:neN { enumext / level-2 }
5450                       { \__enumext_filter_save_key:n {#1} }
5451                       \l__enumext_print_keyans_ii_tl,
5452     print-2 .initial:n = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
5453                       rightmargin=0pt, listparindent=0pt, nosep, label=(\alph*),
5454                       first=\small, font=\small },
5455     print-3 .code:n    = \keys_precompile:neN { enumext / level-3 }
5456                       { \__enumext_filter_save_key:n {#1} }
5457                       \l__enumext_print_keyans_iii_tl,
5458     print-3 .initial:n = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
5459                       rightmargin=0pt, listparindent=0pt, nosep, label=\roman*.,
5460                       first=\small, font=\small },
5461     print-4 .code:n    = \keys_precompile:neN { enumext / level-4 }
5462                       { \__enumext_filter_save_key:n {#1} }
5463                       \l__enumext_print_keyans_iv_tl,
5464     print-4 .initial:n = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
5465                       rightmargin=0pt, listparindent=0pt, nosep, label=\Alph*.,
5466                       first=\small, font=\small },
5467     print-* .code:n    = \keys_precompile:neN { enumext / enumext* }
5468                       { \__enumext_filter_save_key:n {#1} }
5469                       \l__enumext_print_keyans_vii_tl, % starred nested
5470     print-* .initial:n = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
5471                       rightmargin=0pt, listparindent=0pt, nosep, label=\arabic*.,
5472                       first=\small, font=\small },
5473 }

```

- 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`.

```

5474 \NewDocumentCommand \printkeyans { s O{} m }
5475 {
5476   \group_begin:
5477     \bool_set_true:N \l__enumext_print_keyans_cmd_bool
5478     \tl_use:N \l__enumext_print_keyans_i_tl
5479     \tl_use:N \l__enumext_print_keyans_ii_tl
5480     \tl_use:N \l__enumext_print_keyans_iii_tl
5481     \tl_use:N \l__enumext_print_keyans_iv_tl
5482     \tl_use:N \l__enumext_print_keyans_vii_tl
5483     \__enumext_printkeyans:nnn { #1 } { #2 } { #3 }
5484     \bool_set_false:N \l__enumext_print_keyans_cmd_bool
5485   \group_end:
5486 }

```

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.

```

5487 \cs_new_protected:Npn \__enumext_printkeyans:nnn #1 #2 #3
5488 {
5489   \seq_if_exist:cTF { g__enumext_#3_seq }
5490   {
5491     \seq_if_empty:cF { g__enumext_#3_seq }
5492     {

```

If the *starred argument* `*` is present we will check that the environment `enumext*` is not saved in the *sequence*, then execute the variable `\l__enumext_print_keyans_starred_tl` that contains the default  $\langle keys \rangle$  for the environment `enumext*`, we set `\l__enumext_base_line_fix_bool` and `\l__enumext_print_keyans_star_bool` to true for *baseline correction*, open the `enumext*` environment passing the *optional argument* and map the *sequence*, then set `\l__enumext_base_line_fix_bool` and `\l__enumext_print_keyans_star_bool` to false.

```

5493       \bool_if:nTF {#1}
5494       {
5495         \seq_if_in:cnTF { g__enumext_#3_seq } { \end{enumext*} }
5496         {
5497           \msg_error:nnnn { enumext } { print-starred } {#3} { enumext* }
5498         }
5499       }

```

```

5500         \tl_use:N \l__enumext_print_keyans_starred_tl
5501         \bool_set_true:N \l__enumext_base_line_fix_bool
5502         \bool_set_true:N \l__enumext_print_keyans_star_bool
5503         \begin{enumext*}[#2]
5504             \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
5505         \end{enumext*}
5506         \bool_set_false:N \l__enumext_base_line_fix_bool
5507         \bool_set_false:N \l__enumext_print_keyans_star_bool
5508     }
5509 }

```

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

```

5510     {
5511         \begin{enumext}[#2]
5512             \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
5513         \end{enumext}
5514     }
5515 }
5516 }
5517 {
5518     \msg_error:nnn { enumext } { undefined-storage-anskey } {#3}
5519 }
5520 }

```

(End of definition for `\printkeyans` and `\__enumext_printkeyans:nnn`. This function is documented on page 20.)

### 13.50 The command `\setenumext`

The command `\setenumext` will be in charge of managing the *⟨keys⟩* passed to all environments and to the `\printkeyans` command. We must take precautions with the `enumext*` environment and “first level” of the `enumext` environment so as not to capture *⟨keys⟩* that complicate us.

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

```

\__enumext_filter_first_level:n
\__enumext_filter_first_level_key:n
\__enumext_filter_first_level_pair:nn
5521 \cs_new:Npn \__enumext_filter_first_level:n #1
5522 {
5523     \use:e
5524     {
5525         \keyval_parse:NNn
5526         \__enumext_filter_first_level_key:n
5527         \__enumext_filter_first_level_pair:nn {#1}
5528     }
5529 }

```

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

```

5530 \cs_new:Npn \__enumext_filter_first_level_key:n #1
5531 {
5532     \str_case:nnF {#1}
5533     {
5534         { resume } {}
5535         { resume* } {}
5536     }
5537     { , { \exp_not:n {#1} } }
5538 }

```

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

```

5539 \cs_new:Npn \__enumext_filter_first_level_pair:nn #1#2
5540 {
5541     \str_case:nnF {#1}
5542     {
5543         { series } {}
5544         { resume } {}
5545         { save-ans } {}
5546     }
5547     { , { \exp_not:n {#1} } = { \exp_not:n {#2} } }
5548 }

```



(End of definition for `\__enumext_filter_first_level:n`, `\__enumext_filter_first_level_key:n`, and `\__enumext_filter_first_level_pair:nn`.)

Now define a “meta families” of `\keys` to access from `\setenumext`.

```

5549 \keys_define:nn { enumext / meta-families }
5550 {
5551   enumext-1 .code:n =
5552     {
5553       \keys_set:ne { enumext / level-1 }
5554       {
5555         \__enumext_filter_first_level:n {#1}
5556       }
5557     } ,
5558   enumext-2 .code:n = { \keys_set:nn { enumext / level-2 } {#1} } ,
5559   enumext-3 .code:n = { \keys_set:nn { enumext / level-3 } {#1} } ,
5560   enumext-4 .code:n = { \keys_set:nn { enumext / level-4 } {#1} } ,
5561   keyans    .code:n = { \keys_set:nn { enumext / keyans   } {#1} } ,
5562   enumext*  .code:n =
5563     {
5564       \keys_set:ne { enumext / enumext* }
5565       {
5566         \__enumext_filter_first_level:n {#1}
5567       }
5568     } ,
5569   keyans*   .code:n = { \keys_set:nn { enumext / keyans* } {#1} } ,
5570   print*    .code:n = { \keys_set:nn { enumext / print   } { print* = {#1} } } ,
5571   print-1   .code:n = { \keys_set:nn { enumext / print   } { print-1 = {#1} } } ,
5572   print-2   .code:n = { \keys_set:nn { enumext / print   } { print-2 = {#1} } } ,
5573   print-3   .code:n = { \keys_set:nn { enumext / print   } { print-3 = {#1} } } ,
5574   print-4   .code:n = { \keys_set:nn { enumext / print   } { print-4 = {#1} } } ,
5575   print-*   .code:n = { \keys_set:nn { enumext / print   } { print-* = {#1} } } ,
5576   unknown   .code:n = { \msg_error:nn { enumext } { unknown-key-family } } ,
5577 }

```

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

```

5578 \seq_const_from_clist:Nn \c__enumext_all_families_seq
5579 {
5580   enumext-1, enumext-2, enumext-3, enumext-4, keyans, enumext*,
5581   keyans*, print-1, print-2, print-3, print-4, print-*, print*,
5582 }

```

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

```

\__enumext_set_parse:n 5583 \NewDocumentCommand \setenumext { 0{enumext,1} +m }
\__enumext_set_error:nn 5584 {
5585   \seq_clear:N \l__enumext_setkey_tmpa_seq
5586   \seq_set_from_clist:Nn \l__enumext_setkey_tmpb_seq {#1}
5587   \int_set:Nn \l__enumext_setkey_tmpa_int
5588   {
5589     \seq_count:N \l__enumext_setkey_tmpb_seq
5590   }
5591   \int_compare:nNnTF { \l__enumext_setkey_tmpa_int } > { 1 }
5592   {
5593     \seq_pop_left:NN \l__enumext_setkey_tmpb_seq \l__enumext_setkey_tmpa_tl
5594     \seq_map_function:NN \l__enumext_setkey_tmpb_seq \__enumext_set_parse:n
5595     \seq_set_map_e:NNn \l__enumext_setkey_tmpa_seq \l__enumext_setkey_tmpa_seq
5596     {
5597       \tl_use:N \l__enumext_setkey_tmpa_tl - ##1
5598     }
5599   }
5600   {
5601     \seq_put_right:Ne \l__enumext_setkey_tmpa_seq { \tl_trim_spaces:n {#1} }
5602   }
5603   \seq_if_empty:Ntf \l__enumext_setkey_tmpa_seq
5604   { \seq_map_inline:Nn \c__enumext_all_families_seq }
5605   { \seq_map_inline:Nn \l__enumext_setkey_tmpa_seq }
5606   {
5607     \keys_set:nn { enumext / meta-families } { ##1 = {#2} }
5608   }
5609 }

```

Internal functions used by the `\setenumext` command.

```

5610 \cs_new_protected:Npn \__enumext_set_parse:n #1

```

```

5611 {
5612   \tl_set:Nc \l__enumext_setkey_tmpb_tl { \tl_trim_spaces:n {#1} }
5613   \clist_map_inline:nn { 0, 1, 2, 3, 4, * } % <- max level
5614     { \tl_remove_all:Nn \l__enumext_setkey_tmpb_tl {##1} }
5615   \tl_if_empty:NTF \l__enumext_setkey_tmpb_tl
5616     {
5617       \seq_put_right:Nc \l__enumext_setkey_tmpa_seq
5618         { \tl_trim_spaces:n {#1} }
5619     }
5620     { \__enumext_set_error:nn {#1} { } }
5621 }
5622 \cs_new_protected:Npn \__enumext_set_error:nn #1 #2
5623 { \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.)

### 13.51 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
5624 \prop_const_from_keyval:Nn \c__enumext_meta_paths_prop
5625 {
5626   {enumext,1} = level-1,
5627   {enumext,2} = level-2,
5628   {enumext,3} = level-3,
5629   {enumext,4} = level-4,
5630   {enumext*} = enumext*
5631 }

```

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

```

5632 \NewDocumentCommand \setenumextmeta { s O{enumext,1} m +m }
5633 {
5634   \str_if_eq:eeTF { \tl_trim_spaces:n {#3} } { unknown }
5635     { \msg_error:nn { enumext } { prohibited-unknown } }
5636     {
5637       \bool_if:nTF {#1}
5638       {
5639         \int_step_inline:nn { 4 }
5640           { \__enumext_add_meta_key:nnn { enumext, ##1 } {#3} {#4} }
5641           \__enumext_add_meta_key:nnn { enumext* } {#3} {#4}
5642       }
5643       { \__enumext_add_meta_key:nnn {#2} {#3} {#4} }
5644     }
5645 }

```

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

```

5646 \cs_new_protected:Npn \__enumext_add_meta_key:nnn #1
5647 {
5648   \tl_set:Nn \l__enumext_meta_path_tl {#1}
5649   \tl_replace_all:Nnn \l__enumext_meta_path_tl {~} {}
5650   \prop_get:NVNTF
5651     \c__enumext_meta_paths_prop \l__enumext_meta_path_tl \l__enumext_meta_path_tl
5652     { \__enumext_def_meta_key:Vnn \l__enumext_meta_path_tl }
5653     {
5654       \msg_error:nnn { enumext } { unknown-set } {#1}
5655       \use_none:nn
5656     }
5657 }
5658 \cs_new_protected:Npn \__enumext_def_meta_key:nnn #1#2#3
5659 {
5660   \bool_lazy_or:nnTF
5661     { \keys_if_exist_p:nn { enumext / #1 } {#2} }
5662     { \keys_if_exist_p:nn { enumext / enumext* } {#2} }
5663     { \msg_error:nnn { enumext } { already-defined } {#2} }
5664     {
5665       \keys_define:nn { enumext / #1 }
5666       {
5667         #2 .meta:n = {#3},

```

```

5668         #2 .value_forbidden:n = true
5669     }
5670 }
5671 }
5672 \cs_generate_variant:Nn \__enumext_def_meta_key:nnn { V }

```

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

### 13.52 The command `\foreachkeyans`

The command `\foreachkeyans` will execute a *loop* over the *prop list* and return its contents. The implementation code is adapted from the answer provided by Enrico Gregorio (@egreg) in [Expand a .cs defined by key inside the function.](#)

`\foreachkeyans`

We define a set of *⟨keys⟩* for command and we will save the default values of these in `\g__enumext_foreach_default_keys_tl` to avoid the use of group.

```

\__enumext_parse_foreach_keys:nn
\__enumext_parse_foreach_keys:n
\__enumext_foreach_keyans:nn
\__enumext_foreach_add_body:n
5673 \keys_define:nn { enumext / foreach }
5674 {
5675     before .tl_set:N = \l__enumext_foreach_before_tl,
5676     before .value_required:n = true,
5677     after .tl_set:N = \l__enumext_foreach_after_tl,
5678     after .value_required:n = true,
5679     start .int_set:N = \l__enumext_foreach_start_int,
5680     start .value_required:n = true,
5681     stop .int_set:N = \l__enumext_foreach_stop_int,
5682     stop .value_required:n = true,
5683     step .int_set:N = \l__enumext_foreach_step_int,
5684     step .value_required:n = true,
5685     wrapper .cs_set_protected:Np = \__enumext_foreach_wrapper:n #1,
5686     wrapper .value_required:n = true,
5687     sep .tl_set:N = \l__enumext_foreach_sep_tl,
5688     sep .value_required:n = true,
5689     unknown .code:n = { \__enumext_parse_foreach_keys:n {#1} }
5690 }
5691 \keys_precompile:nnN { enumext / foreach }
5692 {
5693     before={},after={},start=1,step=1,stop=0,wrapper=#1,sep={}
5694 }
5695 \l__enumext_foreach_default_keys_tl

```

Functions for handling unknown *⟨keys⟩*.

```

5696 \cs_new_protected:Npn \__enumext_parse_foreach_keys:nn #1#2
5697 {
5698     \tl_if_blank:nTF {#2}
5699     {
5700         \msg_error:nnn { enumext } { for-key-unknown } {#1}
5701     }
5702     {
5703         \msg_error:nnnn { enumext } { for-key-value-unknown } {#1} {#2}
5704     }
5705 }
5706 \cs_new_protected:Npn \__enumext_parse_foreach_keys:n #1
5707 {
5708     \exp_args:NV \__enumext_parse_foreach_keys:nn \l_keys_key_str {#1}
5709 }

```

We create the command.

```

5710 \NewDocumentCommand \foreachkeyans { +0{} m }
5711 {
5712     \__enumext_foreach_keyans:nn {#1} {#2}
5713 }

```

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

```

5714 \cs_new_protected:Npn \__enumext_foreach_keyans:nn #1 #2
5715 {
5716     \tl_use:N \l__enumext_foreach_default_keys_tl
5717     \keys_set:nn { enumext / foreach } {#1}
5718     \tl_set:Nn \l__enumext_foreach_name_prop_tl {#2}
5719     \prop_if_exist:cF { g__enumext_#2_prop }
5720     {
5721         \msg_error:nnn { enumext } { undefined-storage-anskey } {#2}
5722     }

```

```

5723 \int_compare:nNt { \l__enumext_foreach_stop_int } = { 0 }
5724 {
5725   \int_set:Nn \l__enumext_foreach_stop_int
5726     { \prop_count:c { g__enumext_#2_prop } }
5727 }
5728 \seq_clear:N \l__enumext_foreach_print_seq
5729 \int_step_function:nnnN
5730 { \l__enumext_foreach_start_int }
5731 { \l__enumext_foreach_step_int }
5732 { \l__enumext_foreach_stop_int }
5733 \__enumext_foreach_add_body:n
5734 \seq_use:NV \l__enumext_foreach_print_seq \l__enumext_foreach_sep_tl
5735 }
5736 \cs_new_protected:Npn \__enumext_foreach_add_body:n #1
5737 {
5738   \seq_put_right:Ne \l__enumext_foreach_print_seq
5739   {
5740     \exp_not:V \l__enumext_foreach_before_tl
5741     \__enumext_foreach_wrapper:n
5742     {
5743       \prop_item:cn { g__enumext_ \l__enumext_foreach_name_prop_tl _prop }{#1}
5744     }
5745     \exp_not:V \l__enumext_foreach_after_tl
5746   }
5747 }

```

(End of definition for `\foreachkeyans` and others. This function is documented on page 19.)

### 13.53 Messages

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

```

5748 \msg_new:nnn { enumext } { package-load }
5749 {
5750   The~'#1'~package~is~already~loaded.
5751 }
5752 \msg_new:nnn { enumext } { package-not-load }
5753 {
5754   The~'#1'~package~will~be~loaded~as~a~dependency.
5755 }
5756 \msg_new:nnn { enumext } { package-load-foot }
5757 {
5758   The~'#1'~package~is~loaded~with~the~option~'#2'.
5759 }

```

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

```

5760 \msg_new:nnn { enumext } { counters }
5761 {
5762   The~counter~'#1'~is~already~defined~by~some~\\
5763   package~or~macro,~it~cannot~be~continued.
5764 }

```

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

```

5765 \msg_new:nnn { enumext } { unknown-choice }
5766 {
5767   The~value~'#3'~for~'#1'~key~is~invalid~use~('#2').
5768 }

```

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

```

5769 \msg_new:nnnn { enumext } { anskey-env-error }
5770 {
5771   The~environment~'#1'~is~reserved~by ~\\
5772   'enumext'~package,~It~is~already~defined.
5773 }
5774 {
5775   The~environment~'#1'~is~defined~internally ~
5776   for~the~'save-ans'~key~with~save-ans~key~active.~See~documentation.\\
5777 }
5778 \msg_new:nnn { enumext } { anskey-env-nested }
5779 {
5780   The~#1~'#2'~can't~be~nested~\msg_line_context:.
5781 }

```

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

```

5782 \msg_new:nnn { enumext } { store-prop }
5783 {
5784   *~Package~enumext:~Creating ~
5785   \c_backslash_str g__enumext_#1_prop~\msg_line_context:.
5786 }
5787 \msg_new:nnn { enumext } { store-seq }
5788 {
5789   *~Package~enumext:~Creating ~
5790   \c_backslash_str g__enumext_#1_seq~\msg_line_context:.
5791 }
5792 \msg_new:nnn { enumext } { store-int }
5793 {
5794   *~Package~enumext:~Creating ~
5795   \c_backslash_str g__enumext_resume_#1_int~\msg_line_context:.
5796 }
5797 \msg_new:nnn { enumext } { prop-seq-int-hook }
5798 {
5799   *~Package~enumext:~Elements~in ~
5800   \c_backslash_str g__enumext_#1_prop~::~#2.\\
5801   *~Package~enumext:~Elements~in ~
5802   \c_backslash_str g__enumext_#1_seq~::~#3.\\
5803   *~Package~enumext:~Value~off ~
5804   \c_backslash_str g__enumext_resume_#1_int~::~#4.
5805 }
5806 \msg_new:nnn { enumext } { item-answer-hook }
5807 {
5808   *~Package~enumext:~Value~off ~
5809   \c_backslash_str g__enumext_item_number_int~::~#1.\\
5810   *~Package~enumext:~Value~off ~
5811   \c_backslash_str g__enumext_item_anskey_int~::~#2.\\
5812   *~Package~enumext:~Difference~item_number_int~::~item_anskey_int~::~#3.
5813 }

```

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

```

5814 \msg_new:nnn { enumext } { invalid-key }
5815 {
5816   The~key~'#1'~is~not~know~the~level~#2.
5817 }
5818 \msg_new:nnn { enumext } { unknown-key-family }
5819 {
5820   Unknown~key~family~`\l_keys_key_str'~for~enumext.
5821 }

```

Messages used in length calculation.

```

5822 \msg_new:nnn { enumext } { width-negative }
5823 {
5824   Ignoring~negative~value~'#1=#2'~\msg_line_context:.\\
5825   The~key~'#1'~ accepts~values ~>~0pt.
5826 }
5827 \msg_new:nnn { enumext } { width-zero }
5828 {
5829   Invalid~'#1=#2'~\msg_line_context:.\\
5830   The~key~'#1'~ accepts~values ~>~0pt.
5831 }

```

Messages used by show-length key in enumext.

```

5832 \msg_new:nnn { enumext } { list-lengths }
5833 {
5834   ****~Lengths~used~by~'enumext'~level~'#2'~\msg_line_context:~\c_space_tl ****\\
5835   \__enumext_show_length:nnn { dim } { labelsep } {#1}
5836   \__enumext_show_length:nnn { dim } { labelwidth } {#1}
5837   \__enumext_show_length:nnn { dim } { itemindent } {#1}
5838   \__enumext_show_length:nnn { dim } { leftmargin } {#1}
5839   \__enumext_show_length:nnn { dim } { rightmargin } {#1}
5840   \__enumext_show_length:nnn { dim } { listparindent } {#1}
5841   \__enumext_show_length:nnn { skip } { topsep } {#1}
5842   \__enumext_show_length:nnn { skip } { parsep } {#1}
5843   \__enumext_show_length:nnn { skip } { partopsep } {#1}
5844   \__enumext_show_length:nnn { skip } { itemsep } {#1}
5845   ****~
5846 }

```

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

```
5847 \msg_new:nnn { enumext } { list-lengths-not-nested }
5848 {
5849     ****~Lengths~used~by~'#2'~environment~\msg_line_context:~\c_space_tl ****\\
5850     \__enumext_show_length:nnn { dim } { labelsep } {#1}
5851     \__enumext_show_length:nnn { dim } { labelwidth } {#1}
5852     \__enumext_show_length:nnn { dim } { itemindent } {#1}
5853     \__enumext_show_length:nnn { dim } { leftmargin } {#1}
5854     \__enumext_show_length:nnn { dim } { rightmargin } {#1}
5855     \__enumext_show_length:nnn { dim } { listparindent } {#1}
5856     \__enumext_show_length:nnn { skip } { topsep } {#1}
5857     \__enumext_show_length:nnn { skip } { parsep } {#1}
5858     \__enumext_show_length:nnn { skip } { partopsep } {#1}
5859     \__enumext_show_length:nnn { skip } { itemsep } {#1}
5860     *****
5861 }
```

Messages used by `ref` key.

```
5862 \msg_new:nnn { enumext } { key-ref-empty }
5863 {
5864     Key~'ref'~need~a~value~in~'#1'~ \msg_line_context:.
5865 }
```

Messages used by `save-ans` key.

```
5866 \msg_new:nnn { enumext } { save-ans-empty }
5867 {
5868     Key~'save-ans'~need~a~value~in~'#1'~ \msg_line_context:.
5869 }
5870 \msg_new:nnn { enumext } { save-ans-log }
5871 {
5872     *~Package~enumext:~Start~#1\c_space_tl with~save-ans=#2~\msg_line_context:.
5873 }
5874 \msg_new:nnn { enumext } { save-ans-log-hook }
5875 {
5876     *~Package~enumext:~Stop~#1\c_space_tl with~save-ans=#2~\msg_line_context:.
5877 }
5878 \msg_new:nnn { enumext } { save-ans-hook }
5879 {
5880     Stop~storing~for~'save-ans=#1'~\msg_line_context:.
5881 }
```

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

```
5882 \msg_new:nnn { enumext } { need-save-ans }
5883 {
5884     Key~'#1'~ works~only~with~the~'save-ans'~key~in~'#2'~ \msg_line_context:.
5885 }
5886 \msg_new:nnn { enumext } { items-same-answer }
5887 {
5888     *****\\
5889     *~Package~enumext:~Checking~answers~in~'#1' ~
5890     for~\c_left_brace_str #2 \c_right_brace_str\\
5891     *~started~#3~and~close~\msg_line_context: : ~
5892     'OK',~all~items~with~answer.\\
5893     *****
5894 }
5895 \msg_new:nnn { enumext } { item-greater-answer }
5896 {
5897     Checking~answers~in~'#1'~for~\c_left_brace_str #2 \c_right_brace_str\\
5898     started~#3~and~close~\msg_line_context: : ~'NOT~OK'\\
5899     Items~>~Answers.
5900 }
5901 \msg_new:nnn { enumext } { item-less-answer }
5902 {
5903     Checking~answers~in~'#1'~for~\c_left_brace_str #2 \c_right_brace_str\\
5904     started~#3~and~close~\msg_line_context: : ~'NOT~OK'\\
5905     Items~<~Answers.
5906 }
```

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

```
5907 \msg_new:nnn { enumext } { missing-starred }
5908 {
5909     Missing~'\c_backslash_str #1'~#2.
5910 }
```

```

5911 \msg_new:nnn { enumext } { many-starred }
5912 {
5913   Many~'\c_backslash_str #1'~#2.
5914 }

```

Messages used by `\printkeyans*` command.

```

5915 \msg_new:nnn { enumext } { print-starred }
5916 {
5917   \c_backslash_str printkeyans*:~ The~sequence~'#1'~already~contains ~
5918   #2~environment~ \msg_line_context:.
5919 }

```

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

```

5920 \msg_new:nnn { enumext } { list-too-deep }
5921 {
5922   Too~deep~nesting ~for~'enumext'~\msg_line_context:.~ \
5923   The~maximum ~level ~of ~nesting ~is~4.
5924 }

```

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

```

5925 \msg_new:nnn { enumext } { anskey-unnumber-item }
5926 {
5927   Can't~store~with~a~unnumbered~\c_backslash_str item~\msg_line_context:.
5928 }
5929 \msg_new:nnn { enumext } { anskey-already-stored }
5930 {
5931   Content~already~stored~for~this~\c_backslash_str item~\msg_line_context:.
5932 }
5933 \msg_new:nnn { enumext } { anskey-empty-arg }
5934 {
5935   Can't~store~empty~content~\msg_line_context:.
5936 }
5937 \msg_new:nnn { enumext } { anskey-wrong-place }
5938 {
5939   Wrong~place~for~command~'\c_backslash_str #1'~\msg_line_context:.~ \
5940   '\c_backslash_str #1'~works~in~the~environment~'#2'.
5941 }
5942 \msg_new:nnn { enumext } { anskey-nested }
5943 {
5944   The~command~\c_backslash_str anskey~ can't~be~nested~\msg_line_context:.
5945 }
5946 \msg_new:nnn { enumext } { anskey-math-mode }
5947 {
5948   #1~can't~work~in~math~mode~\msg_line_context:.
5949 }
5950 \msg_new:nnn { enumext } { anskey-env-wrong }
5951 {
5952   The~environment~anskey*~cannot~use~in~'#1'~\msg_line_context:.
5953 }
5954 \msg_new:nnn { enumext } { ansPIC-wrong-place }
5955 {
5956   Wrong~place~for~command~'\c_backslash_str #1'~\msg_line_context:.~ \
5957   '\c_backslash_str #1'~works~in~the~environment~'#2'.
5958 }
5959 \msg_new:nnn { enumext } { command-wrong-place }
5960 {
5961   Wrong~place~for~command~'\c_backslash_str #1'~\msg_line_context:.~ \
5962   '\c_backslash_str #1'~works~outside~the~environment~'#2'.
5963 }
5964 \msg_new:nnnn { enumext } { anskey-env-key-unknown }
5965 {
5966   The~key~'#1'~is~unknown~by~environment~
5967   'anskey*'~and~is~being~ignored.
5968 }
5969 {
5970   The~environment~'anskey*'~does~not~have~a~key~called ~'#1'.\\
5971   Check~that~you~have~spelled~the~key~name~correctly.
5972 }
5973 \msg_new:nnnn { enumext } { anskey-env-key-value-unknown }
5974 {
5975   The~key~'#1=#2'~is~unknown~by~environment ~
5976   'anskey*'~and~is~being~ignored.

```



```

5977     }
5978     {
5979         The~environment~'anskey* '~does~not~have~a~key~called ~'#1'.\\
5980         Check~that~you~have~spelled~the~key~name~correctly.
5981     }
5982     \msg_new:nnnn { enumext } { anskey-cmd-key-unknown }
5983     { The~key~'#1'~is~unknown~by~'\c_backslash_str anskey'~and~is~being~ignored. }
5984     {
5985         The~command ~'\c_backslash_str anskey'~does~not~have~a~key~called ~'#1'.\\
5986         Check~that~you~have~spelled~the~key~name~correctly.
5987     }
5988     \msg_new:nnnn { enumext } { anskey-cmd-key-value-unknown }
5989     { The~key~'#1=#2'~is~unknown~by~'\c_backslash_str anskey'~and~is~being~ignored. }
5990     {
5991         The~command~'\c_backslash_str anskey'~does~not~have~a~key~called ~'#1'.\\
5992         Check~that~you~have~spelled~the~key~name~correctly.
5993     }
5994     \msg_new:nnn { enumext } { overwrite-file }
5995     {
5996         Overwriting~file~'#1'.
5997     }
5998     \msg_new:nnn { enumext } { writing-file }
5999     {
6000         Writing~file~'#1'.
6001     }
6002     \msg_new:nnn { enumext } { not-writing }
6003     {
6004         File~'#1'~already~exists.~Not~writing.
6005     }

```

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

```

6006     \msg_new:nnn { enumext } { keyans-nested }
6007     {
6008         The~environment~'keyans'~can't~be ~nested ~\msg_line_context:.
6009     }
6010     \msg_new:nnn { enumext } { keyans-wrong-level }
6011     {
6012         Wrong~level~position~for~'keyans'~\msg_line_context:.~ \\
6013         The~environment~'keyans'~can~only~be~in~the~first~level.
6014     }
6015     \msg_new:nnn { enumext } { wrong-place }
6016     {
6017         Wrong~place~for~'#1'~environment ~\msg_line_context:.~ \\
6018         '#1'~is~only~found~with~'#2'~ in ~ 'enumext.
6019     }
6020     \msg_new:nnn { enumext } { keyanspic-nested }
6021     {
6022         The~environment~'keyanspic'~can't~be ~nested~ \msg_line_context:.~.
6023     }
6024     \msg_new:nnn { enumext } { keyanspic-wrong-level }
6025     {
6026         Wrong~level~position~for~'keyanspic'~\msg_line_context:.~ \\
6027         The~environment~'keyans'~can~only~be~in~the~first~level.
6028     }
6029     \msg_new:nnn { enumext } { keyanspic-item-cmd }
6030     {
6031         Can't~use ~\c_backslash_str item~in~keyanspic~\msg_line_context:.
6032     }
6033     \msg_new:nnnn { enumext } { keyans-unknown-key }
6034     {
6035         The~key~'#1'~is~unknown~by~environment~
6036         '\l__enumext_envir_name_tl'~and~is~being~ignored.
6037     }
6038     {
6039         The~environment~'\l__enumext_envir_name_tl'~does~not
6040         ~have~a~key~called ~'#1'.\\
6041         Check~that~you~have~spelled~the~key~name~correctly.
6042     }
6043     \msg_new:nnnn { enumext } { keyans-unknown-key-value }
6044     {
6045         The~key~'#1=#2'~is~unknown~by~environment ~
6046         '\l__enumext_envir_name_tl'~and~is~being~ignored.

```

```

6047     }
6048     {
6049         The~environment~'\l__enumext_envir_name_tl'~does~not
6050         ~have~a~key~called ~'#1'.\\
6051         Check~that~you~have~spelled~the~key~name~correctly.
6052     }

```

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

```

6053 \msg_new:nnnn { enumext } { starred-unknown-key }
6054 {
6055     The~key~'#1'~is~unknown~by~environment~
6056     '\l__enumext_envir_name_tl'~and~is~being~ignored.
6057 }
6058 {
6059     The~environment~'\l__enumext_envir_name_tl'~does~not
6060     ~have~a~key~called ~'#1'.\\
6061     Check~that~you~have~spelled~the~key~name~correctly.
6062 }
6063 \msg_new:nnnn { enumext } { starred-unknown-key-value }
6064 {
6065     The~key~'#1=#2'~is~unknown~by~environment ~
6066     '\l__enumext_envir_name_tl'~and~is~being~ignored.
6067 }
6068 {
6069     The~environment~'\l__enumext_envir_name_tl'~does~not
6070     ~have~a~key~called ~'#1'.\\
6071     Check~that~you~have~spelled~the~key~name~correctly.
6072 }

```

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

```

6073 \msg_new:nnnn { enumext } { standar-unknown-key }
6074 {
6075     The~key~'#1'~is~unknown~by~environment~'\l__enumext_envir_name_tl' \c_space_tl
6076     ~on~level~\int_use:N \l__enumext_level_int \c_space_tl and~is~being~ignored.
6077 }
6078 {
6079     The~environment~'\l__enumext_envir_name_tl'~does~not
6080     ~have~a~key~called ~'#1'~on~level~\int_use:N \l__enumext_level_int.\\
6081     Check~that~you~have~spelled~the~key~name~correctly.
6082 }
6083 \msg_new:nnnn { enumext } { standar-unknown-key-value }
6084 {
6085     The~key~'#1=#2'~is~unknown~by~environment~'\l__enumext_envir_name_tl' \c_space_tl
6086     ~on~level~\int_use:N \l__enumext_level_int \c_space_tl and~is~being~ignored.
6087 }
6088 {
6089     The~environment~'\l__enumext_envir_name_tl'~does~not
6090     ~have~a~key~called ~'#1'~on~level~\int_use:N \l__enumext_level_int.\\
6091     Check~that~you~have~spelled~the~key~name~correctly.
6092 }

```

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

```

6093 \msg_new:nnnn { enumext } { for-key-unknown }
6094 { The~key~'#1'~is~unknown~by~'\c_backslash_str foreachkeyans'~and~is~being~ignored.}
6095 {
6096     The~command~'\c_backslash_str foreachkeyans'~does~not~have~a~key~called~'#1'.\\
6097     Check~that~you~have~spelled~the~key~name~correctly.
6098 }
6099 \msg_new:nnnn { enumext } { for-key-value-unknown }
6100 { The~key~'#1=#2'~is~unknown~by~'\c_backslash_str foreachkeyans'~and~is~being~ignored. }
6101 {
6102     The~command~'\c_backslash_str foreachkeyans'~does~not~have~a~key~called~'#1'.\\
6103     Check~that~you~have~spelled~the~key~name~correctly.
6104 }

```

Messages used by `\getkeyans` command.

```

6105 \msg_new:nnn { enumext } { undefined-storage-anskey }
6106 {
6107     Storage~named~'#1'~is~not~defined~\msg_line_context:.
6108 }

```

Messages used by `\miniright` command.

```

6109 \msg_new:nnn { enumext } { missing-miniright }

```

```

6110 {
6111     Missing~'\c_backslash_str miniright'~in~\msg_line_context:.\
6112     The~key~'mini-env'~need~'\c_backslash_str miniright'.
6113 }
6114 \msg_new:nnn { enumext } { wrong-miniright-place }
6115 {
6116     Wrong~place~for~'\c_backslash_str miniright'~\msg_line_context:.\
6117     Works~in~'enumext'~and~'keyans'~with~key~'mini-env'.
6118 }
6119 \msg_new:nnn { enumext } { wrong-miniright-use }
6120 {
6121     Wrong~use~for~'\c_backslash_str miniright'~\msg_line_context:.\
6122     '\c_backslash_str miniright'~need~a~key~'mini-env'.
6123 }
6124 \msg_new:nnn { enumext } { wrong-miniright-starred }
6125 {
6126     Can't~use ~\c_backslash_str miniright~in~starred~environments~\msg_line_context:.\
6127 }
6128 \msg_new:nnn { enumext } { many-miniright-used }
6129 {
6130     Can't~use ~\c_backslash_str miniright~more~than~once~ \msg_line_context:.\
6131 }

```

Messages used by `\setenumextmeta` command.

```

6132 \msg_new:nnn { enumext } { unknown-set }
6133 {
6134     Argument~[#1]~is~unknown~by~ \c_backslash_str setenumextmeta~\msg_line_context:.\
6135 }
6136 \msg_new:nnn { enumext } { already-defined }
6137 {
6138     The~key~'#1'~is~already~defined~\msg_line_context:.\
6139 }
6140 \msg_new:nnn { enumext } { prohibited-unknown }
6141 {
6142     The~name~'unknown'~can't~be~chosen~ for~a~meta~key~\msg_line_context:.\
6143 }

```

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

```

6144 \msg_new:nnn { enumext } { nested }
6145 {
6146     The~environment~\l__enumext_envir_name_tl \c_space_tl can't~be~nested~\msg_line_context:.\
6147 }
6148 \msg_new:nnn { enumext } { nested-horizontal }
6149 {
6150     The~environment~\l__enumext_envir_name_tl \c_space_tl can't~be~nested~in~'#1'~ \msg_line_context:.\
6151 }
6152 \msg_new:nnn { enumext } { item-joined }
6153 {
6154     Items~joined~( #1 )~>~#2 ~columns ~\msg_line_context:.\
6155 }
6156 \msg_new:nnn { enumext } { item-joined-columns }
6157 {
6158     Not~space~to~join~items~( #1 )~>~#2 ~\msg_line_context:.\
6159 }

```

Messages used by `resume` key.

```

6160 \msg_new:nnn { enumext } { unknown-series-starred }
6161 {
6162     The~series~'#1'~for~the~resume~key~does~not~exist~in~the~
6163     ~enumext*~environment~ \msg_line_context:.\
6164 }
6165 \msg_new:nnn { enumext } { unknown-series-standar }
6166 {
6167     The~series~'#1'~for~the~resume~key~does~not~exist~at~level~\int_use:N \l__enumext_level_int
6168     \c_space_tl of~enumext~environment~ \msg_line_context:.\
6169 }
6170 \msg_new:nnnn { enumext-reset } { invalid-clist }
6171 { The~argument~must~have~1~or~2~elements~separated~by~a~comma. }
6172 { Received:~'#1'. }
6173 \msg_new:nnn { enumext-reset } { invalid-single-arg-star }
6174 { The~single~argument~must~be~exactly~'enumext*'~when~using~a~'*. }
6175 \msg_new:nnnn { enumext-reset } { invalid-single-arg-no-star }

```

```
6176 { A~single~argument~is~not~allowed~without~a~'*. }
6177 { Received::~#1'. }
6178 \msg_new:nnnn { enumext-reset } { out-of-range }
6179 { The~number~must~be~exactly~1,~2,~3~or~4. }
6180 { Received::~#1'. }
6181 \msg_new:nnnn { enumext-reset } { invalid-package }
6182 { The~first~element~must~be~exactly~'enumext'. }
6183 { Received::~#1'. }
```

### 13.54 Finish package

Finish package implementation.

```
6184 \file_input_stop:
6185 </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	
<code>\+</code>	221
<code>\-</code>	221
<code>\\</code>	229, 4531, 4534, 5762, 5771, 5776, 5800, 5802, 5809, 5811, 5824, 5829, 5834, 5849, 5888, 5890, 5892, 5897, 5898, 5903, 5904, 5922, 5939, 5956, 5961, 5970, 5979, 5985, 5991, 6012, 6017, 6026, 6040, 6050, 6060, 6070, 6080, 6090, 6096, 6102, 6111, 6116, 6121
A	
<code>above</code>	1717
<code>above*</code>	1717
<code>\addvspace</code>	1284, 1312, 1355, 1358, 1526, 1529, 1626, 1632, 1670, 1676, 1697, 1703, 3943, 4115, 4133, 4416, 4420, 4779, 4794, 4840, 4854
<code>after</code>	1114
<code>align</code>	655
<code>\Alph</code>	44, 48, 49
<code>\Alph</code>	597, 725, 769, 829, 5465
<code>\alph</code>	44, 48, 49
<code>\alph</code>	598, 723, 5453
<code>\anskey</code>	14, 86, 88, 2977
<code>anskey*</code>	15, 3107
<code>\anspic</code>	18, 115, 118, 4430
<code>\anspic*</code>	79
<code>\arabic</code>	44
<code>\arabic</code>	596, 722, 768, 5441, 5447, 5471
B	
<code>base-fix</code>	972
<code>\baselineskip</code>	58
<code>\baselineskip</code>	988, 999
<code>before</code>	1114
<code>before*</code>	1114
<code>beginpenalty</code>	912
<code>below</code>	1717
<code>below*</code>	1717
bool commands:	
<code>\bool_gset_false:N</code>	340, 341, 342, 4796, 4800, 4856
<code>\bool_gset_true:N</code>	250, 260, 1217, 2410, 2416, 4765, 4797, 4829, 4857
<code>\bool_if:NTF</code>	390, 400, 417, 491, 498, 507, 514, 528, 541, 1739, 1753, 1766, 1777, 1788, 1799, 1810, 1821, 1835, 1849, 1860, 1898, 1905, 1952, 1996, 2355, 2598, 2608, 2688, 2712, 2719, 2743, 2841, 2863, 2903, 2927, 2931, 2981, 3000, 3024, 3076, 3080, 3110, 3128, 3147, 3163, 3186, 3217, 3232, 3304, 3420, 3454, 3490, 3506, 3527, 3666, 3687, 3733, 3776, 3786, 3820, 3825, 3850, 3859, 3898, 3924, 3974, 3992, 4043, 4098, 4123, 4349, 4414, 4432, 4451, 4502, 4529, 4758, 4774, 4780, 4823, 4837, 4841, 4909, 4930, 4937, 4947, 5035, 5041, 5048, 5064, 5158, 5168, 5282, 5289, 5320, 5336, 5367
<code>\bool_if:nTF</code>	1677, 1704, 2220, 3476, 3645, 4472, 5493, 5637
<code>\bool_if_p:N</code>	269, 283, 982, 983, 995, 996, 1649, 2117, 2118, 2133, 2134, 2161, 2162, 2177, 2178, 2368, 2394, 2407, 2408, 2413, 2414, 2776, 2786, 2798, 2813, 2814, 2848, 2889, 2890, 3291, 3292, 3321, 3322, 3334, 3335, 3375, 3376, 3395, 3396, 3679, 3680, 3681, 3871, 3873, 3884, 5311, 5312, 5313
<code>\bool_lazy_all:nTF</code>	267, 281, 980, 2366, 2392, 2774, 2783, 2796, 2811, 3373, 3393, 3677, 3869, 3882, 5309
<code>\bool_lazy_and:nnTF</code>	246, 256, 994, 1641, 1648, 2116, 2132, 2160, 2176, 2233, 2406, 2412, 2847, 2854, 2888, 3290
<code>\bool_lazy_or:nnTF</code>	2296, 2303, 3320, 3333, 5660
<code>\bool_new:N</code>	22, 23, 24, 25, 26, 27, 28, 49, 61, 85, 90, 91, 96, 97, 100, 107, 122, 123, 135, 136, 143, 149, 150, 152, 156, 158, 159, 176, 188, 190
<code>\bool_not_p:n</code>	247, 257, 984, 1650, 2785, 2849, 2855, 3872, 3885
<code>\bool_set_eq:NN</code>	3429, 3626, 4988, 5233
<code>\bool_set_false:N</code>	397, 1006, 2340, 2341, 2373, 2378, 2382, 2386, 2399, 3654, 3839, 3991, 4051, 4138, 4285, 4346, 4492, 4900, 4929, 4985, 5174, 5229, 5230, 5484, 5506, 5507
<code>\bool_set_true:N</code>	274, 288, 383, 386, 648, 1021, 1723, 1728, 2080, 2093, 2313, 2314, 2630, 2638, 3051, 3423, 3425, 3457, 3459, 3622, 3633, 3647, 3799, 3838, 3878, 3891, 3964, 4048, 4075, 4282, 4474, 4475, 4747, 4812, 4899, 4992, 4999, 5000, 5044, 5172, 5237, 5244, 5245, 5246, 5477, 5501, 5502
box commands:	
<code>\box_dp:N</code>	1572, 1573, 1576, 1583, 1596, 1604, 1610, 1618, 4360, 4366, 4416, 4513
<code>\box_ht:N</code>	1355, 1358, 1369, 1370, 1381, 1383, 1398, 1401, 1409, 1410, 1421, 1423, 1438, 1441, 1448, 1449, 1460, 1462, 1477, 1480, 1526, 1529, 1537, 1538, 1546, 1547, 1559, 1561
<code>\box_ht_plus_dp:N</code>	4355, 4424, 4460
<code>\box_new:N</code>	58, 145, 146, 183, 189
<code>\box_use_drop:N</code>	4791, 4852, 5100, 5379
<code>\box_wd:N</code>	604
<code>break-col</code>	2947, 3033
C	
<code>\c</code>	863, 865, 877, 879
<code>\centering</code>	1679, 1706, 4557, 4784, 4845
<code>check-ans</code>	2332
Document class:	
<code>article</code>	50
clist commands:	
<code>\clist_const:Nn</code>	195
<code>\clist_map_function:nN</code>	4540
<code>\clist_map_inline:Nn</code>	654, 911, 927, 1113, 1128, 1209, 1733
<code>\clist_map_inline:nn</code>	36, 45, 54, 66, 74, 87, 99, 138, 167, 194, 632, 685, 705, 1026, 1047, 1223, 1843, 1856, 2256, 2263, 2280, 2346, 2525, 2595, 2627, 2771, 3226, 3548, 3563, 3603, 3762, 3765, 3767, 3794, 3806, 3809, 3811, 3830, 5613
<code>\columnbreak</code>	86
<code>\columnbreak</code>	2851
<code>columns</code>	1193
<code>columns-sep</code>	1193
<code>\columnsep</code>	108
<code>\columnsep</code>	3919, 4096
<code>\columnseprule</code>	108
<code>\columnseprule</code>	3922, 4097

Commands provide by **enumext**:

\anskey 33, 76, 82, 83, 85–89, 94, 107, 108, 127, 137, 138, 146  
 \anspic\* ..... 33, 34, 79, 83, 94, 95, 118, 137, 138  
 \anspic ..... 34, 83, 115, 118, 146  
 \foreachkeyans ..... 142, 148  
 \getkeyans ..... 83, 137, 148  
 \item\* . 33, 34, 79, 83, 94, 95, 98, 102, 129, 134, 137, 138  
 \item ..... 98, 102, 122, 128, 130, 133, 134  
 \miniright ..... 32, 55, 63, 64, 109, 148  
 \printkeyans\* ..... 137  
 \printkeyans ..... 33, 83, 137, 138  
 \setenumextmeta ..... 141, 149  
 \setenumext ..... 33, 138, 140, 144

Counters defined by **enumext**:

enumXiii ..... 31, 43  
 enumXii ..... 31, 43  
 enumXiv ..... 31, 43  
 enumXi ..... 31, 43  
 enumXviii ..... 31, 43  
 enumXvii ..... 31, 43, 129  
 enumXvi ..... 31, 43  
 enumXv ..... 31, 43

\counterwithin ..... 2250

cs commands:

\cs\_generate\_variant:Nn . 200, 201, 606, 622, 869, 885, 2253, 2680, 2685, 2761, 3106, 3752, 4542, 5672  
 \cs\_if\_exist:NTF ..... 576  
 \cs\_if\_exist\_p:N ..... 3682, 5314  
 \cs\_new:Nn ..... 215  
 \cs\_new:Npn . 225, 1866, 1875, 1883, 2642, 2651, 2659, 5521, 5530, 5539  
 \cs\_new\_eq:NN . 367, 368, 373, 374, 402, 403, 406, 407  
 \cs\_new\_protected:Nn . 231, 239, 265, 296, 326, 332, 338, 344, 350, 358, 378, 425, 429, 447, 459, 477, 489, 505, 521, 534, 555, 745, 802, 849, 978, 1129, 1133, 1137, 1141, 1145, 1149, 1153, 1157, 1161, 1165, 1169, 1173, 1177, 1181, 1185, 1189, 1224, 1236, 1269, 1286, 1297, 1314, 1340, 1361, 1486, 1512, 1532, 1565, 1587, 1622, 1628, 1734, 1748, 1762, 1773, 1784, 1795, 1806, 1817, 1950, 1968, 1994, 2009, 2105, 2146, 2193, 2281, 2286, 2311, 2351, 2361, 2404, 2419, 2426, 2435, 2440, 2445, 2450, 2459, 2464, 2469, 2686, 2710, 2717, 2741, 2748, 2762, 2998, 3017, 3126, 3145, 3176, 3215, 3230, 3258, 3288, 3316, 3329, 3342, 3371, 3384, 3462, 3472, 3483, 3499, 3515, 3641, 3659, 3693, 3705, 3831, 3867, 3896, 3903, 3933, 3950, 3972, 3997, 4011, 4041, 4065, 4082, 4107, 4121, 4142, 4153, 4321, 4524, 4538, 4543, 4567, 4577, 4608, 4737, 4756, 4802, 4821, 4886, 4916, 4923, 4935, 4945, 4970, 5111, 5156, 5187, 5193, 5214, 5270, 5390  
 \cs\_new\_protected:Npn 202, 203, 207, 211, 410, 574, 591, 601, 607, 726, 770, 834, 856, 870, 1661, 1690, 1892, 1936, 2034, 2055, 2076, 2244, 2248, 2254, 2261, 2268, 2291, 2474, 2596, 2606, 2628, 2636, 2672, 2681, 2837, 2900, 2925, 2963, 2967, 3060, 3064, 3097, 3156, 3195, 3268, 3309, 3416, 3435, 3564, 3568, 3582, 3586, 3604, 3608, 3618, 3630, 3675, 3721, 3755, 3797, 3842, 4061, 4330, 4337, 4344, 4449, 4468, 4498, 4639, 4688, 4903, 4976, 4983, 4997, 5005, 5010, 5020, 5180, 5220, 5227, 5242, 5251, 5265, 5307, 5412, 5425, 5487, 5610, 5622, 5646, 5658, 5696, 5706, 5714, 5736  
 \cs\_new\_protected\_nopar:Nn . . 4210, 4254, 4262, 4270, 4955, 4963, 5094, 5199, 5207, 5373  
 \cs\_new\_protected\_nopar:Npn . . 4202, 4218, 5026,

5072, 5326, 5347

\cs\_set:Npn . . . . 2107, 2148, 2195, 2772, 2809, 5418  
 \cs\_set\_eq:NN . . 3685, 4876, 4877, 5074, 5145, 5146, 5317, 5349  
 \cs\_set\_protected:Nn . . . . 1052, 1068, 1081, 1093  
 \cs\_set\_protected:Npn 32, 39, 47, 59, 67, 82, 88, 131, 163, 174, 623, 633, 655, 690, 706, 752, 886, 912, 928, 1008, 1031, 1105, 1114, 1193, 1210, 1717, 1828, 1844, 2272, 2332, 2491, 2526, 2614, 2764, 3219, 3537, 3553, 3596, 3753, 3795  
 \cs\_to\_str:N ..... 593, 616

## D

\d ..... 221  
 \DeclareDocumentEnvironment ..... 559

dim commands:

\dim\_abs:n ..... 3726, 3731  
 \dim\_add:Nn ..... 3368, 4364, 4602, 4633  
 \dim\_compare:nNnTF . . 1054, 1070, 1083, 1095, 1373, 1385, 1413, 1425, 1452, 1464, 1541, 1549, 1663, 1692, 2905, 2913, 3363, 3723, 3728, 3734, 3740, 3742, 3744, 3908, 3955, 4069, 4086, 4339, 4579, 4595, 4610, 4626, 4739, 4804, 5278  
 \dim\_compare:nTF ..... 2873, 4000, 4145  
 \dim\_eval:n ..... 988, 4422, 4509  
 \dim\_gset\_eq:NN ..... 4748, 4813  
 \dim\_gzero:N ..... 4799, 4859  
 \dim\_new:N . 55, 62, 63, 64, 84, 127, 128, 140, 147, 148, 182, 184, 185, 191  
 \dim\_set:Nn . 604, 1022, 2907, 2915, 3350, 3354, 3359, 3365, 3452, 3726, 3731, 3733, 3736, 3737, 3741, 3743, 3746, 3747, 3749, 3911, 3958, 3999, 4071, 4088, 4144, 4353, 4458, 4545, 4581, 4588, 4612, 4619, 4674, 4723, 4741, 4806, 5022, 5280  
 \dim\_set\_eq:NN 713, 759, 826, 3447, 3764, 3808, 3919, 4096, 4681, 4684, 4685, 4730, 4733, 4734, 5015, 5086, 5361  
 \dim\_sub:Nn ..... 4005, 4150, 4597, 4628  
 \dim\_use:N . 1055, 1063, 1664, 1674, 2751, 2754, 2759, 2917, 3467, 3469, 3522, 3909, 3913, 3914, 3916, 3956, 3961, 3962, 3968, 4002, 4007  
 \dim\_zero:N ..... 3800, 3922, 4097, 4367  
 \dim\_zero\_new:N ..... 573  
 \c\_zero\_dim 1057, 1071, 1084, 1096, 1664, 1692, 2875, 2905, 2913, 3350, 3363, 3723, 3728, 3734, 3741, 3909, 3956, 4002, 4069, 4086, 4147, 4339, 4579, 4595, 4610, 4626, 4739, 4804, 5278

\dimeval ..... 2560

## E

\end . . . 2714, 2745, 3940, 4112, 4404, 4559, 5495, 5505, 5513  
 end internal commands:

\end\_\_enumext\_mini\_page . 1672, 1699, 3983, 4132, 4763, 4827, 4853

\endlist ..... 368

\endminipage ..... 374

endpenalty ..... 912

enumext ..... 5, 4018

enumext internal commands:

\\_\_enumext\_add\_meta\_key:nnn . . 141, 5624, 5640, 5641, 5643, 5646

\\_\_enumext\_add\_pre\_parsep: . 56, 1234, 1236, 1236

\\_\_enumext\_after\_args\_exec: 54, 1129, 1141, 4032

\\_\_enumext\_after\_args\_exec\_v: 1145, 1157, 4170

\\_\_enumext\_after\_args\_exec\_vii: . . 1161, 1185

```

\__enumext_after_args_exec_viii: . . . . . 1189
\__enumext_after_env:nn 93, 111, 124, 131, 207, 207,
    547, 551, 4037, 4772, 4835, 5127
\__enumext_after_hyperref: . . . 39, 376, 376, 378
\l__enumext_after_list_args_v_tl . . . . . 1159
\l__enumext_after_list_args_vii_tl 1187, 5092
\l__enumext_after_list_args_viii_tl . . 1191,
    5371
\__enumext_after_list_vii: 124, 127, 4884, 4923,
    4923
\__enumext_after_list_viii: . . . 133, 5154, 5193,
    5193
\__enumext_after_stop_list: 54, 110, 1129, 1137,
    3988
\__enumext_after_stop_list_v: 1145, 1153, 4139
\l__enumext_after_stop_list_v_tl . . . . . 1155
\__enumext_after_stop_list_vii: . . 127, 1161,
    1177, 4926
\l__enumext_after_stop_list_vii_tl . . . 1179
\__enumext_after_stop_list_viii: . 1181, 5196
\l__enumext_after_stop_list_viii_tl . . . 1183
\l__enumext_align_label_pos_v_str 3346, 3711
\l__enumext_align_label_pos_X_str . . . . . 67
\l__enumext_align_label_vii_str . . . . . 5061
\l__enumext_align_label_viii_str . . . . . 5340
\l__enumext_align_label_X_str . . . . . 174
\c__enumext_all_envs_clist . . 195, 654, 911, 927,
    1113, 1128, 1209, 1733
\c__enumext_all_families_seq . . 140, 5578, 5604
\__enumext_anskey_env_file_if_writable:n 91,
    3074, 3074
\__enumext_anskey_env_file_if_-
    writable:nTF . . . . . 3074, 3099
\__enumext_anskey_env_file_write:nn 91, 3097,
    3106, 3161
\l__enumext_anskey_env_force_eol_bool . . 92,
    3047, 3163
\c__enumext_anskey_env_hidden_space_str 33,
    92, 110, 3167
\l__enumext_anskey_env_overwrite_bool 3055,
    3080
\__enumext_anskey_env_safe_inner: . 92, 3121,
    3126, 3145
\__enumext_anskey_env_safe_inner:n . . . . 91
\__enumext_anskey_env_safe_outer: . 91, 3109,
    3126, 3126
\__enumext_anskey_env_unknown:n 90, 3058, 3060,
    3060
\__enumext_anskey_env_unknown:nn . 3060, 3062,
    3064
\l__enumext_anskey_level_int . . 16, 3019, 3020
\__enumext_anskey_safe_inner: . 90, 2992, 2998,
    3017
\__enumext_anskey_safe_inner:n . . . . . 89
\__enumext_anskey_safe_outer: . 89, 2979, 2998,
    2998
\__enumext_anskey_show_wrap_arg:n . 87, 2900,
    2900, 2929, 2944
\__enumext_anskey_show_wrap_left:n 88, 2845,
    2925, 2925
\__enumext_anskey_unknown:n 89, 2947, 2961, 2963
\__enumext_anskey_unknown:nn . 2947, 2965, 2967
\__enumext_anskey_wrapper:n . . . . . 2557, 2923
\l__enumext_anspic_above_int . 139, 4546, 4547,
    4549
\__enumext_anspic_args:nnn 118, 120, 4430, 4446,
    4524
\l__enumext_anspic_args_seq 118, 120, 139, 4444,
    4558, 4571
\l__enumext_anspic_below_int . 139, 4546, 4547,
    4550
\l__enumext_anspic_body_box . . . 139, 4457, 4460
\__enumext_anspic_body_dim:n . . 118, 4430, 4449,
    4501
\l__enumext_anspic_body_htdp_dim . . 118, 139,
    4458, 4512
__enumext_anspic_exec: . . . . . 4430
\__enumext_anspic_exec: . . . 117, 120, 4399, 4567
\__enumext_anspic_label:nn 119, 4430, 4468, 4504,
    4519
\l__enumext_anspic_label_above_bool . . . 139,
    4282, 4285, 4349, 4414, 4451, 4502, 4529
\l__enumext_anspic_label_box . . 139, 4352, 4355
\l__enumext_anspic_label_htdp_dim . 117, 139,
    4353, 4359, 4424, 4511
\__enumext_anspic_label_pos:nnn . . 119, 4430,
    4498, 4527
\l__enumext_anspic_label_sep_skip 4292, 4361,
    4425, 4514, 4531
\l__enumext_anspic_layout_style_tl 4294, 4569,
    4574
\l__enumext_anspic_mini_pos_str . . 139, 4283,
    4286, 4556
\l__enumext_anspic_mini_width_dim 139, 4470,
    4545, 4556
\__enumext_anspic_print:n 120, 4430, 4538, 4542,
    4571, 4574
\__enumext_anspic_row:n . . 120, 4430, 4540, 4543
\__enumext_anspic_start_list_tag: 4226, 4254,
    4526
\__enumext_anspic_stop_list_tag: . 4226, 4270,
    4536
\__enumext_anspic_stop_start_list_tag: 4226,
    4262, 4528
\__enumext_at_begin_document:n . . 39, 203, 203,
    365, 371
\l__enumext_base_line_fix_bool 51, 138, 974, 983,
    1006, 5501, 5506
\__enumext_before_args_exec: 54, 109, 127, 1129,
    1129, 3953
\__enumext_before_args_exec_v: 1145, 1145, 4068
\__enumext_before_args_exec_vii: . 1161, 1161,
    4920
\__enumext_before_args_exec_viii: 1165, 5190
\__enumext_before_env:nn . . . . . 207, 211
\__enumext_before_keys_exec: . . 54, 1129, 1133,
    4028
\__enumext_before_keys_exec_v: 1145, 1149, 4166
\__enumext_before_keys_exec_vii . . . . . 1161
\__enumext_before_keys_exec_vii: . 1169, 4870
\__enumext_before_keys_exec_viii: 1173, 5139
\__enumext_before_list: . . 109, 3950, 3950, 4022
\__enumext_before_list_v: . . . 4065, 4065, 4161
\__enumext_before_list_vii: . . . 127, 4865, 4916,
    4916
\__enumext_before_list_viii: . . 132, 5135, 5187,
    5187
\l__enumext_before_no_starred_key_v_tl 1151

```



```

\l__enumext_before_no_starred_key_vii_-
    tl ..... 1171
\l__enumext_before_no_starred_key_viii_-
    tl ..... 1175
\l__enumext_before_starred_key_v_tl ... 1147
\l__enumext_before_starred_key_vii_tl . 1163
\l__enumext_before_starred_key_viii_tl 1167
\__enumext_calc_hspace:NNNNNN 104, 3721, 3721,
    3752, 3757, 3801
\__enumext_check_ans_active: 77, 109, 127, 2351,
    2351, 3954, 4919
\g__enumext_check_ans_item_tl ..... 95
\g__enumext_check_ans_key_bool 78, 79, 149, 340,
    2410, 2416, 3186
\l__enumext_check_ans_key_bool 78, 2336, 2341,
    2407, 2413
\__enumext_check_ans_key_hook: .. 78, 110, 127,
    2404, 2404, 3989, 4927
\__enumext_check_ans_level: 77, 2351, 2357, 2361
\__enumext_check_ans_log: 78, 79, 93, 2450, 2450,
    3190
\__enumext_check_ans_log_msg_greater: 2450,
    2456, 2469
\__enumext_check_ans_log_msg_less: 2450, 2454,
    2459
\__enumext_check_ans_log_msg_same_ok: 2450,
    2455, 2464
\__enumext_check_ans_msg_greater: 2426, 2432,
    2445
\__enumext_check_ans_msg_less: 2426, 2430, 2435
\__enumext_check_ans_msg_same_ok: 2426, 2431,
    2440
\__enumext_check_ans_show: .. 78, 93, 2426, 2426,
    3188
\l__enumext_check_answers_bool 76, 77, 89, 91, 98,
    149, 2314, 2340, 2355, 2688, 2712, 2719, 2743, 2981,
    3110, 3304, 3420, 3454, 5041
\__enumext_check_starred_cmd:n 37, 79, 95, 131,
    2474, 2474, 4173, 4412, 5153
\g__enumext_check_starred_cmd_int . 102, 149,
    2477, 2483, 2488, 3639, 4480, 5277
\l__enumext_check_start_line_env_tl . 37, 149,
    303, 311, 319, 2480, 2486, 2489
\l__enumext_columns_sep_v_dim 4086, 4088, 4096
\l__enumext_columns_sep_vii_dim .. 4579, 4581,
    4590, 4602, 4678, 5108
\l__enumext_columns_sep_viii_dim . 4610, 4612,
    4621, 4633, 4727, 5387
\l__enumext_columns_v_int 1506, 1524, 1695, 4084,
    4092, 4104, 4109
\l__enumext_columns_vii_int .. 4584, 4587, 4591,
    4600, 4642, 4646, 4649, 4655, 4661, 4665, 5102, 5116
\l__enumext_columns_viii_int . 4615, 4618, 4622,
    4631, 4691, 4695, 4698, 4704, 4710, 4714, 5381, 5396
\l__enumext_counter_i_tl ..... 32, 583
\l__enumext_counter_ii_tl ..... 32, 584
\l__enumext_counter_iii_tl ..... 32, 585
\l__enumext_counter_iv_tl ..... 32, 586
\g__enumext_counter_styles_tl . 31, 44, 55, 594,
    612
\l__enumext_counter_v_tl ..... 32, 587
\l__enumext_counter_vi_tl ..... 32, 588
\l__enumext_counter_vii_tl ..... 32, 589
\l__enumext_counter_viii_tl ..... 32, 590

\l__enumext_current_widest_dim 31, 55, 618, 714,
    760, 827
\__enumext_def_meta_key:nnn .. 141, 5624, 5652,
    5658, 5672
\__enumext_default_item:n ... 3416, 3416, 3480
\__enumext_define_counter:Nn . 31, 574, 574, 583,
    584, 585, 586, 587, 588, 589, 590
\__enumext_endminipage: . 39, 365, 374, 568, 4793,
    5096, 5375
\g__enumext_envir_name_tl 37, 22, 275, 289, 348,
    2284, 2289, 2299, 2438, 2443, 2448, 2462, 2467, 2472
\l__enumext_envir_name_tl . 36, 37, 100, 22, 245,
    255, 302, 310, 318, 3558, 4317, 6036, 6039, 6046, 6049,
    6056, 6059, 6066, 6069, 6075, 6079, 6085, 6089, 6146,
    6150
\__enumext_execute_after_env: 38, 75, 78, 79, 93,
    3176, 3176, 4039, 5129
\__enumext_fake_item_indent: . 1052, 1052, 3785
\l__enumext_fake_item_indent_v_dim 1071, 1076
\l__enumext_fake_item_indent_v_tl 1073, 3623,
    3627, 3634
\__enumext_fake_item_indent_vii: . 1052, 1081,
    3819
\l__enumext_fake_item_indent_vii_dim . 1084,
    1088
\l__enumext_fake_item_indent_vii_tl .. 1086,
    5091
\__enumext_fake_item_indent_viii: 1052, 1093,
    3824
\l__enumext_fake_item_indent_viii_dim 1096,
    1100
\l__enumext_fake_item_indent_viii_tl . 1098,
    5366
\l__enumext_fake_item_indent_X_tl ..... 88
\__enumext_fake_make_label_vii:n . 129, 5026,
    5026, 5083
\__enumext_fake_make_label_viii:n 5307, 5326,
    5358
\__enumext_filter_first_level:n .. 139, 5521,
    5521, 5555, 5566
\__enumext_filter_first_level_key:n 139, 5521,
    5526, 5530
\__enumext_filter_first_level_pair:nn . 139,
    5521, 5527, 5539
\__enumext_filter_save_key:n .. 82, 2603, 2611,
    2634, 2640, 2642, 2642, 5438, 5444, 5450, 5456, 5462,
    5468
\__enumext_filter_save_key_key:n .. 83, 2642,
    2647, 2651
\__enumext_filter_save_key_pair:nn 83, 2642,
    2648, 2659
\__enumext_filter_series:n 68, 1866, 1866, 1917,
    1928, 1942, 1947
\__enumext_filter_series_key:n 68, 1866, 1871,
    1875
\__enumext_filter_series_pair:nn .. 68, 1866,
    1872, 1883
\__enumext_first_item_tmp_vii: 126, 128, 4876,
    4955, 4955
\__enumext_first_item_tmp_viii: .. 133, 5145,
    5199, 5199
\g__enumext_footnote_standar_arg_seq .. 168,
    442, 453, 456
\g__enumext_footnote_standar_int 168, 436, 439,
    441, 444

```

[\g\\_\\_enumext\\_footnote\\_standar\\_int\\_seq](#) .. [168](#),  
[444](#), [449](#), [452](#), [457](#)  
[\g\\_\\_enumext\\_footnote\\_starred\\_arg\\_seq](#) .. [168](#),  
[472](#), [483](#), [486](#)  
[\g\\_\\_enumext\\_footnote\\_starred\\_int](#) [168](#), [466](#), [469](#),  
[471](#), [474](#)  
[\g\\_\\_enumext\\_footnote\\_starred\\_int\\_seq](#) .. [168](#),  
[474](#), [479](#), [482](#), [487](#)  
[\\\_\\_enumext\\_footnotes\\_key\\_bool](#) ..... [39](#)  
[\l\\_\\_enumext\\_footnotes\\_key\\_bool](#) [34](#), [39](#), [158](#), [386](#),  
[390](#), [397](#), [498](#), [514](#), [528](#), [541](#)  
[\\\_\\_enumext\\_footnotetext:nn](#) .. [425](#), [425](#), [454](#), [484](#)  
[\\\_\\_enumext\\_foreach\\_add\\_body:n](#) [142](#), [5673](#), [5733](#),  
[5736](#)  
[\l\\_\\_enumext\\_foreach\\_after\\_tl](#) ..... [5677](#), [5745](#)  
[\l\\_\\_enumext\\_foreach\\_before\\_tl](#) .... [5675](#), [5740](#)  
[\g\\_\\_enumext\\_foreach\\_default\\_keys\\_tl](#) ... [142](#)  
[\l\\_\\_enumext\\_foreach\\_default\\_keys\\_tl](#) ... [117](#),  
[5695](#), [5716](#)  
[\\\_\\_enumext\\_foreach\\_keyans:nn](#) . [142](#), [5673](#), [5712](#),  
[5714](#)  
[\l\\_\\_enumext\\_foreach\\_name\\_prop\\_tl](#) . [117](#), [5718](#),  
[5743](#)  
[\l\\_\\_enumext\\_foreach\\_print\\_seq](#) [117](#), [5728](#), [5734](#),  
[5738](#)  
[\l\\_\\_enumext\\_foreach\\_sep\\_tl](#) ..... [5687](#), [5734](#)  
[\l\\_\\_enumext\\_foreach\\_start\\_int](#) .... [5679](#), [5730](#)  
[\l\\_\\_enumext\\_foreach\\_step\\_int](#) ..... [5683](#), [5731](#)  
[\l\\_\\_enumext\\_foreach\\_stop\\_int](#) . [5681](#), [5723](#), [5725](#),  
[5732](#)  
[\\\_\\_enumext\\_foreach\\_wrapper:n](#) ..... [5685](#), [5741](#)  
[\\\_\\_enumext\\_getkeyans:nn](#) .. [137](#), [5407](#), [5421](#), [5425](#)  
[\\\_\\_enumext\\_getkeyans\\_aux:n](#) [137](#), [5407](#), [5409](#), [5412](#)  
[\l\\_\\_enumext\\_hyperref\\_bool](#) . [34](#), [39](#), [40](#), [158](#), [383](#),  
[400](#), [417](#), [2890](#), [3292](#), [5035](#)  
[\\\_\\_enumext\\_hypertarget:nn](#) [40](#), [376](#), [402](#), [406](#), [422](#)  
[\\\_\\_enumext\\_if\\_is\\_int:n](#) ..... [219](#)  
[\\\_\\_enumext\\_if\\_is\\_int:nTF](#) ..... [219](#), [858](#), [872](#)  
[\\\_\\_enumext\\_internal\\_mini\\_page:](#) [42](#), [106](#), [126](#), [555](#),  
[555](#), [3834](#), [4889](#)  
[\\\_\\_enumext\\_is\\_not\\_nested:](#) . [31](#), [36](#), [106](#), [126](#), [239](#),  
[239](#), [3833](#), [4888](#)  
[\\\_\\_enumext\\_is\\_on\\_first\\_level:](#) . [31](#), [37](#), [106](#), [126](#),  
[239](#), [265](#), [3840](#), [4901](#)  
[\g\\_\\_enumext\\_item\\_anskey\\_int](#) [89](#), [95](#), [149](#), [335](#), [362](#),  
[363](#), [2423](#), [2839](#), [3306](#)  
[\\\_\\_enumext\\_item\\_answer\\_diff:](#) .. [78](#), [79](#), [93](#), [2419](#),  
[2419](#), [3183](#)  
[\g\\_\\_enumext\\_item\\_answer\\_diff\\_int](#) . [78](#), [79](#), [149](#),  
[336](#), [2421](#), [2428](#), [2452](#)  
[\l\\_\\_enumext\\_item\\_column\\_pos\\_vii\\_int](#) [128](#), [4649](#),  
[4655](#), [4661](#), [4665](#), [4672](#), [4966](#), [5102](#), [5105](#)  
[\l\\_\\_enumext\\_item\\_column\\_pos\\_viii\\_int](#) .. [133](#),  
[4698](#), [4704](#), [4710](#), [4714](#), [4721](#), [5210](#), [5381](#), [5384](#)  
[l\\_\\_enumext\\_item\\_column\\_pos\\_X\\_int](#) ..... [174](#)  
[\g\\_\\_enumext\\_item\\_count\\_all\\_vii\\_int](#) [128](#), [4673](#),  
[4967](#), [5116](#), [5124](#)  
[\g\\_\\_enumext\\_item\\_count\\_all\\_viii\\_int](#) [133](#), [4722](#),  
[5211](#), [5395](#), [5404](#)  
[\g\\_\\_enumext\\_item\\_count\\_all\\_X\\_int](#) ..... [174](#)  
[\g\\_\\_enumext\\_item\\_number\\_bool](#) ..... [149](#)  
[\l\\_\\_enumext\\_item\\_number\\_bool](#) [77](#), [156](#), [2373](#), [2378](#),  
[2382](#), [2386](#), [2399](#), [3024](#), [3147](#), [3423](#), [3457](#), [5044](#)  
[\g\\_\\_enumext\\_item\\_number\\_int](#) [77](#), [78](#), [149](#), [334](#), [361](#),  
[363](#), [2372](#), [2377](#), [2381](#), [2385](#), [2398](#), [2423](#), [3422](#), [3456](#),  
[5043](#)  
[\\\_\\_enumext\\_item\\_peek\\_args\\_vii:](#) [128](#), [4963](#), [4968](#),  
[4970](#)  
[\\\_\\_enumext\\_item\\_peek\\_args\\_viii:](#) .. [133](#), [5207](#),  
[5212](#), [5214](#)  
[\\\_\\_enumext\\_item\\_starred\\_exec:](#) . [99](#), [3435](#), [3462](#),  
[3504](#), [3525](#)  
[\\\_\\_enumext\\_item\\_starred\\_exec:nn](#) .. [3435](#), [3435](#),  
[3478](#)  
[\l\\_\\_enumext\\_item\\_starred\\_vii\\_bool](#) [4985](#), [4999](#),  
[5048](#)  
[\l\\_\\_enumext\\_item\\_starred\\_viii\\_bool](#) [5229](#), [5244](#),  
[5336](#), [5367](#)  
[\l\\_\\_enumext\\_item\\_starred\\_X\\_bool](#) ..... [174](#)  
[\\\_\\_enumext\\_item\\_std:w](#) . [39](#), [98](#), [102](#), [365](#), [369](#), [3426](#),  
[3432](#), [3460](#), [3623](#), [3627](#), [3634](#)  
[\g\\_\\_enumext\\_item\\_symbol\\_aux\\_tl](#) . [98](#), [121](#), [3440](#),  
[3443](#), [3468](#), [3512](#), [3532](#)  
[\g\\_\\_enumext\\_item\\_symbol\\_aux\\_vii\\_tl](#) [5007](#), [5050](#),  
[5053](#), [5057](#), [5059](#)  
[\g\\_\\_enumext\\_item\\_symbol\\_aux\\_X\\_tl](#) ..... [174](#)  
[\l\\_\\_enumext\\_item\\_symbol\\_sep\\_vii\\_dim](#) .. [5015](#),  
[5022](#), [5056](#), [5058](#)  
[\l\\_\\_enumext\\_item\\_symbol\\_vii\\_tl](#) ..... [5053](#)  
[\l\\_\\_enumext\\_item\\_text\\_vii\\_box](#) .... [5075](#), [5100](#)  
[\l\\_\\_enumext\\_item\\_text\\_viii\\_box](#) ... [5350](#), [5379](#)  
[\l\\_\\_enumext\\_item\\_text\\_X\\_box](#) ..... [174](#)  
[\l\\_\\_enumext\\_item\\_width\\_vii\\_dim](#) ... [4588](#), [4597](#),  
[4676](#), [4684](#), [4685](#)  
[\l\\_\\_enumext\\_item\\_width\\_viii\\_dim](#) .. [4619](#), [4628](#),  
[4725](#), [4733](#), [4734](#)  
[\l\\_\\_enumext\\_item\\_width\\_X\\_dim](#) ..... [174](#)  
[\l\\_\\_enumext\\_item\\_wrap\\_key\\_bool](#) [102](#), [149](#), [3376](#),  
[3396](#), [3647](#), [3654](#), [3681](#), [4474](#), [4492](#), [5230](#), [5245](#), [5313](#)  
[\l\\_\\_enumext\\_itemindent\\_X\\_dim](#) ..... [59](#)  
[\l\\_\\_enumext\\_itemsep\\_i\\_skip](#) ... [1367](#), [1374](#), [1377](#),  
[1379](#), [1386](#), [1390](#), [1393](#), [1395](#), [1535](#), [1542](#), [1544](#), [1545](#),  
[1550](#), [1554](#), [1556](#), [1557](#)  
[\l\\_\\_enumext\\_itemsep\\_ii\\_skip](#) .. [1407](#), [1414](#), [1417](#),  
[1419](#), [1426](#), [1430](#), [1433](#), [1435](#)  
[\l\\_\\_enumext\\_itemsep\\_iii\\_skip](#) . [1446](#), [1453](#), [1456](#),  
[1458](#), [1465](#), [1469](#), [1472](#), [1474](#)  
[\l\\_\\_enumext\\_itemsep\\_vii\\_skip](#) ..... [5122](#)  
[\l\\_\\_enumext\\_itemsep\\_viii\\_skip](#) ..... [5402](#)  
[\l\\_\\_enumext\\_joined\\_item\\_aux\\_vii\\_int](#) .. [4670](#),  
[4671](#), [4672](#), [4673](#), [4679](#)  
[\l\\_\\_enumext\\_joined\\_item\\_aux\\_viii\\_int](#) . [4719](#),  
[4720](#), [4721](#), [4722](#), [4728](#)  
[\l\\_\\_enumext\\_joined\\_item\\_aux\\_X\\_int](#) .... [174](#)  
[\\\_\\_enumext\\_joined\\_item\\_vii:w](#) .. [128](#), [4963](#), [4973](#),  
[4974](#), [4976](#)  
[\l\\_\\_enumext\\_joined\\_item\\_vii\\_int](#) .. [4641](#), [4642](#),  
[4645](#), [4647](#), [4653](#), [4658](#), [4663](#), [4668](#), [4670](#), [4676](#)  
[\\\_\\_enumext\\_joined\\_item\\_viii:w](#) . [133](#), [5207](#), [5217](#),  
[5218](#), [5220](#)  
[\l\\_\\_enumext\\_joined\\_item\\_viii\\_int](#) . [4690](#), [4691](#),  
[4694](#), [4696](#), [4702](#), [4707](#), [4712](#), [4717](#), [4719](#), [4725](#)  
[\l\\_\\_enumext\\_joined\\_item\\_X\\_int](#) ..... [174](#)  
[\l\\_\\_enumext\\_joined\\_width\\_vii\\_dim](#) . [4674](#), [4681](#),  
[4684](#), [5077](#), [5085](#)  
[\l\\_\\_enumext\\_joined\\_width\\_viii\\_dim](#) [4723](#), [4730](#),  
[4733](#), [5352](#), [5360](#)  
[\l\\_\\_enumext\\_joined\\_width\\_X\\_dim](#) ..... [174](#)

```

\__enumext_keyans_addto_prop:n 93, 3195, 3195,
    3636, 4477
\__enumext_keyans_addto_seq:n . 95, 3268, 3268,
    3638, 4479
\__enumext_keyans_addto_seq_link: 3268, 3286,
    3288, 5276
\__enumext_keyans_default_item:n . 102, 3618,
    3618, 3655
\l__enumext_keyans_env_bool 22, 3872, 3885, 4048,
    4138
\__enumext_keyans_fake_item_indent: .. 1052,
    1068, 3775
\l__enumext_keyans_level_h_int .. 132, 16, 787,
    811, 3008, 3136, 3246, 4895, 5162, 5163
\l__enumext_keyans_level_int .. 16, 1655, 3004,
    3132, 3241, 3386, 4047, 4052, 4440
\__enumext_keyans_make_label: . 103, 3659, 3659,
    3773
\__enumext_keyans_make_label_box: 3659, 3663,
    3668, 3705
\__enumext_keyans_make_label_std: 3659, 3671,
    3693
\__enumext_keyans_mini_right_cmd:n 64, 1657,
    1690, 1690
\__enumext_keyans_mini_set_vskip: ..... 61
\__enumext_keyans_minipage_add_space: 1486,
    1512, 4077
\__enumext_keyans_minipage_set_skip: . 1486,
    1486, 1514
\__enumext_keyans_multi_addvspace: 1286, 1297,
    4101
\__enumext_keyans_multi_set_vskip: 57, 1286,
    1286, 1299
\__enumext_keyans_multicols_start: 4065, 4080,
    4082
\__enumext_keyans_multicols_stop: 1694, 4065,
    4107, 4136
\__enumext_keyans_name_and_start: 31, 37, 132,
    296, 296, 4049, 4328, 5167
\__enumext_keyans_parse_keys:n 4061, 4061, 4160
\__enumext_keyans_pic_arg_two: 116, 4321, 4344,
    4375
\l__enumext_keyans_pic_level_int .. 16, 1636,
    3012, 3140, 3198, 3236, 3271, 4323, 4324
\__enumext_keyans_pic_parse_keys:n 4321, 4330,
    4374
\__enumext_keyans_pic_safe_exec: . 116, 4321,
    4321, 4373
\__enumext_keyans_pic_skip_abs:N . 116, 4321,
    4337, 4348
\__enumext_keyans_pos_mark_set: 96, 3342, 3342,
    3379, 3411
\__enumext_keyans_pre_itemsep_skip: .. 1486,
    1505, 1532
\__enumext_keyans_redefine_item: . 102, 3641,
    3641, 3772
\__enumext_keyans_ref: ..... 48, 834, 849, 3774
\__enumext_keyans_ref:n ..... 48, 831, 834, 834
\__enumext_keyans_safe_exec: . 4041, 4041, 4159
\__enumext_keyans_save_item_opt:n .. 96, 102,
    3309, 3309, 3632, 4476
\__enumext_keyans_set_item_width: 112, 4142,
    4142, 4169
\__enumext_keyans_show_ans: 97, 3342, 3371, 3698,
    3713, 4481
\__enumext_keyans_show_item_opt: 96, 102, 3309,
    3316, 3635, 4489
\__enumext_keyans_show_item_opt_viii: .. 96,
    3309, 3329, 5369
\__enumext_keyans_show_pos: 97, 3342, 3384, 3699,
    3714, 4482
\__enumext_keyans_starred_item:n . 102, 3630,
    3630, 3650
\__enumext_keyans_starred_item_star: .. 134,
    5242, 5270, 5338
\__enumext_keyans_start_counter: . 4153, 4153,
    4168
\__enumext_keyans_store_ref: .. 94, 3215, 3215,
    3637, 4478, 5274
\__enumext_keyans_store_ref_aux_i: 94, 3215,
    3227, 3230
\__enumext_keyans_store_ref_aux_ii: 94, 3215,
    3256, 3258
\__enumext_keyans_unknown_keys:n . 3553, 3559,
    3564, 4318
\__enumext_keyans_unknown_keys:nn 3553, 3566,
    3568
\__enumext_keyans_wraper_label:n ..... 103
\__enumext_keyans_wraper_label_viii:n 5307,
    5307, 5343
\__enumext_keyans_wrapper_item_v:n 3682, 3685
\__enumext_keyans_wrapper_item_viii:n 5314,
    5318
\__enumext_keyans_wrapper_label:n 3659, 3675,
    3701, 3716, 4486
\__enumext_keyans_wrapper_opt_v:n .... 3324
\__enumext_keyans_wrapper_opt_viii:n .. 3337
\l__enumext_label_copy_i_tl .. 2805, 3234, 3239,
    3244, 3249
\l__enumext_label_copy_v_tl ..... 3244
\l__enumext_label_copy_vi_tl ..... 3239
\l__enumext_label_copy_vii_tl 2781, 2792, 2821,
    3234
\l__enumext_label_copy_viii_tl ..... 3249
\l__enumext_label_copy_X_tl ..... 160
\l__enumext_label_fill_left_v_tl ..... 3697
\l__enumext_label_fill_left_X_tl ..... 88
\l__enumext_label_fill_right_v_tl .... 3702
\l__enumext_label_fill_right_X_tl ..... 88
\l__enumext_label_font_style_v_tl 3700, 3715,
    4485, 4493
\l__enumext_label_font_style_vii_tl ... 5063
\l__enumext_label_font_style_viii_tl .. 5342
\l__enumext_label_i_tl ..... 706
\l__enumext_label_ii_tl ..... 706
\l__enumext_label_iii_tl ..... 706
\l__enumext_label_iv_tl ..... 706
\__enumext_label_style:Nnn 31, 44, 607, 607, 622,
    711, 757, 822, 824
\l__enumext_label_v_tl 95, 819, 3203, 3276, 3345,
    4163, 4352
\l__enumext_label_vi_tl 95, 819, 3200, 3273, 4486,
    4494
\l__enumext_label_vii_tl . 752, 4994, 5017, 5024
\l__enumext_label_viii_tl 752, 5239, 5268, 5272
\l__enumext_label_width_by_box .. 55, 603, 604
\__enumext_label_width_by_box:Nn 44, 601, 601,
    606, 618, 882, 3344
\l__enumext_labelsep_v_dim ... 3365, 4091, 4364,

```

4488  
 \l\_\_enumext\_labelsep\_vii\_dim . 2907, 4583, 4593, 4677, 4959, 5015, 5070, 5079  
 \l\_\_enumext\_labelsep\_viii\_dim 4614, 4624, 4726, 5203, 5280, 5345, 5354  
 \l\_\_enumext\_labelwidth\_v\_dim . 827, 3355, 3360, 3381, 3413, 3711, 4091, 4364, 4483  
 \l\_\_enumext\_labelwidth\_vii\_dim ... 2910, 4583, 4592, 4677, 4959, 5061, 5078  
 \l\_\_enumext\_labelwidth\_viii\_dim .. 4614, 4623, 4726, 5203, 5287, 5304, 5340, 5353  
 \l\_\_enumext\_leftmargin\_tmp\_v\_bool . 116, 4346  
 \l\_\_enumext\_leftmargin\_tmp\_X\_bool ..... 59  
 \l\_\_enumext\_leftmargin\_tmp\_X\_dim ..... 59  
 \l\_\_enumext\_leftmargin\_X\_dim ..... 59  
 \\_\_enumext\_level: 215, 215, 736, 738, 747, 749, 1055, 1059, 1063, 1131, 1135, 1139, 1143, 1226, 1228, 1230, 1232, 1274, 1276, 1278, 1280, 1284, 1318, 1324, 1329, 1331, 1334, 1337, 1350, 1353, 1664, 1668, 1674, 1737, 1739, 1741, 1744, 1751, 1753, 1755, 1758, 1898, 1914, 1916, 1918, 1920, 1940, 1942, 1973, 1982, 1987, 1990, 2043, 2047, 2080, 2598, 2600, 2602, 2630, 2631, 2633, 2690, 2698, 2702, 2706, 2917, 2921, 3425, 3426, 3430, 3431, 3432, 3440, 3448, 3449, 3452, 3459, 3460, 3464, 3467, 3469, 3503, 3505, 3506, 3508, 3511, 3522, 3523, 3526, 3527, 3529, 3878, 3891, 3898, 3906, 3909, 3911, 3913, 3914, 3915, 3916, 3919, 3924, 3930, 3936, 3943, 3956, 3958, 3961, 3962, 3964, 3968, 3974, 4002, 4007, 4013, 4015, 4025, 4027  
 \l\_\_enumext\_level\_h\_int 126, 16, 248, 271, 284, 773, 804, 1643, 1903, 1923, 1944, 2057, 2091, 2130, 2174, 2209, 2369, 2389, 2800, 3886, 4890, 4891  
 \l\_\_enumext\_level\_int . 106, 16, 217, 258, 270, 285, 557, 1238, 1363, 1642, 1896, 1912, 1938, 1955, 2036, 2046, 2078, 2114, 2124, 2127, 2158, 2168, 2171, 2201, 2205, 2207, 2363, 2395, 2777, 2787, 2793, 2799, 2806, 2815, 2820, 3178, 3789, 3835, 3836, 3847, 3858, 3876, 3889, 3920, 4056, 4436, 4939, 4949, 5175, 6076, 6080, 6086, 6090, 6167  
 \\_\_enumext\_list\_arg\_two\_i: ..... 3753  
 \\_\_enumext\_list\_arg\_two\_ii: ..... 3753  
 \\_\_enumext\_list\_arg\_two\_iii: ..... 3753  
 \\_\_enumext\_list\_arg\_two\_iv: ..... 3753  
 \\_\_enumext\_list\_arg\_two\_v: 102, 3753, 4165, 4347  
 \\_\_enumext\_list\_arg\_two\_vii: ..... 3795, 4869  
 \\_\_enumext\_list\_arg\_two\_viii: .... 3795, 5138  
 \l\_\_enumext\_listoffset\_v\_dim . 4093, 4147, 4150  
 \l\_\_enumext\_listparindent\_vii\_dim 5086, 5090  
 \l\_\_enumext\_listparindent\_viii\_dim 5361, 5365  
 \\_\_enumext\_log\_answer\_vars: . 38, 350, 358, 3185  
 \\_\_enumext\_log\_global\_vars: . 38, 350, 350, 3184  
 \\_\_enumext\_make\_label: .... 99, 3483, 3483, 3783  
 \\_\_enumext\_make\_label\_box: ... 3483, 3487, 3492, 3515  
 \\_\_enumext\_make\_label\_std: ... 3483, 3495, 3499  
 \l\_\_enumext\_mark\_answer\_sym\_tl 85, 2542, 2756, 2933, 3367, 5284, 5291  
 \l\_\_enumext\_mark\_answer\_sym\_v\_tl . 3367, 3399  
 \l\_\_enumext\_mark\_answer\_sym\_viii\_tl ... 5284  
 \l\_\_enumext\_mark\_position\_str 121, 2548, 2549, 2550, 2754, 3369, 5285, 5302  
 \l\_\_enumext\_mark\_position\_v\_str .. 121, 3369  
 \l\_\_enumext\_mark\_position\_viii\_str 121, 5285, 5302  
 \l\_\_enumext\_mark\_ref\_sym\_tl .. 2530, 2895, 3300  
 \l\_\_enumext\_mark\_sep\_tmpa\_dim 121, 3345, 3355, 3360  
 \l\_\_enumext\_mark\_sep\_tmpb\_dim 121, 3350, 3354, 3359, 3368  
 \l\_\_enumext\_mark\_sym\_sep\_dim . 2545, 2905, 2907, 2910, 2913, 2915  
 \l\_\_enumext\_mark\_sym\_sep\_v\_dim ... 3363, 3365, 3368, 3381, 3413  
 \l\_\_enumext\_mark\_sym\_sep\_viii\_dim 5278, 5280, 5287, 5304  
 \l\_\_enumext\_meta\_path\_tl . 117, 5648, 5649, 5651, 5652  
 \c\_\_enumext\_meta\_paths\_prop ..... 141, 5624  
 \\_\_enumext\_mini\_addvspace\_vii: 63, 1622, 1622, 4751  
 \\_\_enumext\_mini\_addvspace\_viii: 63, 1622, 1628, 4816  
 \_\_enumext\_mini\_env\* ..... 555  
 \\_\_enumext\_mini\_page 1674, 1701, 3968, 4078, 4753, 4818, 4839  
 \\_\_enumext\_mini\_right\_cmd:n 64, 1659, 1661, 1661  
 \\_\_enumext\_mini\_set\_vskip\_vii: 62, 1565, 1565, 1624  
 \\_\_enumext\_mini\_set\_vskip\_viii: 62, 1565, 1587, 1630  
 \\_\_enumext\_minipage:w 39, 365, 373, 562, 4776, 5085, 5360  
 \l\_\_enumext\_minipage\_active\_v\_bool 4075, 4098, 4123  
 \g\_\_enumext\_minipage\_active\_vii\_bool .. 124, 4765, 4774, 4796  
 \l\_\_enumext\_minipage\_active\_vii\_bool . 4747, 4758  
 \g\_\_enumext\_minipage\_active\_viii\_bool 4829, 4837, 4856  
 \l\_\_enumext\_minipage\_active\_viii\_bool 4812, 4823  
 \g\_\_enumext\_minipage\_active\_X\_bool ... 174  
 \l\_\_enumext\_minipage\_active\_X\_bool .... 75  
 \\_\_enumext\_minipage\_add\_space: . 59, 109, 1314, 1340, 3966  
 \g\_\_enumext\_minipage\_after\_skip 75, 1569, 1581, 4794, 4854  
 \l\_\_enumext\_minipage\_after\_skip .. 58, 109, 75, 1327, 1367, 1369, 1374, 1377, 1381, 1386, 1390, 1393, 1397, 1409, 1414, 1417, 1421, 1426, 1430, 1433, 1437, 1448, 1453, 1456, 1460, 1465, 1469, 1472, 1476, 1488, 1502, 1535, 1537, 1542, 1544, 1546, 1550, 1554, 1556, 1558, 1589, 1602, 1616, 1670, 1697, 4133  
 \g\_\_enumext\_minipage\_center\_vii\_bool . 4780, 4797  
 \g\_\_enumext\_minipage\_center\_viii\_bool 4841, 4857  
 \g\_\_enumext\_minipage\_center\_X\_bool ... 174  
 \l\_\_enumext\_minipage\_hsep\_v\_dim ..... 4073  
 \l\_\_enumext\_minipage\_hsep\_vii\_dim .... 4745  
 \l\_\_enumext\_minipage\_hsep\_viii\_dim ... 4810  
 \l\_\_enumext\_minipage\_left\_skip 75, 1489, 1567, 1572, 1576, 1590, 1594, 1608, 1626, 1632  
 \l\_\_enumext\_minipage\_left\_v\_dim .. 4071, 4078  
 \l\_\_enumext\_minipage\_left\_vii\_dim 4741, 4753  
 \l\_\_enumext\_minipage\_left\_viii\_dim 4806, 4818  
 \l\_\_enumext\_minipage\_left\_X\_dim ..... 75  
 \g\_\_enumext\_minipage\_right\_skip 75, 1568, 1573,



1577, 4779, 4840  
 \l\_\_enumext\_minipage\_right\_skip . 58, 75, 1316,  
 1322, 1327, 1329, 1331, 1490, 1491, 1497, 1502, 1503,  
 1504, 1509, 1591, 1598, 1612, 1676, 1703  
 \l\_\_enumext\_minipage\_right\_v\_dim . 1692, 1701,  
 4069, 4073  
 \g\_\_enumext\_minipage\_right\_vii\_dim 123, 4749,  
 4776, 4799  
 \l\_\_enumext\_minipage\_right\_vii\_dim 123, 4739,  
 4744, 4750  
 \g\_\_enumext\_minipage\_right\_viii\_dim .. 4814,  
 4839, 4859  
 \l\_\_enumext\_minipage\_right\_viii\_dim .. 4804,  
 4809, 4815  
 \g\_\_enumext\_minipage\_right\_X\_dim ..... 174  
 \g\_\_enumext\_minipage\_right\_X\_skip .... 174  
 \\_\_enumext\_minipage\_set\_skip: . 58, 1314, 1314,  
 1342  
 \g\_\_enumext\_minipage\_stat\_int .. 109, 75, 1681,  
 1708, 3965, 3976, 3981, 4076, 4125, 4130  
 \l\_\_enumext\_minipage\_temp\_skip 75, 1388, 1398,  
 1401, 1428, 1438, 1441, 1467, 1477, 1480, 1552, 1559,  
 1561  
 \l\_\_enumext\_miniright\_code\_vii\_box 4787, 4791  
 \g\_\_enumext\_miniright\_code\_vii\_tl 124, 4782,  
 4789, 4798  
 \l\_\_enumext\_miniright\_code\_viii\_box .. 4848,  
 4852  
 \g\_\_enumext\_miniright\_code\_viii\_tl 4843, 4850,  
 4858  
 \l\_\_enumext\_miniright\_code\_X\_box ..... 174  
 \l\_\_enumext\_mode\_box\_bool .... 627, 3490, 3666  
 \\_\_enumext\_multi\_addvspace: 57, 108, 1269, 1269,  
 3927  
 \\_\_enumext\_multi\_set\_vskip: 56, 1224, 1224, 1271  
 \l\_\_enumext\_multicols\_above\_ii\_skip ... 1243  
 \l\_\_enumext\_multicols\_above\_iii\_skip .. 1252  
 \l\_\_enumext\_multicols\_above\_iv\_skip ... 1261  
 \l\_\_enumext\_multicols\_above\_v\_skip 1288, 1302,  
 1312, 1503  
 \l\_\_enumext\_multicols\_above\_X\_skip .... 67  
 \l\_\_enumext\_multicols\_below\_ii\_skip .. 1370,  
 1379, 1383, 1395, 1400  
 \l\_\_enumext\_multicols\_below\_iii\_skip . 1410,  
 1419, 1423, 1435, 1440  
 \l\_\_enumext\_multicols\_below\_iv\_skip .. 1449,  
 1458, 1462, 1474, 1479  
 \l\_\_enumext\_multicols\_below\_v\_skip 1292, 1306,  
 1504, 1538, 1545, 1547, 1557, 1560, 4115  
 \l\_\_enumext\_multicols\_below\_X\_skip .... 67  
 \g\_\_enumext\_multicols\_right\_X\_skip .... 67  
 \\_\_enumext\_multicols\_start: 108, 109, 3903, 3903,  
 3970  
 \\_\_enumext\_multicols\_stop: 108, 1666, 3933, 3933,  
 3986  
 \\_\_enumext\_nested\_base\_line\_fix: 51, 107, 972,  
 978, 3854  
 \\_\_enumext\_newlabel:nn 34, 40, 86, 410, 410, 2831,  
 3262  
 \l\_\_enumext\_newlabel\_arg\_one\_tl 34, 40, 86, 94,  
 160, 2824, 2832, 2894, 3251, 3263, 3298  
 \l\_\_enumext\_newlabel\_arg\_two\_tl 34, 40, 85, 160,  
 2780, 2790, 2803, 2818, 2833, 3238, 3243, 3248, 3264  
 \g\_\_enumext\_not\_key\_series\_vii\_tl 1946, 1947,  
 2211, 2214  
 \g\_\_enumext\_not\_key\_series\_X\_tl ..... 46  
 \\_\_enumext\_parse\_foreach\_keys:n .. 5673, 5689,  
 5706  
 \\_\_enumext\_parse\_foreach\_keys:nn . 5673, 5696,  
 5708  
 \\_\_enumext\_parse\_keys:n 51, 68, 3842, 3842, 4021  
 \\_\_enumext\_parse\_keys\_vii:n 68, 4864, 4903, 4903  
 \\_\_enumext\_parse\_keys\_viii:n . 5134, 5180, 5180  
 \\_\_enumext\_parse\_save\_key:n 82, 2623, 2628, 2628  
 \\_\_enumext\_parse\_save\_key\_vii:n 82, 2618, 2628,  
 2636  
 \\_\_enumext\_parse\_series:n .. 68, 107, 126, 1892,  
 1892, 3852, 3861, 4911  
 \\_\_enumext\_parse\_store\_keys:n ..... 107  
 \l\_\_enumext\_parsep\_i\_skip ..... 1241, 1245  
 \l\_\_enumext\_parsep\_ii\_skip ..... 1250, 1254  
 \l\_\_enumext\_parsep\_iii\_skip ..... 1259, 1263  
 \l\_\_enumext\_parsep\_vii\_skip ..... 5087  
 \l\_\_enumext\_parsep\_viii\_skip ..... 5362  
 \l\_\_enumext\_partopsep\_v\_skip . 1304, 1308, 1499,  
 1522  
 \l\_\_enumext\_partopsep\_viii\_skip ..... 1600  
 \\_\_enumext\_phantomsection: 40, 376, 403, 407, 423  
 \\_\_enumext\_pre\_itemsep\_skip: 58, 59, 1332, 1361,  
 1361  
 \\_\_enumext\_print\_footnote: .. 425, 447, 511, 516  
 \\_\_enumext\_print\_footnote\_mini: 425, 477, 538,  
 543  
 \\_\_enumext\_print\_footnote\_standar: 489, 505,  
 569  
 \\_\_enumext\_print\_footnote\_starred: 489, 534,  
 549, 553  
 \\_\_enumext\_print\_keyans\_box:NN 85, 2748, 2748,  
 2761, 2909, 2920, 3380, 3412, 5286, 5303  
 \l\_\_enumext\_print\_keyans\_cmd\_bool 121, 1835,  
 1849, 1860, 3850, 3859, 3992, 4909, 4930, 5477, 5484  
 \l\_\_enumext\_print\_keyans\_i\_tl .... 5445, 5478  
 \l\_\_enumext\_print\_keyans\_ii\_tl ... 5451, 5479  
 \l\_\_enumext\_print\_keyans\_iii\_tl .. 5457, 5480  
 \l\_\_enumext\_print\_keyans\_iv\_tl ... 5463, 5481  
 \l\_\_enumext\_print\_keyans\_star\_bool . 51, 138,  
 121, 984, 996, 5502, 5507  
 \l\_\_enumext\_print\_keyans\_starred\_tl 137, 138,  
 121, 5439, 5500  
 \l\_\_enumext\_print\_keyans\_vii\_tl 137, 5469, 5482  
 \l\_\_enumext\_print\_keyans\_X\_tl ..... 121  
 \\_\_enumext\_printkeyans:nnn 138, 5474, 5483, 5487  
 \\_\_enumext\_redefine\_item: . 99, 3472, 3472, 3782  
 \l\_\_enumext\_ref\_key\_arg\_t ..... 46  
 \l\_\_enumext\_ref\_key\_arg\_tl 37, 728, 729, 741, 772,  
 775, 783, 789, 797, 836, 837, 845  
 \l\_\_enumext\_ref\_the\_count\_tl . 46, 37, 734, 740,  
 780, 783, 794, 797, 842, 845  
 \\_\_enumext\_register\_default\_label\_wd:Nn 591,  
 591, 596, 597, 598, 599, 600  
 \\_\_enumext\_remove\_extra\_parsep\_vii: .. 4883,  
 5111, 5111  
 \\_\_enumext\_remove\_extra\_parsep\_viii: . 5152,  
 5390, 5390  
 \l\_\_enumext\_renew\_counter\_v\_tl . 843, 851, 853  
 \l\_\_enumext\_renew\_counter\_vii\_tl 781, 806, 808  
 \l\_\_enumext\_renew\_counter\_viii\_tl . 795, 813,  
 815  
 \l\_\_enumext\_renew\_counter\_X\_tl ..... 37

\\_\_enumext\_renew\_footnote: . . . [425](#), [429](#), [495](#), [500](#)  
 \\_\_enumext\_renew\_footnote\_mini: [425](#), [459](#), [525](#),  
     [530](#)  
 \\_\_enumext\_renew\_footnote\_standar: [489](#), [489](#),  
     [561](#)  
 \\_\_enumext\_renew\_footnote\_starred: [489](#), [521](#),  
     [5081](#), [5356](#)  
 \\_\_enumext\_reset\_count\_resume:nn . [2218](#), [2246](#),  
     [2248](#), [2253](#), [2258](#), [2265](#), [2270](#)  
 \\_\_enumext\_reset\_count\_resume\_all:n . . . [2218](#),  
     [2222](#), [2254](#)  
 \\_\_enumext\_reset\_count\_resume\_levels:n [2218](#),  
     [2227](#), [2261](#)  
 \\_\_enumext\_reset\_global\_bool: . . . [326](#), [329](#), [338](#)  
 \\_\_enumext\_reset\_global\_int: . . . . [326](#), [328](#), [332](#)  
 \\_\_enumext\_reset\_global\_tl: . . . . [326](#), [330](#), [344](#)  
 \\_\_enumext\_reset\_global\_vars: . [38](#), [93](#), [326](#), [326](#),  
     [3192](#)  
 \\_\_enumext\_resume\_counter: [72](#), [2076](#), [2085](#), [2098](#),  
     [2105](#)  
 \\_\_enumext\_resume\_counter:n . [68](#), [71](#), [2040](#), [2045](#),  
     [2061](#), [2066](#), [2076](#), [2076](#), [2199](#), [2213](#)  
 \\_\_enumext\_resume\_counter\_series: [72](#), [73](#), [2076](#),  
     [2088](#), [2101](#), [2146](#)  
 \\_\_enumext\_resume\_last:n [68](#), [69](#), [1892](#), [1900](#), [1907](#),  
     [1936](#)  
 \\_\_enumext\_resume\_save\_counter: . . . [110](#), [127](#)  
 \\_\_enumext\_resume\_series:n . [71](#), [1851](#), [2034](#), [2034](#)  
 \\_\_enumext\_resume\_series\_vii:n [71](#), [1862](#), [2034](#),  
     [2055](#)  
 \\_\_enumext\_resume\_star: . . . [73](#), [1837](#), [2193](#), [2193](#)  
 \l\_\_enumext\_resume\_vii\_bool . . . . . [1905](#), [2093](#)  
 \g\_\_enumext\_resume\_vii\_int . . . . . [2022](#), [2142](#)  
 \l\_\_enumext\_resume\_X\_bool . . . . . [46](#)  
 \g\_\_enumext\_resume\_X\_int . . . . . [46](#)  
 \l\_\_enumext\_rightmargin\_vii\_dim . . [4595](#), [4599](#),  
     [4604](#)  
 \l\_\_enumext\_rightmargin\_viii\_dim . [4626](#), [4630](#),  
     [4635](#)  
 \\_\_enumext\_safe\_exec: . . [42](#), [106](#), [3831](#), [3831](#), [4020](#)  
 \\_\_enumext\_safe\_exec\_vii: . [42](#), [4863](#), [4886](#), [4886](#)  
 \\_\_enumext\_safe\_exec\_viii: [132](#), [5133](#), [5156](#), [5156](#)  
 \\_\_enumext\_scan\_tokens:n . . . [92](#), [202](#), [202](#), [3173](#)  
 \\_\_enumext\_second\_part: . . [109](#), [3972](#), [3972](#), [4035](#)  
 \\_\_enumext\_second\_part\_v: . . . [4065](#), [4121](#), [4174](#)  
 \l\_\_enumext\_series\_name\_str . [69](#), [107](#), [126](#), [1832](#),  
     [1894](#), [1914](#), [1916](#), [1918](#), [1920](#), [1925](#), [1927](#), [1929](#), [1931](#),  
     [1970](#), [1973](#), [1977](#), [2011](#), [2014](#), [2018](#), [3846](#), [4907](#)  
 \l\_\_enumext\_series\_name\_tl . [69](#), [71](#), [72](#), [46](#), [1975](#),  
     [1987](#), [1990](#), [2016](#), [2027](#), [2030](#), [2081](#), [2082](#), [2083](#), [2094](#),  
     [2095](#), [2096](#), [2150](#), [2154](#), [2188](#)  
 \g\_\_enumext\_series\_name\_X\_tl . . . . . [46](#)  
 \\_\_enumext\_set\_error:nn . . . . . [5583](#), [5620](#), [5622](#)  
 \\_\_enumext\_set\_item\_width: [110](#), [3997](#), [3997](#), [4031](#)  
 \\_\_enumext\_set\_parse:n . . . . . [5583](#), [5594](#), [5610](#)  
 \l\_\_enumext\_setkey\_tmpa\_int . . . [112](#), [5587](#), [5591](#)  
 \l\_\_enumext\_setkey\_tmpa\_seq . . [112](#), [5585](#), [5595](#),  
     [5601](#), [5603](#), [5605](#), [5617](#)  
 \l\_\_enumext\_setkey\_tmpa\_tl . . . . [112](#), [5593](#), [5597](#)  
 \l\_\_enumext\_setkey\_tmpb\_seq . . [112](#), [5586](#), [5589](#),  
     [5593](#), [5594](#)  
 \l\_\_enumext\_setkey\_tmpb\_tl [112](#), [5612](#), [5614](#), [5615](#)  
 \l\_\_enumext\_show\_answer\_bool . [2517](#), [2536](#), [2927](#),  
     [3321](#), [3334](#), [3375](#), [3680](#), [5282](#), [5312](#)  
 \\_\_enumext\_show\_length:nnn . . [53](#), [225](#), [225](#), [5835](#),  
     [5836](#), [5837](#), [5838](#), [5839](#), [5840](#), [5841](#), [5842](#), [5843](#), [5844](#),  
     [5850](#), [5851](#), [5852](#), [5853](#), [5854](#), [5855](#), [5856](#), [5857](#), [5858](#),  
     [5859](#)  
 \l\_\_enumext\_show\_pos\_tmp\_int . [121](#), [3388](#), [3391](#),  
     [3406](#)  
 \l\_\_enumext\_show\_position\_bool . . . [2520](#), [2539](#),  
     [2931](#), [3322](#), [3335](#), [3395](#), [5289](#)  
 \g\_\_enumext\_standar\_bool [36](#), [106](#), [22](#), [247](#), [250](#), [269](#),  
     [341](#), [491](#), [507](#), [1952](#), [2394](#), [2408](#), [2785](#), [2798](#), [2813](#),  
     [3873](#)  
 \l\_\_enumext\_standar\_bool [106](#), [110](#), [22](#), [1650](#), [2786](#),  
     [3838](#), [3991](#), [4900](#)  
 \l\_\_enumext\_standar\_first\_bool [37](#), [106](#), [22](#), [274](#),  
     [2117](#), [2161](#), [2297](#), [2304](#)  
 \\_\_enumext\_standar\_item\_vii:w . [128](#), [4963](#), [4981](#),  
     [4983](#)  
 \\_\_enumext\_standar\_item\_viii:w [133](#), [134](#), [5207](#),  
     [5225](#), [5227](#)  
 \\_\_enumext\_standar\_ref: . . . . [46](#), [726](#), [745](#), [3784](#)  
 \\_\_enumext\_standar\_ref:n . . . . . [718](#), [726](#), [726](#)  
 \\_\_enumext\_standar\_save\_counter: . . [69](#), [1950](#),  
     [1950](#), [3994](#)  
 \\_\_enumext\_standar\_save\_counter\_aux: . [1950](#),  
     [1954](#), [1965](#), [1968](#)  
 \\_\_enumext\_standar\_unknown\_keys:n [3596](#), [3600](#),  
     [3604](#)  
 \\_\_enumext\_standar\_unknown\_keys:nn [3596](#), [3606](#),  
     [3608](#)  
 \\_\_enumext\_standard\_ref:n . . . . . [46](#)  
 \\_\_enumext\_standard\_reset:nn . [2218](#), [2236](#), [2244](#)  
 \g\_\_enumext\_starred\_bool [36](#), [126](#), [22](#), [257](#), [260](#), [283](#),  
     [342](#), [1649](#), [1996](#), [2368](#), [2414](#), [2776](#), [3232](#), [4800](#)  
 \l\_\_enumext\_starred\_bool [126](#), [127](#), [132](#), [22](#), [2814](#),  
     [2849](#), [2855](#), [2903](#), [3839](#), [4899](#), [4929](#), [5168](#), [5172](#)  
 \\_\_enumext\_starred\_columns\_set\_vii: . . [4577](#),  
     [4577](#), [4874](#)  
 \\_\_enumext\_starred\_columns\_set\_viii: . [4577](#),  
     [4608](#), [5143](#)  
 \l\_\_enumext\_starred\_first\_bool [37](#), [126](#), [22](#), [288](#),  
     [982](#), [995](#), [2133](#), [2177](#), [2297](#), [2304](#)  
 \\_\_enumext\_starred\_item\_vii:w . [128](#), [129](#), [4963](#),  
     [4980](#), [4997](#)  
 \\_\_enumext\_starred\_item\_vii\_aux\_i:w . . [4963](#),  
     [5002](#), [5005](#)  
 \\_\_enumext\_starred\_item\_vii\_aux\_ii:w . [4963](#),  
     [5003](#), [5008](#), [5010](#)  
 \\_\_enumext\_starred\_item\_vii\_aux\_iii:w [4963](#),  
     [5013](#), [5020](#)  
 \\_\_enumext\_starred\_item\_viii:w [133](#), [134](#), [5224](#),  
     [5242](#), [5242](#)  
 \\_\_enumext\_starred\_item\_viii\_aux\_i:w . . [134](#),  
     [5242](#), [5248](#), [5251](#)  
 \\_\_enumext\_starred\_item\_viii\_aux\_ii:w . [134](#),  
     [5242](#), [5249](#), [5263](#), [5265](#)  
 \\_\_enumext\_starred\_joined\_item\_vii:n [122](#), [128](#),  
     [4639](#), [4639](#), [4978](#)  
 \\_\_enumext\_starred\_joined\_item\_viii:n . [122](#),  
     [133](#), [4639](#), [4688](#), [5222](#)  
 \\_\_enumext\_starred\_ref: . . . . [47](#), [770](#), [802](#), [3816](#)  
 \\_\_enumext\_starred\_ref:n . . . . [47](#), [764](#), [770](#), [770](#)  
 \\_\_enumext\_starred\_reset:n . . . [2218](#), [2231](#), [2268](#)  
 \\_\_enumext\_starred\_save\_counter: . . [69](#), [1950](#),  
     [1994](#), [4932](#)

\\_\_enumext\_starred\_save\_counter\_aux: . [1950](#),  
     [1998](#), [2006](#), [2009](#)  
 \\_\_enumext\_starred\_unknown\_keys:n [3578](#), [3580](#),  
     [3582](#)  
 \\_\_enumext\_starred\_unknown\_keys:nn [3578](#), [3584](#),  
     [3586](#)  
 \\_\_enumext\_start\_counter: . . . [4011](#), [4011](#), [4030](#)  
 \\_\_enumext\_start\_from:NNn [48](#), [856](#), [856](#), [869](#), [891](#),  
     [897](#)  
 \l\_\_enumext\_start\_i\_int . . . . . [2120](#), [2164](#)  
 \\_\_enumext\_start\_item\_tmp\_vii: [126](#), [4877](#), [4963](#),  
     [4963](#)  
 \\_\_enumext\_start\_item\_tmp\_viii: . . [5146](#), [5207](#),  
     [5207](#)  
 \\_\_enumext\_start\_item\_vii:w [128](#), [130](#), [4989](#), [4994](#),  
     [5017](#), [5024](#), [5072](#), [5072](#)  
 \\_\_enumext\_start\_item\_viii:w . [134](#), [5234](#), [5239](#),  
     [5268](#), [5347](#), [5347](#)  
 \g\_\_enumext\_start\_line\_tl [37](#), [22](#), [276](#), [290](#), [347](#),  
     [2438](#), [2443](#), [2448](#), [2462](#), [2467](#), [2472](#)  
 \\_\_enumext\_start\_list:nn [39](#), [104](#), [365](#), [367](#), [4024](#),  
     [4162](#), [4867](#), [5136](#)  
 \\_\_enumext\_start\_list\_tag:n . . [4176](#), [4202](#), [5082](#),  
     [5357](#)  
 \\_\_enumext\_start\_mini\_vii: [127](#), [4737](#), [4737](#), [4921](#)  
 \\_\_enumext\_start\_mini\_viii: . . . [132](#), [4802](#), [4802](#),  
     [5191](#)  
 \\_\_enumext\_start\_save\_ans\_msg: [75](#), [2281](#), [2281](#),  
     [2306](#)  
 \\_\_enumext\_start\_store\_level: . [107](#), [3867](#), [3867](#),  
     [4023](#)  
 \\_\_enumext\_start\_store\_level\_vii: [127](#), [4866](#),  
     [4935](#), [4935](#)  
 \l\_\_enumext\_start\_vii\_int [2136](#), [2142](#), [2180](#), [2186](#)  
 \l\_\_enumext\_start\_X\_int . . . . . [88](#)  
 \\_\_enumext\_stop\_item\_tmp\_vii: . . [126](#), [128](#), [130](#),  
     [4876](#), [4882](#), [4965](#), [5074](#)  
 \\_\_enumext\_stop\_item\_tmp\_viii: [133](#), [5145](#), [5151](#),  
     [5209](#), [5349](#)  
 \\_\_enumext\_stop\_item\_vii: [130](#), [131](#), [5072](#), [5074](#),  
     [5094](#)  
 \\_\_enumext\_stop\_item\_viii: . . . [5347](#), [5349](#), [5373](#)  
 \\_\_enumext\_stop\_list: [39](#), [124](#), [127](#), [365](#), [368](#), [3938](#),  
     [3946](#), [4111](#), [4118](#), [4760](#), [4768](#), [4825](#), [4832](#)  
 \\_\_enumext\_stop\_list\_tag:n . . . [4176](#), [4218](#), [5097](#),  
     [5376](#)  
 \\_\_enumext\_stop\_mini\_vii: [124](#), [127](#), [4737](#), [4756](#),  
     [4925](#)  
 \\_\_enumext\_stop\_mini\_viii: [133](#), [4802](#), [4821](#), [5195](#)  
 \\_\_enumext\_stop\_save\_ans\_msg: . [75](#), [2281](#), [2286](#),  
     [3182](#)  
 \\_\_enumext\_stop\_start\_list\_tag: . . [4176](#), [4210](#),  
     [5084](#), [5359](#)  
 \\_\_enumext\_stop\_store\_level: . . [108](#), [3896](#), [3896](#),  
     [3939](#), [3947](#)  
 \\_\_enumext\_stop\_store\_level\_vii: . . [124](#), [127](#),  
     [4761](#), [4769](#), [4935](#), [4945](#)  
 \l\_\_enumext\_store\_active\_bool [33](#), [76](#), [100](#), [2118](#),  
     [2134](#), [2162](#), [2178](#), [2313](#), [3000](#), [3128](#), [3871](#), [3884](#), [4043](#),  
     [4051](#), [4432](#), [4937](#), [4947](#), [5158](#), [5174](#)  
 \\_\_enumext\_store\_active\_keys:n [81](#), [82](#), [107](#), [2596](#),  
     [2596](#), [3864](#)  
 \\_\_enumext\_store\_active\_keys\_vii:n [81](#), [82](#), [126](#),  
     [2596](#), [2606](#), [4913](#)  
 \\_\_enumext\_store\_addto\_prop:n [83](#), [93](#), [2672](#), [2672](#),  
     [2680](#), [2840](#), [3213](#), [5273](#)  
 \\_\_enumext\_store\_addto\_seq:n [83](#), [95](#), [2681](#), [2681](#),  
     [2685](#), [2692](#), [2706](#), [2714](#), [2723](#), [2737](#), [2745](#), [2898](#), [3303](#)  
 \\_\_enumext\_store\_anskey\_arg:n . . [86](#), [89](#), [91](#), [92](#),  
     [2837](#), [2837](#), [2993](#), [3171](#)  
 \l\_\_enumext\_store\_anskey\_arg\_tl [33](#), [86](#), [87](#), [105](#),  
     [2846](#), [2851](#), [2853](#), [2858](#), [2865](#), [2868](#), [2878](#), [2883](#), [2886](#),  
     [2892](#), [2898](#)  
 \\_\_enumext\_store\_anskey\_env:n . [92](#), [3122](#), [3126](#),  
     [3156](#)  
 \l\_\_enumext\_store\_anskey\_env\_tl . . [33](#), [92](#), [105](#),  
     [3158](#), [3160](#), [3162](#), [3165](#), [3173](#)  
 \\_\_enumext\_store\_anskey\_safe\_outer: . . [89](#), [92](#)  
 \l\_\_enumext\_store\_columns\_break\_bool . [2848](#),  
     [2949](#), [3035](#)  
 \l\_\_enumext\_store\_current\_label\_tl [33](#), [93](#), [95](#),  
     [134](#), [100](#), [3197](#), [3200](#), [3203](#), [3209](#), [3211](#), [3213](#), [3270](#),  
     [3273](#), [3276](#), [3282](#), [3284](#), [3294](#), [3303](#), [5253](#), [5258](#), [5259](#),  
     [5272](#), [5273](#), [5275](#)  
 \l\_\_enumext\_store\_current\_opt\_arg\_tl . [33](#), [96](#),  
     [134](#), [100](#), [3313](#), [3318](#), [3325](#), [3331](#), [3338](#), [5261](#)  
 \\_\_enumext\_store\_internal\_ref: . . [85](#), [86](#), [2762](#),  
     [2762](#), [2843](#)  
 \l\_\_enumext\_store\_item\_join\_int . . [2856](#), [2860](#),  
     [2952](#), [3038](#)  
 \l\_\_enumext\_store\_item\_star\_bool . [2863](#), [2954](#),  
     [3040](#)  
 \l\_\_enumext\_store\_item\_symbol\_sep\_dim [2875](#),  
     [2880](#), [2959](#), [3045](#)  
 \l\_\_enumext\_store\_item\_symbol\_tl . [2866](#), [2870](#),  
     [2957](#), [3043](#)  
 \l\_\_enumext\_store\_keyans\_item\_opt\_sep\_v\_-  
     tl . . . . . [3207](#), [3209](#), [3280](#), [3282](#)  
 \l\_\_enumext\_store\_keyans\_item\_opt\_sep\_-  
     viii\_tl . . . . . [5256](#), [5258](#)  
 \\_\_enumext\_store\_level\_close: . [84](#), [2686](#), [2710](#),  
     [3900](#)  
 \\_\_enumext\_store\_level\_close\_vii: . [84](#), [2717](#),  
     [2741](#), [4951](#)  
 \\_\_enumext\_store\_level\_open: [84](#), [107](#), [2686](#), [2686](#),  
     [3879](#), [3892](#)  
 \\_\_enumext\_store\_level\_open\_vii: . . [84](#), [2717](#),  
     [2717](#), [4941](#)  
 \g\_\_enumext\_store\_name\_tl [33](#), [76](#), [100](#), [346](#), [353](#),  
     [354](#), [355](#), [356](#), [2289](#), [2315](#), [2437](#), [2442](#), [2447](#), [2461](#),  
     [2466](#), [2471](#), [3180](#)  
 \l\_\_enumext\_store\_name\_tl [33](#), [75](#), [77](#), [100](#), [1957](#),  
     [1960](#), [1979](#), [1999](#), [2002](#), [2020](#), [2122](#), [2138](#), [2166](#), [2182](#),  
     [2284](#), [2293](#), [2294](#), [2315](#), [2316](#), [2318](#), [2319](#), [2321](#), [2323](#),  
     [2324](#), [2326](#), [2328](#), [2329](#), [2353](#), [2674](#), [2676](#), [2683](#), [2826](#),  
     [2827](#), [2939](#), [3253](#), [3254](#), [3405](#), [5297](#)  
 \l\_\_enumext\_store\_ref\_key\_bool [86](#), [2533](#), [2841](#),  
     [2889](#), [3217](#), [3291](#)  
 \l\_\_enumext\_store\_save\_key\_vii\_bool . . [2608](#),  
     [2638](#)  
 \l\_\_enumext\_store\_save\_key\_vii\_tl [2610](#), [2611](#),  
     [2639](#), [2640](#), [2721](#), [2729](#), [2733](#), [2737](#)  
 \l\_\_enumext\_store\_save\_key\_X\_bool . . [81](#), [121](#)  
 \l\_\_enumext\_store\_save\_key\_X\_tl . . [81](#), [82](#), [121](#)  
 \l\_\_enumext\_store\_upper\_level\_X\_bool . . [121](#)  
 \\_\_enumext\_storing\_exec: [75](#), [76](#), [2291](#), [2307](#), [2311](#)  
 \\_\_enumext\_storing\_set:n . . [75](#), [2276](#), [2291](#), [2291](#)  
 \l\_\_enumext\_the\_counter\_v\_tl . . . . . [842](#)  
 \l\_\_enumext\_the\_counter\_vii\_tl . . . . . [780](#)  
 \l\_\_enumext\_the\_counter\_viii\_tl . . . . . [794](#)



<code>\l__enumext_the_counter_X_tl</code> . . . . .	37	<code>\l__enumext_wrap_label_opt_viii_bool</code> . .	134, 5233
<code>\__enumext_tmp:n</code> 32, 36, 39, 45, 47, 54, 59, 66, 67, 74, 82, 87, 88, 99, 131, 138, 163, 167, 174, 194, 623, 632, 1828, 1843, 1844, 1856, 2107, 2124, 2127, 2148, 2168, 2171, 2195, 2207, 2272, 2280, 2332, 2350, 2526, 2595, 2614, 2627, 2764, 2771, 2772, 2793, 2806, 2809, 2820, 3219, 3226, 3553, 3563, 3596, 3603, 3753, 3794, 3795, 3830		<code>\l__enumext_wrap_label_opt_X_bool</code> . . . . .	88
<code>\__enumext_tmp:nn</code> 633, 654, 655, 689, 690, 705, 886, 911, 912, 927, 1008, 1030, 1031, 1051, 1105, 1113, 1114, 1128, 1193, 1209, 1210, 1223, 1717, 1733, 2491, 2525, 3537, 3552		<code>\l__enumext_wrap_label_v_bool</code> 3622, 3626, 3633, 3679, 3687, 4475	
<code>\__enumext_tmp:nnn</code> 706, 722, 723, 724, 725, 752, 768, 769		<code>\l__enumext_wrap_label_vii_bool</code> . .	128, 4988, 4992, 5000, 5064
<code>\__enumext_tmp:nnnnn</code> 928, 953, 956, 959, 961, 963, 966, 969		<code>\l__enumext_wrap_label_viii_bool</code> .	134, 5233, 5237, 5246, 5311, 5320
<code>\__enumext_tmp:w</code> . . . . .	5418, 5421	<code>\l__enumext_wrap_label_X_bool</code> . . . . .	88
<code>\l__enumext_tmpa_vii_int</code> 4587, 4590, 4599, 4630		<code>\__enumext_wrapper_label_v:n</code> .	3685, 3689, 4494
<code>\l__enumext_tmpa_viii_int</code> . . . . .	4618, 4621	<code>\__enumext_wrapper_label_vii:n</code> . . . . .	5066
<code>\l__enumext_tmpa_X_dim</code> . . . . .	174	<code>\__enumext_wrapper_label_viii:n</code> . .	5318, 5322
<code>\l__enumext_tmpa_X_int</code> . . . . .	174	<code>\l__enumext_write_anskey_env_bool</code> . .	33, 105, 3051, 3076
<code>\l__enumext_topsep_v_skip</code> 1290, 1294, 1493, 4425		<code>\l__enumext_write_anskey_env_file_iow</code> . .	33, 105, 3101, 3102, 3103
<code>\l__enumext_topsep_vii_skip</code> . .	1570, 1579, 1583	<code>\l__enumext_write_anskey_env_file_name_tl</code> . . . . .	33, 105, 3052, 3162
<code>\l__enumext_topsep_viii_skip</code> .	1592, 1614, 1618	<code>\l__enumext_write_aux_file_tl</code> .	34, 86, 94, 160, 2829, 2835, 3260, 3266
<code>\__enumext_unskip_unkern:</code> . .	36, 231, 231, 1343, 1515, 3941, 3942, 3982, 4113, 4114, 4131, 5088, 5089, 5363, 5364	<code>enumext*</code> . . . . .	5, 4861
<code>\l__enumext_vspace_a_star_v_bool</code> . . . . .	1766	<code>enumXi</code> . . . . .	574
<code>\l__enumext_vspace_a_star_vii_bool</code> . .	1788	<code>enumXii</code> . . . . .	574
<code>\l__enumext_vspace_a_star_viii_bool</code> . .	1799	<code>enumXiii</code> . . . . .	574
<code>\l__enumext_vspace_a_star_X_bool</code> . . . . .	88	<code>enumXiv</code> . . . . .	574
<code>\__enumext_vspace_above:</code> 65, 109, 1734, 1734, 3952		<code>enumXvi</code> . . . . .	574
<code>\__enumext_vspace_above_v:</code> .	66, 1762, 1762, 4067	<code>enumXvii</code> . . . . .	574
<code>\l__enumext_vspace_above_v_skip</code> . .	1764, 1768, 1770	<code>enumXviii</code> . . . . .	574
<code>\__enumext_vspace_above_vii:</code> 66, 127, 1784, 1784, 4918		<code>Environments provide by enumext:</code>	
<code>\l__enumext_vspace_above_vii_skip</code> 1786, 1790, 1792		<code>anskey*</code> .	30, 33, 35, 76, 80, 82, 85–88, 91, 107, 108, 127, 137, 138, 143, 146
<code>\__enumext_vspace_above_viii:</code> .	66, 1784, 1795, 5189	<code>enumext*</code> 30, 31, 35, 36, 40–44, 47, 49, 50, 52, 53, 55, 62, 63, 66–71, 73, 75, 77, 78, 80–89, 93, 94, 100, 101, 104, 106, 107, 113, 121, 122, 124, 125, 127, 129–133, 135–139, 141, 145, 148, 149	
<code>\l__enumext_vspace_above_viii_skip</code> 1797, 1801, 1803		<code>enumext</code> 30, 31, 35, 36, 40–44, 46–58, 61, 63–71, 73, 75, 77, 78, 80–86, 88, 89, 93, 94, 98–101, 104, 107, 110, 111, 116, 121, 123, 126, 127, 129, 132, 137, 139, 141, 144, 146, 148	
<code>\l__enumext_vspace_b_star_v_bool</code> . . . . .	1777	<code>keyans*</code> 30, 31, 33–37, 40–43, 47–50, 52, 53, 55, 62, 63, 66, 67, 76, 79, 80, 83, 92, 94, 96, 100, 104, 106, 113, 121, 123, 131, 132, 145, 147, 149	
<code>\l__enumext_vspace_b_star_vii_bool</code> . .	1810	<code>keyanspic</code> 30, 31, 33, 34, 37, 43, 48, 76, 79, 83, 92–96, 100, 113–118, 120, 147	
<code>\l__enumext_vspace_b_star_viii_bool</code> . .	1821	<code>keyans</code> 30, 31, 33, 34, 36, 37, 40, 41, 43, 44, 48–50, 52, 53, 55, 57, 61, 63–66, 76, 79, 80, 83, 92–97, 100, 102–104, 111, 113, 115–117, 119, 123, 133, 145, 147	
<code>\l__enumext_vspace_b_star_X_bool</code> . . . . .	88	<code>Environments:</code>	
<code>\__enumext_vspace_below:</code> 66, 110, 1748, 1748, 3990		<code>center</code> . . . . .	121
<code>\__enumext_vspace_below_v:</code> .	66, 1773, 1773, 4140	<code>description</code> . . . . .	100, 121
<code>\l__enumext_vspace_below_v_skip</code> . .	1775, 1779, 1781	<code>enumerate</code> . . . . .	121
<code>\__enumext_vspace_below_vii:</code> 67, 127, 1806, 1806, 4928		<code>flushleft</code> . . . . .	121
<code>\l__enumext_vspace_below_vii_skip</code> 1808, 1812, 1814		<code>flushright</code> . . . . .	121
<code>\__enumext_vspace_below_viii:</code> .	67, 1806, 1817, 5197	<code>itemize</code> . . . . .	121
<code>\l__enumext_vspace_below_viii_skip</code> 1819, 1823, 1825		<code>list</code> 35, 39, 50, 88, 100, 104, 108, 110, 113, 115–117, 121, 124	
<code>\__enumext_widest_from:nnNn</code> . .	49, 870, 870, 885, 904	<code>lrbox</code> . . . . .	130
<code>\g__enumext_widest_label_tl</code> 31, 44, 55, 611, 615, 619		<code>minipage</code> 35, 39, 41, 42, 55, 58, 59, 115, 118, 120, 121, 124, 130, 131	
<code>\l__enumext_wrap_label_opt_v_bool</code> . . . .	3626	<code>multicols</code> . . . . .	56–59, 64, 108, 109
<code>\l__enumext_wrap_label_opt_vii_bool</code> 128, 4988		<code>quotation</code> . . . . .	121
		<code>quote</code> . . . . .	121
		<code>tabbing</code> . . . . .	121

trivlist .....	121
verbatim .....	121
verse .....	121
exp commands:	
\exp_after:wN .....	5421
\exp_args:Ne 2046, 2109, 2152, 2200, 3170, 3857, 5409	
\exp_args:NV ... 2965, 3062, 3566, 3584, 3606, 5708	
\exp_not:N 43, 614, 740, 783, 797, 845, 1061, 1064, 1075, 1076, 1077, 1088, 1089, 1100, 1101, 2894, 2936, 2937, 3296, 3402, 3403, 5294, 5295, 5418	
\exp_not:n 278, 292, 305, 313, 321, 680, 700, 740, 741, 783, 797, 845, 1062, 1881, 1890, 2504, 2553, 2657, 2670, 2832, 2860, 2870, 2880, 2894, 2895, 3263, 3298, 3300, 4289, 5537, 5547, 5740, 5745	

F

\fbox .....	2560
\fboxrule .....	2560
\fboxsep .....	2560
file commands:	
\file_if_exist:nTF .....	3078
\file_input_stop: .....	6184
first .....	1114
font .....	633
\footnote .....	40
\footnote .....	40, 431, 461
\footnotemark .....	441, 471
\footnotesize .....	2937, 3403, 5295
\footnotetext .....	427
force-eol .....	3033
\foreachkeyans .....	19, 142, 5673

G

\getkeyans .....	19, 137, 5407
group commands:	
\group_begin: .....	2935, 2980, 3401, 5293, 5476
\group_end: .....	2942, 2996, 3409, 5300, 5485

H

\hbadness .....	5099, 5378
hbox commands:	
\hbox_overlap_left:n .....	2752, 3468, 5057
\hbox_set:Nn .....	603, 4352
\hbox_set_end: .....	5098, 5377
\hbox_set_to_wd:Nnw .....	5075, 5350
\hfill 663, 668, 674, 675, 1673, 1700, 2894, 3296, 4764, 4828	
hook commands:	
\hook_gput_code:nnn .....	5, 205, 209, 213, 376
\hook_gset_rule:nnnn .....	377
\hyperlink .....	87, 95
\hyperlink .....	2894, 3296
\hypertarget .....	40
\hypertarget .....	402

I

\IfDocumentMetadataT 4204, 4212, 4220, 4256, 4264, 4272, 4376, 4385, 4393, 4400, 4405, 4453, 4462, 4552, 4560, 4762, 4873, 4881, 5033, 5142, 5150	
\IfDocumentMetadataTF .. 493, 509, 523, 536, 3485, 3661, 4826	
\IfHyperBoolean .....	384
\IfPackageLoadedT .....	380
\IfPackageLoadedTF .....	7, 392
\ignorespaces .. 1064, 1077, 1089, 1101, 4365, 4878, 4961, 4994, 5017, 5024, 5070, 5090, 5147, 5205, 5239, 5268, 5345, 5365	

\inputlineno .....	278, 292, 305, 313, 321
int commands:	
\int_add:Nn .....	4672, 4721
\int_case:nn ... 1238, 1363, 2363, 2389, 2428, 2452	
\int_case:nnTF .....	233
\int_compare:nNnTF .. 557, 773, 787, 804, 811, 1333, 1352, 1506, 1524, 1636, 1655, 1667, 1695, 1896, 1903, 1912, 1923, 1938, 1944, 1955, 2036, 2057, 2078, 2091, 2114, 2130, 2158, 2174, 2205, 2209, 2476, 2482, 3004, 3008, 3012, 3020, 3132, 3136, 3140, 3178, 3198, 3236, 3241, 3246, 3271, 3386, 3836, 3847, 3876, 3889, 3905, 3920, 3935, 3976, 4052, 4056, 4084, 4109, 4125, 4324, 4436, 4440, 4642, 4652, 4668, 4691, 4701, 4717, 4891, 4895, 4939, 4949, 5101, 5113, 5163, 5175, 5380, 5392, 5591, 5723	
\int_compare_p:nNn ... 248, 258, 270, 271, 284, 285, 1642, 1643, 2234, 2235, 2369, 2395, 2777, 2787, 2799, 2800, 2815, 2856, 3886	
\int_decr:N .....	4671, 4720
\int_eval:n .. 363, 899, 2238, 2676, 2827, 2937, 3254, 3403, 4015, 4155, 4660, 4709, 4872, 5141, 5295	
\int_from_alph:n .....	864, 878
\int_from_roman:n .....	866, 880
\int_gadd:Nn .....	4673, 4722
\int_gdecr:N .....	2372, 2377, 2381, 2385, 2398
\int_gincr:N 2839, 3306, 3422, 3456, 3639, 3965, 4076, 4480, 4967, 5043, 5211, 5277	
\int_gset:Nn .....	439, 469, 2421
\int_gset_eq:NN .. 436, 466, 1959, 1972, 1981, 1989, 2001, 2013, 2022, 2029	
\int_gzero:N . 334, 335, 336, 1681, 1708, 2251, 2488, 3981, 4130, 5124, 5404	
\int_if_exist:NnTF 1918, 1929, 1957, 1987, 1999, 2027, 2150, 2326	
\int_incr:N 3019, 3388, 3835, 4047, 4323, 4890, 4966, 5162, 5210	
\int_mod:nn .....	5115, 5394
\int_new:N . 16, 17, 18, 19, 20, 21, 50, 75, 92, 114, 129, 141, 142, 153, 154, 155, 157, 168, 169, 177, 178, 179, 180, 181, 1920, 1931, 2329	
\int_set:Nn 860, 864, 866, 2109, 2120, 2136, 2142, 2152, 2164, 2180, 2186, 4546, 4547, 4587, 4618, 4641, 4647, 4663, 4690, 4696, 4712, 5099, 5378, 5587, 5725	
\int_set_eq:NN .....	3768, 3812, 4670, 4719
\int_sign:n .....	2423
\int_step_function:nnN .. 2124, 2127, 2168, 2171, 2207, 2793, 2806, 2820	
\int_step_function:nnnN .....	5729
\int_step_inline:nn .....	5639
\int_step_inline:nnn .....	4548
\int_to_roman:n . 217, 2109, 2111, 2150, 2152, 2154, 2197, 2202, 2246, 2773, 2810	
\int_use:N 356, 361, 362, 1334, 1353, 1668, 2046, 2111, 2122, 2138, 2154, 2166, 2182, 2188, 2201, 3789, 3858, 3906, 3915, 3930, 3936, 4015, 4155, 4645, 4646, 4658, 4694, 4695, 4707, 4872, 5141, 6076, 6080, 6086, 6090, 6167	
\int_zero:N .....	3391, 5105, 5384

iow commands:

\iow_char:N .....	3159, 3160
\iow_close:N .....	3103
\iow_new:N .....	109
\iow_now:Nn .....	3102
\iow_open:Nn .....	3101
\item 97, 102, 128, 130, 133, 136, 369, 2694, 2700, 2725, 2731,	

2853, 3273, 3276, 3474, 3643, 4380, 4381, 4875, 4877,  
5144, 5146, 5275

\item\* ..... 5, 17, 79, 3641

item-join ..... 2947, 3033

item-pos\* ..... 2947, 3033, 3537

item-star ..... 2947, 3033

item-sym\* ..... 2947, 3033, 3537

\itemindent ..... 105

\itemindent ..... 104

itemindent ..... 1008

\itemsep ..... 4369

\itemwidth . 573, 2560, 3999, 4005, 4144, 4150, 4681, 4685,  
4730, 4734

K

keyans ..... 16, 4157

keyans\* ..... 16, 5131

keyanspic ..... 17, 4371

Keys for \anskey provide by enumext:

break-col ..... 86, 88

force-eol ..... 90

item-join ..... 87, 88

item-pos\* ..... 87, 88

item-star ..... 87, 88

item-sym\* ..... 87, 88

overwrite ..... 90

write-env ..... 90

Keys for anskey\* provide by enumext:

break-col ..... 86, 88

force-eol ..... 90

item-join ..... 87, 88

item-pos\* ..... 87, 88

item-star ..... 87, 88

item-sym\* ..... 87, 88

overwrite ..... 90

write-env ..... 90

Keys for environments provide by enumext:

above\* ..... 32, 51, 65, 66, 109, 127

above ..... 32, 51, 65, 66, 109, 127, 132

after ..... 53, 54, 110, 127, 133

align ..... 32, 45, 96, 97, 99, 103, 129, 143

base-fix ..... 51, 68, 83, 107

before\* ..... 53, 54, 109, 127, 132

before ..... 53, 54

below\* ..... 32, 65-67, 110, 127

below ..... 32, 65-67, 110, 127, 133

check-ans 34, 35, 37, 75-79, 83, 93, 95, 110, 111, 127, 131,  
145

columns-sep ..... 55, 108, 131

columns ..... 32, 55, 65, 108

first ..... 53, 54, 130

font ..... 44, 99, 103, 119, 129

item-pos\* ..... 98, 100

item-sym\* ..... 33, 98, 100

itemindent ..... 32, 52, 98, 102, 104, 130

itemsep ..... 50, 106, 131

label-pos ..... 115, 117-119

label-sep ..... 115

labelsep ..... 44, 105, 129

labelwidth ..... 43, 44, 46-49, 105, 129

label ..... 31, 43, 44, 46, 48, 49, 116, 121

layout-sep ..... 115

layout-sty ..... 115, 120

layout-top ..... 115

lisparindent ..... 106

list-indent ..... 32, 52, 116

list-offset ..... 52, 110, 112

listparindent ..... 52, 130

mark-ans\* ..... 80, 83, 97

mark-ans ..... 80, 83, 88

mark-pos\* ..... 80, 83, 97

mark-pos ..... 33, 80, 83, 143

mark-ref ..... 80, 83, 85, 87

mark-sep\* ..... 80, 83, 96, 97

mark-sep ..... 33, 80, 83, 134

mini-env 32, 40-42, 55, 64, 65, 83, 109, 121, 123, 125, 127,  
132

mini-right\* ..... 32, 35, 55, 83, 124, 125, 127

mini-right ..... 32, 35, 55, 63, 83, 124, 125, 127

mini-sep ..... 32, 55, 83, 109

mode-box ..... 44, 98-100, 103

no-store ..... 34, 75-77, 83, 89, 91, 98

noitemsep ..... 50

nosep ..... 50

overwrite ..... 33, 91

parindent ..... 106

parsep ..... 50, 106, 116, 130

partopsep ..... 50

ref ..... 31, 46-48, 104, 145

resume\* ..... 31, 67, 68, 73, 75, 76, 83, 110, 127, 139

resume ... 31, 38, 67-73, 75, 76, 83, 110, 127, 139, 149

rightmargin ..... 52, 121

save-ans 33, 38, 68, 69, 72, 73, 75, 77, 78, 81-83, 89, 92,  
93, 95, 102, 111, 118, 129, 132-134, 137, 139, 145

save-key ..... 33, 68, 82, 83, 107, 126

save-pos ..... 83

save-ref ..... 34, 40, 80, 83, 85-87, 94, 95, 102, 134

save-sep ..... 80, 83, 93, 134

series ... 31, 67-69, 71, 73, 83, 107, 110, 126, 127, 139

show-ans ..... 33, 80, 83, 85, 86, 88, 96, 97, 119, 134

show-length ..... 36, 53, 104, 144, 145

show-pos ..... 33, 80, 85, 86, 88, 96, 119, 134

start\* ..... 32, 48, 49, 68

start ..... 32, 36, 48, 49, 68

store-key ..... 81

topsep ..... 50, 51, 116

widest ..... 31, 36, 49

wrap-ans\* ..... 34, 80, 83, 102, 103, 119

wrap-ans ..... 43, 80, 83, 85, 87

wrap-label\* ... 32, 44, 98, 99, 102, 103, 128, 129, 134

wrap-label 32, 44, 98, 99, 102, 103, 116, 119, 128, 129, 134

wrap-opt ..... 80, 83, 96, 102, 119

wrap-sep ..... 87

write-env ..... 33, 91

keys commands:

\keys\_define:nn 625, 635, 657, 692, 708, 754, 819, 888,  
914, 930, 972, 1010, 1033, 1107, 1116, 1195, 1212,  
1719, 1830, 1846, 1857, 2274, 2334, 2493, 2528, 2616,  
2621, 2947, 3033, 3539, 3555, 3578, 3598, 4278, 5435,  
5549, 5665, 5673

\keys\_if\_exist\_p:nn ..... 5661, 5662

\l\_keys\_key\_str 89, 90, 2965, 3062, 3566, 3584, 3606,  
5708, 5820

\keys\_precompile:nnN .. 138, 200, 200, 5437, 5443,  
5449, 5455, 5461, 5467, 5691

\keys\_set:nn . 649, 989, 1001, 1218, 1724, 1729, 2046,  
2067, 2200, 2214, 2564, 2565, 2569, 2570, 2574, 2575,  
2579, 2580, 2584, 2585, 2589, 2590, 2985, 3114, 3849,  
3857, 4063, 4296, 4298, 4300, 4302, 4304, 4306, 4308,  
4310, 4312, 4314, 4334, 4908, 5184, 5553, 5558, 5559,

5560, 5561, 5564, 5569, 5570, 5571, 5572, 5573, 5574, 5575, 5607, 5717

keyval commands:

\keyval\_parse:NNn ..... 1870, 2646, 5525

L

label ..... 706, 752, 819

label-pos ..... 4278

label-sep ..... 4278

Labels provide by enumext:

\Alph\* ..... 43, 44

\Roman\* ..... 43, 44

\alph\* ..... 43, 44

\arabic\* ..... 43, 44

\roman\* ..... 43, 44

labelsep ..... 633

\labelwidth ..... 44

labelwidth ..... 633

\lastnodetype ..... 233

layout-sep ..... 4278

layout-sty ..... 4278

layout-top ..... 4278

\leftmargin ..... 105

\leftmargin ..... 104, 4364

legacy commands:

\legacy\_if:nTF ..... 5028, 5031, 5328, 5331

\legacy\_if\_gset\_false:n ..... 563, 4777

\legacy\_if\_set\_false:n ..... 5030, 5330

\legacy\_if\_set\_true:n ..... 4993, 5016, 5023, 5037, 5238, 5267

\linewidth ..... 109

\linewidth 3960, 3999, 4073, 4144, 4545, 4590, 4621, 4743, 4808

\list ..... 367

list-indent ..... 1008

list-offset ..... 1008

\listparindent ..... 4367

listparindent ..... 1008

M

\makebox ..... 121

\makebox ..... 2754, 3521, 3711, 4470, 4483, 5061, 5340

\makelabel ..... 97, 99, 103, 121

\makelabel ..... 97, 102, 3501, 3517, 3695, 3707

mark-ans ..... 2526, 4278

mark-ans\* ..... 2491, 2526

mark-pos ..... 2526, 4278

mark-pos\* ..... 2491, 2526

mark-ref ..... 2526

mark-sep ..... 2526, 4278

mark-sep\* ..... 2491, 2526

midpenalty ..... 912

mini-env ..... 1193

mini-sep ..... 1193

\minipage ..... 373

\miniright ..... 11, 63, 1634, 1685, 1712, 3979, 4128

mode commands:

\mode\_if\_math:TF ..... 3028, 3151

\mode\_if\_vertical:TF ..... 1272, 1300, 1320, 1344, 1495, 1516

\mode\_leave\_vertical: ..... 987, 998, 1061, 1075, 2750, 3466, 5055

mode-box ..... 623

msg commands:

\msg\_error:nn .. 1687, 1714, 2989, 3022, 3026, 3118, 3149, 4054, 4058, 4326, 4383, 4438, 4893, 5165, 5177, 5576, 5635

\msg\_error:nnn 731, 777, 791, 839, 1638, 1645, 1652, 1683, 1710, 2050, 2071, 2238, 2299, 2971, 3030, 3068, 3130, 3134, 3138, 3142, 3153, 3572, 3590, 3612, 4897, 5170, 5423, 5432, 5518, 5623, 5654, 5663, 5700, 5721

\msg\_error:nnnn 2974, 3002, 3006, 3010, 3014, 3071, 3575, 3593, 3615, 4045, 4434, 4442, 5160, 5497, 5703

\msg\_error:nnnnn ..... 679, 699, 2503, 2552, 4288

\msg\_fatal:nn ..... 3837

\msg\_fatal:nnn ..... 577

\msg\_info:nnn ..... 9, 12, 382, 394

\msg\_line\_context: .. 5780, 5785, 5790, 5795, 5824, 5829, 5834, 5849, 5864, 5868, 5872, 5876, 5880, 5884, 5891, 5898, 5904, 5918, 5922, 5927, 5931, 5935, 5939, 5944, 5948, 5952, 5956, 5961, 6008, 6012, 6017, 6022, 6026, 6031, 6107, 6111, 6116, 6121, 6126, 6130, 6134, 6138, 6142, 6146, 6150, 6154, 6158, 6163, 6168

\msg\_log:nnn ..... 2318, 2323, 2328

\msg\_log:nnnnn ..... 360, 2461, 2466, 2471

\msg\_log:nnnnnn ..... 352

\msg\_new:nnn 5748, 5752, 5756, 5760, 5765, 5778, 5782, 5787, 5792, 5797, 5806, 5814, 5818, 5822, 5827, 5832, 5847, 5862, 5866, 5870, 5874, 5878, 5882, 5886, 5895, 5901, 5907, 5911, 5915, 5920, 5925, 5929, 5933, 5937, 5942, 5946, 5950, 5954, 5959, 5994, 5998, 6002, 6006, 6010, 6015, 6020, 6024, 6029, 6105, 6109, 6114, 6119, 6124, 6128, 6132, 6136, 6140, 6144, 6148, 6152, 6156, 6160, 6165, 6173

\msg\_new:nnnn .. 5769, 5964, 5973, 5982, 5988, 6033, 6043, 6053, 6063, 6073, 6083, 6093, 6099, 6170, 6175, 6178, 6181

\msg\_term:nnnn . 2283, 2288, 3778, 3788, 3821, 3826

\msg\_term:nnnnn ..... 2442

\msg\_warning:nn ..... 3978, 4127

\msg\_warning:nnn ..... 3082, 3086, 3091

\msg\_warning:nnnn 2479, 2485, 3725, 3730, 4644, 4657, 4693, 4706

\msg\_warning:nnnnn ..... 2437, 2447

\multicolsep ..... 108

\multicolsep ..... 1337, 1509, 3926, 4100

N

\NeedsTeXFormat ..... 3

\NewCommandCopy ..... 369

\newcounter ..... 580

\NewDocumentCommand 1634, 2218, 2977, 4430, 5407, 5474, 5583, 5632, 5710

\NewDocumentEnvironment . 3107, 4018, 4157, 4371, 4861, 5131

\newlabel ..... 40

\newlabel ..... 414

no-store ..... 2332

\noindent ..... 3967, 4752, 4817, 5104, 5383

\nointerlineskip 1346, 1349, 1518, 1521, 1675, 1702, 4752, 4817

noitemsep ..... 928

\nopagebreak 1283, 1311, 1346, 1349, 1518, 1521, 1625, 1631

\normalfont ..... 2936, 3402, 5294

nosep ..... 928

O

\obeyedline ..... 3159, 3160

overwrite ..... 3033

P

Packages:

caption	124
enumext	30, 43, 46, 75, 80, 100, 104, 115, 143, 144
enumitem	43
expl3	121
footnotehyper	39, 41, 42
hyperref	34, 35, 39, 40, 87, 95, 129, 143
latex-lab-block	39
ltxcmd	39, 90
ltsockets	113
lua-visual-debug	58
multicol	30, 143
scontents	90
shortlst	121, 126, 130
tagpdf	113

\par . . 1283, 1311, 1349, 1521, 1625, 1631, 1670, 1675, 1697, 1702, 2902, 3943, 4115, 4133, 4416, 4419, 4565, 4779, 4794, 4840, 4854, 5104, 5383

para commands:

\para_end:	5121, 5401
------------	------------

\parbox . . . . . 2560

\parindent . . . . . 5086, 5361

\parsep . . . . . 56, 116

\parsep . . . . . 988, 3813, 4348, 4357

parsep . . . . . 928

\parskip . . . . . 5087, 5362

\partopsep . . . . . 3814, 4131, 4368

partopsep . . . . . 928

peek commands:

\peek_meaning:Ntf	4972, 4986, 5001, 5012, 5216, 5231, 5247
\peek_meaning_remove:Ntf	4979, 5223
\peek_remove_spaces:n	3648

\phantomsection . . . . . 40

\phantomsection . . . . . 403

prg commands:

\prg_do_nothing:	407
\prg_new_protected_conditional:Npnn	219, 3074
\prg_replicate:nn	228
\prg_return_false:	223, 3087, 3095
\prg_return_true:	222, 3083, 3092

\printkeyans . . . . . 20, 137, 5474

prop commands:

\prop_const_from_keyval:Nn	5624
\prop_count:N	354, 2676, 2827, 2939, 3254, 3405, 5297, 5726
\prop_get:NnNtf	5650
\prop_gput_if_not_in:Nnn	2674
\prop_if_exist:Ntf	2316, 5427, 5719
\prop_item:Nn	5429, 5743
\prop_new:N	2319

\ProvidesExplPackage . . . . . 4

R

\raggedcolumns . . . . . 3929, 4103

\raisebox . . . . . 4507

\ref . . . . . 85, 94

ref . . . . . 706, 752, 819

\refstepcounter . . . . . 5040, 5333

regex commands:

\regex_if_match:nnTF	221, 863, 865, 877, 879
----------------------	-------------------------

\renewcommand . . . . . 740, 783, 797, 845

\RenewDocumentCommand . 431, 461, 1685, 1712, 3159, 3474, 3501, 3517, 3643, 3695, 3707, 4381

\RequirePackage . . . . . 13

\resetenumext . . . . . 11, 74, 2218

resume . . . . . 1828

resume\* . . . . . 1828

rightmargin . . . . . 1008

\Roman . . . . . 44, 48, 49

\Roman . . . . . 599

\roman . . . . . 44, 48, 49

\roman . . . . . 600, 724, 5459

S

save-ans . . . . . 2272

save-key . . . . . 2614

save-ref . . . . . 2526

save-sep . . . . . 2491, 2526, 4278

scan commands:

\scan_stop:	4380, 4875, 5144, 5418, 5421
-------------	------------------------------

seq commands:

\seq_clear:N	5585, 5728
\seq_const_from_clist:Nn	5578
\seq_count:N	355, 4571, 5589
\seq_gclear:N	456, 457, 486, 487
\seq_gput_right:Nn	442, 443, 472, 473, 2683
\seq_if_empty:Ntf	449, 479, 5491, 5603
\seq_if_exist:Ntf	2321, 5489
\seq_if_in:NnTF	5495
\seq_item:Nn	4558
\seq_map_function:NN	5594
\seq_map_inline:Nn	5504, 5512, 5604, 5605
\seq_map_pairwise_function:NNN	451, 481
\seq_new:N	115, 116, 118, 139, 170, 171, 172, 173, 2324
\seq_pop_left:NN	5593
\seq_put_right:Nn	4444, 5601, 5617, 5738
\seq_set_from_clist:Nn	5586
\seq_set_map_e:NNn	5595
\seq_use:Nn	200, 201, 5734

series . . . . . 1828

\setcounter . . 874, 878, 880, 4013, 4155, 4413, 4872, 5141

\setenumext . . . . . 6, 139, 5583

\setenumextmeta . . . . . 6, 141, 5624

show-ans . . . . . 2491, 2526, 4278

show-length . . . . . 1105

show-pos . . . . . 2491, 2526, 4278

skip commands:

\skip_add:Nn	1243, 1252, 1261, 1274, 1278, 1302, 1306, 1322, 1380, 1382, 1396, 1399, 1420, 1422, 1436, 1439, 1459, 1461, 1475, 1478, 1497, 1546, 1547, 1558, 1560, 4357, 4366
\skip_gset:Nn	1573, 1577, 1581
\skip_gzero_new:N	1568, 1569
\skip_horizontal:N	1076, 1088, 1100, 5058, 5070, 5108, 5345, 5387
\skip_horizontal:n	1062, 2751, 2759, 3467, 3469, 4488, 4957, 5056, 5090, 5201, 5365
\skip_if_eq:nnTF	1241, 1250, 1259, 1366, 1406, 1446, 1534, 1570, 1592, 1736, 1750, 1764, 1775, 1786, 1797, 1808, 1819
\skip_new:N	69, 70, 71, 76, 77, 78, 79, 80, 81, 192
\skip_set:Nn	1226, 1230, 1288, 1292, 1316, 1369, 1370, 1388, 1409, 1410, 1428, 1448, 1449, 1467, 1491, 1537, 1538, 1552, 1572, 1576, 1594, 1598, 1602, 1608, 1612, 1616, 4341
\skip_set_eq:NN	1327, 1328, 1330, 1337, 1502, 1503, 1504, 1509, 3766, 3810, 3813, 5087, 5362



<code>\skip_sub:Nn</code>	1376, 1378, 1392, 1394, 1416, 1418, 1432, 1434, 1455, 1457, 1471, 1473, 1544, 1545, 1556, 1557
<code>\skip_use:N</code>	1228, 1232, 1276, 1280, 1284, 1304, 1308, 1318, 1324, 1737, 1741, 1744, 1751, 1755, 1758, 3943
<code>\skip_vertical:N</code>	564, 567, 1000, 4778, 4792, 5123, 5403
<code>\skip_vertical:n</code>	999, 5122, 5402
<code>\skip_zero:N</code>	1336, 1350, 1488, 1489, 1490, 1508, 1522, 3814, 3926, 4100, 4368, 4369
<code>\skip_zero_new:N</code>	1567, 1589, 1590, 1591
<code>\c_zero_skip</code>	564, 567, 1000, 1241, 1250, 1259, 1407, 1446, 1570, 1592, 1737, 1751, 1764, 1775, 1786, 1797, 1808, 1819, 4778, 4792, 5123, 5403
<code>\small</code>	5442, 5448, 5454, 5460, 5466, 5472
<code>\smash</code>	3519, 3709
socket commands:	
<code>\socket_assign_plug:nn</code>	4206, 4214, 4222, 4258, 4266, 4274
<code>\socket_new:nn</code>	4176, 4226
<code>\socket_new_plug:nnn</code>	4177, 4185, 4193, 4227, 4235, 4244
<code>\socket_use:n</code>	4259, 4267, 4275
<code>\socket_use:nn</code>	4207, 4215, 4223
<code>start</code>	886
<code>start*</code>	886
<code>start-list-tags</code>	4176, 4226
<code>\stepcounter</code>	435, 465, 4351, 4500
<code>stop-list-tags</code>	4176, 4226
<code>stop-start-tags</code>	4176, 4226
str commands:	
<code>\c_backslash_str</code>	3030, 5785, 5790, 5795, 5800, 5802, 5804, 5809, 5811, 5909, 5913, 5917, 5927, 5931, 5939, 5940, 5944, 5956, 5957, 5961, 5962, 5983, 5985, 5989, 5991, 6031, 6094, 6096, 6100, 6102, 6111, 6112, 6116, 6121, 6122, 6126, 6130, 6134
<code>\c_circumflex_str</code>	111
<code>\c_colon_str</code>	2826, 3253, 5418
<code>\c_left_brace_str</code>	5890, 5897, 5903
<code>\c_percent_str</code>	111
<code>\c_right_brace_str</code>	5890, 5897, 5903
<code>\str_case:nn</code>	241, 298, 3346
<code>\str_case:nnTF</code>	1877, 1885, 2653, 2661, 5532, 5541
<code>\str_clear:N</code>	3846, 4907
<code>\str_const:Nn</code>	110
<code>\str_count:n</code>	228
<code>\str_if_empty:NTF</code>	1894, 1970, 1977, 2011, 2018
<code>\str_if_eq:nnTF</code>	2230, 3770, 3817, 5634
<code>\str_if_in:nnTF</code>	5414
<code>\str_new:N</code>	72, 124, 125, 126, 144, 187
<code>\str_set:Nn</code>	664, 670, 676, 695, 696, 697, 2499, 2500, 2501, 2548, 2549, 2550, 4283, 4286
<code>\str_set_eq:NN</code>	3369, 5285, 5302
<code>\str_use:N</code>	3523
<code>\strut</code>	3519, 3709
<code>\strutbox</code>	1355, 1358, 1369, 1370, 1381, 1383, 1398, 1401, 1409, 1410, 1421, 1423, 1438, 1441, 1448, 1449, 1460, 1462, 1477, 1480, 1526, 1529, 1537, 1538, 1546, 1547, 1559, 1561, 1572, 1573, 1576, 1583, 1596, 1604, 1610, 1618, 4360, 4366, 4416, 4424, 4513

T

tag commands:	
<code>\tag_mc_begin:n</code>	4183, 4233, 4242
<code>\tag_mc_begin_pop:n</code>	4199, 4251, 4408, 4410
<code>\tag_mc_end:</code>	4187, 4237, 4246

<code>\tag_mc_end_push:</code>	4180, 4230, 4396
<code>\tag_resume:n</code>	4179, 4229, 4387, 4395, 4464, 4562, 4762, 4826
<code>\tag_struct_begin:n</code>	4181, 4182, 4189, 4190, 4191, 4231, 4232, 4239, 4240, 4241, 4397
<code>\tag_struct_end:n</code>	4188, 4195, 4196, 4197, 4198, 4238, 4247, 4248, 4249, 4250, 4407, 4409, 4881, 5150
<code>\tag_suspend:n</code>	4200, 4252, 4378, 4389, 4402, 4455, 4554, 4873, 5142
<code>\tag_tool:n</code>	4388
TeX and L <sup>A</sup> T <sub>E</sub> X 2 <sub>ε</sub> commands:	
<code>\@auxout</code>	412
<code>\@currentenv</code>	241, 298
<code>\protected@write</code>	412
tex commands:	
<code>\tex_scantokens:D</code>	202
text commands:	
<code>\text_expand:n</code>	5410
<code>\textasteriskcentered</code>	2496, 2543
<code>\textborn</code>	3543
<code>\textreferencemark</code>	2531
<code>\thepage</code>	418
tl commands:	
<code>\c_space_tl</code>	3325, 3338, 5834, 5849, 5872, 5876, 6075, 6076, 6085, 6086, 6146, 6150, 6168
<code>\tl_clear:N</code>	662, 669, 2081, 2094, 2489, 2600, 2610, 2631, 2639, 2846, 3197, 3270, 5253
<code>\tl_clear_new:N</code>	609
<code>\tl_const:Nn</code>	593
<code>\tl_gclear:N</code>	346, 347, 348, 1940, 1946, 3512, 3532, 4798, 4858, 5059
<code>\tl_gclear_new:N</code>	1914, 1925
<code>\tl_gput_right:Nn</code>	594
<code>\tl_greplace_all:Nnn</code>	615
<code>\tl_gset:Nn</code>	275, 276, 289, 290, 1915, 1926, 1941, 1947, 2315, 3443, 5007
<code>\tl_gset_eq:NN</code>	611, 3439, 5052
<code>\tl_if_blank:NTF</code>	2969, 2987, 3066, 3116, 3570, 3588, 3610, 5050, 5698
<code>\tl_if_empty:NTF</code>	729, 747, 775, 789, 806, 813, 837, 851, 1975, 1979, 2016, 2020, 2083, 2096, 2197, 2211, 2294, 2353, 2690, 2721, 2866, 3180, 3207, 3280, 3318, 3331, 3464, 4569, 5256, 5615
<code>\tl_if_empty:nTF</code>	2038, 2059
<code>\tl_if_exist:NTF</code>	2043, 2064
<code>\tl_if_novalue:NTF</code>	433, 463, 2225, 2983, 3112, 3205, 3278, 3311, 3418, 3437, 3445, 3620, 3844, 4332, 4905, 5182, 5254
<code>\tl_map_inline:Nn</code>	612
<code>\tl_new:N</code>	29, 30, 31, 34, 37, 38, 41, 42, 46, 51, 52, 56, 57, 93, 94, 95, 101, 102, 103, 104, 105, 106, 108, 112, 113, 117, 119, 120, 121, 130, 133, 134, 151, 160, 161, 162, 165, 186
<code>\tl_put_left:Nn</code>	2698, 2729, 2851, 4782, 4843, 5272, 5275
<code>\tl_put_right:Nn</code>	610, 843, 2702, 2733, 2780, 2790, 2803, 2818, 2824, 2829, 2853, 2858, 2865, 2868, 2878, 2883, 2886, 2892, 3165, 3200, 3203, 3209, 3211, 3238, 3243, 3248, 3251, 3260, 3273, 3276, 3282, 3284, 3294, 5258, 5259
<code>\tl_remove_all:Nn</code>	5614
<code>\tl_remove_once:Nn</code>	2768, 3223
<code>\tl_replace_all:Nnn</code>	614, 3160, 5649
<code>\tl_reverse:N</code>	2767, 2769, 3222, 3224
<code>\tl_set:Nn</code>	43, 245, 255, 302, 303, 310, 311, 318, 319,

579, 663, 668, 674, 675, 728, 738, 772, 781, 795, 836, 1059, 1073, 1086, 1098, 2082, 2095, 2293, 2601, 2611, 2632, 2640, 2933, 3052, 3158, 3313, 3399, 3558, 4317, 5261, 5291, 5612, 5648, 5718	\unskip . . . . . 235
\tl_set_eq:NN . . . 620, 734, 780, 794, 842, 2766, 3221, 3234, 3367, 5284	use commands:
\tl_to_str:n . . . . . 2043, 2047, 2064, 2068, 5410	\use:N . . . . . 229, 3508, 3529, 4027
\tl_trim_spaces:n . . . 610, 5601, 5612, 5618, 5634	\use:n . . . . . 1868, 2644, 5416, 5523
\tl_use:N 616, 619, 749, 808, 815, 853, 1131, 1135, 1139, 1143, 1147, 1151, 1155, 1159, 1163, 1167, 1171, 1175, 1179, 1183, 1187, 1191, 2756, 2773, 2781, 2792, 2805, 2810, 2821, 3426, 3432, 3460, 3503, 3505, 3511, 3526, 3623, 3627, 3634, 3697, 3700, 3702, 3715, 4025, 4163, 4485, 4493, 4789, 4850, 5063, 5091, 5092, 5342, 5366, 5371, 5478, 5479, 5480, 5481, 5482, 5500, 5597, 5716	\use_none:nn . . . . . 406, 5655
token commands:	\usecounter . . . . . 3769, 3815
\token_to_str:N . . . . . 414	
\topsep . . . . . 4131, 4366	<b>V</b>
topsep . . . . . 928	\value . . . . . 1960, 2002, 2014, 2022, 2030
\topskip . . . . . 1336, 1508	vbox commands:
	\vbox_set:Nn . . . . . 4457
<b>U</b>	\vbox_set_top:Nn . . . . . 4787, 4848
\unkern . . . . . 236	\vspace 988, 1741, 1744, 1755, 1758, 1768, 1770, 1779, 1781, 1790, 1792, 1801, 1803, 1812, 1814, 1823, 1825
unknown . . . . . 2947, 3033, 3553, 3578, 3596	
	<b>W</b>
	widest . . . . . 886
	wrap-ans . . . . . 2526
	wrap-ans* . . . . . 2491, 2526, 4278
	wrap-label . . . . . 633
	wrap-label* . . . . . 633
	wrap-opt . . . . . 2491, 2526, 4278
	write-env . . . . . 3033