enumext

ENUMERATE EXERCISE SHEETS

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CTAN: https://www.ctan.org/pkg/enumext
https://github.com/pablgonz/enumext

Abstract

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

Contents

1 Introduction . . . 1
1.1 Description and usage . . . 2
1.2 The concept of left margin . . . 3
1.3 User interface . . . 3
1.3.1 Internal counters . . . 3
1.3.2 Public dimension . . . 3
1.3.3 Support for multicol . . . 4
1.3.4 Support for minipage . . . 4
1.3.5 The \label and \ref system . . . 4
1.3.6 Support for \footnote . . . 4
2 The environments provided . . . 5
2.1 The environment enumext . . . 5
2.2 The environment enumext* . . . 5
2.3 The command \item* . . . 5
2.3.1 Keys for \item* . . . 6
2.4 The command \item in enumext* . . . 6
3 The command \setenumext . . . 6
4 The command \setenumextmeta . . . 6
5 The keyval system . . . 7
5.1 Keys for label and ref . . . 7
5.2 Keys for spaces . . . 8
5.2.1 Vertical spaces . . . 8
5.2.2 Horizontal spaces . . . 9
5.3 Keys for add code . . . 9
5.4 Keys for start, series and resume . . . 10
5.5 Keys for multicols . . . 10
5.6 Keys for minipage . . . 11
5.6.1 The command \miniright . . . 11
5.6.2 The key mini-right . . . 11
6 The storage system . . . 11
6.1 Keys for storage system . . . 11
6.1.1 Keys for label and ref . . . 12
6.1.2 Keys for wrap and marks . . . 12
6.1.3 Keys for debug and checking . . . 13
6.2 The command \anskey . . . 13
6.2.1 Keys for \anskey . . . 14
6.3 The environment anskey* . . . 14
6.3.1 Keys for anskey* . . . 14
6.4 The environment keyans . . . 15
6.4.1 The \item* in keyans . . . 16
6.5 The environment keyanspic . . . 16
6.5.1 Keys for keyanspic . . . 17
6.5.2 The command \anspic . . . 17
6.6 Printing stored content . . . 18
6.6.1 The command \getkeyans . . . 18
6.6.2 The command \foreachkeyans . . . 18
6.6.3 The command \printkeyans . . . 19
7 Full examples . . . 20
8 Tagged PDF examples . . . 23
9 The way of non-enumerated lists . . . 23
10 References . . . 25
11 Change history . . . 26
12 Index of Documentation . . . 27
13 Implementation . . . 29
14 Index of Implementation . . . 147

Motivation and acknowledgments

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

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

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

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

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License and Requirements

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

The enumext package loads and requires multicol[3] and scontents[4] packages, need to have a modern TEX distribution such as TEX Live or MiKTEX. It has been tested with the standard classes provided by LATEX: book, report, article and letter on 10pt, 11pt and 12pt.

The minimum requirement is LATEX release 2024-11-01.

1 Introduction

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

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

1. Factor $x^2 - 2x + 1$
2. Factor $3x + 3y + 3z$
3. True False
   (a) $\alpha > \delta$
   (b) LATEX2e 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) LATEX2e is cool?
      * Very True!
4. Related to Linux

(a) You use linux?
   * Yes
(b) Usually uses the package manager?
   * Yes, dnf
(c) Rate the following package and class
   i. xsim-exam
      * doesn't exist for now :(
   ii. xsim
      * very good
   iii. exsheets
      * obsolete

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

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

Or we are interested in printing all the *"answers"*:

1. $(x-1)^2$ ※
2. $3(x+y+z)$ ※
3. (a) False ※
   (b) Very True! ※
4. (a) Yes ※

(b) Yes, dnf ※
(c) i. doesn't exist for now :(※
   ii. very good ※
   iii. obsolete ※

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

1. First type of questions

   A) value
   B) correct
   C) value
   D) value

2. Second type of questions

   I. $2\alpha + 2\delta = 90°$
   II. $\alpha = \delta$
   III. $\angle EDF = 45°$

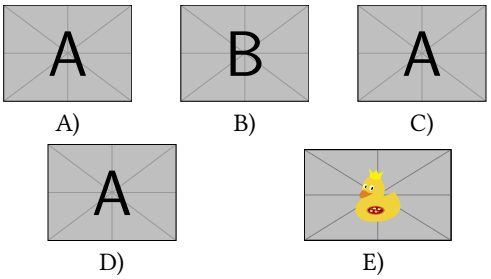
   A) I only
   B) II only
   C) I and II only
   D) I and III only
   E) I, II, and III

⋆ 3. Third type of questions

   (1) $2\alpha + 2\delta = 90°$
   (2) $\angle EDF = 45°$

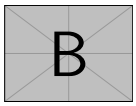
   A) value
   B) value
   C) value
   D) value
   E) value

4. Question with image and label below:



5. Question with image on right side:

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



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

1. B), $x = 5$ ※
2. D) ※
3. C), some note ※
4. E), A duck ※
5. D), "other note" ※

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 LaTeX, but *"does not redefine"* any internal commands associated with it such as `\list`, `\endlist` or `\item` outside of the *"scope"* in which they are defined.

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

This package can be used with `xelatex`, `lualatex`, `pdflatex` and the classical `latex»dvips»ps2pdf` and is present in TeX Live and MiKTeX, 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`.

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

The package is loaded in the usual way:

```
\usepackage{enumext}
```

1.2 The concept of left margin

There is a direct relationship between the parameters `\leftmargin`, `\itemindent`, `\labelwidth` and `\labelsep` plus an *"extra space"* that makes it difficult to obtain the desired *horizontal spaces* in a `list` environment. Usually we don't want the `list` to go beyond the left margin of the page, but since these four values are related, that causes a problem.
The `enumitem`[6] package adds the `\labelindent` parameter to solve some of these problems. A simplified representation of this in the figure 1.

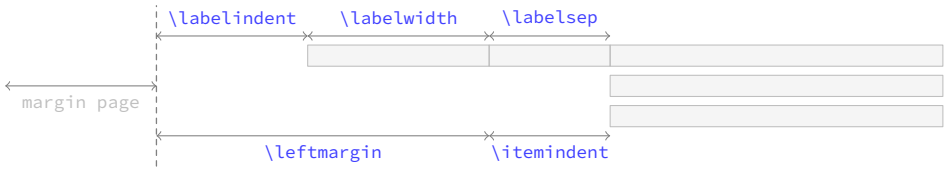


Figure 1: Representation of horizontal lengths in `enumitem`.

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

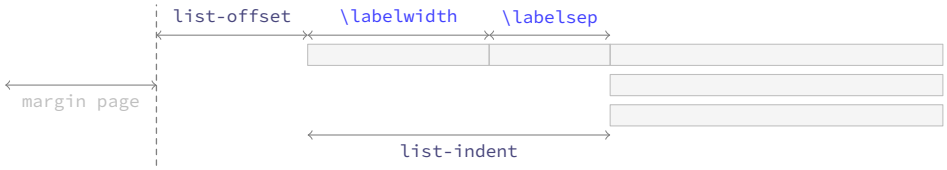


Figure 2: Representation of horizontal lengths concept in enumext.

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

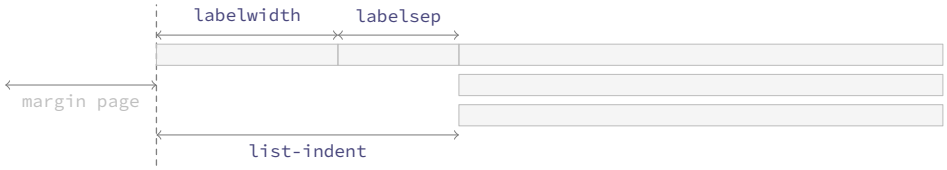


Figure 3: Default horizontal lengths `list-offset=0pt`, `list-indent=\labelwidth+\labelsep` in enumext.

1.3 User interface

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

1.3.1 Internal counters

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

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

1.3.2 Public dimension

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

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

1.3.3 Support for multicol

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

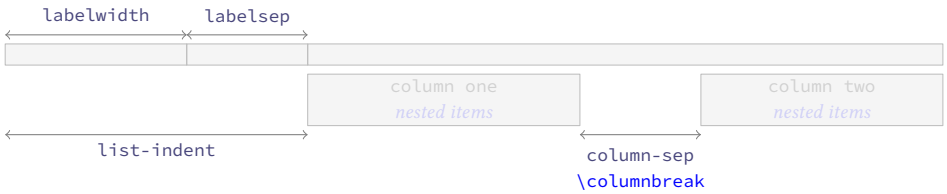


Figure 4: Representation of the two column output for a nested level in enumext environment.

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

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

1.3.4 Support for minipage

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

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

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

1.3.5 The \label and \ref system

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

1.3.6 Support for \footnote

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

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

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

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

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

2 The environments provided

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

enumext
enumext*

```
\begin{enumext}[⟨keyval list⟩]
  \item ⟨item content⟩
  \item [⟨custom⟩] ⟨item content⟩
  \item*[⟨symbol⟩][⟨offset⟩] ⟨item content⟩
\end{enumext}
```

```
\begin{enumext*}[⟨keyval list⟩]
  \item ⟨item content⟩
  \item [⟨custom⟩] ⟨item content⟩
  \item*[⟨symbol⟩][⟨offset⟩] ⟨item content⟩
\end{enumext*}
```

2.1 The environment enumext

The enumext is an environment that works in the same way as the standard enumerate environment provided by 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 second level.
      i. This text is in the third level.
   A. This text is in the fourth level.
   X This text is in the first level.
   ⋆ 2. This text is in the first level.

2.2 The environment enumext*

The enumext* is a *horizontal list environment* similar to the shortenumerate or tasks environments provided by the shortlst[15] and tasks[16] packages, \item and \item[⟨*custom*⟩] work as usual. The options can be configured globally using \setenumext command and locally using [⟨*key* = *val*⟩] in the environment.

Some considerations to take into account for this environment:

- The environment cannot be nested within itself or in the environment keyans*, but it can be nested within enumext and vice versa.
- Each *"item content"* in the environment is placed within a minipage environment whose *width* is stored in the dimension \itemwidth that NOT includes labelwith, 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.

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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 The eighth item is way too long for this and needs two columns (196.17749pt)
9. The ninth
Z The tenth (89.28171pt)

3 The command \setenumext

\setenumext

\setenumext{⟨*key = val*⟩}
\setenumext[⟨*enumext, level*⟩]{⟨*key = val*⟩}
\setenumext[⟨*enumext**⟩]{⟨*key = val*⟩}
\setenumext[⟨*keyans*⟩]{⟨*key = val*⟩}
\setenumext[⟨*keyans**⟩]{⟨*key = val*⟩}
\setenumext[⟨*print, level*⟩]{⟨*key = val*⟩}
\setenumext[⟨*print, **⟩]{⟨*key = val*⟩}
\setenumext[⟨*print**⟩]{⟨*key = val*⟩}

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

\setenumextmeta

\setenumextmeta {⟨*key name*⟩}{⟨*key-one = val, key-two = val, ...*⟩}
\setenumextmeta*{⟨*key name*⟩}{⟨*key-one = val, key-two = val, ...*⟩}
\setenumextmeta [⟨*enumext**⟩]{⟨*key name*⟩}{⟨*key-one = val, key-two = val, ...*⟩}
\setenumextmeta [⟨*enumext, level*⟩]{⟨*key name*⟩}{⟨*key-one = val, key-two = val, ...*⟩}

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.

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5 The keyval system

The ⟨*key = val*⟩ 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 ⟨*key*⟩ is different from ⟨*key=*⟩.

All ⟨*keys*⟩ 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 ⟨*keys*⟩ 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 ⟨*key*⟩ 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 ⟨*value forbidden*⟩ default: *not used*

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

This key is intended for compatibility with *tagged* PDF and is forcibly *"enabled"* when \DocumentMetadata is present. If you want to get the same document output whether \DocumentMetadata is active or not, you must enable this key.

In the enumext* and keyans* environments \makelabel are redefined using \makebox by default. If enumext or keyans is used in the enumext* environment the key must be activated manually.

label = {⟨\alph* | \Alph* | \arabic* | \roman* | \Roman*⟩} default: *by levels*

Sets the ⟨*label*⟩ 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 (\alph*), 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 ⟨*label*⟩ 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 ⟨*label*⟩ as an argument, for example \emph{⟨\alph*⟩} will return an error. For full customization of how ⟨*label*⟩ is displayed use the font, wrap-label and/or wrap-label* keys.

labelsep = {⟨*rigid length*⟩} default: 0.3333em

Sets the *horizontal space* between the box containing the current ⟨*label*⟩ 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 = {⟨*rigid length*⟩} default: *by label*

Sets the *width* of the box containing the current ⟨*label*⟩ 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 = {⟨*integer | string*⟩} default: *empty*

Sets the labelwidth key pass the ⟨*integer*⟩ or converting the ⟨*string*⟩ 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 = {⟨*font commands*⟩} default: *empty*

Sets the *font style* for the current ⟨*label*⟩ defined by label key. For example font={\bfseries\small}.

align = {⟨*left | right | center*⟩} default: *left*

Sets the *aligned* of ⟨*label*⟩ defined by label key on the current level in the label box.

wrap-label = {⟨*code* {#1} *more code*⟩} default: *empty*

Wraps the *current* ⟨*label*⟩ defined by label key referenced by {#1} after executing the align and font keys. The {⟨*code*⟩} 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* = {⟨*code* {#1} *more code*⟩} default: *empty*

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

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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{eunumXi} to indicate the count of the first level instead of using \theenumXi.

5.2 Keys for spaces

show-length = {⟨*true* | *false*⟩} default: *false*

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

5.2.1 Vertical spaces

topsep = {⟨*rubber length* | *rigid length*⟩} default: *by levels*

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

parsep = {⟨*rubber length* | *rigid length*⟩} default: *by levels*

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

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

partopsep = {⟨*rubber length* | *rigid length*⟩} default: *by levels*

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

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

itemsep = {⟨*rubber length* | *rigid length*⟩} default: *by levels*

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

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

noitemsep ⟨*value forbidden*⟩ default: *not used*

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

nosep ⟨*value forbidden*⟩ default: *not used*

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

base-fix ⟨*value forbidden*⟩ default: *not used*

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

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

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

`above` = {⟨*rubber length* | *rigid length*⟩} default: *not used*

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

`above*` = {⟨*rubber length* | *rigid length*⟩} default: *not used*

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

`below` = {⟨*rubber length* | *rigid length*⟩} default: *not used*

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

`below*` = {⟨*rubber length* | *rigid length*⟩} default: *not used*

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

5.2.2 Horizontal spaces

`list-offset` = {⟨*rigid length*⟩} default: `0pt`

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

`list-indent` = {⟨*rigid length*⟩} default: *labelwidth + labelsep*

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

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` = {⟨*rigid length*⟩} 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.

5.3 Keys for add code

The following ⟨*keys*⟩ should be used with *"caution"*, they are intended to inject {⟨*code*⟩} into different parts of the defined environments. We must keep in mind that the defined environments are based on the `list` base environment provided by LaTeX which is defined (simplified) as plain form `\list{`⟨*arg one*⟩`}{`⟨*arg two*⟩`}`. Using the `before*` key does not allow access to the `list` parameters defined by `[`⟨*key* = *val*⟩`]`.

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

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

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

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

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

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

Keep in mind that the code set in this key will affect the entire *"body"* of the environment and therefore the inner levels of the list and the keyans environment. It is recommended to set this key per level.

In the enumext* and keyans* environments this key is executed after the listparindent, parsep and itemindent keys within the minipage environment in which the *"item content"* is placed.

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

Execute {⟨*code*⟩} *"after"* finishing the environment. The {⟨*code*⟩} must be passed between braces.

5.4 Keys for start, series and resume

`start` = {⟨*integer* | *integer expression*⟩} default: *1*

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

`start*` = {⟨*integer* | *string*⟩} default: *not used*

Sets the *start value* of the numbering on the current level. Internally ⟨*string*⟩ is converted and passed as value to the counter defined by label key on the current level, i.e. it is equivalent to enter start=5, start=E or start=v.

The following ⟨*keys*⟩ are *"only"* available for the enumext* environment and the *"first level"* of the enumext environment and are ignored if set when nested within each other.

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

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

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

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

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

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

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

5.5 Keys for multicols

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

Set the *number of columns* to be used by the multicols 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 multicols 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.

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5.6 Keys for minipage

mini-env = {⟨rigid length⟩} default: *not used*

Sets the *width* of the minipage environment on the *"right side"*. This value added to the value set by the mini-sep key to determines the *width* of the minipage environment on the *"left side"*, taking \linewidth as the maximum reference value.

mini-sep = {⟨rigid length⟩} default: 0.3333em

Sets the *space between* the minipage environment on the *"left side"* and the minipage environment on the *"right side"*. This separation is applied together with \hfill.

5.6.1 The command \miniright

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

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

The *starred argument* '*' inhibits the use of \centering command i.e. the usual LaTeX justification is maintained in the minipage on the *"right side"*.

5.6.2 The key mini-right

In the *horizontal list environments* enumext* and keyans* it is not possible to use the \miniright command and the mini-right key must be used instead.

mini-right = {⟨content⟩} default: *not used*

Set the *content* for the drawing or tabular to be placed in the minipage environment on the *"right side"* by starting it with \centering. The {⟨content⟩} must be passed between braces.

mini-right* = {⟨content⟩} default: *not used*

Same as above, but *without* starting with \centering.

6 The storage system

The entire mechanism for *"storing content"* it is activated according to save-ans key on the *"first level"* of enumext or enumext* environments and it is ignored if they are established when they are nested inside each other. Only when this ⟨key⟩ is *"active"* the \anskey command and the environments anskey*, keyans, keyans* and keyanspic are available.

```
\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:

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```
\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* {⟨*store name*⟩} set by `save-ans` key at the entire level or a nested environment in which it runs. This key is intended for use in internal levels or nested `enumext` or `enumext*` environments in which you want to use `enumext` or `enumext*` but *"without"* using the `\anskey` command or use `anskey*` environment and *"without"* interfering with the `check-ans` key.

6.1.1 Keys for `label` and `ref`

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

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

`mark-ref` = {⟨*symbol*⟩} default: *\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 ⟨*keys*⟩ to set and manipulate *"symbol marks"* associated with *"answers"* and how they are displayed and stored in the *sequence* and *prop list*.

The ⟨*keys*⟩ 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 ⟨*keys*⟩ 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 ⟨*keys*⟩ 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` = {⟨*true* | *false*⟩} default: *false*

Display the *symbol* set by the `mark-ans` key to the left of the *mandatory argument* ⟨*content*⟩ passed to the `\anskey` command and ⟨*body*⟩ 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 ⟨*label*⟩ 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` = {⟨*symbol*⟩} 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` = {⟨*left* | *right* | *center*⟩} 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 = {⟨*rigid length*⟩} default: *labelsep*

Sets the *horizontal space* between the box containing the *"symbol"* defined by mark-ans key and the *mandatory argument* ⟨*content*⟩ passed to the \anskey command and the *body* in anskey* environment.

wrap-ans = {⟨*code* {#1} *more code*⟩} default: *\fbox+\parbox{#1}*

Wraps the *mandatory argument* ⟨*content*⟩ passed to the \anskey and the ⟨*body*⟩ in anskey* environment referenced by {#1} when using the show-ans or show-pos keys. The {⟨*code*⟩} must be passed between braces and only affects how the *argument* or *body* is displayed 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}'.

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.

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

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

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

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

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

Example

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

⋆ 1. Text containing our instructions or questions.
∗ first answer
2. Text containing our instructions or questions.
(a) Question.
∗ second answer
3. Text containing our instructions or questions.
∗ third answer
4. Text containing our instructions or questions.
∗ fourth answer

6.3 The environment anskey*

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

The environment anskey* takes a mandatory {⟨*body content*⟩} and *"stores it"* in the *sequence* and *prop list* {⟨*store name*⟩} set by save-ans key. If save-ref key are active and the hyperref[8] package is detected \hyperlink and \hypertarget will be used, otherwise the usual *"label and ref"* system provided by LaTeX will be used.

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

The anskey* environment is implemented using the scontents package, \begin{anskey*} and \end{anskey*} must be in different lines, all ⟨*keys*⟩ must be passed separated by commas and "without separation" of the start of the environment.

Comments "%" or "any character" after \begin{anskey*} or [⟨*key = val*⟩] on the same line are NOT supported, the package scontents will return an "error" message if this happens. In a similar way comments "%" or "any character" after \end{anskey*} on the same line the package scontents will return a "warning" message.

6.3.1 Keys for anskey*

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

write-env = {⟨*file.ext*⟩} default: *not used*

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

overwrite = {⟨*true* | *false*⟩} default: *false*

Sets whether the ⟨*file.ext*⟩ generated by write-env from the anskey* environment will be rewritten.

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force-eol = {⟨*true* | *false*⟩} default: *false*

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

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

Example

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

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

  \item Text containing our instructions or questions.

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

  \item Text containing our instructions or questions.

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

  \item Text containing our instructions or questions.

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

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

6.4 The environments keyans and keyans*

keyans \begin{keyans}[⟨*key* = *val*⟩] \item \item[⟨*custom*⟩] \item* \item*[⟨*content*⟩] \end{keyans}
keyans* \begin{keyans*}[⟨*key* = *val*⟩] \item \item[⟨*custom*⟩] \item* \item*[⟨*content*⟩] \end{keyans*}

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

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

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

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

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[⟨*keyans*⟩]{⟨*key* = *val*⟩} or \setenumext[⟨*keyans**⟩]{⟨*key* = *val*⟩}. 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*).

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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*[⟨content⟩]`

The `\item*` and `\item*[⟨content⟩]` command *"store"* the current ⟨*label*⟩ set by `label` key next to the *optional argument* ⟨*content*⟩ in *sequence* and *prop list* {⟨*store name*⟩} 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}[⟨key = val⟩] \anspic*[⟨content⟩]{⟨drawing or tabular⟩} \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 ⟨*labels*⟩ are centered *below* the *drawings or tabular* in a *single line* layout style.
A representation of the output can be seen in the figure 6.

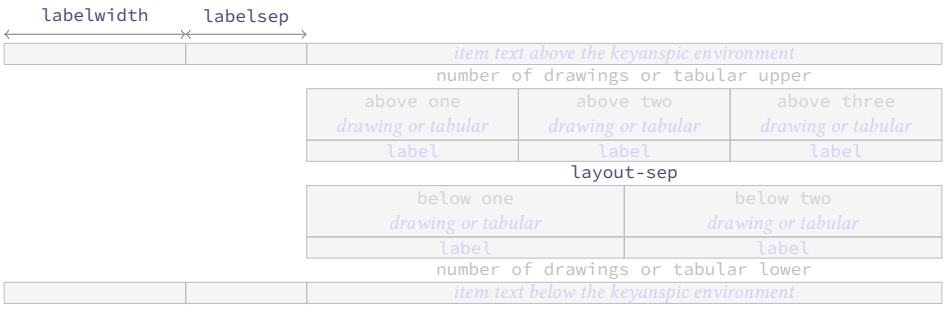

Figure 6: Representation of the `keyanspic` environment with `layout-sty`={⟨*3, 2*⟩} in enumext.

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

6.5.1 Keys for `keyanspic`

`label-pos` = {⟨*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`

`\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}
```

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1. Question with images and labels below.

A)

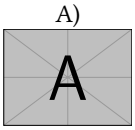
B)

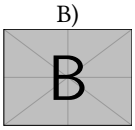
C)

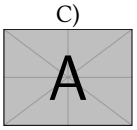
D)

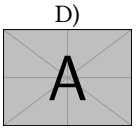
∗ E) [note]

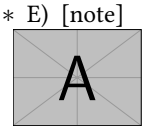
2. Question with images and labels above.

A)


B)


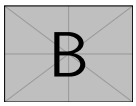
C)


D)


∗ E) [note]


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

A)



B)

C)

D)

∗ E) [note]

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

6.6 Printing stored content

6.6.1 The command `\getkeyans`

`\getkeyans` `\getkeyans{`*store name : position*`}`

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

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

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

6.6.2 The command `\foreachkeyans`

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

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

Options for command

`sep` = `{`*code*`}` default: *{;}*

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

`step` = `{`*integer*`}` default: `1`

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

`start` = `{`*integer*`}` default: `1`

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

`stop` = `{`*integer*`}` default: `0`

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

before = {⟨code⟩} default: *empty*

Sets the {⟨code⟩} that will be executed ⟨before⟩ each {⟨content⟩} stored in *prop list* {⟨store name⟩}. The {⟨code⟩} must be passed between braces.

after = {⟨code⟩} default: *empty*

Sets the {⟨code⟩} that will be executed ⟨after⟩ each {⟨content⟩} stored in *prop list* {⟨store name⟩}. The {⟨code⟩} must be passed between braces.

wrapper = {⟨code {#1} more code⟩} default: *empty*

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

6.6.3 The command \printkeyans

\printkeyans

```
\printkeyans{⟨store name⟩}
\printkeyans[⟨keys⟩]{⟨store name⟩}
\printkeyans*[⟨keys⟩]{⟨store name⟩}
```

The command \printkeyans prints *"all stored content"* in *sequence* {⟨store name⟩} defined by save-ans key placing this inside the enumext or enumext* environment if the *starred argument* '*' is used.

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

The *optional argument* allows managing the ⟨keys⟩ in the *"first level"* of the environment in which the *"stored content"* of the *sequence* {⟨store name⟩} will be printed, if the *starred argument* '*' is used it will be enumext* otherwise enumext.

The default values for the *"first level"* are the same as the default values for the enumext and enumext* environments along with the keys nosep,first=\small,font=\small and columns=2. For the inner levels of the environment enumext saved in the *sequence* {⟨store name⟩} the default values are the same as those established for the second, third and fourth levels plus the keys nosep,first=\small,font=\small. If the environment enumext* is saved within the *sequence* {⟨store name⟩} it will have the same default values plus the keys nosep,first=\small, font=\small.

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

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

The default values for the *"first level"* of \printkeyans commands and \printkeyans* are established using \setenumext[⟨print , 1⟩]{⟨keys⟩} and \setenumext[⟨print*⟩]{⟨keys⟩}.

If we need to set the ⟨keys⟩ for the environment enumext "saved" in the *sequence* {⟨store name⟩} we will use \setenumext[⟨print , level⟩]{⟨keys⟩} and if we need to set the ⟨keys⟩ for the environment enumext* "saved" in the *sequence* {⟨store name⟩} we will use \setenumext[⟨print , *⟩]{⟨keys⟩}.

Example

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

    \begin{enumext}[nosep]
      \item \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] $3(x + y + z)$

2. True False
   (a) LaTeX2e is cool?
   [2] Very True!
3. Related to Linux
   (a) You use linux?
   [3] Yes
   (b) Rate the following package and class
      i. `xsim`
      [4] very good
      ii. `exsheets`
      [5] obsolete

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

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

7 Full examples

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

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

and then you can use the excellent arara[1] 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: $1\,\text{Å} = 1 \times 10^{-10}$ 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 $1\,\text{Å} = 1 \times 10^{5}$ fm.
   B $1\,\text{Å} = 1 \times 10^{-5}$ fm.
   C $1\,\text{Å} = 1 \times 10^{-15}$ fm.
   D $1\,\text{Å} = 1 \times 10^{3}$ 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: $1\,\text{Å} = 1 \times 10^{-10}$ 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 $1\,\text{Å} = 1 \times 10^{5}$ fm.
   B $1\,\text{Å} = 1 \times 10^{-5}$ fm.
   C $1\,\text{Å} = 1 \times 10^{-15}$ fm.
   D $1\,\text{Å} = 1 \times 10^{3}$ fm.

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

Example 2

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

[1] The cool TeX automation tool: https://www.ctan.org/pkg/arara

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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: $1\,\text{Å} = 1 \times 10^{-10}$ 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 $1\,\text{Å} = 1 \times 10^{5}$ fm.
   - B $1\,\text{Å} = 1 \times 10^{-5}$ fm.
   - C $1\,\text{Å} = 1 \times 10^{-15}$ fm.
   - D $1\,\text{Å} = 1 \times 10^{3}$ 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: $1\,\text{Å} = 1 \times 10^{-10}$ 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 $1\,\text{Å} = 1 \times 10^{5}$ fm.
   - B $1\,\text{Å} = 1 \times 10^{-5}$ fm.
   - C $1\,\text{Å} = 1 \times 10^{-15}$ fm.
   - D $1\,\text{Å} = 1 \times 10^{3}$ fm.

1. B ※ 2. A ※
3. B ※ 4. A ※

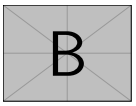
Example 3

A *"simple multiple choice"* test.

1. First type of questions
   - A value
   - B correct
   - C value
   - D value
2. Second type of questions
   I. $2\alpha + 2\delta = 90°$
   II. $\alpha = \delta$
   III. $\angle EDF = 45°$
   - 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) $2\alpha + 2\delta = 90°$
   (2) $\angle EDF = 45°$
   - A value
   - B value
   - C value
   - D value
   - E value
4. Question with image and label below:

A B C D E

5. Question with image on right side:
   - A value
   - B value
   - C value
   - D correct
   - E value



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) LaTeX2e is cool?

Related to Linux

(a) You use linux?

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

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

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

Example 5

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

1

Which choice best describes what happens in the passage?

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

2

Which choice best describes what happens in the passage?

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

3

Which choice best describes what happens in the passage?

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

4

Which choice best describes what happens in the passage?

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

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

12. sample

A sample
B answer
C sample
D sample

13. sample

A sample
B sample
C sample
D answer

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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`, `scontents`, `unicode-math`, `geometry`, `graphicx`, `luamml` and `hyperref` are required along with the line:

```
\DocumentMetadata
  {
    lang = en-US, pdfversion = 2.0, pdfstandard = ua-2,
    testphase = {phase-III, math, title, table, firstaid},
  }
```

All examples have been checked using veraPDF together with ngpdf.

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

9 The way of non-enumerated lists

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

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

Fake `itemize` environment

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

- First level item
  - Second level item
    - Third level item
      - Fourth level item
- First level item

∗ First level item
  ◇ Second level item
    ◦ Third level item
      ⋆ Fourth 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, consectetuer 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, consectetuer 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, consectetuer 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, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris.
Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris.

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

Final notes

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

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

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

Why list environments?

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

Why not random questions and other utilities

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

Why has it taken so long?

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

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11 Change history

v1.2 (ctan), 2025-03-28
- 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

Document class:
- article . . . 2
- book . . . 2
- exam . . . 2
- letter . . . 2
- report . . . 2

\columnbreak . . . 4, 14
\columnsep . . . 10

Commands provide by enumext:
- \anskey . . . 11–14
- \anspic . . . 11–13, 16, 17
- \foreachkeyans . . . 18
- \getkeyans . . . 13, 18
- \item* . . . 5–7, 11–13, 15, 16
- \item . . . 5–7, 10, 11, 13, 15, 17
- \miniright . . . 11
- \printkeyans . . . 6, 12, 19
- \setenumextmeta . . . 6
- \setenumext . . . 5–7, 11, 13, 15, 19

Counters defined by enumext:
- enumXiii . . . 4
- enumXii . . . 4
- enumXiv . . . 4
- enumXi . . . 4
- enumXviii . . . 4
- enumXvii . . . 4
- enumXvi . . . 4
- enumXv . . . 4

E

Environments provide by enumext:
- anskey* . . . 11–14, 23
- enumext* . . . 4–16, 19, 23
- enumext . . . 4–17, 19, 23
- keyans* . . . 4–15, 23
- keyanspic . . . 4, 7, 8, 11–14, 16, 23
- keyans . . . 4–17, 23

Environments:
- Verbatim . . . 15
- center . . . 5
- description . . . 5, 23, 24
- enumerate . . . 1, 3, 5, 25
- figure . . . 5
- flushleft . . . 5
- flushright . . . 5
- itemize . . . 5, 23
- list . . . 3, 5, 9, 25
- minipage . . . 3–5, 8–11, 23, 25
- multicols . . . 3, 4, 10, 23
- quotation . . . 5
- quote . . . 5
- shortenumerate . . . 5
- tabbing . . . 5
- table . . . 5
- tasks . . . 5
- trivlist . . . 5
- verbatim . . . 5
- verse . . . 5

F

\footnote . . . 5

I

\itemsep . . . 8

K

Keys for \anskey provide by enumext:
- break-col . . . 14
- item-join . . . 14
- item-pos* . . . 14
- item-star . . . 14
- item-sym* . . . 14

Keys for \foreachkeyans provide by enumext:
- after . . . 19
- before . . . 19
- sep . . . 18
- start . . . 18
- step . . . 18
- stop . . . 18
- wrapper . . . 19

Keys for anskey* provide by enumext:
- break-col . . . 14
- force-eol . . . 15
- item-join . . . 14
- item-pos* . . . 14
- item-star . . . 14
- item-sym* . . . 14
- overwrite . . . 14
- write-env . . . 14

Keys for environments provide by enumext:
- above* . . . 9
- above . . . 8, 9
- after . . . 10
- align . . . 7, 13, 23, 24
- base-fix . . . 8
- before* . . . 9, 10
- before . . . 9
- below* . . . 9
- below . . . 9
- check-ans . . . 12, 13
- columns-sep . . . 4, 10, 23
- columns . . . 4, 9, 10, 23
- first . . . 10
- font . . . 7, 12, 13
- item-pos* . . . 5, 6
- item-sym* . . . 5, 6
- itemindent . . . 8–10
- itemsep . . . 8
- label-pos . . . 17
- label-sep . . . 17
- labelsep . . . 3–7, 9, 10, 23, 24
- labelwidth . . . 3, 4, 6, 7, 9, 10, 12, 13, 23, 24
- labelwith . . . 5
- label . . . 7, 8, 10, 15, 16, 23, 24
- labewdith . . . 9
- layout-sep . . . 17
- layout-sty . . . 16, 17
- layout-top . . . 17
- list-indent . . . 3, 9
- list-offset . . . 3, 8, 9, 24

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listparindent 9, 10
mark-ans* 12, 13, 16, 17
mark-ans 12, 13
mark-pos* 13, 16, 17
mark-pos 12
mark-ref 12
mark-sep* 13, 16, 17
mark-sep 12, 13
mini-env 4, 9, 11, 23
mini-right* 7, 11
mini-right 7, 11, 23
mini-sep 4, 11
mode-box 7
no-store 11–14, 23
noitemsep 8
nosep 8, 23
overwrite 14
parsep 8, 10, 17
partopsep 8
ref 4, 8, 23
resume* 7, 10, 11
resume 7, 10, 11
rightmargin 9
save-ans 4, 6, 10–19, 23
save-key 10–12, 19
save-ref 4, 7, 12–14, 18, 23
save-sep 12, 16, 17, 23
series 7, 10, 11
show-ans 12, 13, 16, 17, 23
show-length 8
show-pos 12, 13, 16–18
start* 10
start 10
topsep 8, 9, 17
widest 7
wrap-ans* 13, 16, 17
wrap-ans 12, 13
wrap-label* 7, 24
wrap-label 7, 12, 13, 23, 24
wrap-opt 12, 13, 16, 17
write-env 14

L

\label 4

Labels provide by enumext:

\Alph* 7, 8, 15
\Roman* 7, 8
\alph* 7, 8
\arabic* 7, 8
\roman* 7, 8
\labelsep 3, 7
\labelwidth 3, 7
\linewidth 11
\listparindent 9

P

Packages:

enumerate 25
enumext 1–5, 7, 12, 16, 23, 25
enumitem 3, 4, 24, 25
fancyvrb 15
footnotehyper 5
geometry 23
graphicx 23
hyperref 4, 5, 12–14, 23, 25
l3keys 7
l3prop 25
l3seq 25
luamml 23
multicol 1, 2, 4, 23, 25
scontents 1, 2, 14, 15, 23
shortlst 5
tasks 5
task 6
unicode-math 23
xsim 2
\parsep 8
\partopsep 8

R

\raggedcolumns 4
\ref 4
\rightmargin 9

T

\topsep 8

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13 Implementation

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

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

13.1 General conventions

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

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

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

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

13.2 Initial set up

Start the DocStrip guards.

```
⟨*package⟩
```

Identify the internal prefix (LaTeX3 DocStrip convention) for l3doc class.

```
⟨@@=enumext⟩
```

13.3 Declaration of the package

First we will make sure we have a minimum (super updated) version of LaTeX to work correctly.

```
\NeedsTeXFormat{LaTeX2e}[2024-11-01]
```

Now declare the enumext package.

```
\ProvidesExplPackage {enumext} {2025-03-28} {1.2} {Enumerate exercise sheets}
```

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

```
\hook_gput_code:nnn {begindocument} {enumext}
  {
    \IfPackageLoadedTF { multicol }
      {
        \msg_info:nnn { enumext } { package-load } { multicol }
      }
      {
        \msg_info:nnn { enumext } { package-not-load } { multicol }
        \RequirePackage{multicol}[2024-05-23]
      }
    \IfPackageLoadedTF { scontents }
      {
        \msg_info:nnn { enumext } { package-load } { scontents }
      }
      {
        \msg_info:nnn { enumext } { package-not-load } { scontents }
        \RequirePackage{scontents}
      }
  }
```

13.4 Definition of variables

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

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

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

```
\int_new:N  \l__enumext_level_int
\int_new:N  \l__enumext_level_h_int
\int_new:N  \l__enumext_anskey_level_int
\int_new:N  \l__enumext_keyans_level_int
\int_new:N  \l__enumext_keyans_level_h_int
\int_new:N  \l__enumext_keyans_pic_level_int
```

(*End of definition for* `\l__enumext_level_int` *and others.*)

\l__enumext_starred_bool
\g__enumext_starred_bool
\l__enumext_starred_first_bool
\l__enumext_standar_bool
\g__enumext_standar_bool
\l__enumext_standar_first_bool
\l__enumext_anskey_env_bool
\l__enumext_keyans_env_bool
\g__enumext_start_line_tl
\g__enumext_envir_name_tl
\l__enumext_envir_name_tl

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

```
\bool_new:N \l__enumext_starred_bool
\bool_new:N \g__enumext_starred_bool
\bool_new:N \l__enumext_starred_first_bool
\bool_new:N \l__enumext_standar_bool
\bool_new:N \g__enumext_standar_bool
\bool_new:N \l__enumext_standar_first_bool
\bool_new:N \l__enumext_anskey_env_bool
\bool_new:N \l__enumext_keyans_env_bool
\tl_new:N   \g__enumext_start_line_tl
\tl_new:N   \g__enumext_envir_name_tl
\tl_new:N   \l__enumext_envir_name_tl
```

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

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

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

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

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

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

\c__enumext_counter_style_tl
\l__enumext_ref_key_arg_tl
\l__enumext_ref_the_count_tl
\l__enumext_the_counter_X_tl
\l__enumext_renew_the_count_X_tl

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

```
\tl_const:Nn \c__enumext_counter_style_tl
  { { arabic } { roman } { Roman } { alph } { Alph } }
\tl_new:N \l__enumext_ref_key_arg_tl
\tl_new:N \l__enumext_ref_the_count_tl
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \tl_new:c  { l__enumext_renew_the_count_#1_tl }
    \tl_new:c  { l__enumext_the_counter_#1_tl }
    \tl_set:ce { l__enumext_the_counter_#1_tl } { \exp_not:c { theenumX#1 } }
  }
\clist_map_inline:nn { i, ii, iii, iv, v, vi, vii, viii } { \__enumext_tmp:n {#1} }
```

(*End of definition for* `\c__enumext_counter_style_tl` *and others.*)

\g__enumext_resume_int
\g__enumext_resume_vii_int
\l__enumext_resume_name_tl
\l__enumext_resume_active_bool
\g__enumext_starred_series_tl
\g__enumext_standar_series_tl

Internal variables used by `resume`, `resume*` and `series` keys (§13.25).

```
\int_new:N  \g__enumext_resume_int
\int_new:N  \g__enumext_resume_vii_int
\tl_new:N   \l__enumext_resume_name_tl
\bool_new:N \l__enumext_resume_active_bool
\tl_new:N   \g__enumext_standar_series_tl
\tl_new:N   \g__enumext_starred_series_tl
```

(*End of definition for* `\g__enumext_resume_int` *and others.*)

\l__enumext_current_widest_dim
\g__enumext_counter_styles_tl
\g__enumext_widest_label_tl
\l__enumext_label_width_by_box

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

```
\dim_new:N \l__enumext_current_widest_dim
\tl_new:N  \g__enumext_counter_styles_tl
\tl_new:N  \g__enumext_widest_label_tl
\box_new:N \l__enumext_label_width_by_box
```

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

\l__enumext_leftmargin_tmp_X_bool
\l__enumext_leftmargin_tmp_X_dim
\l__enumext_leftmargin_X_dim
\l__enumext_itemindent_X_dim

The boolean variable \l__enumext_leftmargin_tmp_X_bool and the dimensional variable \l__enumext_leftmargin_tmp_X_dim are used by the list-indent key (§13.18). The variables \l__enumext_leftmargin_X_dim and \l__enumext_itemindent_X_dim are used and set by the function __enumext_calc_hspace:NNNNNNNNNNNN (§13.38.1).

```
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \bool_new:c { l__enumext_leftmargin_tmp_#1_bool }
    \dim_new:c  { l__enumext_leftmargin_tmp_#1_dim  }
    \dim_new:c  { l__enumext_leftmargin_#1_dim      }
    \dim_new:c  { l__enumext_itemindent_#1_dim      }
  }
\clist_map_inline:nn { i, ii, iii, iv, v, vi, vii, viii } { \__enumext_tmp:n {#1} }
```

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

\l__enumext_multicols_above_X_skip
\l__enumext_multicols_below_X_skip
\g__enumext_multicols_right_X_skip
\l__enumext_align_label_pos_X_str

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

```
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \skip_new:c  { l__enumext_multicols_above_#1_skip }
    \skip_new:c  { l__enumext_multicols_below_#1_skip }
    \skip_new:c  { g__enumext_multicols_right_#1_skip }
    \str_new:c   { l__enumext_align_label_pos_#1_str  }
  }
\clist_map_inline:nn { i, ii, iii, iv, v } { \__enumext_tmp:n {#1} }
```

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

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

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

```
\int_new:N  \g__enumext_minipage_stat_int
\skip_new:N \l__enumext_minipage_temp_skip
\skip_new:N \l__enumext_minipage_left_skip
\skip_new:N \l__enumext_minipage_right_skip
\skip_new:N \l__enumext_minipage_after_skip
\skip_new:N \g__enumext_minipage_right_skip
\skip_new:N \g__enumext_minipage_after_skip
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \dim_new:c  { l__enumext_minipage_left_#1_dim    }
    \bool_new:c { l__enumext_minipage_active_#1_bool }
  }
\clist_map_inline:nn { i, ii, iii, iv, v, vii, viii } { \__enumext_tmp:n {#1} }
```

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

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

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

```
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \bool_new:c { l__enumext_wrap_label_#1_bool     }
    \bool_new:c { l__enumext_wrap_label_opt_#1_bool }
    \int_new:c  { l__enumext_start_#1_int           }
    \tl_new:c   { l__enumext_fake_item_indent_#1_tl }
    \tl_new:c   { l__enumext_label_fill_left_#1_tl  }
    \tl_new:c   { l__enumext_label_fill_right_#1_tl }
    \bool_new:c { l__enumext_vspace_a_star_#1_bool  }
    \bool_new:c { l__enumext_vspace_b_star_#1_bool  }
  }
\clist_map_inline:nn { i, ii, iii, iv, v, vii, viii } { \__enumext_tmp:n {#1} }
```

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

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

The variable `\l__enumext_store_active_bool` setting by `save-ans` key (§13.26.1) activates all the mechanism related to `\anskey`, `anskey*`, `keyans`, `keyans*` and `keyanspic` environments.

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

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

The variables `\l__enumext_store_current_label_tl` and `\l__enumext_store_current_opt_arg_tl` save the *current label* and *optional argument* of `\item*` (§13.37) and `\anspic*` (§13.42.2) for the `keyans`, `keyans*` and `keyanspic` environments.

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

```
\bool_new:N \l__enumext_store_active_bool
\tl_new:N   \l__enumext_store_name_tl
\tl_new:N   \g__enumext_store_name_tl
\tl_new:N   \l__enumext_store_anskey_arg_tl
\tl_new:N   \l__enumext_store_anskey_env_tl
\tl_new:N   \l__enumext_store_anskey_opt_tl
\tl_new:N   \l__enumext_store_current_label_tl
\tl_new:N   \l__enumext_store_current_opt_arg_tl
\tl_new:N   \l__enumext_store_current_label_tmp_tl
```

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

\l__enumext_setkey_tmpa_tl
\l__enumext_setkey_tmpb_tl
\l__enumext_setkey_tmpa_int
\l__enumext_setkey_tmpa_seq
\l__enumext_setkey_tmpb_seq

Internal variables used by the command `\setenumext` (§13.48).

```
\tl_new:N  \l__enumext_setkey_tmpa_tl
\tl_new:N  \l__enumext_setkey_tmpb_tl
\int_new:N \l__enumext_setkey_tmpa_int
\seq_new:N \l__enumext_setkey_tmpa_seq
\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 (§13.47) and `\foreachkeyans` command (§13.50).

```
\tl_new:N  \l__enumext_meta_path_tl
\seq_new:N \l__enumext_foreach_print_seq
\tl_new:N  \l__enumext_foreach_name_prop_tl
\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_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` (§13.47), `show-pos`, `show-ans`, `mark-pos`, `mark-sep` keys (§13.27), `item-sym*` key (§13.35), `save-key` key (§13.27.3) and *"storing structure"*.

```
\tl_new:N   \l__enumext_print_keyans_starred_tl
\bool_new:N \l__enumext_print_keyans_star_bool
\str_new:N  \l__enumext_mark_position_str
\str_new:N  \l__enumext_mark_position_v_str
\str_new:N  \l__enumext_mark_position_viii_str
\dim_new:N  \l__enumext_mark_sep_tmpa_dim
\dim_new:N  \l__enumext_mark_sep_tmpb_dim
\int_new:N  \l__enumext_show_pos_tmp_int
\tl_new:N   \g__enumext_item_symbol_aux_tl
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \tl_new:c   { l__enumext_print_keyans_#1_tl        }
    \tl_new:c   { l__enumext_store_save_key_#1_tl      }
    \bool_new:c { l__enumext_store_save_key_#1_bool    }
    \bool_new:c { l__enumext_store_upper_level_#1_bool }
  }
\clist_map_inline:nn { i, ii, iii, iv, vii } { \__enumext_tmp:n {#1} }
```

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

\l__enumext_anspic_args_seq
\l__enumext_anspic_mini_width_dim
\l__enumext_anspic_above_int
\l__enumext_anspic_below_int
\l__enumext_anspic_label_above_bool
\l__enumext_anspic_mini_pos_str
\l__enumext_anspic_label_box
\l__enumext_anspic_body_box
\l__enumext_anspic_label_htdp_dim
\l__enumext_anspic_body_htdp_dim

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

```
\seq_new:N  \l__enumext_anspic_args_seq
\dim_new:N  \l__enumext_anspic_mini_width_dim
\int_new:N  \l__enumext_anspic_above_int
\int_new:N  \l__enumext_anspic_below_int
\bool_new:N \l__enumext_anspic_label_above_bool
\str_new:N  \l__enumext_anspic_mini_pos_str
\box_new:N  \l__enumext_anspic_label_box
\box_new:N  \l__enumext_anspic_body_box
\dim_new:N  \l__enumext_anspic_label_htdp_dim
\dim_new:N  \l__enumext_anspic_body_htdp_dim
```

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

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

Internal variables used by *"internal check answer"* mechanism (§13.26.3) 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.

```
\bool_new:N \l__enumext_check_answers_bool
\bool_new:N \g__enumext_check_ans_key_bool
\tl_new:N   \l__enumext_check_start_line_env_tl
\bool_new:N \l__enumext_item_wrap_key_bool
\int_new:N  \g__enumext_check_starred_cmd_int
\int_new:N  \g__enumext_item_anskey_int
\int_new:N  \g__enumext_item_number_int
\bool_new:N \l__enumext_item_number_bool
\int_new:N  \g__enumext_item_answer_diff_int
```

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

\l__enumext_hyperref_bool
\l__enumext_footnotes_key_bool

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

```
\bool_new:N \l__enumext_hyperref_bool
\bool_new:N \l__enumext_footnotes_key_bool
```

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

\l__enumext_newlabel_arg_one_tl
\l__enumext_newlabel_arg_two_tl
\l__enumext_write_aux_file_tl
\l__enumext_label_copy_X_tl

Internal variables used by save-ref key (§13.27). The variables \l__enumext_label_copy_X_tl correspond to temporary copies of the ⟨*labels*⟩ defined by level on which operations will be performed.

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

```
\tl_new:N \l__enumext_newlabel_arg_one_tl
\tl_new:N \l__enumext_newlabel_arg_two_tl
\tl_new:N \l__enumext_write_aux_file_tl
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \tl_new:c { l__enumext_label_copy_#1_tl }
  }
\clist_map_inline:nn { i, ii, iii, iv, v, vi, vii, viii } { \__enumext_tmp:n {#1} }
```

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

\g__enumext_footnote_standar_int
\g__enumext_footnote_starred_int
\g__enumext_footnote_standar_arg_seq
\g__enumext_footnote_starred_arg_seq
\g__enumext_footnote_standar_int_seq
\g__enumext_footnote_starred_int_seq

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

```
\int_new:N \g__enumext_footnote_standar_int
\int_new:N \g__enumext_footnote_starred_int
\seq_new:N \g__enumext_footnote_standar_arg_seq
\seq_new:N \g__enumext_footnote_starred_arg_seq
\seq_new:N \g__enumext_footnote_standar_int_seq
\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

Internal variables used by enumext* and keyans* environments.

```
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \bool_new:c { l__enumext_item_starred_#1_bool    }
    \int_new:c  { l__enumext_item_column_pos_#1_int  }
    \int_new:c  { g__enumext_item_count_all_#1_int   }
    \int_new:c  { l__enumext_joined_item_#1_int      }
```

```
    \int_new:c  { l__enumext_joined_item_aux_#1_int  }
    \int_new:c  { l__enumext_tmpa_#1_int             }
    \dim_new:c  { l__enumext_tmpa_#1_dim             }
    \box_new:c  { l__enumext_item_text_#1_box        }
    \dim_new:c  { l__enumext_joined_width_#1_dim     }
    \dim_new:c  { l__enumext_item_width_#1_dim       }
    \tl_new:c   { g__enumext_item_symbol_aux_#1_tl   }
    \str_new:c  { l__enumext_align_label_#1_str      }
    \bool_new:c { g__enumext_minipage_active_#1_bool }
    \box_new:c  { l__enumext_miniright_code_#1_box   }
    \bool_new:c { g__enumext_minipage_center_#1_bool }
    \dim_new:c  { g__enumext_minipage_right_#1_dim   }
    \skip_new:c { g__enumext_minipage_right_#1_skip  }
  }
\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`.

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

(*End of definition for* `\c__enumext_all_envs_clist`.)

13.5 Some utility functions

`\keys_precompile:neN` `\seq_use:NV` Non-standard kernel variants used by the `\printkeyans` command (§13.47) and `\foreachkeyans` command (§13.50).

```
\cs_generate_variant:Nn \keys_precompile:nnN { neN }
\cs_generate_variant:Nn \seq_use:Nn { NV }
```

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

`\__enumext_at_begin_document:n` A internal *"hook"* function used for copying plain `list` and `minipage` environments definition and `hyperref` detection.

```
\cs_new_protected:Npn \__enumext_at_begin_document:n #1
  {
    \hook_gput_code:nnn {begindocument} {enumext} { #1 }
  }
```

(*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.

```
\cs_new_protected:Npn \__enumext_after_env:nn #1 #2
  {
    \hook_gput_code:nnn {env/#1/after} {enumext} {#2}
  }
\cs_new_protected:Npn \__enumext_before_env:nn #1 #2
  {
    \hook_gput_code:nnn {env/#1/before} {enumext} {#2}
  }
```

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

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

```
\cs_new:Nn \__enumext_level:
  {
    \int_to_roman:n { \l__enumext_level_int }
  }
```

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

__enumext_if_is_int:nT
__enumext_if_is_int:nF
__enumext_if_is_int:nTF

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

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

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

__enumext_regex_counter_style:

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

```
\cs_new_protected:Nn \__enumext_regex_counter_style:
  {
    \tl_map_inline:Nn \c__enumext_counter_style_tl
      {
        \regex_replace_once:nnN { \c{##1}\* }
          { \c{##1}\cB{\u{l__enumext_ref_the_count_tl}\cE} } \l__enumext_ref_key_arg_tl
      }
  }
```

(*End of definition for* __enumext_regex_counter_style:.)

__enumext_show_length:nnn

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

```
\cs_new:Npn \__enumext_show_length:nnn #1 #2 #3
  {
    * ~ #2
    \prg_replicate:nn { 14 - \str_count:n {#2} } { ~ }
      = ~ \use:c { #1_use:c } { l__enumext_#2_#3_#1 } \\
  }
```

(*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.

```
\cs_new_protected:Nn \__enumext_unskip_unkern:
  {
    \int_case:nnT { \lastnodetype }
      {
        { 11 }{ \unskip }
        { 12 }{ \unkern }
      }
  }
```

(*End of definition for* __enumext_unskip_unkern:.)

13.5.1 Utilities for environments and levels

__enumext_is_not_nested:
__enumext_is_on_first_level:

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

```
\cs_new_protected:Nn \__enumext_is_not_nested:
  {
    \str_case:en { \@currenvir }
      {
        {enumext}
          {
            \tl_set:Nn \l__enumext_envir_name_tl { enumext }
            \bool_lazy_and:nnT
              { \bool_not_p:n { \g__enumext_standar_bool } }
              { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
              {
                \bool_gset_true:N \g__enumext_standar_bool
              }
          }
        {enumext*}
```

```
      {
        \tl_set:Nn \l__enumext_envir_name_tl { enumext* }
        \bool_lazy_and:nnT
          { \bool_not_p:n { \g__enumext_starred_bool } }
          { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
          {
            \bool_gset_true:N \g__enumext_starred_bool
          }
      }
  }
}
```

The function `\__enumext_is_on_first_level:` will set the variables `\l__enumext_standar_first_bool` (§13.26.1), `\l__enumext_starred_first_bool` (§13.26.1) and `\l__enumext_anskey_env_bool` (§13.31) to *"true"* only if the environment is not nested and we are in the *"first level"* of it . We will also save the *start line number* of each environment in the variable `\g__enumext_start_line_tl` and the *name* of each environment in the variable `\g__enumext_envir_name_tl` to use in messages related to the check-ans key and `.log` file.

```
\cs_new_protected:Nn \__enumext_is_on_first_level:
  {
    \bool_lazy_all:nT
      {
        { \bool_if_p:N \g__enumext_standar_bool }
        { \int_compare_p:nNn { \l__enumext_level_int } = { 1 } }
        { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
      }
      {
        \bool_set_true:N \l__enumext_standar_first_bool
        \bool_set_true:N \l__enumext_anskey_env_bool
        \tl_gset:Nn \g__enumext_envir_name_tl { enumext }
        \tl_gset:Ne \g__enumext_start_line_tl
          {
            on ~ line ~ \exp_not:V \inputlineno
          }
      }
    \bool_lazy_all:nT
      {
        { \bool_if_p:N \g__enumext_starred_bool }
        { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
        { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
      }
      {
        \bool_set_true:N \l__enumext_starred_first_bool
        \bool_set_true:N \l__enumext_anskey_env_bool
        \tl_gset:Nn \g__enumext_envir_name_tl { enumext* }
        \tl_gset:Ne \g__enumext_start_line_tl
          {
            on ~ line ~ \exp_not:V \inputlineno
          }
      }
  }
```

(*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.

```
\cs_new_protected:Nn \__enumext_keyans_name_and_start:
  {
    \str_case:en { \@currenvir }
      {
        {keyans}
          {
            \tl_set:Nn \l__enumext_envir_name_tl { keyans }
            \tl_set:Ne \l__enumext_check_start_line_env_tl
              {
                in ~ 'keyans' ~ start ~ on ~ line ~ \exp_not:V \inputlineno
              }
          }
        {keyans*}
          {
```

```
            \tl_set:Nn \l__enumext_envir_name_tl { keyans* }
            \tl_set:Ne \l__enumext_check_start_line_env_tl
              {
                in ~ 'keyans*' ~ start ~ on ~ line ~ \exp_not:V \inputlineno
              }
          }
        {keyanspic}
          {
            \tl_set:Nn \l__enumext_envir_name_tl { keyanspic }
            \tl_set:Ne \l__enumext_check_start_line_env_tl
              {
                in ~ 'keyanspic' ~ start ~ on ~ line ~ \exp_not:V \inputlineno
              }
          }
      }
  }
```

(*End of definition for* `\__enumext_keyans_name_and_start:`.)

13.5.2 Utilities for log and terminal

`\__enumext_reset_global_vars:`
`\__enumext_reset_global_int:`
`\__enumext_reset_global_bool:`
`\__enumext_reset_global_tl:`

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.

```
\cs_new_protected:Nn \__enumext_reset_global_vars:
  {
    \__enumext_reset_global_int:
    \__enumext_reset_global_bool:
    \__enumext_reset_global_tl:
  }
\cs_new_protected:Nn \__enumext_reset_global_int:
  {
    \int_gzero:N \g__enumext_item_number_int
    \int_gzero:N \g__enumext_item_anskey_int
    \int_gzero:N \g__enumext_item_answer_diff_int
  }
\cs_new_protected:Nn \__enumext_reset_global_bool:
  {
    \bool_gset_false:N \g__enumext_check_ans_key_bool
    \bool_gset_false:N \g__enumext_standar_bool
    \bool_gset_false:N \g__enumext_starred_bool
  }
\cs_new_protected:Nn \__enumext_reset_global_tl:
  {
    \tl_gclear:N \g__enumext_store_name_tl
    \tl_gclear:N \g__enumext_start_line_tl
    \tl_gclear:N \g__enumext_envir_name_tl
  }
```

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

`\__enumext_log_global_vars:`
`\__enumext_log_answer_vars:`

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

```
\cs_new_protected:Nn \__enumext_log_global_vars:
  {
    \msg_log:nneeee { enumext } { prop-seq-int-hook }
      { \g__enumext_store_name_tl }
      { \prop_count:c { g__enumext_ \g__enumext_store_name_tl _prop } }
      { \seq_count:c { g__enumext_ \g__enumext_store_name_tl _seq } }
      { \int_use:c { g__enumext_resume_ \g__enumext_store_name_tl _int } }
  }
```

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.

```
\cs_new_protected:Nn \__enumext_log_answer_vars:
  {
    \msg_log:nneee { enumext } { item-answer-hook }
      { \int_use:N \g__enumext_item_number_int }
      { \int_use:N \g__enumext_item_anskey_int }
      { \int_eval:n { \g__enumext_item_number_int - \g__enumext_item_anskey_int} }
  }
```

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

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13.6 Copying `list` and `minipage` environments

The `list` environment provided by LaTeX has the following plain form:

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

And `minipage` environment provided by 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 `ltcmd` (see `latex-lab-block`[18]).

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

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

```
\__enumext_at_begin_document:n
  {
    \cs_new_eq:NN   \__enumext_start_list:nn \list
    \cs_new_eq:NN   \__enumext_stop_list: \endlist
    \NewCommandCopy \__enumext_item_std:w \item
  }
```

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

```
\__enumext_at_begin_document:n
  {
    \cs_new_eq:NN \__enumext_minipage:w \minipage
    \cs_new_eq:NN \__enumext_endminipage: \endminipage
  }
```

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

13.7 Compatibility with hyperref and footnotehyper

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

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

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

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

```
\cs_new_protected:Nn \__enumext_after_hyperref:
  {
    \IfPackageLoadedTF { hyperref }
      {
        \msg_info:nnn { enumext } { package-load } { hyperref }
        \bool_set_true:N \l__enumext_hyperref_bool
        \IfHyperBoolean{hyperfootnotes}
          {
            \bool_set_true:N \l__enumext_footnotes_key_bool
          }
          {  }
      }
      {  }
```

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`.

```
    \bool_if:NT \l__enumext_footnotes_key_bool
      {
        \IfPackageLoadedTF { footnotehyper }
          {
            \msg_info:nnn { enumext } { package-load } { footnotehyper }
          }
          {
```

```
            \bool_set_false:N \l__enumext_footnotes_key_bool
          }
      }
```

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.

```
    \bool_if:NTF \l__enumext_hyperref_bool
      {
        \cs_new_eq:NN \__enumext_hypertarget:nn \hypertarget
        \cs_new_eq:NN \__enumext_phantomsection: \phantomsection
      }
      {
        \cs_new_eq:NN \__enumext_hypertarget:nn \use_none:nn
        \cs_new_eq:NN \__enumext_phantomsection: \prg_do_nothing:
      }
  }
```

(*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.

```
\cs_new_protected:Npn \__enumext_newlabel:nn #1 #2
  {
    \protected@write \@auxout { }
      {
        \token_to_str:N \newlabel {#1}
          {
            {#2}
            \bool_if:NT \l__enumext_hyperref_bool
              { { \thepage } {#2} {#1} }
            { }
          }
      }
    \__enumext_hypertarget:nn {#1} { }
    \__enumext_phantomsection:
  }
```

(*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.

```
\cs_new_protected:Nn \__enumext_footnotetext:nn
  {
    \footnotetext[#1]{#2}
  }
\cs_new_protected:Nn \__enumext_renew_footnote:
  {
    \RenewDocumentCommand \footnote { o +m }
      {
        \tl_if_novalue:nTF {##1}
          {
            \stepcounter{footnote}
            \int_gset_eq:Nc \g__enumext_footnote_standar_int { c@footnote }
          }
          {
            \int_gset:Nn \g__enumext_footnote_standar_int { ##1 }
          }
        \footnotemark [ \g__enumext_footnote_standar_int ]
        \seq_gput_right:Nn \g__enumext_footnote_standar_arg_seq { ##2 }
        \seq_gput_right:NV
```

```
      \g__enumext_footnote_standar_int_seq \g__enumext_footnote_standar_int
    }
  }
\cs_new_protected:Nn \__enumext_print_footnote:
  {
    \seq_if_empty:NF \g__enumext_footnote_standar_int_seq
      {
        \seq_map_pairwise_function:NNN
          \g__enumext_footnote_standar_int_seq
          \g__enumext_footnote_standar_arg_seq
          \__enumext_footnotetext:nn
      }
    \seq_gclear:N \g__enumext_footnote_standar_arg_seq
    \seq_gclear:N \g__enumext_footnote_standar_int_seq
  }
```

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.

```
\cs_new_protected:Nn \__enumext_renew_footnote_mini:
  {
    \RenewDocumentCommand \footnote { o +m }
      {
        \tl_if_novalue:nTF {##1}
          {
            \stepcounter{footnote}
            \int_gset_eq:Nc \g__enumext_footnote_starred_int { c@footnote }
          }
          {
            \int_gset:Nn \g__enumext_footnote_starred_int { ##1 }
          }
        \footnotemark [ \g__enumext_footnote_starred_int ]
        \seq_gput_right:Nn \g__enumext_footnote_starred_arg_seq { ##2 }
        \seq_gput_right:NV
          \g__enumext_footnote_starred_int_seq \g__enumext_footnote_starred_int
      }
  }
\cs_new_protected:Nn \__enumext_print_footnote_mini:
  {
    \seq_if_empty:NF \g__enumext_footnote_starred_int_seq
      {
        \seq_map_pairwise_function:NNN
          \g__enumext_footnote_starred_int_seq
          \g__enumext_footnote_starred_arg_seq
          \__enumext_footnotetext:nn
      }
    \seq_gclear:N \g__enumext_footnote_starred_arg_seq
    \seq_gclear:N \g__enumext_footnote_starred_int_seq
  }
```

(*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.

```
\cs_new_protected:Nn \__enumext_renew_footnote_standar:
  {
    \bool_if:NT \g__enumext_standar_bool
      {
        \IfDocumentMetadataTF
          {
            \__enumext_renew_footnote:
          }
          {
            \bool_if:NF \l__enumext_footnotes_key_bool
              {
                \__enumext_renew_footnote:
              }
          }
      }
  }
\cs_new_protected:Nn \__enumext_print_footnote_standar:
```

```
  {
    \bool_if:NT \g__enumext_standar_bool
      {
        \IfDocumentMetadataTF
          {
            \__enumext_print_footnote:
          }
          {
            \bool_if:NF \l__enumext_footnotes_key_bool
              {
                \__enumext_print_footnote:
              }
          }
      }
  }
```

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.

```
\cs_new_protected:Nn \__enumext_renew_footnote_starred:
  {
    \IfDocumentMetadataTF
      {
        \__enumext_renew_footnote_mini:
      }
      {
        \bool_if:NF \l__enumext_footnotes_key_bool
          {
            \__enumext_renew_footnote_mini:
          }
      }
  }
\cs_new_protected:Nn \__enumext_print_footnote_starred:
  {
    \IfDocumentMetadataTF
      {
        \__enumext_print_footnote_mini:
      }
      {
        \bool_if:NF \l__enumext_footnotes_key_bool
          {
            \__enumext_print_footnote_mini:
          }
      }
  }
```

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

```
\__enumext_after_env:nn { enumext* }
  {
    \__enumext_print_footnote_starred:
  }
\__enumext_after_env:nn { keyans* }
  {
    \__enumext_print_footnote_starred:
  }
```

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

13.9 The internal minipage environment

`\__enumext_internal_mini_page:`
`__enumext_mini_env*`

The function __enumext_internal_mini_page: creates a internal __enumext_mini_page environment (*custom version* of minipage) setting the \if@minipage switch to *"false"* to allow spaces at the *"above"* of the environment, plus we will add \skip_vertical:N \c_zero_skip to maintain alignment on *"top"* in the first part and \skip_vertical:N \c_zero_skip in the second part to allow spaces *"below"*. This environment will be used internally by the mini-env key, it is NOT documented in the user interface and is for internal use only. Within this environment we redefine \footnote to make them look the same as if they were elsewhere in the document. This function is passed to the function __enumext_safe_exec: in the enumext environment definition (§13.39) and __enumext_safe_exec_vii: in the enumext* environment definition (§13.44)

```
\cs_new_protected:Nn \__enumext_internal_mini_page:
  {
    \int_compare:nNnT { \l__enumext_level_int } = { 0 }
```

```
572       {
573         \DeclareDocumentEnvironment{__enumext_mini_page}{ m }
574           {
575             \__enumext_renew_footnote_standar:
576             \__enumext_minipage:w [ t ] { ##1 }
577               \legacy_if_gset_false:n { @minipage }
578               \skip_vertical:N \c_zero_skip
579           }
580           {
581               \skip_vertical:N \c_zero_skip
582             \__enumext_endminipage:
583             \__enumext_print_footnote_standar:
584           }
585       }
586   }
```

(*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.

```
587 \dim_zero_new:N \itemwidth
```

13.11 Definition of counters

`\__enumext_define_counters:Nn`
`enumXi`
`enumXii`
`enumXiii`
`enumXiv`
`enumXv`
`enumXvi`
`enumXvii`
`enumXviii`

To create the necessary *"counters"* we must first make sure that they are not already defined by the user or a package such as enumitem, otherwise a error will be returned and the package loading will be aborted. The arguments taken by the function are:

`#1` : A token list `\l__enumext_counter_X_tl` for *"store"* the counter's name.
`#2` : The counter's name.

```
588 \cs_new_protected:Npn \__enumext_define_counters:Nn #1 #2
589   {
590     \cs_if_exist:cTF { c@ #2 }
591       { \msg_fatal:nnn { enumext } { counters }{ #2 } }
592       {
593         \tl_set:Nn #1 { #2 }
594         \newcounter { #2 }
595       }
596   }
```

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.

```
597 \__enumext_define_counters:Nn \l__enumext_counter_i_tl    { enumXi    }
598 \__enumext_define_counters:Nn \l__enumext_counter_ii_tl   { enumXii   }
599 \__enumext_define_counters:Nn \l__enumext_counter_iii_tl  { enumXiii  }
600 \__enumext_define_counters:Nn \l__enumext_counter_iv_tl   { enumXiv   }
601 \__enumext_define_counters:Nn \l__enumext_counter_v_tl    { enumXv    }
602 \__enumext_define_counters:Nn \l__enumext_counter_vi_tl   { enumXvi   }
603 \__enumext_define_counters:Nn \l__enumext_counter_vii_tl  { enumXvii  }
604 \__enumext_define_counters:Nn \l__enumext_counter_viii_tl { enumXviii }
```

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

13.12 Definition of labels

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

`\__enumext_register_counter_style:Nn`

These ⟨*counters*⟩ will be used as default ⟨*labels*⟩ if the `label` key is not used for the different levels of the `enumext`, `enumext*`, `keyans` and `keyans*` environments, so it is necessary to get a default value for `labelwidth` from these ⟨*labels*⟩ at the same time.

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

```
\__enumext_register_counter_style:Nn \Roman  { VIII }
\__enumext_register_counter_style:Nn \roman  { viii }
```

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

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

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

```
\cs_new_protected:Npn \__enumext_label_width_by_box:Nn #1 #2
  {
    \hbox_set:Nn \l__enumext_label_width_by_box {#2}
    \dim_set:Nn #1 { \box_wd:N \l__enumext_label_width_by_box }
  }
\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.

```
\cs_new_protected:Npn \__enumext_label_style:Nnn #1 #2 #3
  {
    \tl_clear_new:N #1
    \tl_put_right:Ne #1 { \tl_trim_spaces:n {#3} }
    \tl_gset_eq:NN \g__enumext_widest_label_tl #1
    \tl_map_inline:Nn \g__enumext_counter_styles_tl
      {
        \tl_replace_all:Nne #1 { ##1* } { \exp_not:N ##1 {#2} }
        \tl_greplace_all:Nne \g__enumext_widest_label_tl { ##1* }
          { \tl_use:c { c__enumext_widest_ \cs_to_str:N ##1 _tl } }
      }
    \__enumext_label_width_by_box:Nn \l__enumext_current_widest_dim
      { \tl_use:N \g__enumext_widest_label_tl }
    \tl_set_eq:cN { the #2 } #1
  }
\cs_generate_variant:Nn \__enumext_label_style:Nnn { cvn }
```

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

13.13 Setting keys associated with label

When *tagged* PDF is active `\makelabel` is redefined using `\makebox` to work correctly (§13.34). From the user side it is convenient to have a key that allows using this redefinition with `\makebox` without having `\IfDocumentMetadataTF` active.

`mode-box`

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

```
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \keys_define:nn { enumext /  #1 }
      {
        mode-box .bool_set:N = \l__enumext_mode_box_bool,
        mode-box .initial:n  = false,
        mode-box .value_forbidden:n = true,
      }
  }
\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.

```
\cs_set_protected:Npn \__enumext_tmp:nn #1 #2
  {
    \keys_define:nn { enumext / #1 }
      {
        font        .tl_set:c   = { l__enumext_label_font_style_#2_tl },
        font        .value_required:n = true,
        labelsep    .dim_set:c  = { l__enumext_labelsep_#2_dim },
        labelsep    .initial:n  = {0.3333em},
        labelsep    .value_required:n = true,
```

```
      labelwidth  .dim_set:c  = { l__enumext_labelwidth_#2_dim },
      labelwidth  .value_required:n = true,
      wrap-label  .cs_set_protected:cp = { __enumext_wrapper_label_#2:n } ##1,
      wrap-label  .initial:n  = {##1},
      wrap-label  .value_required:n = true,
      wrap-label* .code:n = {
                              \bool_set_true:c { l__enumext_wrap_label_opt_#2_bool }
                              \keys_set:nn { enumext / #1 } { wrap-label = {##1} }
                            },
      wrap-label* .value_required:n = true,
    }
  }
\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`.

```
\cs_set_protected:Npn \__enumext_tmp:nn #1 #2
  {
    \keys_define:nn { enumext / #1 }
      {
        align .choice:,
        align / left    .code:n =
                          {
                            \tl_clear:c { l__enumext_label_fill_left_#2_tl  }
                            \tl_set:cn  { l__enumext_label_fill_right_#2_tl } { \hfill }
                            \str_set:cn { l__enumext_align_label_pos_#2_str } { l }
                          },
        align / right   .code:n =
                          {
                            \tl_set:cn  { l__enumext_label_fill_left_#2_tl  } { \hfill }
                            \tl_clear:c { l__enumext_label_fill_right_#2_tl }
                            \str_set:cn { l__enumext_align_label_pos_#2_str } { r }
                          },
        align / center  .code:n =
                          {
                            \tl_set:cn { l__enumext_label_fill_left_#2_tl  } { \hfill }
                            \tl_set:cn { l__enumext_label_fill_right_#2_tl } { \hfill }
                            \str_set:cn { l__enumext_align_label_pos_#2_str } { c }
                          },
        align / unknown .code:n =
                            \msg_error:nneee { enumext } { unknown-choice }
                              { align } { left, ~ right, ~  center } { \exp_not:n {##1} },
        align .initial:n  = left,
        align .value_required:n  = true,
      }
  }
\clist_map_inline:nn
  {
    {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {keyans}{v}
  }
  { \__enumext_tmp:nn #1 }

\cs_set_protected:Npn \__enumext_tmp:nn #1 #2
  {
    \keys_define:nn { enumext / #1 }
      {
        align .choice:,
        align / left    .code:n = \str_set:cn { l__enumext_align_label_#2_str } { l },
        align / right   .code:n = \str_set:cn { l__enumext_align_label_#2_str } { r },
        align / center  .code:n = \str_set:cn { l__enumext_align_label_#2_str } { c },
        align / unknown .code:n =
                            \msg_error:nneee { enumext } { unknown-choice }
                              { align } { left, ~ right, ~  center } { \exp_not:n {##1} },
        align .initial:n = left,
        align .value_required:n = true,
      }
  }
\clist_map_inline:nn { {enumext*}{vii}, {keyans*}{viii} } { \__enumext_tmp:nn #1 }
```

(*End of definition for* `align`.)

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13.14 Setting label and ref keys

The implementation of the keys label and ref are part of the core of the package enumext, here the default values for ⟨*label*⟩, the value of the variables \l__enumext_label_X_tl, the default values for \labelwidth and the *"label and ref"* system.

13.14.1 Define and set label and ref keys for enumext environment

label
ref
\l__enumext_label_i_tl
\l__enumext_label_ii_tl
\l__enumext_label_iii_tl
\l__enumext_label_iv_tl

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

```
\cs_set_protected:Npn \__enumext_tmp:nnn #1 #2 #3
  {
    \keys_define:nn { enumext / #1 }
      {
        label .code:n    = {
                             \__enumext_label_style:cvn { l__enumext_label_#2_tl }
                               { l__enumext_counter_#2_tl } {##1}
                             \dim_set_eq:cN  { l__enumext_labelwidth_#2_dim }
                               \l__enumext_current_widest_dim
                           },
        label .initial:n = #3,
        label .value_required:n = true,
        ref   .code:n    = \__enumext_standar_ref:n {##1},
        ref   .value_required:n = true,
      }
  }
\__enumext_tmp:nnn { level-1 } {   i } { \arabic*.}
\__enumext_tmp:nnn { level-2 } {  ii } { (\alph*) }
\__enumext_tmp:nnn { level-3 } { iii } { \roman*. }
\__enumext_tmp:nnn { level-4 } {  iv } { \Alph*.  }
```

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

__enumext_standar_ref:n
__enumext_standar_ref:

The __enumext_standar_ref:n first we will pass the key argument to \l__enumext_ref_key_arg_tl and we will analyze its state, if it is not *empty* we will make a copy of the current counter in \l__enumext_ref_the_count_tl and we will execute the function __enumext_regex_counter_style: which will return the modified \l__enumext_ref_key_arg_tl and we make the value of \l__enumext_ref_the_count_tl the same as that \l__enumext_the_counter_X_tl which contains \theenumX and finally we set \l__enumext_renew_the_count_X_tl with the renewed command.

```
\cs_new_protected:Npn \__enumext_standar_ref:n #1
  {
    \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
    \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
      {
        \msg_error:nnn { enumext } { key-ref-empty } { enumext }
      }
      {
        \tl_set_eq:Nc
          \l__enumext_ref_the_count_tl { l__enumext_counter_ \__enumext_level: _tl }
        \__enumext_regex_counter_style:
        \tl_set_eq:Nc
          \l__enumext_ref_the_count_tl { l__enumext_the_counter_ \__enumext_level: _tl }
        \tl_put_right:ce { l__enumext_renew_the_count_ \__enumext_level: _tl }
          {
            \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V \l_
          }
      }
  }
```

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

```
\cs_new_protected:Nn \__enumext_standar_ref:
  {
    \tl_if_empty:cF { l__enumext_renew_the_count_ \__enumext_level: _tl }
      {
        \tl_use:c { l__enumext_renew_the_count_ \__enumext_level: _tl }
      }
  }
```

(*End of definition for* __enumext_standar_ref:n *and* __enumext_standar_ref:.)

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

label
ref
\l__enumext_label_vii_tl
\l__enumext_label_viii_tl

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

```
\cs_set_protected:Npn \__enumext_tmp:nnn #1 #2 #3
  {
    \keys_define:nn { enumext / #1 }
      {
        label .code:n    = {
                               \__enumext_label_style:cvn { l__enumext_label_#2_tl }
                                 { l__enumext_counter_#2_tl } {##1}
                               \dim_set_eq:cN  { l__enumext_labelwidth_#2_dim }
                                   \l__enumext_current_widest_dim
                             },
        label .initial:n = #3,
        label .value_required:n = true,
        ref   .code:n    = \__enumext_starred_ref:n {##1},
        ref   .value_required:n = true,
      }
  }
\__enumext_tmp:nnn { enumext* } {  vii } { \arabic*.}
\__enumext_tmp:nnn { keyans*  } { viii } { \Alph*) }
```

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

__enumext_starred_ref:n
__enumext_starred_ref:

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

```
\cs_new_protected:Npn \__enumext_starred_ref:n #1
  {
    \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
    \int_compare:nNnT { \l__enumext_level_h_int } = { 1 }
      {
        \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
          {
            \msg_error:nnn { enumext } { key-ref-empty } { enumext* }
          }
          {
            \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_counter_vii_tl
            \__enumext_regex_counter_style:
            \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_vii_tl
            \tl_put_right:Ne \l__enumext_renew_the_count_vii_tl
              {
                \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V
              }
          }
      }
    \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
      {
        \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
          {
            \msg_error:nnn { enumext } { key-ref-empty } { keyans* }
          }
          {
            \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_counter_viii_tl
            \__enumext_regex_counter_style:
            \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_viii_tl
            \tl_put_right:Ne \l__enumext_renew_the_count_viii_tl
              {
                \exp_not:N \renewcommand  { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:
              }
          }
      }
  }
```

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.

```
\cs_new_protected:Nn \__enumext_starred_ref:
  {
    \int_compare:nNnT { \l__enumext_level_h_int } = { 1 }
      {
        \tl_if_empty:NF \l__enumext_renew_the_count_vii_tl
          {
            \tl_use:N \l__enumext_renew_the_count_vii_tl
```

```
827           }
828       }
829     \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
830       {
831         \tl_if_empty:NF \l__enumext_renew_the_count_viii_tl
832           {
833             \tl_use:N \l__enumext_renew_the_count_viii_tl
834           }
835       }
836   }
```

(*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

`label` `ref` `\l__enumext_label_v_tl` `\l__enumext_label_vi_tl`

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.

```
837 \keys_define:nn { enumext / keyans }
838   {
839     label .code:n    = {
840                          \__enumext_label_style:cvn { l__enumext_label_v_tl }
841                            { l__enumext_counter_v_tl } {#1}
842                          \__enumext_label_style:cvn { l__enumext_label_vi_tl }
843                            { l__enumext_counter_vi_tl } {#1}
844                          \dim_set_eq:NN
845                            \l__enumext_labelwidth_v_dim \l__enumext_current_widest_dim
846                        },
847     label .initial:n = \Alph*),
848     label .value_required:n = true,
849     ref   .code:n    = \__enumext_keyans_ref:n {#1},
850     ref   .value_required:n = true,
851   }
```

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

`\__enumext_keyans_ref:n` `\__enumext_keyans_ref:`

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

```
852 \cs_new_protected:Npn \__enumext_keyans_ref:n #1
853   {
854     \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
855     \tl_if_empty:NTF \l__enumext_ref_key_arg_tl
856       {
857         \msg_error:nnn { enumext } { key-ref-empty } { keyans }
858       }
859       {
860         \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_counter_v_tl
861         \__enumext_regex_counter_style:
862         \tl_set_eq:NN \l__enumext_ref_the_count_tl \l__enumext_the_counter_v_tl
863         \tl_put_right:Ne \l__enumext_renew_the_count_v_tl
864           {
865             \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_the_count_tl } { \exp_not:V \l_
866           }
867       }
868   }
```

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

```
869 \cs_new_protected:Nn \__enumext_keyans_ref:
870   {
871     \tl_if_empty:NF \l__enumext_renew_the_count_v_tl
872       {
873         \tl_use:N \l__enumext_renew_the_count_v_tl
874       }
875   }
```

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

13.15 Setting start, start* and widest keys

__enumext_start_from:NNn
__enumext_start_from:ccn
__enumext_start_from:cce

The function __enumext_start_from:NNn used by start and start* keys take three arguments:
#1 : \l__enumext_label_X_tl
#2 : \l__enumext_start_X_int
#3 : ⟨*integer or string*⟩
The first argument of this function are the *"counter style"* set by label key, the second argument is returned by the function, the third argument can be an ⟨*integer*⟩ or ⟨*string*⟩ of the form \Alph, \alph, \Roman or \roman. This effectively allows start=A or start=1 to be used.

```
\cs_new_protected:Npn \__enumext_start_from:NNn #1 #2 #3
  {
    \__enumext_if_is_int:nTF { #3 }
       {
         \int_set:Nn #2 {#3}
       }
       {
         \regex_match:nVT { \c{Alph} | \c{alph} } {#1}
           { \int_set:Nn #2 { \int_from_alph:n {#3} } }
         \regex_match:nVT { \c{Roman} | \c{roman} } {#1}
           { \int_set:Nn #2  { \int_from_roman:n {#3} } }
       }
  }
\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.

```
\cs_new_protected:Npn \__enumext_widest_from:nNNn #1 #2 #3 #4
  {
    \__enumext_if_is_int:nTF {#4}
      {
        \setcounter{enumX#1} { #4 }
      }
      {
        \regex_match:nVT { \c{Alph} | \c{alph} } {#2}
          { \setcounter{enumX#1} { \int_from_alph:n {#4} } }
        \regex_match:nVT { \c{Roman} | \c{roman} } {#2}
          { \setcounter{enumX#1} { \int_from_roman:n {#4} } }
      }
     \__enumext_label_width_by_box:cv
       { l__enumext_labelwidth_#1_dim } { l__enumext_label_#1_tl }
  }
\cs_generate_variant:Nn \__enumext_widest_from:nNNn { nccn }
```

(*End of definition for* __enumext_widest_from:nNNn.)

start
start*
widest

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

```
\cs_set_protected:Npn \__enumext_tmp:nn #1 #2
  {
    \keys_define:nn { enumext / #1 }
      {
        start* .code:n    = {
                              \__enumext_start_from:ccn
                                { l__enumext_label_#2_tl }
                                { l__enumext_start_#2_int } {##1}
                            },
        start* .value_required:n = true,
        start  .code:n    = {
                              \__enumext_start_from:cce
                                { l__enumext_label_#2_tl }
                                { l__enumext_start_#2_int } { \int_eval:n {##1} }
```

```
                              },
        start  .initial:n = 1,
        start  .value_required:n = true,
        widest .code:n    = {
                                \__enumext_widest_from:nccn {#2}
                                  { l__enumext_label_#2_tl }
                                  { l__enumext_labelwidth_#2_dim } {##1}
                              },
        widest .value_required:n = true,
      }
  }
\clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }
```

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

13.16 Setting keys for vertical spaces

topsep
partopsep
parsep
noitemsep
nosep

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

```
\cs_set_protected:Npn \__enumext_tmp:nnnnnn #1 #2 #3 #4 #5 #6
  {
    \keys_define:nn { enumext / #1 }
      {
        topsep    .skip_set:c = { l__enumext_topsep_#2_skip },
        topsep    .initial:n  = {#3},
        topsep    .value_required:n = true,
        partopsep .skip_set:c = { l__enumext_partopsep_#2_skip },
        partopsep .initial:n  = {#4},
        partopsep .value_required:n = true,
        parsep    .skip_set:c = { l__enumext_parsep_#2_skip },
        parsep    .initial:n  = {#5},
        parsep    .value_required:n = true,
        itemsep   .skip_set:c = { l__enumext_itemsep_#2_skip },
        itemsep   .initial:n  = {#6},
        itemsep   .value_required:n = true,
        noitemsep .meta:n     = { itemsep = 0pt, parsep = 0pt },
        noitemsep .value_forbidden:n = true,
        nosep     .meta:n     = {
                                  itemsep = 0pt, parsep= 0pt,
                                  topsep = 0pt, partopsep = 0pt,
                                },
        nosep     .value_forbidden:n = true,
      }
  }
```

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

```
\__enumext_tmp:nnnnnn { level-1 } { i } { 8.0pt plus 2.0pt minus 4.0pt }
  { 2.0pt plus 1.0pt minus 1.0pt } { 4.0pt plus 2.0pt minus 1.0pt }
  { 4.0pt plus 2.0pt minus 1.0pt }
\__enumext_tmp:nnnnnn { level-2 } { ii } { 4.0pt plus 2.0pt minus 1.0pt }
  { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
  { 2.0pt plus 1.0pt minus 1.0pt }
\__enumext_tmp:nnnnnn { level-3 } { iii } { 2.0pt plus 1.0pt minus 1.0pt }
  { 1.0pt minus 1.0pt }{ 0pt }{ 2.0pt plus 1.0pt minus 1.0pt }
\__enumext_tmp:nnnnnn { level-4 } { iv } { 2.0pt plus 1.0pt minus 1.0pt }
  { 1.0pt minus 1.0pt }{ 0pt }{ 2.0pt plus 1.0pt minus 1.0pt }
\__enumext_tmp:nnnnnn { keyans  } { v }{ 4.0pt plus 2.0pt minus 1.0pt }
  { 2.0pt plus 1.0pt minus 1.0pt }{ 2.0pt plus 1.0pt minus 1.0pt }
  { 2.0pt plus 1.0pt minus 1.0pt }
\__enumext_tmp:nnnnnn { enumext* } { vii } { 8.0pt plus 2.0pt minus 4.0pt }
  { 2.0pt plus 1.0pt minus 1.0pt } { 4.0pt plus 2.0pt minus 1.0pt }
  { 4.0pt plus 2.0pt minus 1.0pt }
\__enumext_tmp:nnnnnn { keyans* } { viii } { 4.0pt plus 2.0pt minus 1.0pt }
  { 2.0pt plus 1.0pt minus 1.0pt } { 2.0pt plus 1.0pt minus 1.0pt }
  { 2.0pt plus 1.0pt minus 1.0pt }
```

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

13.17 Setting `base-fix` key

When nesting starting right after `\item` (without material between them) there is a problem with the alignment of the *baseline* between the two environments. One way to get around this problem is to place

\mode_leave_vertical: apply \vspace{-\baselineskip} and set \topsep=0pt for the *"first level"* of the nested enumext environment.

base-fix
__enumext_nested_base_line_fix:

We define the key base-fix only for the *"first level"* of enumext environment.

```
\keys_define:nn { enumext /  level-1 }
  {
    base-fix .bool_set:N = \l__enumext_base_line_fix_bool,
    base-fix .initial:n  = false,
    base-fix .value_forbidden:n = true,
  }
```

The function __enumext_nested_base_line_fix: passed to the __enumext_parse_keys:n function in the definition of the enumext environment (§13.39) will be responsible for applying the *baseline correction* and adjusting the ⟨*keys*⟩ for the enumext environment and the \printkeyans with *starred argument* '*' (§13.47).
We will first implement the function code from the user side of the base-fix key, that is, only the user knows when it is necessary to apply it within the document in which case the variable \l__enumext_print_keyans_star_bool set by the \printkeyans command is false and the variable \l__enumext_base_line_fix_bool is true.

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.

```
\cs_new_protected:Nn \__enumext_nested_base_line_fix:
  {
    \bool_lazy_all:nT
      {
        { \bool_if_p:N \l__enumext_starred_first_bool }
        { \bool_if_p:N \l__enumext_base_line_fix_bool }
        { \bool_not_p:n { \l__enumext_print_keyans_star_bool } }
      }
      {
        \mode_leave_vertical:
        \vspace { -\dim_eval:n { \baselineskip + \parsep } }
        \keys_set:nn { enumext / level-1 }
          {
            topsep = 0pt, above = 0pt, above* = 0pt,
          }
      }
```

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.

```
    \bool_lazy_and:nnT
      { \bool_if_p:N \l__enumext_starred_first_bool }
      { \bool_if_p:N \l__enumext_print_keyans_star_bool }
      {
        \mode_leave_vertical:
        \skip_vertical:n { -\baselineskip }
        \skip_vertical:N \c_zero_skip
        \keys_set:nn { enumext / level-1 }
          {
            topsep = 0pt, above = 0pt, above* = 0pt,
          }
      }
    \bool_set_false:N \l__enumext_base_line_fix_bool
  }
```

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

13.18 Setting keys for horizontal spaces

itemindent
rightmargin
listparindent
list-offset
list-indent

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

```
\cs_set_protected:Npn \__enumext_tmp:nn #1 #2
  {
    \keys_define:nn { enumext / #1 }
      {
        itemindent    .dim_set:c = { l__enumext_fake_item_indent_#2_dim },
        itemindent    .value_required:n = true,
        rightmargin   .dim_set:c = { l__enumext_rightmargin_#2_dim },
        rightmargin   .value_required:n = true,
        listparindent .dim_set:c = { l__enumext_listparindent_#2_dim },
```

```
      listparindent .value_required:n = true,
      list-offset   .dim_set:c = { l__enumext_listoffset_#2_dim },
      list-offset   .value_required:n = true,
      list-indent   .code:n    =
                      \bool_set_true:c { l__enumext_leftmargin_tmp_#2_bool }
                      \dim_set:cn { l__enumext_leftmargin_tmp_#2_dim } {##1},
      list-indent   .value_required:n = true,
    }
  }
\clist_map_inline:nn
  {
    {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {keyans}{v}
  }
  { \__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.

```
\cs_set_protected:Npn \__enumext_tmp:nn #1 #2
  {
    \keys_define:nn { enumext / #1 }
      {
        itemindent    .dim_set:c = { l__enumext_fake_item_indent_#2_dim },
        itemindent    .value_required:n = true,
        rightmargin   .dim_set:c = { l__enumext_rightmargin_#2_dim },
        rightmargin   .value_required:n = true,
        listparindent .dim_set:c = { l__enumext_listparindent_#2_dim },
        listparindent .value_required:n = true,
        list-offset   .dim_set:c = { l__enumext_listoffset_#2_dim },
        list-offset   .value_required:n = true,
        list-indent   .meta:n    = { list-offset = ##1 },
        list-indent   .value_required:n = true,
      }
  }
\clist_map_inline:nn
  {
    {enumext*}{vii}, {keyans*}{viii}
  }
  { \__enumext_tmp:nn #1 }
```

13.18.1 Functions for setting the fake `itemindent`

`\__enumext_fake_item_indent:`
`\__enumext_keyans_fake_item_indent:`
`\__enumext_fake_item_indent_vii:`
`\__enumext_fake_item_indent_viii:`

The `itemindent` key does not set the value of `\itemindent`, it only sets the value of the *horizontal space* applied using `\skip_horizontal:N`. We will store this value in the variable and only apply it when it is greater than `0pt`. Here I will need to place `\mode_leave_vertical:` and the plain TEX macro `\ignorespaces` to avoid unwanted extra space when using the `itemindent` key.

```
\cs_set_protected:Nn \__enumext_fake_item_indent:
  {
    \dim_compare:nNnT
      { \dim_use:c { l__enumext_fake_item_indent_ \__enumext_level: _dim } }
      >
      { \c_zero_dim }
      {
        \tl_set:ce { l__enumext_fake_item_indent_ \__enumext_level: _tl }
          {
            \exp_not:N \mode_leave_vertical:
            \exp_not:n { \skip_horizontal:n }
              { \dim_use:c { l__enumext_fake_item_indent_ \__enumext_level: _dim } }
            \exp_not:N \ignorespaces
          }
      }
   }
\cs_set_protected:Nn \__enumext_keyans_fake_item_indent:
  {
    \dim_compare:nNnT
      { \l__enumext_fake_item_indent_v_dim } > { \c_zero_dim }
      {
        \tl_set:Ne \l__enumext_fake_item_indent_v_tl
          {
            \exp_not:N \mode_leave_vertical:
            \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_v_dim
```

```
            \exp_not:N \ignorespaces
          }
      }
  }
\cs_set_protected:Nn \__enumext_fake_item_indent_vii:
  {
    \dim_compare:nNnT
      { \l__enumext_fake_item_indent_vii_dim } > { \c_zero_dim }
      {
        \tl_set:Ne \l__enumext_fake_item_indent_vii_tl
          {
            \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_vii_dim
            \exp_not:N \ignorespaces
          }
      }
  }
\cs_set_protected:Nn \__enumext_fake_item_indent_viii:
  {
    \dim_compare:nNnT
      { \l__enumext_fake_item_indent_viii_dim } > { \c_zero_dim }
      {
        \tl_set:Ne \l__enumext_fake_item_indent_viii_tl
          {
            \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_viii_dim
            \exp_not:N \ignorespaces
          }
      }
  }
```

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

13.19 Setting show-length key

show-length

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

```
\cs_set_protected:Npn \__enumext_tmp:nn #1 #2
  {
    \keys_define:nn { enumext / #1 }
      {
        show-length .bool_set:c = { l__enumext_show_length_#2_bool },
        show-length .initial:n  = false,
      }
  }
\clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }
```

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

13.20 Setting before, after and first keys

before
before*
after
first

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

```
\cs_set_protected:Npn \__enumext_tmp:nn #1 #2
  {
    \keys_define:nn { enumext / #1 }
      {
        before  .tl_set:c   = { l__enumext_before_no_starred_key_#2_tl },
        before  .value_required:n = true,
        before* .tl_set:c   = { l__enumext_before_starred_key_#2_tl },
        before* .value_required:n = true,
        after   .tl_set:c   = { l__enumext_after_stop_list_#2_tl },
        after   .value_required:n = true,
        first   .tl_set:c   = { l__enumext_after_list_args_#2_tl },
        first   .value_required:n = true,
      }
  }
\clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }
```

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

13.20.1 Functions for before, after and first keys in enumext

__enumext_before_args_exec:
__enumext_before_keys_exec:
__enumext_after_stop_list:
__enumext_after_args_exec:

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

```
\cs_new_protected:Nn \__enumext_before_args_exec:
  {
    \tl_use:c { l__enumext_before_starred_key_ \__enumext_level: _tl }
  }
```

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⟩}}

```
\cs_new_protected:Nn \__enumext_before_keys_exec:
  {
    \tl_use:c { l__enumext_before_no_starred_key_ \__enumext_level: _tl }
  }
```

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

```
\cs_new_protected:Nn \__enumext_after_stop_list:
  {
    \tl_use:c { l__enumext_after_stop_list_ \__enumext_level: _tl }
  }
```

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.

```
\cs_new_protected:Nn \__enumext_after_args_exec:
  {
    \tl_use:c { l__enumext_after_list_args_ \__enumext_level: _tl }
  }
```

(*End of definition for* __enumext_before_args_exec: *and others.*)

13.20.2 Functions for before, after and first keys in keyans

__enumext_before_args_exec_v:
__enumext_before_keys_exec_v:
__enumext_after_stop_list_v:
__enumext_after_args_exec_v:

Same implementation as the one used in the enumext environment.

```
\cs_new_protected:Nn \__enumext_before_args_exec_v:
  {
    \tl_use:N \l__enumext_before_starred_key_v_tl
  }
\cs_new_protected:Nn \__enumext_before_keys_exec_v:
  {
    \tl_use:N \l__enumext_before_no_starred_key_v_tl
  }
\cs_new_protected:Nn \__enumext_after_stop_list_v:
  {
    \tl_use:N \l__enumext_after_stop_list_v_tl
  }
\cs_new_protected:Nn \__enumext_after_args_exec_v:
  {
    \tl_use:N \l__enumext_after_list_args_v_tl
  }
```

(*End of definition for* __enumext_before_args_exec_v: *and others.*)

13.20.3 Functions for before, after and first keys in enumext* and keyans*

__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.

```
\cs_new_protected:Nn \__enumext_before_args_exec_vii:
  {
    \tl_use:N \l__enumext_before_starred_key_vii_tl
  }
\cs_new_protected:Nn \__enumext_before_args_exec_viii:
  {
    \tl_use:N \l__enumext_before_starred_key_viii_tl
  }
\cs_new_protected:Nn \__enumext_before_keys_exec_vii:
  {
    \tl_use:N \l__enumext_before_no_starred_key_vii_tl
  }
\cs_new_protected:Nn \__enumext_before_keys_exec_viii:
  {
```

```
    \tl_use:N \l__enumext_before_no_starred_key_viii_tl
  }
\cs_new_protected:Nn \__enumext_after_stop_list_vii:
  {
    \tl_use:N \l__enumext_after_stop_list_vii_tl
  }
\cs_new_protected:Nn \__enumext_after_stop_list_viii:
  {
    \tl_use:N \l__enumext_after_stop_list_viii_tl
  }
\cs_new_protected:Nn \__enumext_after_args_exec_vii:
  {
    \tl_use:N \l__enumext_after_list_args_vii_tl
  }
\cs_new_protected:Nn \__enumext_after_args_exec_viii:
  {
    \tl_use:N \l__enumext_after_list_args_viii_tl
  }
```

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

13.21 Setting keys for `multicols` and `minipage`

mini-env
mini-sep
columns-sep
columns

The default value of the `columns-sep` key is handled by the state of the boolean variable `\l__enumext_columns_sep_X_bool` which is handled in the internal definition of the `enumext` and `keyans` environments. Define and set `mini-env`, `mini-sep`, `columns-sep` and `columns` keys for `enumext`, `enumext*`, `keyans` and `keyans*` environments.

```
\cs_set_protected:Npn \__enumext_tmp:nn #1 #2
  {
    \keys_define:nn { enumext / #1 }
      {
        mini-env    .dim_set:c  = { l__enumext_minipage_right_#2_dim },
        mini-env    .value_required:n = true,
        mini-sep    .dim_set:c  = { l__enumext_minipage_hsep_#2_dim },
        mini-sep    .initial:n  = 0.3333em,
        mini-sep    .value_required:n = true,
        columns-sep .dim_set:c  = { l__enumext_columns_sep_#2_dim },
        columns-sep .value_required:n = true,
        columns     .int_set:c  = { l__enumext_columns_#2_int },
        columns     .initial:n  = 1,
        columns     .value_required:n = true,
      }
  }
\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.

```
\cs_set_protected:Npn \__enumext_tmp:nn #1 #2
  {
    \keys_define:nn { enumext / #1 }
      {
        mini-right  .tl_gset:c = { g__enumext_miniright_code_#2_tl },
        mini-right  .value_required:n = true,
        mini-right* .code:n    = {
                                   \bool_gset_true:c { g__enumext_minipage_center_#2_bool }
                                   \keys_set:nn { enumext / #1 } { mini-right = {##1} }
                                 },
        mini-right* .value_required:n = true,
      }
  }
\clist_map_inline:nn { {enumext*}{vii}, {keyans*}{viii} } { \__enumext_tmp:nn #1 }
```

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

13.22 Adjustment of vertical spaces for `multicols`

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

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

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

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

13.22.1 Adjustment of vertical spaces for `multicols` in `enumext`

`\__enumext_multi_set_vskip:`

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

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

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

```
\cs_new_protected:Nn \__enumext_multi_set_vskip:
  {
    \skip_set:cn { l__enumext_multicols_above_ \__enumext_level: _skip }
      {
        \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip }
      }
    \skip_set:cn { l__enumext_multicols_below_ \__enumext_level: _skip }
      {
        \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip }
      }
    \__enumext_add_pre_parsep:
  }
```

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

`\__enumext_add_pre_parsep:`

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

```
\cs_new_protected:Nn \__enumext_add_pre_parsep:
  {
    \int_case:nn { \l__enumext_level_int }
      {
        { 2 }{
                \skip_if_eq:nnF { \l__enumext_parsep_i_skip } { \c_zero_skip }
                  {
                    \skip_add:Nn \l__enumext_multicols_above_ii_skip
                      {
                        \l__enumext_parsep_i_skip
                      }
                  }
              }
        { 3 }{
                \skip_if_eq:nnF { \l__enumext_parsep_ii_skip } { \c_zero_skip }
                  {
                    \skip_add:Nn \l__enumext_multicols_above_iii_skip
                      {
                        \l__enumext_parsep_ii_skip
                      }
                  }
              }
        { 4 }{
                \skip_if_eq:nnF { \l__enumext_parsep_iii_skip } { \c_zero_skip }
                  {
                    \skip_add:Nn \l__enumext_multicols_above_iv_skip
                      {
                        \l__enumext_parsep_iii_skip
                      }
```

```
                }
              }
        }
    }
```

(*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*⟩.

```
\cs_new_protected:Nn \__enumext_multi_addvspace:
  {
    \__enumext_multi_set_vskip:
    \mode_if_vertical:T
      {
        \skip_add:cn { l__enumext_multicols_above_ \__enumext_level: _skip }
          {
            \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
          }
        \skip_add:cn { l__enumext_multicols_below_ \__enumext_level: _skip }
          {
            \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
          }
      }
    \par\nopagebreak
    \addvspace{ \skip_use:c { l__enumext_multicols_above_ \__enumext_level: _skip } }
  }
```

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

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

`\__enumext_keyans_multi_set_vskip:`
`\__enumext_keyans_multi_addvspace:`

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

```
\cs_new_protected:Nn \__enumext_keyans_multi_set_vskip:
  {
    \skip_set:Nn \l__enumext_multicols_above_v_skip
      {
        \l__enumext_topsep_v_skip
      }
    \skip_set:Nn \l__enumext_multicols_below_v_skip
      {
        \l__enumext_topsep_v_skip
      }
  }
\cs_new_protected:Nn \__enumext_keyans_multi_addvspace:
  {
    \__enumext_keyans_multi_set_vskip:
    \mode_if_vertical:T
      {
        \skip_add:Nn \l__enumext_multicols_above_v_skip
          {
            \skip_use:N \l__enumext_partopsep_v_skip
          }
        \skip_add:Nn \l__enumext_multicols_below_v_skip
          {
            \skip_use:N \l__enumext_partopsep_v_skip
          }
      }
    \par\nopagebreak
    \addvspace{ \l__enumext_multicols_above_v_skip }
  }
```

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

13.23 Adjustment of vertical spaces for `minipage`

When nesting a *"list environment"* within the `minipage` environment, the values of the *"vertical spaces"* are lost. Graphically it can be seen like in the figure 8.
Since we want to keep the *"left"* and *"right"* environments *"aligned on top"*, preserving the `\baselineskip` and keep the desired *"spaces"* (`\topsep + [\partopsep]`) it is necessary to *"adjust"* the *"vertical spaces"* for `minipage` environments.

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

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

Again I must make clear that the implementation here is a *"bit questionable"*, but hunting the spaces (glue) produced by the minipage environment is quite complicated, even more if multicols it is nested. The setting of the values was more *"trial and error"* (aprox to \strutbox), using the help of the lua-visual-debug[14] package, again my attempts to find the correct values using \showoutput and \showboxdepth absolutely failed.

13.23.1 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.

```
\cs_new_protected:Nn \__enumext_minipage_set_skip:
  {
    \skip_set:Nn \l__enumext_minipage_right_skip
      {
        \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip }
      }
    \mode_if_vertical:T
      {
        \skip_add:Nn \l__enumext_minipage_right_skip
          {
            \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
          }
      }
    \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:.

```
    \skip_set_eq:cN
      { l__enumext_multicols_above_ \__enumext_level: _skip } \l__enumext_minipage_right_skip
    \skip_set_eq:cN
      { l__enumext_multicols_below_ \__enumext_level: _skip } \l__enumext_minipage_right_skip
    \__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.

```
    \int_compare:nNnT
      { \int_use:c { l__enumext_columns_ \__enumext_level: _int } } > { 1 }
      {
        \skip_zero:N \topskip
        \skip_set_eq:Nc \multicolsep { l__enumext_multicols_above_ \__enumext_level: _skip }
      }
  }
```

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

```
\cs_new_protected:Nn \__enumext_minipage_add_space:
  {
    \__enumext_minipage_set_skip:
    \__enumext_unskip_unkern:
    \mode_if_vertical:TF
      {
        \nopagebreak\nointerlineskip
```

```
      }
      {
        \par\nopagebreak\nointerlineskip
        \skip_zero:c { l__enumext_partopsep_ \__enumext_level: _skip }
      }
    \int_compare:nNnTF
      { \int_use:c { l__enumext_columns_ \__enumext_level: _int } } > { 1 }
      {
        \addvspace{ 0.445\box_ht:N \strutbox }
      }
      {
        \addvspace{ 0.250\box_ht:N \strutbox }
      }
  }
```

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

`\__enumext_pre_itemsep_skip:`

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

```
\cs_new_protected:Nn \__enumext_pre_itemsep_skip:
  {
    \int_case:nn { \l__enumext_level_int }
      {
        { 2 }{
               \skip_if_eq:nnTF
                 { \l__enumext_itemsep_i_skip } { \l__enumext_minipage_after_skip }
                 {
                   \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
                   \skip_set:Nn \l__enumext_multicols_below_ii_skip { 0.350\box_ht:N \strutbox }
                 }
                 {
                   \dim_compare:nNnT
                     { \l__enumext_itemsep_i_skip } < { \l__enumext_minipage_after_skip }
                     {
                       \skip_sub:Nn
                         \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
                       \skip_sub:Nn
                         \l__enumext_multicols_below_ii_skip { \l__enumext_itemsep_i_skip }
                       \skip_add:Nn
                         \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
                       \skip_add:Nn
                         \l__enumext_multicols_below_ii_skip { 0.350\box_ht:N \strutbox }
                     }
                   \dim_compare:nNnT
                     { \l__enumext_itemsep_i_skip } > { \l__enumext_minipage_after_skip }
                     {
                       \skip_set:Nn \l__enumext_minipage_temp_skip
                         {
                           \l__enumext_itemsep_i_skip - \l__enumext_minipage_after_skip
                         }
                       \skip_sub:Nn
                         \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
                       \skip_sub:Nn
                         \l__enumext_multicols_below_ii_skip { \l__enumext_itemsep_i_skip }
                       \skip_add:Nn
                         \l__enumext_minipage_after_skip
                         { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
                       \skip_add:Nn
                         \l__enumext_multicols_below_ii_skip
                         { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
                     }
                 }
             }
        { 3 }{
               \skip_if_eq:nnTF
                 { \l__enumext_itemsep_ii_skip } { \c_zero_skip }
                 {
                   \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
                   \skip_set:Nn \l__enumext_multicols_below_iii_skip { 0.350\box_ht:N \strutbox }
                 }
```

```
                {
                  \dim_compare:nNnT
                    { \l__enumext_itemsep_ii_skip } < { \l__enumext_minipage_after_skip }
                    {
                      \skip_sub:Nn
                        \l__enumext_minipage_after_skip { \l__enumext_itemsep_ii_skip }
                      \skip_sub:Nn
                        \l__enumext_multicols_below_iii_skip { \l__enumext_itemsep_ii_skip }
                      \skip_add:Nn
                        \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
                      \skip_add:Nn
                        \l__enumext_multicols_below_iii_skip { 0.350\box_ht:N \strutbox }
                    }
                  \dim_compare:nNnT
                    { \l__enumext_itemsep_ii_skip } > { \l__enumext_minipage_after_skip }
                    {
                      \skip_set:Nn \l__enumext_minipage_temp_skip
                        {
                          \l__enumext_itemsep_ii_skip - \l__enumext_minipage_after_skip
                        }
                      \skip_sub:Nn
                        \l__enumext_minipage_after_skip { \l__enumext_itemsep_ii_skip }
                      \skip_sub:Nn
                        \l__enumext_multicols_below_iii_skip { \l__enumext_itemsep_ii_skip }
                      \skip_add:Nn
                        \l__enumext_minipage_after_skip
                        { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
                      \skip_add:Nn
                        \l__enumext_multicols_below_iii_skip
                        { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
                    }
                }
              }
            { 4 }{
              \skip_if_eq:nnTF { \l__enumext_itemsep_iii_skip } { \c_zero_skip }
                {
                  \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
                  \skip_set:Nn \l__enumext_multicols_below_iv_skip { 0.350\box_ht:N \strutbox }
                }
                {
                  \dim_compare:nNnT
                    { \l__enumext_itemsep_iii_skip } < { \l__enumext_minipage_after_skip }
                    {
                      \skip_sub:Nn
                        \l__enumext_minipage_after_skip { \l__enumext_itemsep_iii_skip }
                      \skip_sub:Nn
                        \l__enumext_multicols_below_iv_skip { \l__enumext_itemsep_iii_skip }
                      \skip_add:Nn
                        \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
                      \skip_add:Nn
                        \l__enumext_multicols_below_iv_skip { 0.350\box_ht:N \strutbox }
                    }
                  \dim_compare:nNnT
                    { \l__enumext_itemsep_iii_skip } > { \l__enumext_minipage_after_skip }
                    {
                      \skip_set:Nn \l__enumext_minipage_temp_skip
                        {
                          \l__enumext_itemsep_iii_skip - \l__enumext_minipage_after_skip
                        }
                      \skip_sub:Nn
                        \l__enumext_minipage_after_skip { \l__enumext_itemsep_iii_skip }
                      \skip_sub:Nn
                        \l__enumext_multicols_below_iv_skip { \l__enumext_itemsep_iii_skip }
                      \skip_add:Nn
                        \l__enumext_minipage_after_skip
                        { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
                      \skip_add:Nn
                        \l__enumext_multicols_below_iv_skip
                        { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
                    }
                }
```

```
                }
        }
    }
```

(*End of definition for* `\__enumext_pre_itemsep_skip:`.)

13.23.2 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`.

```
\cs_new_protected:Nn \__enumext_keyans_minipage_set_skip:
  {
    \skip_zero:N \l__enumext_minipage_after_skip
    \skip_zero:N \l__enumext_minipage_left_skip
    \skip_zero:N \l__enumext_minipage_right_skip
    \skip_set:Nn \l__enumext_minipage_right_skip
      {
        \l__enumext_topsep_v_skip
      }
    \mode_if_vertical:T
      {
        \skip_add:Nn \l__enumext_minipage_right_skip
          {
            \l__enumext_partopsep_v_skip
          }
      }
    \skip_set_eq:NN \l__enumext_minipage_after_skip \l__enumext_minipage_right_skip
    \skip_set_eq:NN \l__enumext_multicols_above_v_skip \l__enumext_minipage_right_skip
    \skip_set_eq:NN \l__enumext_multicols_below_v_skip \l__enumext_minipage_right_skip
    \__enumext_keyans_pre_itemsep_skip:
    \int_compare:nNnT { \l__enumext_columns_v_int } > { 1 }
      {
        \skip_zero:N \topskip
        \skip_set_eq:NN \multicolsep \l__enumext_minipage_right_skip
      }
  }
\cs_new_protected:Nn \__enumext_keyans_minipage_add_space:
  {
    \__enumext_keyans_minipage_set_skip:
    \__enumext_unskip_unkern:
    \mode_if_vertical:TF
      {
        \nopagebreak\nointerlineskip
      }
      {
        \par\nopagebreak\nointerlineskip
        \skip_zero:N \l__enumext_partopsep_v_skip
      }
    \int_compare:nNnTF { \l__enumext_columns_v_int } > { 1 }
      {
        \addvspace{ 0.445\box_ht:N \strutbox }
      }
      {
        \addvspace{ 0.250\box_ht:N \strutbox }
      }
  }
\cs_new_protected:Nn \__enumext_keyans_pre_itemsep_skip:
  {
    \skip_if_eq:nnTF
      { \l__enumext_itemsep_i_skip } { \l__enumext_minipage_after_skip }
      {
        \skip_set:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
        \skip_set:Nn \l__enumext_multicols_below_v_skip { 0.350\box_ht:N \strutbox }
      }
      {
        \dim_compare:nNnT
          { \l__enumext_itemsep_i_skip } < { \l__enumext_minipage_after_skip }
          {
            \skip_sub:Nn \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
            \skip_sub:Nn \l__enumext_multicols_below_v_skip { \l__enumext_itemsep_i_skip }
            \skip_add:Nn \l__enumext_minipage_after_skip { 0.150\box_ht:N \strutbox }
```

```
      \skip_add:Nn \l__enumext_multicols_below_v_skip { 0.350\box_ht:N \strutbox }
    }
  \dim_compare:nNnT
    { \l__enumext_itemsep_i_skip } > { \l__enumext_minipage_after_skip }
    {
      \skip_set:Nn \l__enumext_minipage_temp_skip
        {
          \l__enumext_itemsep_i_skip - \l__enumext_minipage_after_skip
        }
      \skip_sub:Nn \l__enumext_minipage_after_skip { \l__enumext_itemsep_i_skip }
      \skip_sub:Nn \l__enumext_multicols_below_v_skip { \l__enumext_itemsep_i_skip }
      \skip_add:Nn \l__enumext_minipage_after_skip
        { 0.150\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
      \skip_add:Nn \l__enumext_multicols_below_v_skip
        { 0.350\box_ht:N \strutbox + \l__enumext_minipage_temp_skip }
    }
  }
}
```

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

13.23.3 Adjustment of vertical spaces for `minipage` in `enumext*` and `keyans*`

`\__enumext_mini_set_vskip_vii:`
`\__enumext_mini_set_vskip_viii:`

The functions `\__enumext_mini_set_vskip_vii:` and `\__enumext_mini_set_vskip_viii:` will take care of determining the "adjusted" spaces that we will apply *"above"* and *"below"* the `__enumext_mini_page` environment in `enumext*` and `keyans*`.

```
\cs_new_protected:Nn \__enumext_mini_set_vskip_vii:
  {
    \skip_zero_new:N \l__enumext_minipage_left_skip
    \skip_gzero_new:N \g__enumext_minipage_right_skip
    \skip_gzero_new:N \g__enumext_minipage_after_skip
    \skip_if_eq:nnTF { \l__enumext_topsep_vii_skip } { \c_zero_skip }
      {
        \skip_set:Nn \l__enumext_minipage_left_skip { 0.5\box_dp:N \strutbox }
        \skip_gset:Nn \g__enumext_minipage_right_skip { 0.325\box_dp:N \strutbox }
      }
      {
        \skip_set:Nn \l__enumext_minipage_left_skip { 0.5875\box_dp:N \strutbox }
        \skip_gset:Nn \g__enumext_minipage_right_skip
          {
            \l__enumext_topsep_vii_skip
          }
        \skip_gset:Nn \g__enumext_minipage_after_skip
          {
            0.325\box_dp:N \strutbox + \l__enumext_topsep_vii_skip
          }
      }
  }
\cs_new_protected:Nn \__enumext_mini_set_vskip_viii:
  {
    \skip_zero_new:N \l__enumext_minipage_after_skip
    \skip_zero_new:N \l__enumext_minipage_left_skip
    \skip_zero_new:N \l__enumext_minipage_right_skip
    \skip_if_eq:nnTF { \l__enumext_topsep_viii_skip } { \c_zero_skip }
      {
        \skip_set:Nn \l__enumext_minipage_left_skip
          {
            0.5\box_dp:N \strutbox
          }
        \skip_set:Nn \l__enumext_minipage_right_skip
          {
            \l__enumext_partopsep_viii_skip
          }
        \skip_set:Nn \l__enumext_minipage_after_skip
          {
            1.6\box_dp:N \strutbox
          }
      }
      {
        \skip_set:Nn \l__enumext_minipage_left_skip
          {
```

```
            0.5875\box_dp:N \strutbox
          }
        \skip_set:Nn \l__enumext_minipage_right_skip
          {
            \l__enumext_topsep_viii_skip
          }
        \skip_set:Nn \l__enumext_minipage_after_skip
          {
            0.325\box_dp:N \strutbox + \l__enumext_topsep_viii_skip
          }
      }
  }
```

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

`\__enumext_mini_addvspace_vii:`
`\__enumext_mini_addvspace_viii:`

The functions `\__enumext_mini_addvspace_vii:` and `\__enumext_mini_addvspace_viii:` will apply the vertical space *"only above"* the `__enumext_mini_page` environment on the *left side* when the `mini-right` key is active in the `enumext*` and `keyans*` environments.
Here we will NOT take into account whether TEX is in ⟨*horizontal mode*⟩ or ⟨*vertical mode*⟩, since `\partopsep` is equal to `0pt` in both environments.

```
\cs_new_protected:Nn \__enumext_mini_addvspace_vii:
  {
    \__enumext_mini_set_vskip_vii:
    \par\nopagebreak
    \addvspace { \l__enumext_minipage_left_skip }
  }
\cs_new_protected:Nn \__enumext_mini_addvspace_viii:
  {
    \__enumext_mini_set_vskip_viii:
    \par\nopagebreak
    \addvspace { \l__enumext_minipage_left_skip }
  }
```

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

13.23.4 The command `\miniright`

The command `\miniright` will close the `__enumext_mini_page` environment on the *"left side"*, open the `__enumext_mini_page` environment on the *"right side"* adding the *adjusted vertical space*. By default we will add `\centering` when starting the *"right side"* environment. The *starred argument* '`*`' inhibits the use of `\centering` command i.e. the usual LATEX 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.

```
\NewDocumentCommand \miniright { s }
  {
    \int_compare:nNnT { \l__enumext_keyans_pic_level_int } = { 1 }
      {
        \msg_error:nnn { enumext } { wrong-miniright-place }
      }
    % outside
    \bool_lazy_and:nnT
      { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
      { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
      {
        \msg_error:nnn { enumext } { wrong-miniright-place }
      }
    % starred env
    \bool_lazy_and:nnT
      { \bool_if_p:N \g__enumext_starred_bool }
      { \bool_not_p:n { \l__enumext_standar_bool } }
      {
        \msg_error:nnn { enumext } { wrong-miniright-starred }
      }
    % exec
    \int_compare:nNnTF { \l__enumext_keyans_level_int } = { 1 }
      {
        \__enumext_keyans_mini_right_cmd:n {#1}
      }
```

```
      { \__enumext_mini_right_cmd:n {#1} }
  }
```

(*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.

```
\cs_new_protected:Npn \__enumext_mini_right_cmd:n #1
  {
    \dim_compare:nNnTF
      { \dim_use:c { l__enumext_minipage_right_ \__enumext_level: _dim } } > { \c_zero_dim }
      {
        \__enumext_multicols_stop:
        \int_compare:nNnT
          { \int_use:c { l__enumext_columns_ \__enumext_level: _int } } = { 1 }
          {
            \par\addvspace{ \l__enumext_minipage_after_skip }
          }
        \end__enumext_mini_page
        \hfill
        \__enumext_mini_page{ \dim_use:c { l__enumext_minipage_right_ \__enumext_level: _dim } }
          \par\nointerlineskip
          \addvspace { \l__enumext_minipage_right_skip }
          \bool_if:nF {#1}
            {
              \centering
            }
          \int_gzero:N \g__enumext_minipage_stat_int
      }
      { \msg_error:nnn { enumext } { wrong-miniright-use } }
    % paranoia
    \RenewDocumentCommand \miniright { s }
      {
        \msg_error:nn { enumext } { many-miniright-used }
      }
  }
```

(*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.

```
\cs_new_protected:Npn \__enumext_keyans_mini_right_cmd:n #1
  {
    \dim_compare:nNnTF { \l__enumext_minipage_right_v_dim } > { \c_zero_dim }
      {
        \__enumext_keyans_multicols_stop:
        \int_compare:nNnT { \l__enumext_columns_v_int } = { 1 }
          {
            \par\addvspace{ \l__enumext_minipage_after_skip }
          }
        \end__enumext_mini_page
        \hfill
        \__enumext_mini_page{ \l__enumext_minipage_right_v_dim }
          \par\nointerlineskip
          \addvspace { \l__enumext_minipage_right_skip }
          \bool_if:nF {#1}
            {
              \centering
            }
          \int_gzero:N \g__enumext_minipage_stat_int
      }
      { \msg_error:nnn { enumext } { wrong-miniright-use } }
    % paranoia
    \RenewDocumentCommand \miniright { s }
      {
        \msg_error:nn { enumext } { many-miniright-used }
```

```
    }
  }
```

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

13.24 Setting above and below keys

While having controlled the *vertical spaces* within the `enumext` and `keyans` environments when using the `columns` or `mini-env` keys, sometimes the *"vertical spaces above"* or *"vertical spaces below"* the environments are not as expected and it is necessary to be able to apply a *"fine correction"* to these. As I have not been able to correct these *glitches*, the best option is to leave a couple of ⟨*keys*⟩ dedicated to this purpose, in this case it is best to use `\vspace` or `\vspace*` when convenient.

above
above*
below
below*

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

```
\cs_set_protected:Npn \__enumext_tmp:nn #1 #2
  {
    \keys_define:nn { enumext / #1 }
      {
        above  .skip_set:c = { l__enumext_vspace_above_#2_skip },
        above  .value_required:n = true,
        above* .code:n     = \bool_set_true:c { l__enumext_vspace_a_star_#2_bool }
                             \keys_set:nn { enumext / #1 } { above = {##1} },
        above* .value_required:n = true,
        below  .skip_set:c = { l__enumext_vspace_below_#2_skip },
        below  .value_required:n = true,
        below* .code:n     = \bool_set_true:c { l__enumext_vspace_b_star_#2_bool }
                             \keys_set:nn { enumext / #1 } { below = {##1} },
        below* .value_required:n = true,
      }
  }
\clist_map_inline:Nn \c__enumext_all_envs_clist { \__enumext_tmp:nn #1 }
```

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

13.24.1 Functions for above and below keys in enumext

`\__enumext_vspace_above:`

The function `\__enumext_vspace_above:` apply the *vertical space above* the `enumext` environment set by the `above*` and `above` keys.

```
\cs_new_protected:Nn \__enumext_vspace_above:
  {
    \skip_if_eq:nnF
      { \skip_use:c { l__enumext_vspace_above_ \__enumext_level: _skip } } { \c_zero_skip }
      {
        \bool_if:cTF { l__enumext_vspace_a_star_ \__enumext_level: _bool }
          {
            \vspace*{ \skip_use:c { l__enumext_vspace_above_ \__enumext_level: _skip } }
          }
          {
            \vspace { \skip_use:c { l__enumext_vspace_above_ \__enumext_level: _skip } }
          }
      }
  }
```

(*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.

```
\cs_new_protected:Nn \__enumext_vspace_below:
  {
    \skip_if_eq:nnF
      { \skip_use:c { l__enumext_vspace_below_ \__enumext_level: _skip } } { \c_zero_skip }
      {
        \bool_if:cTF { l__enumext_vspace_b_star_ \__enumext_level: _bool }
          {
            \vspace*{ \skip_use:c { l__enumext_vspace_below_ \__enumext_level: _skip } }
          }
          {
            \vspace { \skip_use:c { l__enumext_vspace_below_ \__enumext_level: _skip } }
          }
      }
  }
```

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

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13.24.2 Functions for above and below keys in keyans

__enumext_vspace_above_v: The function __enumext_vspace_above_v: apply the *vertical space above* the keyans environment set by the above and above* keys.

```
\cs_new_protected:Nn \__enumext_vspace_above_v:
  {
    \skip_if_eq:nnF { \l__enumext_vspace_above_v_skip } { \c_zero_skip }
      {
        \bool_if:NTF \l__enumext_vspace_a_star_v_bool
          {
            \vspace*{ \l__enumext_vspace_above_v_skip }
          }
          { \vspace { \l__enumext_vspace_above_v_skip } }
      }
  }
```

(*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.

```
\cs_new_protected:Nn \__enumext_vspace_below_v:
  {
    \skip_if_eq:nnF { \l__enumext_vspace_below_v_skip } { \c_zero_skip }
      {
        \bool_if:NTF \l__enumext_vspace_b_star_v_bool
          {
            \vspace*{ \l__enumext_vspace_below_v_skip }
          }
          { \vspace { \l__enumext_vspace_below_v_skip } }
      }
  }
```

(*End of definition for* __enumext_vspace_below_v:.)

13.24.3 Functions for above and below keys in enumext* keyans*

__enumext_vspace_above_vii: __enumext_vspace_above_viii: 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.

```
\cs_new_protected:Nn \__enumext_vspace_above_vii:
  {
    \skip_if_eq:nnF { \l__enumext_vspace_above_vii_skip } { \c_zero_skip }
      {
        \bool_if:NTF \l__enumext_vspace_a_star_vii_bool
          {
            \vspace*{ \l__enumext_vspace_above_vii_skip }
          }
          { \vspace { \l__enumext_vspace_above_vii_skip } }
      }
  }
\cs_new_protected:Nn \__enumext_vspace_above_viii:
  {
    \skip_if_eq:nnF { \l__enumext_vspace_above_viii_skip } { \c_zero_skip }
      {
        \bool_if:NTF \l__enumext_vspace_a_star_viii_bool
          {
            \vspace*{ \l__enumext_vspace_above_viii_skip }
          }
          { \vspace { \l__enumext_vspace_above_viii_skip } }
      }
  }
```

(*End of definition for* __enumext_vspace_above_vii: *and* __enumext_vspace_above_viii:.)

__enumext_vspace_below_vii: __enumext_vspace_below_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.

```
\cs_new_protected:Nn \__enumext_vspace_below_vii:
  {
    \skip_if_eq:nnF { \l__enumext_vspace_below_vii_skip } { \c_zero_skip }
      {
        \bool_if:NTF \l__enumext_vspace_b_star_vii_bool
          {
            \vspace*{ \l__enumext_vspace_below_vii_skip }
```

```
            }
            { \vspace { \l__enumext_vspace_below_vii_skip } }
        }
    }
\cs_new_protected:Nn \__enumext_vspace_below_viii:
    {
      \skip_if_eq:nnF { \l__enumext_vspace_below_viii_skip } { \c_zero_skip }
        {
          \bool_if:NTF \l__enumext_vspace_b_star_viii_bool
            {
              \vspace*{ \l__enumext_vspace_below_viii_skip }
            }
            { \vspace { \l__enumext_vspace_below_viii_skip } }
        }
    }
```

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

13.25 Setting `series`, `resume` and `resume*` keys

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

`series` `resume` `resume*`

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

```
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \keys_define:nn { enumext / #1 }
      {
        series  .str_set:N = \l__enumext_series_str,
        series  .value_required:n = true,
        resume  .code:n = \__enumext_resume_series:n {##1},
        resume* .code:n = \__enumext_resume_starred:,
        resume* .value_forbidden:n = true,
      }
  }
\clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }
```

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

13.25.1 Internal functions for `series` key

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

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

```
\cs_new:Npn \__enumext_filter_series:n #1
  {
    \use:e
      {
        \keyval_parse:NNn
          \__enumext_filter_series_key:n
          \__enumext_filter_series_pair:nn {#1}
      }
  }
```

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.

```
\cs_new:Npn \__enumext_filter_series_key:n #1
  {
    \str_case:nnF {#1}
      {
        { resume } {} { resume* } {} { base-fix } {}
      }
      { , { \exp_not:n {#1} } }
  }
```

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.

```
\cs_new:Npn \__enumext_filter_series_pair:nn #1#2
  {
    \str_case:nnF {#1}
      {
        { series } {} { resume } {} { start } {}
```

```
      { start* } {}  { save-ans } {} { save-key } {}
    }
    { , { \exp_not:n {#1} } = { \exp_not:n {#2} } }
}
```

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

`\__enumext_parse_series:n` `\__enumext_resume_last:n`

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

The value of boolean variable `\l__enumext_resume_active_bool` is set to true by the function `\__enumext_resume_counter:n` which is used by the keys `resume` and `resume*`, in this case we must Make sure it is set to false so that it does not overwrite the default filtered ⟨*keys*⟩. This function is passed to the function `\__enumext_parse_keys:n` in the `enumext` environment definition (§13.39) and to the function `\__enumext_parse_keys_vii:n` in the `enumext*` environment definition (§13.44).

```
\cs_new_protected:Npn \__enumext_parse_series:n #1
  {
    \str_if_empty:NTF \l__enumext_series_str
      {
        \bool_if:NF \l__enumext_resume_active_bool
          {
            \__enumext_resume_last:n {#1}
          }
      }
      {
        \tl_gclear_new:c { g__enumext_series_ \l__enumext_series_str _tl }
        \tl_gset:ce { g__enumext_series_ \l__enumext_series_str _tl }
          { \__enumext_filter_series:n {#1} }
        \int_if_exist:cF { g__enumext_series_ \l__enumext_series_str _int }
          {
            \int_new:c { g__enumext_series_ \l__enumext_series_str _int }
          }
      }
  }
```

The function `\__enumext_resume_last:n` will be in charge of saving the filtering ⟨*keys*⟩ when the `series` key is *not used* and will save them in the variable `\g__enumext_standar_series_tl` for the `enumext` environment and in the variable `\g__enumext_starred_series_tl` for the `enumext*` environment.

```
\cs_new_protected:Npn \__enumext_resume_last:n #1
  {
    \bool_if:NT \l__enumext_standar_first_bool
      {
        \tl_gclear:N \g__enumext_standar_series_tl
        \tl_gset:Ne \g__enumext_standar_series_tl { \__enumext_filter_series:n {#1} }
      }
    \bool_if:NT \l__enumext_starred_first_bool
      {
        \tl_gclear:N \g__enumext_starred_series_tl
        \tl_gset:Ne \g__enumext_starred_series_tl { \__enumext_filter_series:n {#1} }
      }
  }
```

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

13.25.2 Internal function to save counter value

`\__enumext_resume_save_counter:`

The `\__enumext_resume_save_counter:` function will save the last counter value to `\g__enumext_series_`⟨*series name*⟩`_int` if the `series=`{⟨*series name*⟩} key has been passed, to `\g__enumext_resume_int` if it has passed the key `resume` *without value* and the key `series` is not active, in `\g__enumext_series_`⟨*series name*⟩`_int` if the key `resume=`{⟨*series name*⟩} has been passed and in `\g__enumext_series_`⟨*store name*⟩`_int` if the key has been passed `save-ans=`{⟨*store name*⟩}.

The variables `\l__enumext_series_str` and `\l__enumext__resume_name_tl` contain the same {⟨*series name*⟩} but are executed at different moments, the integer variable with `\l__enumext_series_str` sets the value when execute `series=`{⟨*series name*⟩} and the integer variable with `\l__enumext__resume_name_tl` sets the subsequent values when use `resume=`{⟨*series name*⟩}. This function is passed to the `enumext` environment definition (§13.39) and the `enumext*` environment definition (§13.44).

```
\cs_new_protected:Nn \__enumext_resume_save_counter:
  {
```

```
    \bool_if:NT \g__enumext_standar_bool
      {
        \tl_if_empty:NF \l__enumext_series_str
          {
            \int_gset_eq:cN
              { g__enumext_series_ \l__enumext_series_str _int } \value{enumXi}
          }
        \tl_if_empty:NTF \l__enumext_resume_name_tl
          {
            \str_if_empty:NT \l__enumext_series_str
              {
                \int_gset_eq:NN \g__enumext_resume_int \value{enumXi}
              }
          }
          {
            \int_if_exist:cT { g__enumext_series_ \l__enumext_resume_name_tl _int }
              {
                \int_gset_eq:cN
                  { g__enumext_series_ \l__enumext_resume_name_tl _int } \value{enumXi}
              }
          }
        \int_if_exist:cT { g__enumext_resume_ \l__enumext_store_name_tl _int }
          {
            \int_gset_eq:cN
              { g__enumext_resume_ \l__enumext_store_name_tl _int } \value{enumXi}
          }
      }
    \bool_if:NT \g__enumext_starred_bool
      {
        \tl_if_empty:NF \l__enumext_series_str
          {
            \int_gset_eq:cN
              { g__enumext_series_ \l__enumext_series_str _int } \value{enumXvii}
          }
        \tl_if_empty:NTF \l__enumext_resume_name_tl
          {
            \str_if_empty:NT \l__enumext_series_str
              {
                \int_gset_eq:NN \g__enumext_resume_vii_int \value{enumXvii}
              }
          }
          {
            \int_if_exist:cT { g__enumext_series_ \l__enumext_resume_name_tl _int }
              {
                \int_gset_eq:cN
                  { g__enumext_series_ \l__enumext_resume_name_tl _int } \value{enumXvii}
              }
          }
        \int_if_exist:cT { g__enumext_resume_ \l__enumext_store_name_tl _int }
          {
            \int_gset_eq:cN
              { g__enumext_resume_ \l__enumext_store_name_tl _int } \value{enumXvii}
          }
      }
  }
```

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

13.25.3 Internal functions for resume key

`\__enumext_resume_series:n`

The function `\__enumext_resume_series:n` will handle the argument passed to the `resume` key in `enumext` and `enumext*` environments. If the key is passed *without value* the function `\__enumext_resume_counter:` is executed which will set the counter according to the numbering of the last `enumext` or `enumext*` environments in which `series=`{⟨*series name*⟩} key is not present, if the `save-ans` key is active it will set the counter according to the value of the integer variable created by that key, otherwise it will verify that the `\g__enumext_series_`⟨*series name*⟩`_tl` variable set by the `series` key exists, if so it will pass these keys to the *first level* of the environment, otherwise it will return an error.

```
\cs_new_protected:Npn \__enumext_resume_series:n #1
  {
    \tl_if_empty:nTF {#1}
      {
        \__enumext_resume_counter:n { }
```

```
      }
      {
        \tl_if_exist:cTF { g__enumext_series_ \tl_to_str:n {#1} _tl }
          {
            \__enumext_resume_counter:n {#1}
            \bool_if:NT \g__enumext_standar_bool
              {
                \keys_set:nv { enumext / level-1 }
                  { g__enumext_series_ \tl_to_str:n {#1} _tl }
              }
            \bool_if:NT \g__enumext_starred_bool
              {
                \keys_set:nv { enumext / enumext* }
                  { g__enumext_series_ \tl_to_str:n {#1} _tl }
              }
          }
          {
            \bool_if:NT \g__enumext_standar_bool
              {
                \msg_error:nnn { enumext } { unknown-series } {#1}
              }
            \bool_if:NT \g__enumext_starred_bool
              {
                \msg_error:nnn { enumext } { unknown-series } {#1}
              }
          }
      }
  }
```

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

`\__enumext_resume_counter:n`
`\__enumext_resume_counter:`
`\__enumext_resume_counter_series:`
`\__enumext_resume_counter_save_ans:`

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

```
\cs_new_protected:Npn \__enumext_resume_counter:n #1
  {
    \bool_set_true:N \l__enumext_resume_active_bool
    \tl_set:Nn \l__enumext_resume_name_tl {#1}
    \tl_if_empty:NTF \l__enumext_resume_name_tl
      {
        \__enumext_resume_counter:
      }
      {
        \__enumext_resume_counter_series:
      }
    \__enumext_resume_counter_save_ans:
  }
```

The `\__enumext_resume_counter:` function is executed when the `resume` key is used *without value*, only the counters for the *"first level"* of the environments will be set.

```
\cs_new_protected:Nn \__enumext_resume_counter:
  {
    \bool_if:NT \g__enumext_standar_bool
      {
        \int_gincr:N \g__enumext_resume_int
        \int_set_eq:NN \l__enumext_start_i_int \g__enumext_resume_int
      }
    \bool_if:NT \g__enumext_starred_bool
      {
        \int_gincr:N \g__enumext_resume_vii_int
        \int_set_eq:NN \l__enumext_start_vii_int \g__enumext_resume_vii_int
      }
  }
```

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

```
\cs_new_protected:Nn \__enumext_resume_counter_series:
  {
    \bool_if:NT \g__enumext_standar_bool
      {
        \int_set:Nn \l__enumext_start_i_int
          {
            \int_use:c { g__enumext_series_ \l__enumext_resume_name_tl _int } + 1
          }
      }
    \bool_if:NT \g__enumext_starred_bool
      {
        \int_set:Nn \l__enumext_start_vii_int
          {
            \int_use:c { g__enumext_series_ \l__enumext_resume_name_tl _int } + 1
          }
      }
  }
```

The function `\__enumext_resume_counter_save_ans:` will be executed when the `save-ans` key is active along with the `resume` key, setting the counters for the *"first level"* of the environments according to the value of the integer variables created by the `save-ans` key.

```
\cs_new_protected:Nn \__enumext_resume_counter_save_ans:
  {
    \bool_lazy_and:nnT
      { \bool_if_p:N \l__enumext_standar_first_bool }
      { \bool_if_p:N \l__enumext_store_active_bool }
      {
        \int_set:Nn \l__enumext_start_i_int
          {
            \int_use:c { g__enumext_resume_ \l__enumext_store_name_tl _int } + 1
          }
      }
    \bool_lazy_and:nnT
      { \bool_if_p:N \l__enumext_starred_first_bool }
      { \bool_if_p:N \l__enumext_store_active_bool }
      {
        \int_set:Nn \l__enumext_start_vii_int
          {
            \int_use:c { g__enumext_resume_ \l__enumext_store_name_tl _int } + 1
          }
      }
  }
```

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

13.25.4 Internal function for `resume*` key

`\__enumext_resume_starred:`

The function `\__enumext_resume_starred:` will handle the `resume*` key in the `enumext` and `enumext*` environments. This function will execute the filtered ⟨*keys*⟩ in the last one and will continue with the numbering according to the last execution of the environment `enumext` or `enumext*` in which the keys `resume`={⟨*series name*⟩} or `series`={⟨*series name*⟩} were not active.

```
\cs_new_protected:Nn \__enumext_resume_starred:
  {
    \bool_if:NT \g__enumext_standar_bool
      {
        \tl_if_empty:NF \g__enumext_standar_series_tl
          {
            \__enumext_resume_counter:n { }
            \keys_set:nV { enumext / level-1 } \g__enumext_standar_series_tl
          }
      }
    \bool_if:NT \g__enumext_starred_bool
      {
        \tl_if_empty:NF \g__enumext_starred_series_tl
          {
            \__enumext_resume_counter:n { }
            \keys_set:nV { enumext / enumext* } \g__enumext_starred_series_tl
          }
      }
  }
```

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

13.26 Setting save-ans, check-ans and no-store keys

The key save-ans is directly associated with the keys check-ans, no-store, resume and resume*, this will activate the entire *"storage system"* in the enumext package.

13.26.1 Setting save-ans key

save-ans

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

```
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \keys_define:nn { enumext / #1 }
      {
        save-ans .code:n = \__enumext_storing_set:n {##1},
        save-ans .value_required:n = true,
      }
  }
\clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }
```

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

13.26.2 Internal functions for save-ans key

__enumext_start_save_ans_msg:
__enumext_stop_save_ans_msg:

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

```
\cs_new_protected:Nn \__enumext_start_save_ans_msg:
  {
    \msg_term:nnVV { enumext } { save-ans-log }
      \g__enumext_envir_name_tl \l__enumext_store_name_tl
  }
\cs_new_protected:Nn \__enumext_stop_save_ans_msg:
  {
    \msg_term:nnVV { enumext } { save-ans-log-hook }
      \g__enumext_envir_name_tl \g__enumext_store_name_tl
  }
```

(*End of definition for* __enumext_start_save_ans_msg: *and* __enumext_stop_save_ans_msg:.)

__enumext_storing_set:n
__enumext_storing_exec:

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

```
\cs_new_protected:Npn \__enumext_storing_set:n #1
  {
    \tl_set:Ne \l__enumext_store_name_tl {#1}
    \tl_if_empty:NTF \l__enumext_store_name_tl
      {
        \bool_lazy_or:nnT
          { \l__enumext_standar_first_bool } { \l__enumext_starred_first_bool }
          {
            \msg_error:nnV { enumext } { save-ans-empty } \g__enumext_envir_name_tl
          }
      }
      {
        \bool_lazy_or:nnT
          { \l__enumext_standar_first_bool } { \l__enumext_starred_first_bool }
          {
            \__enumext_start_save_ans_msg:
            \__enumext_storing_exec:
          }
      }
  }
```

The function __enumext_storing_exec: will set to true the variable \l__enumext_store_active_bool which activates the use of the \anskey command and the anskey*, keyans, keyans* and keyanspic environments and will set to "true" the variable \l__enumext_check_answers_bool used for internal checking answers mechanism set by the check-ans and no-store keys, copy {⟨*store name*⟩} into the variable \g__enumext_store_name_tl and execute the function __enumext_anskey_env_make:V creating the environment anskey* (§13.31).

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

```
{
  \bool_set_true:N \l__enumext_store_active_bool
  \bool_set_true:N \l__enumext_check_answers_bool
  \tl_gset:NV \g__enumext_store_name_tl \l__enumext_store_name_tl
  \__enumext_anskey_env_make:V \l__enumext_store_name_tl
```

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

```
  \prop_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _prop }
    {
      \msg_log:nnV { enumext } { store-prop } \l__enumext_store_name_tl
      \prop_new:c { g__enumext_ \l__enumext_store_name_tl _prop }
    }
  \seq_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _seq }
    {
      \msg_log:nnV { enumext } { store-seq } \l__enumext_store_name_tl
      \seq_new:c { g__enumext_ \l__enumext_store_name_tl _seq }
    }
  \int_if_exist:cF { g__enumext_resume_ \l__enumext_store_name_tl _int }
    {
      \msg_log:nnV { enumext } { store-int } \l__enumext_store_name_tl
      \int_new:c { g__enumext_resume_ \l__enumext_store_name_tl _int }
    }
}
```

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

13.26.3 The check answer mechanism

The internal mechanism for *"checking answers"* follows this logic:

> If the line begins with \item or \item* and does NOT *open a nested environment*, each \item or \item* must contain a *single* execution of the \anskey command, i.e. the counter of the executions of the \anskey command must be equal to the counter associated with the sum of executions of \item and \item*.
>
> If the line begins with \item or \item* and *opens a nested environment* each \item or \item* in the nested environment must have a *single* execution of the \anskey command and the counter associated to the sum of \item and \item* executions must decrementing by *"one"* to maintain equality.

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

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

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

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

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

13.26.4 Setting check-ans and no-store keys

check-ans
no-store

Now we define the keys check-ans and no-store for all levels of enumext and enumext* environments.

```
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \keys_define:nn { enumext / #1 }
      {
        check-ans .bool_set:N = \l__enumext_check_ans_key_bool,
        check-ans .initial:n  = false,
        check-ans .value_required:n = true,
        no-store  .code:n = {
                              \bool_set_false:N \l__enumext_check_answers_bool
```

```
                                \bool_set_false:N \l__enumext_check_ans_key_bool
                              },
        no-store  .value_forbidden:n = true,
      }
  }
\clist_map_inline:nn
  {
    level-1, level-2, level-3, level-4, enumext*
  }
  { \__enumext_tmp:n {#1} }
```

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

13.26.5 Set-up check answer mechanism

`\__enumext_check_ans_active:` `\__enumext_check_ans_level:`

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

```
\cs_new_protected:Nn \__enumext_check_ans_active:
  {
    \tl_if_empty:NF \l__enumext_store_name_tl
      {
        \bool_if:NT \l__enumext_check_answers_bool
          {
            \__enumext_check_ans_level:
          }
      }
  }
```

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

```
\cs_new_protected:Nn \__enumext_check_ans_level:
  {
    \int_case:nn { \l__enumext_level_int }
      {
        { 1 }{
                \bool_lazy_all:nT
                  {
                    { \bool_if_p:N \g__enumext_starred_bool }
                    { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
                  }
                  {
                    \int_gdecr:N \g__enumext_item_number_int
                    \bool_set_false:N \l__enumext_item_number_bool
                  }
              }
        { 2 }{
                \int_gdecr:N \g__enumext_item_number_int
                \bool_set_false:N \l__enumext_item_number_bool
              }
        { 3 }{
                \int_gdecr:N \g__enumext_item_number_int
                \bool_set_false:N \l__enumext_item_number_bool
              }
        { 4 }{
                \int_gdecr:N \g__enumext_item_number_int
                \bool_set_false:N \l__enumext_item_number_bool
              }
      }
```

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.

```
    \int_case:nn { \l__enumext_level_h_int }
      {
        { 1 }{
                \bool_lazy_all:nT
                  {
                    { \bool_if_p:N \g__enumext_standar_bool }
                    { \int_compare_p:nNn { \l__enumext_level_int } = { 1 } }
```

```
                    }
                    {
                      \int_gdecr:N \g__enumext_item_number_int
                      \bool_set_false:N \l__enumext_item_number_bool
                    }
                }
            }
        }
```

(*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.

```
\cs_new_protected:Nn \__enumext_check_ans_key_hook:
  {
    \bool_lazy_and:nnT
      { \bool_if_p:N \l__enumext_check_ans_key_bool }
      { \bool_if_p:N \g__enumext_standar_bool }
      {
        \bool_gset_true:N \g__enumext_check_ans_key_bool
      }
    \bool_lazy_and:nnT
      { \bool_if_p:N \l__enumext_check_ans_key_bool }
      { \bool_if_p:N \g__enumext_starred_bool }
      {
        \bool_gset_true:N \g__enumext_check_ans_key_bool
      }
  }
```

(*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:`.

```
\cs_new_protected:Nn \__enumext_item_answer_diff:
  {
    \int_gset:Nn \g__enumext_item_answer_diff_int
      {
        \int_sign:n { \g__enumext_item_number_int - \g__enumext_item_anskey_int }
      }
  }
```

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

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

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

```
\cs_new_protected:Nn \__enumext_check_ans_show:
  {
    \int_case:nn { \g__enumext_item_answer_diff_int }
      {
        { -1 }{ \__enumext_check_ans_msg_less:    }
        {  0 }{ \__enumext_check_ans_msg_same_ok: }
        {  1 }{ \__enumext_check_ans_msg_greater: }
      }
  }
\cs_new_protected:Nn \__enumext_check_ans_msg_less:
  {
    \msg_warning:nneee { enumext } { item-less-answer } { \g__enumext_store_name_tl }
      { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
  }
\cs_new_protected:Nn \__enumext_check_ans_msg_same_ok:
  {
    \msg_term:nneee { enumext } { items-same-answer } { \g__enumext_store_name_tl }
      { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
  }
\cs_new_protected:Nn \__enumext_check_ans_msg_greater:
```

```
  {
    \msg_warning:nneee { enumext } { item-greater-answer } { \g__enumext_store_name_tl }
      { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
  }
```

(*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:`.

```
\cs_new_protected:Nn \__enumext_check_ans_log:
  {
    \int_case:nn { \g__enumext_item_answer_diff_int }
      {
        { -1 }{ \__enumext_check_ans_log_msg_less:    }
        {  0 }{ \__enumext_check_ans_log_msg_same_ok: }
        {  1 }{ \__enumext_check_ans_log_msg_greater: }
      }
  }
\cs_new_protected:Nn \__enumext_check_ans_log_msg_less:
  {
    \msg_log:nneee { enumext } { item-less-answer } { \g__enumext_store_name_tl }
      { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
  }
\cs_new_protected:Nn \__enumext_check_ans_log_msg_same_ok:
  {
    \msg_log:nneee { enumext } { items-same-answer }  { \g__enumext_store_name_tl }
      { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
  }
\cs_new_protected:Nn \__enumext_check_ans_log_msg_greater:
  {
    \msg_log:nneee { enumext } { item-greater-answer } { \g__enumext_store_name_tl }
      { \g__enumext_envir_name_tl } { \g__enumext_start_line_tl }
  }
```

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

13.26.6 Check for `\item*` and `\anspic*` commands

`\__enumext_check_starred_cmd:n`

The function `\__enumext_check_starred_cmd:n` performs an *extra check* for the `keyans`, `keyans*` and `keyanspic` environments. Unlike the *check* executed by `check-ans` key this one is not controlled by any key, it is intended to prevent the forgetting of `\item*` or `\anspic*` in these environments.

```
\cs_new_protected:Npn \__enumext_check_starred_cmd:n #1
  {
    \int_compare:nNnT
      { \g__enumext_check_starred_cmd_int } = { 0 }
      {
        \msg_warning:nnnV
          { enumext } { missing-starred }{ #1 } \l__enumext_check_start_line_env_tl
      }
    \int_compare:nNnT
      { \g__enumext_check_starred_cmd_int } > { 1 }
      {
        \msg_warning:nnnV
          { enumext } { many-starred }{ #1 } \l__enumext_check_start_line_env_tl
      }
    \int_gzero:N \g__enumext_check_starred_cmd_int
    \tl_clear:N \l__enumext_check_start_line_env_tl
  }
```

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

13.27 Keys and functions associated with storage

13.27.1 Keys for `marks`, `wrapp` 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*
mark-pos*
mark-sep*
wrap-ans*
wrap-opt
save-sep
show-ans
show-pos

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

```
\cs_set_protected:Npn \__enumext_tmp:nn #1 #2
  {
    \keys_define:nn { enumext / #1 }
      {
        mark-ans*  .tl_set:c  = { l__enumext_mark_answer_sym_#2_tl },
        mark-ans*  .initial:n = \textasteriskcentered,
        mark-ans*  .value_required:n = true,
        mark-pos*  .choice:,
        mark-pos* / left    .code:n = \str_set:cn { l__enumext_mark_position_#2_str } { l },
        mark-pos* / right   .code:n = \str_set:cn { l__enumext_mark_position_#2_str } { r },
        mark-pos* / center  .code:n = \str_set:cn { l__enumext_mark_position_#2_str } { c },
        mark-pos* / unknown .code:n =
                          \msg_error:nneee { enumext } { unknown-choice }
                            { mark-pos } { left, ~ right, ~ center } { \exp_not:n {##1} },
        mark-pos*  .initial:n = right,
        mark-pos*  .value_required:n = true,
        mark-sep*  .dim_set:c = { l__enumext_mark_sym_sep_#2_dim },
        mark-sep*  .value_required:n = true,
        wrap-ans*  .cs_set_protected:cp = { __enumext_keyans_wrapper_item_#2:n } ##1,
        wrap-ans*  .value_required:n = true,
        wrap-opt   .cs_set_protected:cp = { __enumext_keyans_wrapper_opt_#2:n } ##1,
        wrap-opt   .initial:n = [{##1}],
        wrap-opt   .value_required:n = true,
        save-sep   .tl_set:c = { l__enumext_store_keyans_item_opt_sep_#2_tl },
        save-sep   .initial:n = {, ~ },
        save-sep   .value_required:n = true,
        show-ans   .bool_set:N = \l__enumext_show_answer_bool,
        show-ans   .initial:n = false,
        show-ans   .value_required:n = true,
        show-pos   .bool_set:N = \l__enumext_show_position_bool,
        show-pos   .initial:n = false,
        show-pos   .value_required:n = true,
      }
  }
\clist_map_inline:nn { {keyans}{v}, {keyans*}{viii} } { \__enumext_tmp:nn #1 }
```

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

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

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 the ⟨*keys*⟩ for environments keyans and keyans* only at the *first level* of enumext and enumext*.

```
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \keys_define:nn { enumext / #1 }
      {
        mark-ref  .tl_set:N   = \l__enumext_mark_ref_sym_tl,
        mark-ref  .initial:n  = \textreferencemark,
        mark-ref  .value_required:n = true,
        save-ref  .bool_set:N = \l__enumext_store_ref_key_bool,
        save-ref  .initial:n  = false,
        save-ref  .value_required:n = true,
        show-ans  .bool_set:N = \l__enumext_show_answer_bool,
        show-ans  .initial:n  = false,
        show-ans  .value_required:n = true,
        show-pos  .bool_set:N = \l__enumext_show_position_bool,
        show-pos  .initial:n  = false,
        show-pos  .value_required:n = true,
        mark-ans  .tl_set:N  = \l__enumext_mark_answer_sym_tl,
        mark-ans  .initial:n = \textasteriskcentered,
        mark-ans  .value_required:n = true,
        mark-sep  .dim_set:N  = \l__enumext_mark_sym_sep_dim,
        mark-sep  .value_required:n = true,
        mark-pos  .choice:,
        mark-pos / left    .code:n = \str_set:Nn \l__enumext_mark_position_str { l },
        mark-pos / right   .code:n = \str_set:Nn \l__enumext_mark_position_str { r },
        mark-pos / center  .code:n = \str_set:Nn \l__enumext_mark_position_str { c },
        mark-pos / unknown .code:n =
                          \msg_error:nneee { enumext } { unknown-choice }
```

```
                                { mark-pos } { left, ~ right, ~ center } { \exp_not:n {##1} },
        mark-pos  .initial:n = right,
        mark-pos  .value_required:n = true,

        wrap-ans  .cs_set_protected:Np = \__enumext_anskey_wrapper:n ##1,
        wrap-ans  .initial:n =
                    {
                      \fbox{\parbox[t]{\dimeval{\itemwidth -2\fboxsep -2\fboxrule}}{##1}}
                    },
        wrap-ans  .value_required:n = true,
        mark-ans* .code:n = {
                              \keys_set:nn { enumext / keyans  } { mark-ans* = {##1} }
                              \keys_set:nn { enumext / keyans* } { mark-ans* = {##1} }
                            },
        mark-ans* .value_required:n = true,
        mark-pos* .code:n = {
                              \keys_set:nn { enumext / keyans  } { mark-pos* = {##1} }
                              \keys_set:nn { enumext / keyans* } { mark-pos* = {##1} }
                            },
        mark-pos* .value_required:n = true,
        mark-sep* .code:n = {
                              \keys_set:nn { enumext / keyans  } { mark-sep* = {##1} }
                              \keys_set:nn { enumext / keyans* } { mark-sep* = {##1} }
                            },
        mark-sep* .value_required:n = true,
        wrap-ans* .code:n = {
                              \keys_set:nn { enumext / keyans  } { wrap-ans* = {##1} }
                              \keys_set:nn { enumext / keyans* } { wrap-ans* = {##1} }
                            },
        wrap-ans* .value_required:n = true,
        wrap-opt  .code:n = {
                              \keys_set:nn { enumext / keyans  } { wrap-opt = {##1} }
                              \keys_set:nn { enumext / keyans* } { wrap-opt = {##1} }
                            },
        wrap-opt  .value_required:n = true,
        save-sep  .code:n = {
                              \keys_set:nn { enumext / keyans  } { save-sep = {##1} }
                              \keys_set:nn { enumext / keyans* } { save-sep = {##1} }
                            },
        save-sep  .value_required:n = true,
      }
  }
\clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }
```

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

13.27.2 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*⟩.

```
\cs_new_protected:Npn \__enumext_store_active_keys:n #1
  {
    \bool_if:cF { l__enumext_store_save_key_ \__enumext_level: _bool }
      {
        \tl_clear:c { l__enumext_store_save_key_ \__enumext_level: _tl }
        \tl_set:ce
          { l__enumext_store_save_key_ \__enumext_level: _tl }
          { \__enumext_filter_save_key:n {#1} }
      }
  }
\cs_new_protected:Npn \__enumext_store_active_keys_vii:n #1
  {
    \bool_if:NF \l__enumext_store_save_key_vii_bool
      {
```

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```
2414          \tl_clear:N \l__enumext_store_save_key_vii_tl
2415          \tl_set:Ne \l__enumext_store_save_key_vii_tl { \__enumext_filter_save_key:n {#1} }
2416        }
2417    }
```

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

13.27.3 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.

```
2418 \cs_set_protected:Npn \__enumext_tmp:n #1
2419   {
2420     \keys_define:nn { enumext / enumext* }
2421       {
2422         save-key .code:n = \__enumext_parse_save_key_vii:n {##1},
2423         save-key .value_required:n = true,
2424       }
2425     \keys_define:nn { enumext / #1 }
2426       {
2427         save-key .code:n = \__enumext_parse_save_key:n {##1},
2428         save-key .value_required:n = true,
2429       }
2430   }
2431 \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*`.

```
2432 \cs_new_protected:Npn \__enumext_parse_save_key:n #1
2433   {
2434     \bool_set_true:c { l__enumext_store_save_key_ \__enumext_level: _bool }
2435     \tl_clear:c { l__enumext_save_key_ \__enumext_level: _tl }
2436     \tl_set:ce
2437       { l__enumext_store_save_key_ \__enumext_level: _tl }
2438       { \__enumext_filter_save_key:n {#1} }
2439   }
2440 \cs_new_protected:Npn \__enumext_parse_save_key_vii:n #1
2441   {
2442     \bool_set_true:N \l__enumext_store_save_key_vii_bool
2443     \tl_clear:N \l__enumext_store_save_key_vii_tl
2444     \tl_set:Ne \l__enumext_store_save_key_vii_tl { \__enumext_filter_save_key:n {#1} }
2445   }
```

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

13.27.4 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.

```
2446 \cs_new:Npn \__enumext_filter_save_key:n #1
2447   {
2448     \use:e
2449       {
2450         \keyval_parse:NNn
2451           \__enumext_filter_save_key_key:n
2452           \__enumext_filter_save_key_pair:nn {#1}
2453       }
2454   }
```

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.

```
2455 \cs_new:Npn \__enumext_filter_save_key_key:n #1
2456   {
2457     \str_case:nnF {#1}
2458       {
```

```
      { resume } {} { resume* } {} { no-store } {} { base-fix } {}
    }
    { , { \exp_not:n {#1} } }
}
```

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.

```
\cs_new:Npn \__enumext_filter_save_key_pair:nn #1#2
  {
    \str_case:nnF {#1}
      {
        { series    } {} { resume     } {} { save-ans    } {} { save-ref  } {}
        { save-key  } {} { check-ans  } {} { show-ans    } {} { show-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 } {} { mini-right* } {}
      }
      { , { \exp_not:n {#1} } = { \exp_not:n {#2} } }
  }
```

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

13.27.5 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 {⟨*content*⟩} in *prop list* defined by save-ans key. The *"stored content"* is retrieved by means of the \getkeyans command.

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

```
\cs_new_protected:Npn \__enumext_store_addto_prop:n #1
  {
    \prop_gput_if_not_in:cen { g__enumext_ \l__enumext_store_name_tl _prop }
      {
        \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } + 1 }
      }
      { #1 }
  }
\cs_generate_variant:Nn \__enumext_store_addto_prop:n { V }
```

(*End of definition for* __enumext_store_addto_prop:n.)

13.27.6 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 {⟨*content*⟩} in *sequence* defined by save-ans key. This function is used by \anskey in enumext, \item* in keyans and \anspic in keyanspic.

The form in which the {⟨*content*⟩} is stored in *sequence* is in a internal enumext or enumext* environments with the *"same structure"* in which the command was executed.
The *"stored content"* is retrieved by means of the \printkeyans command.

```
\cs_new_protected:Npn \__enumext_store_addto_seq:n #1
  {
    \seq_gput_right:cn { g__enumext_ \l__enumext_store_name_tl _seq } { #1 }
  }
\cs_generate_variant:Nn \__enumext_store_addto_seq:n { v, V }
```

(*End of definition for* __enumext_store_addto_seq:n.)

13.27.7 Functions for storing structure in the sequence

__enumext_store_level_open:
__enumext_store_level_close:

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

```
\cs_new_protected:Nn \__enumext_store_level_open:
  {
    \bool_if:NT \l__enumext_check_answers_bool
      {
        \tl_if_empty:cTF { l__enumext_store_save_key_ \__enumext_level: _tl }
          {
            \__enumext_store_addto_seq:n
              {
                \item \begin{enumext}
```

```
      }
    }
    {
      \tl_put_left:cn { l__enumext_store_save_key_ \__enumext_level: _tl }
        {
          \item \begin{enumext} [
        }
      \tl_put_right:cn { l__enumext_store_save_key_ \__enumext_level: _tl }
        {
          ]
        }
      \__enumext_store_addto_seq:v { l__enumext_store_save_key_ \__enumext_level: _tl }
    }
  }
}
\cs_new_protected:Nn \__enumext_store_level_close:
{
  \bool_if:NT \l__enumext_check_answers_bool
    {
      \__enumext_store_addto_seq:n { \end{enumext} }
    }
}
```

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

`\__enumext_store_level_open_vii:` `\__enumext_store_level_close_vii:`

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

```
\cs_new_protected:Nn \__enumext_store_level_open_vii:
{
  \bool_if:NT \l__enumext_check_answers_bool
    {
      \tl_if_empty:NTF \l__enumext_store_save_key_vii_tl
        {
          \__enumext_store_addto_seq:n
            {
              \item \begin{enumext*}
            }
        }
        {
          \tl_put_left:Nn \l__enumext_store_save_key_vii_tl
            {
              \item \begin{enumext*}[
            }
          \tl_put_right:Nn \l__enumext_store_save_key_vii_tl
            {
              ]
            }
          \__enumext_store_addto_seq:V \l__enumext_store_save_key_vii_tl
        }
    }
}
\cs_new_protected:Nn \__enumext_store_level_close_vii:
{
  \bool_if:NT \l__enumext_check_answers_bool
    {
      \__enumext_store_addto_seq:n { \end{enumext*} }
    }
}
```

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

13.27.8 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`

```
\cs_new_protected:Nn \__enumext_print_keyans_box:NN
{
  \mode_leave_vertical:
  \skip_horizontal:n { -\dim_use:N #2 }
```

```
    \hbox_overlap_left:n
      {
        \makebox[ \dim_use:N #1 ][ \l__enumext_mark_position_str ]
          {
            \tl_use:N \l__enumext_mark_answer_sym_tl
          }
      }
    \skip_horizontal:n { \dim_use:N #2 }
  }
\cs_generate_variant:Nn \__enumext_print_keyans_box:NN { cc }
```

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

13.28 The internal label and ref

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

`\__enumext_store_internal_ref:`

First we will remove the dots "." from the current ⟨*labels*⟩, we do not want to get double dots in our references, then we will place this in the variable `\l__enumext_newlabel_arg_two_tl`.

```
\cs_new_protected:Nn \__enumext_store_internal_ref:
  {
    \cs_set_protected:Npn \__enumext_tmp:n ##1
      {
        \tl_set_eq:cc { l__enumext_label_copy_##1_tl } { l__enumext_label_##1_tl }
        \tl_reverse:c { l__enumext_label_copy_##1_tl }
        \tl_remove_once:cn { l__enumext_label_copy_##1_tl } { . }
        \tl_reverse:c { l__enumext_label_copy_##1_tl }
      }
    \clist_map_inline:nn { i, ii, iii, iv, vii } { \__enumext_tmp:n {##1} }
    \cs_set:Npn \__enumext_tmp:n ##1
      { . \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.

```
    \bool_lazy_all:nT
      {
        { \bool_if_p:N \g__enumext_starred_bool }
        { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
      }
      {
        \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
          { \tl_use:N \l__enumext_label_copy_vii_tl }
      }
    \bool_lazy_all:nT
      {
        { \bool_not_p:n { \g__enumext_standar_bool } }
        { \bool_if_p:N \l__enumext_standar_bool }
        { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } }
      }
      {
        \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
          {
            \tl_use:N \l__enumext_label_copy_vii_tl
            \int_step_function:nnN { 1 } { \l__enumext_level_int } \__enumext_tmp:n
          }
      }
```

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.

```
    \bool_lazy_all:nT
      {
        { \bool_if_p:N \g__enumext_standar_bool }
        { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } }
        { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
      }
      {
        \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
          {
            \tl_use:N \l__enumext_label_copy_i_tl
            \int_step_function:nnN { 2 } { \l__enumext_level_int } \__enumext_tmp:n
```

```
            }
        }
      \cs_set:Npn \__enumext_tmp:n ##1
        { \tl_use:c { l__enumext_label_copy_ \int_to_roman:n {##1} _tl } . }
      \bool_lazy_all:nT
        {
          { \bool_if_p:N \g__enumext_standar_bool }
          { \bool_if_p:N \l__enumext_starred_bool }
          { \int_compare_p:nNn { \l__enumext_level_int } > { 0 } }
        }
        {
          \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
            {
              \int_step_function:nnN { 1 } { \l__enumext_level_int } \__enumext_tmp:n
              \tl_use:N \l__enumext_label_copy_vii_tl
            }
        }
```

Now we set the variable `\l__enumext_newlabel_arg_one_tl` which will contain {⟨*store name* : *position*⟩}.

```
      \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
        {
          \l__enumext_store_name_tl \c_colon_str
          \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } }
        }
```

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

```
      \tl_put_right:Ne \l__enumext_write_aux_file_tl
        {
          \__enumext_newlabel:nn
            { \exp_not:V \l__enumext_newlabel_arg_one_tl }
            { \l__enumext_newlabel_arg_two_tl }
        }
      \l__enumext_write_aux_file_tl
    }
```

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

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

`\__enumext_store_anskey_code:n`

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

```
\cs_new_protected:Npn \__enumext_store_anskey_code:n #1
  {
    \int_gincr:N \g__enumext_item_anskey_int
    \__enumext_store_addto_prop:n {#1}
    \bool_if:NT \l__enumext_store_ref_key_bool
      {
        \__enumext_store_internal_ref:
      }
    \__enumext_anskey_show_wrap_left:n { #1 }
```

Now we start processing the [⟨*key* = *val*⟩] 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 ⟨*keys*⟩, if the `break-col` key is present and the command is running under `enumext` (not in `enumext*`) we will add `\columnbreak` and then `\item`.

```
    \tl_clear:N \l__enumext_store_anskey_arg_tl
    \bool_lazy_and:nnT
      { \bool_if_p:N \l__enumext_store_columns_break_bool }
      { \bool_not_p:n { \l__enumext_starred_bool } }
      {
        \tl_put_left:Nn \l__enumext_store_anskey_arg_tl { \columnbreak }
      }
    \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`.

```
    \bool_lazy_and:nnT
      { \bool_not_p:n { \l__enumext_starred_bool } }
      { \int_compare_p:nNn { \l__enumext_store_item_join_int } > { 1 } }
      {
```

```
      \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
        {
          ( \exp_not:V \l__enumext_store_item_join_int )
        }
    }
```

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 {⟨*argument*⟩} for `\anskey` or ⟨*body*⟩ for `anskey*`.

```
  \bool_if:NTF \l__enumext_store_item_star_bool
    {
      \tl_put_right:Nn \l__enumext_store_anskey_arg_tl { * }
      \tl_if_empty:NF \l__enumext_store_item_symbol_tl
        {
          \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
            {
              [ \exp_not:V \l__enumext_store_item_symbol_tl ]
            }
        }
      \dim_compare:nT
        {
          \l__enumext_store_item_symbol_sep_dim != \c_zero_dim
        }
        {
          \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
            {
              [ \exp_not:V \l__enumext_store_item_symbol_sep_dim ]
            }
        }
      \tl_put_right:Nn \l__enumext_store_anskey_arg_tl {#1}
    }
    {
      \tl_put_right:Nn \l__enumext_store_anskey_arg_tl {#1}
    }
```

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*.

```
  \bool_lazy_and:nnT
    { \bool_if_p:N \l__enumext_store_ref_key_bool }
    { \bool_if_p:N \l__enumext_hyperref_bool }
    {
      \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
        {
          \hfill \exp_not:N \hyperlink { \exp_not:V \l__enumext_newlabel_arg_one_tl }
               { \exp_not:V \l__enumext_mark_ref_sym_tl }
        }
    }
  \__enumext_store_addto_seq:V \l__enumext_store_anskey_arg_tl
}
```

(*End of definition for* `\__enumext_store_anskey_code:n`.)

`\__enumext_anskey_show_wrap_arg:n`

The function `\__enumext_anskey_show_wrap_arg:n` *"wraps"* the {⟨*argument*⟩} passed to `\anskey` and the ⟨*body*⟩ for `anskey*` when using the `wrap-ans` and `wrap-sep` keys.

```
\cs_new_protected:Npn \__enumext_anskey_show_wrap_arg:n #1
 {
   \par
   \bool_if:NTF \l__enumext_starred_bool
     {
       \dim_compare:nNnT { \l__enumext_mark_sym_sep_dim } = { \c_zero_dim }
         {
           \dim_set:Nn \l__enumext_mark_sym_sep_dim { \l__enumext_labelsep_vii_dim }
         }
       \__enumext_print_keyans_box:NN
         \l__enumext_labelwidth_vii_dim \l__enumext_mark_sym_sep_dim
     }
     {
       \dim_compare:nNnT { \l__enumext_mark_sym_sep_dim } = { \c_zero_dim }
         {
           \dim_set:Nn \l__enumext_mark_sym_sep_dim
             {
               \dim_use:c {l__enumext_labelsep_ \__enumext_level: _dim }
             }
```

```
          }
        \__enumext_print_keyans_box:cc
          { l__enumext_labelwidth_ \__enumext_level: _dim } { l__enumext_mark_sym_sep_dim }
      }
    \__enumext_anskey_wrapper:n { #1 }
  }
```

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

`\__enumext_anskey_show_wrap_left:n`

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

```
\cs_new_protected:Npn \__enumext_anskey_show_wrap_left:n #1
  {
    \bool_if:NT \l__enumext_show_answer_bool
      {
        \__enumext_anskey_show_wrap_arg:n { #1 }
      }
    \bool_if:NT \l__enumext_show_position_bool
      {
        \tl_set:Ne \l__enumext_mark_answer_sym_tl
          {
            \group_begin:
            \exp_not:N \normalfont
            \exp_not:N \footnotesize [ \int_eval:n
              {
                \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
              }
              ]
            \group_end:
          }
        \__enumext_anskey_show_wrap_arg:n { #1 }
      }
  }
```

(*End of definition for* `\__enumext_anskey_show_wrap_left:n`.)

13.30 The command \anskey

Since we will be *"storing content"* in a `list` environment within *sequences* and can (more or less) manage the options passed to each level, it is necessary that we have a little more control over `\item` when storing.

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

`break-col` `item-join` `item-star` `item-sym*` `item-pos*` `unknown` `\__enumext_anskey_unknown:n` `\__enumext_anskey_unknown:nn`

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

```
\keys_define:nn { enumext / anskey }
  {
    break-col .bool_set:N = \l__enumext_store_columns_break_bool,
    break-col .default:n  = true,
    break-col .value_forbidden:n = true,
    item-join .int_set:N  = \l__enumext_store_item_join_int,
    item-join .value_required:n = true,
    item-star .bool_set:N = \l__enumext_store_item_star_bool,
    item-star .default:n  = true,
    item-star .value_forbidden:n = true,
    item-sym* .tl_set:N   = \l__enumext_store_item_symbol_tl,
    item-sym* .value_required:n = true,
    item-pos* .dim_set:N  = \l__enumext_store_item_symbol_sep_dim,
    item-pos* .value_required:n = true,
    unknown   .code:n     = { \__enumext_anskey_unknown:n {#1} },
  }
```

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

```
\cs_new_protected:Npn \__enumext_anskey_unknown:n #1
  {
    \exp_args:NV \__enumext_anskey_unknown:nn \l_keys_key_str {#1}
  }
\cs_new_protected:Npn \__enumext_anskey_unknown:nn #1 #2
  {
    \tl_if_blank:nTF {#2}
```

```
      {
        \msg_error:nnn { enumext } { anskey-cmd-key-unknown } {#1}
      }
      {
        \msg_error:nnnn { enumext } { anskey-cmd-key-value-unknown } {#1} {#2}
      }
  }
```

(*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 `\__enumext_anskey_safe_outer:` to be sure where we execute the command, then we will check the state of the variable `\l__enumext_check_answers_bool` set by the key `no-store`, if is true we will increment `\g__enumext_item_anskey_int` for the internal *"check answer"* system and execute the function `\__enumext_anskey_safe_inner:n` to ensure that the command is not nested and that the argument is not empty, finally search the `[`⟨*key* = *val*⟩`]` and call the function `\__enumext_store_anskey_code:n`.

```
\NewDocumentCommand \anskey { o +m }
  {
    \__enumext_anskey_safe_outer:
    \group_begin:
      \bool_if:NT \l__enumext_check_answers_bool
        {
          \tl_if_novalue:nF {#1}
            {
              \keys_set:nn { enumext / anskey } {#1}
            }
          \tl_if_blank:nTF {#2}
            {
              \msg_error:nn { enumext } { anskey-empty-arg }
            }
            {
              \__enumext_anskey_safe_inner:
              \__enumext_store_anskey_code:n {#2}
            }
        }
    \group_end:
  }
```

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

13.30.1 Internal functions for the command

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

```
\cs_new_protected:Nn \__enumext_anskey_safe_outer:
  {
    \bool_if:NF \l__enumext_store_active_bool
      {
        \msg_error:nnnn { enumext } { anskey-wrong-place }{ anskey }{ enumext }
      }
    \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
      {
        \msg_error:nnnn { enumext } { command-wrong-place }{ anskey }{ keyans }
      }
    \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
      {
        \msg_error:nnnn { enumext } { command-wrong-place }{ anskey }{ keyans* }
      }
    \int_compare:nNnT { \l__enumext_keyans_pic_level_int } = { 1 }
      {
        \msg_error:nnnn { enumext } { command-wrong-place }{ anskey }{ keyanspic }
      }
  }
```

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.

```
\cs_new_protected:Nn \__enumext_anskey_safe_inner:
  {
    \int_incr:N \l__enumext_anskey_level_int
    \int_compare:nNnT { \l__enumext_anskey_level_int } > { 1 }
```

```
      {
        \msg_error:nn { enumext } { anskey-nested }
      }
    \bool_if:NF \l__enumext_item_number_bool
      {
        \msg_error:nn { enumext } { anskey-unnumber-item }
      }
    \mode_if_math:T
      {
        \msg_error:nne { enumext } { anskey-math-mode } { \c_backslash_str anskey }
      }
  }
```

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

13.31 The environment anskey*

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

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

`\__enumext_undefine_anskey_env:`

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

```
\cs_new_protected:Nn \__enumext_undefine_anskey_env:
  {
    \cs_undefine:c { anskey* }
    \cs_undefine:c { endanskey* }
    \cs_undefine:c { __scontents_anskey*_env_begin: }
    \cs_undefine:c { __scontents_anskey*_env_end: }
  }
```

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

```
\__enumext_before_env:nn { enumext }
  {
    \bool_lazy_and:nnT
      { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
      { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
      {
        \cs_if_free:cF { __scontents_anskey*_env_begin: }
          {
            \msg_error:nnn { enumext } { anskey-env-error } { anskey* }
          }
      }
  }
\__enumext_before_env:nn { enumext* }
  {
    \bool_lazy_and:nnT
      { \int_compare_p:nNn { \l__enumext_level_int } = { 0 } }
      { \int_compare_p:nNn { \l__enumext_level_h_int } = { 0 } }
      {
        \cs_if_free:cF { __scontents_anskey*_env_begin: }
          {
            \msg_error:nnn { enumext } { anskey-env-error } { anskey* }
          }
      }
  }
```

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

```
\__enumext_before_env:nn { anskey* }
```

```
2869  {
2870    \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
2871      {
2872        \msg_error:nnn { enumext } { anskey-env-wrong }{ keyans }
2873      }
2874    \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
2875      {
2876        \msg_error:nnn { enumext } { anskey-env-wrong } { keyans* }
2877      }
2878    \int_compare:nNnT { \l__enumext_keyans_pic_level_int } = { 1 }
2879      {
2880        \msg_error:nnn { enumext } { anskey-env-wrong } { keyanspic }
2881      }
2882    \bool_if:NF \l__enumext_item_number_bool
2883      {
2884        \msg_error:nn { enumext } { anskey-unnumber-item }
2885      }
2886    \mode_if_math:T
2887      {
2888        \msg_error:nnn { enumext } { anskey-math-mode } { anskey* }
2889      }
2890  }
```

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

anskey*
__enumext_anskey_env_make:n
__enumext_anskey_env_make:V
__enumext_anskey_env_define_keys:
__enumext_anskey_env_unknown:n
__enumext_anskey_env_unknown:nn
__enumext_anskey_env_reset_keys:
__enumext_rescan_anskey_env:n

The function `\__enumext_anskey_env_make:n` creates the environment `anskey*` (*custom version* of `scontents` environment) by setting the initial keys `store-env={`⟨*store name*⟩`}` and `print-env=false`. To maintain the *scope* of the environment and that it is only active when the key `save-ans` is active we will pass this function to the function `\__enumext_storing_exec:` (§13.26.1) and we will execute it only if the variable `\l__enumext_anskey_env_bool` is true, with this we prevent it from being executed again when the environment is nested and the key `save-ans` is active, which returns an error for part of the package `scontents`.

```
2891  \cs_new_protected:Npn \__enumext_anskey_env_make:n #1
2892    {
2893      \bool_if:NT \l__enumext_anskey_env_bool
2894        {
2895          \newenvsc{anskey*}[store-env=#1,print-env=false]
2896          \__enumext_anskey_env_exec:
2897        }
2898    }
2899  \cs_generate_variant:Nn \__enumext_anskey_env_make:n { V }
```

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

```
2900  \cs_new_protected:Nn \__enumext_anskey_env_define_keys:
2901    {
2902      \keys_define:nn { scontents / scontents }
2903        {
2904          break-col .bool_gset:N = \g__enumext_store_columns_break_bool,
2905          break-col .default:n   = true,
2906          break-col .value_forbidden:n = true,
2907          item-join .int_gset:N  = \g__enumext_store_item_join_int,
2908          item-join .value_required:n = true,
2909          item-star .bool_gset:N = \g__enumext_store_item_star_bool,
2910          item-star .default:n   = true,
2911          item-star .value_forbidden:n = true,
2912          item-sym* .tl_gset:N   = \g__enumext_store_item_symbol_tl,
2913          item-sym* .value_required:n = true,
2914          item-pos* .dim_gset:N  = \g__enumext_store_item_symbol_sep_dim,
2915          item-pos* .value_required:n = true,
2916          print-env .undefine:,
2917          store-env .undefine:,
2918          write-out .undefine:,
2919          unknown   .code:n      = { \__enumext_anskey_env_unknown:n {##1} },
2920        }
2921    }
```

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`.

```
2922  \cs_new_protected:Npn \__enumext_anskey_env_unknown:n #1
```

```
  {
    \exp_args:NV \__enumext_anskey_env_unknown:nn \l_keys_key_str {#1}
  }
\cs_new_protected:Npn \__enumext_anskey_env_unknown:nn #1#2
  {
    \tl_if_blank:nTF {#2}
      {
        \msg_error:nnn { enumext } { anskey-env-key-unknown } {#1}
      }
      {
        \msg_error:nnnn { enumext } { anskey-env-key-value-unknown } {#1} {#2}
      }
  }
```

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

```
\cs_new_protected:Nn \__enumext_anskey_env_reset_keys:
  {
    \keys_define:nn { scontents / scontents }
      {
        break-col .undefine:,
        item-join .undefine:,
        item-star .undefine:,
        item-sym* .undefine:,
        item-pos* .undefine:,
        write-out .code:n    = {
                                 \bool_set_false:N \l__scontents_storing_bool
                                 \bool_set_true:N  \l__scontents_writing_bool
                                 \tl_set:Nn \l__scontents_fname_out_tl {##1}
                               },
        write-out .value_required:n = true,
        print-env .meta:nn   = { scontents } { print-env = ##1 },
        print-env .default:n = true,
        store-env .meta:nn   = { scontents } { store-env = ##1 },
        unknown   .code:n    = { \__scontents_parse_environment_keys:n {##1} },
      }
  }
```

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

```
\cs_new_protected:Npn \__enumext_rescan_anskey_env:n #1
  {
    \group_begin:
      \int_set:Nn \tex_newlinechar:D { `\^^J }
      \__scontents_rescan_tokens:x
        {
          \endgroup % This assumes \catcode`\\=0... Things might go off otherwise.
         #1
        }
  }
```

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

`\__enumext_anskey_env_exec:`

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

```
\cs_new_protected:Nn \__enumext_anskey_env_exec:
  {
    \__enumext_before_env:nn { anskey* }
      {
        \__enumext_anskey_env_define_keys:
      }
```

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

```
    \hook_if_empty:nF {env/anskey*/after}
      {
        \hook_gremove_code:nn {env/anskey*/after} { * }
      }
    \__enumext_after_env:nn { anskey* }
```

```
    {
      \__enumext_anskey_env_save_keys:
      \tl_clear:N \l__enumext_store_anskey_env_tl
      \tl_clear:N \l__enumext_store_anskey_opt_tl
      \bool_if:NT \l__enumext_check_answers_bool
        {
          \tl_set:Ne \l__enumext_store_anskey_env_tl
            {
              \seq_item:ce { g__scontents_name_ \l__enumext_store_name_tl _seq } { -1 }
            }
          \regex_match:nVTF
            { ^\s* \z | ^\s* \u{c__scontents_hidden_space_str} \z }
            \l__enumext_store_anskey_env_tl
            {
              \msg_error:nn { enumext } { anskey-empty-arg }
            }
            {
              \__enumext_anskey_env_store:
            }
        }
      \__enumext_anskey_env_clean_vars:
      \__enumext_anskey_env_reset_keys:
    }
}
```

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

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

`\__enumext_anskey_env_save_keys:`
`\__enumext_anskey_env_store:`
`\__enumext_anskey_env_clean_vars:`

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

```
\cs_new_protected:Nn \__enumext_anskey_env_save_keys:
  {
    \bool_lazy_and:nnT
      { \bool_if_p:N \g__enumext_store_columns_break_bool }
      { \bool_not_p:n { \l__enumext_starred_bool } }
      {
        \tl_put_left:Ne \l__enumext_store_anskey_opt_tl { ,break-col, }
      }
```

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

```
    \bool_lazy_and:nnT
      { \bool_not_p:n { \l__enumext_starred_bool } }
      { \int_compare_p:nNn { \g__enumext_store_item_join_int } > { 1 } }
      {
        \tl_put_left::Ne \l__enumext_store_anskey_opt_tl
          {
            ,item-join = \exp_not:V \g__enumext_store_item_join_int,
          }
      }
```

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

```
    \bool_if:NT \g__enumext_store_item_star_bool
      {
        \tl_put_left:Ne \l__enumext_store_anskey_opt_tl
          {
            ,item-star,
          }
        \tl_if_empty:NF \g__enumext_store_item_symbol_tl
          {
            \tl_put_left:Ne \l__enumext_store_anskey_opt_tl
              {
                ,item-sym* = \exp_not:V \g__enumext_store_item_symbol_tl,
              }
          }
        \dim_compare:nT
          {
```

```
3034              \g__enumext_store_item_symbol_sep_dim != \c_zero_dim
3035            }
3036            {
3037              \tl_put_left:Ne \l__enumext_store_anskey_opt_tl
3038                {
3039                  ,item-pos* = \exp_not:V \g__enumext_store_item_symbol_sep_dim,
3040                }
3041            }
3042        }
3043    }
```

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

```
3044 \cs_new_protected:Nn \__enumext_anskey_env_store:
3045   {
3046     \group_begin:
3047       \tl_if_empty:NTF \l__enumext_store_anskey_opt_tl
3048         {
3049           \exp_args:Ne
3050             \__enumext_store_anskey_code:n
3051               {
3052                 \__enumext_rescan_anskey_env:n { \l__enumext_store_anskey_env_tl }
3053               }
3054         }
3055         {
3056           \keys_set_known:nV { enumext / anskey } \l__enumext_store_anskey_opt_tl
3057           \exp_args:Ne
3058             \__enumext_store_anskey_code:n
3059               {
3060                 \__enumext_rescan_anskey_env:n { \l__enumext_store_anskey_env_tl }
3061               }
3062         }
3063     \group_end:
3064   }
```

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

```
3065 \cs_new_protected:Nn \__enumext_anskey_env_clean_vars:
3066   {
3067     \bool_gset_false:N \g__enumext_store_columns_break_bool
3068     \int_gzero:N       \g__enumext_store_item_join_int
3069     \bool_gset_false:N \g__enumext_store_item_star_bool
3070     \tl_gclear:N       \g__enumext_store_item_symbol_tl
3071     \dim_gzero:N       \g__enumext_store_item_symbol_sep_dim
3072   }
```

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

13.32 Executing anskey*, check-ans and write .log

`\__enumext_execute_after_env:`

The `\__enumext_execute_after_env:` function will first return the appropriate message for the end of the environment in which the save-ans key is being executed, then call the `\__enumext_item_answer_diff:` function and then will write the values of the global variables used to the `.log` file. If the key check-ans is active it will execute the function `\__enumext_check_ans_show:` and show the result in the terminal, otherwise it will execute the function `\__enumext_check_ans_log:` and write the results in the `.log` file, undefine the environment anskey* (§13.31) through the function `\__enumext_undefine_anskey_env:` and finally we execute the function `\__enumext_reset_global_vars:` returning the used variables to their original state.

```
3073 \cs_new_protected:Nn \__enumext_execute_after_env:
3074   {
3075     \int_compare:nNnT { \l__enumext_level_int } = { 0 }
3076       {
3077         \tl_if_empty:NF \g__enumext_store_name_tl
3078           {
3079             \__enumext_stop_save_ans_msg:
3080             \__enumext_item_answer_diff:
3081             \__enumext_log_global_vars:
3082             \__enumext_log_answer_vars:
3083             \bool_if:NTF \g__enumext_check_ans_key_bool
3084               {
3085                 \__enumext_check_ans_show:
```

```
3086                }
3087                { \__enumext_check_ans_log: }
3088              \__enumext_undefine_anskey_env:
3089            }
3090          \__enumext_reset_global_vars:
3091        }
3092    }
```

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

This function is passed to the function `\__enumext_after_env:nn` for the environments `enumext` (§13.39) and `enumext*` (§13.44) and it is executed only when the environments are not nested or at some level of these..

13.33 Common functions for keyans, keyans* and keyanspic

13.33.1 Storing content in prop list

`\__enumext_keyans_addto_prop:n`

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

```
3093 \cs_new_protected:Npn \__enumext_keyans_addto_prop:n #1
3094   {
3095     \tl_clear:N \l__enumext_store_current_label_tl
3096     \int_compare:nNnTF { \l__enumext_keyans_pic_level_int } = { 1 }
3097       {
3098         \tl_put_right:Ne \l__enumext_store_current_label_tl { \l__enumext_label_vi_tl }
3099       }
3100       {
3101         \tl_put_right:Ne \l__enumext_store_current_label_tl { \l__enumext_label_v_tl }
3102       }
```

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

```
3103     \tl_if_novalue:nF { #1 }
3104       {
3105         \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_v_tl
3106           {
3107             \tl_put_right:Nn \l__enumext_store_current_label_tl { \l__enumext_store_keyans_item_op
3108           }
3109         \tl_put_right:Nn \l__enumext_store_current_label_tl { #1 }
3110       }
3111     \__enumext_store_addto_prop:V \l__enumext_store_current_label_tl
3112   }
```

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

13.33.2 The save-ref key for keyans, keyans* and keyanspic

The *"internal label and ref"* system for the `keyans`, `keyans*` and `keyanspic` environments has *slight differences* with the one implemented for `\anskey` basically because in this environments the interest is in the current ⟨*label*⟩ for `\item*` and `\anspic*` with the ⟨*contents*⟩ of the *optional argument*. The mechanism defined here will allow to execute `\ref{`⟨*store name : position*⟩`}` and will return `1.(A)`.

`\__enumext_keyans_store_ref:`
`\__enumext_keyans_store_ref_aux_i:`
`\__enumext_keyans_store_ref_aux_ii:`

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

```
3113 \cs_new_protected:Nn \__enumext_keyans_store_ref:
3114   {
3115     \bool_if:NT \l__enumext_store_ref_key_bool
3116       {
3117         \cs_set_protected:Npn \__enumext_tmp:n ##1
3118           {
3119             \tl_set_eq:cc { l__enumext_label_copy_##1_tl } { l__enumext_label_##1_tl }
3120             \tl_reverse:c { l__enumext_label_copy_##1_tl }
3121             \tl_remove_once:cn { l__enumext_label_copy_##1_tl } { . }
3122             \tl_reverse:c { l__enumext_label_copy_##1_tl }
3123           }
3124         \clist_map_inline:nn { i, v, vi, vii, viii } { \__enumext_tmp:n {##1} }
3125         \__enumext_keyans_store_ref_aux_i:
3126       }
3127   }
```

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`.

```
\cs_new_protected:Nn \__enumext_keyans_store_ref_aux_i:
  {
    \bool_if:NT \g__enumext_starred_bool
      {
        \tl_set_eq:NN \l__enumext_label_copy_i_tl \l__enumext_label_copy_vii_tl
      }
    \int_compare:nNnT { \l__enumext_keyans_pic_level_int } = { 1 }
      {
        \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
          { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_vi_tl }
      }
    \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
      {
        \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
          { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_v_tl }
      }
    \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
      {
        \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
          { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_viii_tl }
      }
    \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
      {
        \l__enumext_store_name_tl \c_colon_str
        \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } }
      }
    \__enumext_keyans_store_ref_aux_ii:
  }
```

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.

```
\cs_new_protected:Nn \__enumext_keyans_store_ref_aux_ii:
  {
    \tl_put_right:Ne \l__enumext_write_aux_file_tl
      {
        \__enumext_newlabel:nn
          { \exp_not:V \l__enumext_newlabel_arg_one_tl }
          { \l__enumext_newlabel_arg_two_tl }
      }
    \l__enumext_write_aux_file_tl
  }
```

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

13.33.3 Storing content in sequence

`\__enumext_keyans_addto_seq:n`
`\__enumext_keyans_addto_seq_link:`

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

```
\cs_new_protected:Npn \__enumext_keyans_addto_seq:n #1
  {
    \tl_clear:N \l__enumext_store_current_label_tl
    \int_compare:nNnTF { \l__enumext_keyans_pic_level_int } = { 1 }
      {
        \tl_put_right:Ne \l__enumext_store_current_label_tl { \item \l__enumext_label_vi_tl }
      }
      {
        \tl_put_right:Ne \l__enumext_store_current_label_tl { \item \l__enumext_label_v_tl }
      }
    \tl_if_novalue:nF { #1 }
      {
        \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_v_tl
          {
            \tl_put_right:Nn \l__enumext_store_current_label_tl { \l__enumext_store_keyans_item_op
          }
        \tl_put_right:Nn \l__enumext_store_current_label_tl { #1 }
```

```
      }
    \__enumext_keyans_addto_seq_link:
  }
```

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.

```
\cs_new_protected:Nn \__enumext_keyans_addto_seq_link:
  {
    \bool_lazy_and:nnT
      { \bool_if_p:N \l__enumext_store_ref_key_bool }
      { \bool_if_p:N \l__enumext_hyperref_bool }
      {
        \tl_put_right:Ne \l__enumext_store_current_label_tl
          {
            \hfill \exp_not:N \hyperlink
              {
                \exp_not:V \l__enumext_newlabel_arg_one_tl
              }
              { \exp_not:V \l__enumext_mark_ref_sym_tl }
          }
      }
    \__enumext_store_addto_seq:V \l__enumext_store_current_label_tl
    \bool_if:NT \l__enumext_check_answers_bool
      {
        \int_gincr:N \g__enumext_item_anskey_int
      }
  }
```

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

13.33.4 The show-ans and show-pos keys for keyans and keyanspic

__enumext_keyans_save_item_opt:n
__enumext_keyans_show_item_opt:
__enumext_keyans_show_item_opt_viii:

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.

```
\cs_new_protected:Npn \__enumext_keyans_save_item_opt:n #1
  {
    \tl_if_novalue:nF { #1 }
      {
        \tl_set:Nn \l__enumext_store_current_opt_arg_tl { #1 }
      }
  }
```

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.

```
\cs_new_protected:Nn \__enumext_keyans_show_item_opt:
  {
    \tl_if_empty:NF \l__enumext_store_current_opt_arg_tl
      {
        \bool_lazy_or:nnT
          { \bool_if_p:N \l__enumext_show_answer_bool }
          { \bool_if_p:N \l__enumext_show_position_bool }
          {
            \__enumext_keyans_wrapper_opt_v:n
              { \l__enumext_store_current_opt_arg_tl } \c_space_tl
          }
      }
  }
```

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.

```
\cs_new_protected:Nn \__enumext_keyans_show_item_opt_viii:
  {
    \tl_if_empty:NF \l__enumext_store_current_opt_arg_tl
      {
        \bool_lazy_or:nnT
          { \bool_if_p:N \l__enumext_show_answer_bool }
          { \bool_if_p:N \l__enumext_show_position_bool }
          {
```

```
            \__enumext_keyans_wrapper_opt_viii:n
              { \l__enumext_store_current_opt_arg_tl } \c_space_tl
          }
      }
  }
```

(*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*⟩.

```
\cs_new_protected:Nn \__enumext_keyans_pos_mark_set:
  {
    \__enumext_label_width_by_box:Nn
      \l__enumext_mark_sep_tmpa_dim { \l__enumext_label_v_tl }
    \str_case:Vn \l__enumext_align_label_pos_v_str
      {
        { l }
            {
              \dim_set:Nn \l__enumext_mark_sep_tmpb_dim { \c_zero_dim }
            }
        { r }
            {
              \dim_set:Nn \l__enumext_mark_sep_tmpb_dim
                { \l__enumext_labelwidth_v_dim - \l__enumext_mark_sep_tmpa_dim }
            }
        { c }
            {
              \dim_set:Nn \l__enumext_mark_sep_tmpb_dim
                { 0.5\l__enumext_labelwidth_v_dim - 0.5\l__enumext_mark_sep_tmpa_dim }
            }
       }
```

Here we set the default values for the key `mark-ans*`, `mark-sep*` and `mark-pos*`.

```
    \dim_compare:nNnT { \l__enumext_mark_sym_sep_v_dim } = { \c_zero_dim }
      {
        \dim_set:Nn \l__enumext_mark_sym_sep_v_dim { \l__enumext_labelsep_v_dim }
      }
    \tl_set_eq:NN \l__enumext_mark_answer_sym_tl \l__enumext_mark_answer_sym_v_tl
    \dim_add:Nn \l__enumext_mark_sym_sep_v_dim { \l__enumext_mark_sep_tmpb_dim }
    \str_set_eq:NN \l__enumext_mark_position_str \l__enumext_mark_position_v_str
  }
```

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

```
\cs_new_protected:Nn \__enumext_keyans_show_ans:
  {
    \bool_lazy_all:nT
      {
        { \bool_if_p:N \l__enumext_show_answer_bool   }
        { \bool_if_p:N \l__enumext_item_wrap_key_bool }
      }
      {
        \__enumext_keyans_pos_mark_set:
        \__enumext_print_keyans_box:NN
          \l__enumext_labelwidth_v_dim \l__enumext_mark_sym_sep_v_dim
      }
  }
```

The function `\__enumext_keyans_show_pos:` will print the ⟨*position*⟩ of the stored content in *prop list*. Need add `1` to `\g__enumext_`⟨*store name*⟩`_prop` for `keyans` environment.

```
\cs_new_protected:Nn \__enumext_keyans_show_pos:
  {
    \int_compare:nNnTF { \l__enumext_keyans_level_int } = { 1 }
      {
        \int_incr:N \l__enumext_show_pos_tmp_int
      }
      {
        \int_zero:N \l__enumext_show_pos_tmp_int
      }
    \bool_lazy_all:nT
      {
```

```
      { \bool_if_p:N \l__enumext_show_position_bool }
      { \bool_if_p:N \l__enumext_item_wrap_key_bool }
    }
    {
      \tl_set:Ne \l__enumext_mark_answer_sym_v_tl
        {
          \group_begin:
            \exp_not:N \normalfont
            \exp_not:N \footnotesize [ \int_eval:n
              {
                \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
                + \l__enumext_show_pos_tmp_int
              }
            ]
          \group_end:
        }
      \__enumext_keyans_pos_mark_set:
      \__enumext_print_keyans_box:NN
        \l__enumext_labelwidth_v_dim \l__enumext_mark_sym_sep_v_dim
    }
}
```

(*End of definition for* `\__enumext_keyans_pos_mark_set:`, `\__enumext_keyans_show_ans:`, *and* `\__enumext_keyans_show_pos:`.)

13.34 Redefining `\item` and `\makelabel` in enumext

Redefining the `\item` command is not as simple as I thought. This command works in conjunction with the `\makelabel` command so I have to redefine both of them, in addition to this, we will have to use a couple of *global* variables to pass the values from one command to the other.

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

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

`\__enumext_default_item:n`

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

```
\cs_new_protected:Npn \__enumext_default_item:n #1
  {
    \tl_if_novalue:nTF {#1}
      {
        \bool_if:NT \l__enumext_check_answers_bool
          {
            \int_gincr:N \g__enumext_item_number_int
            \bool_set_true:N \l__enumext_item_number_bool
          }
        \bool_set_true:c { l__enumext_wrap_label_ \__enumext_level: _bool }
        \__enumext_item_std:w \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
      }
      {
        \bool_set_eq:cc
          { l__enumext_wrap_label_ \__enumext_level: _bool }
          { l__enumext_wrap_label_opt_ \__enumext_level: _bool }
        \__enumext_item_std:w [#1] \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl
      }
  }
```

(*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.

```
\cs_new_protected:Npn \__enumext_item_starred_exec:nn #1 #2
  {
    \tl_if_novalue:nTF {#1}
      {
        \tl_gset_eq:Nc
          \g__enumext_item_symbol_aux_tl { l__enumext_item_symbol_ \__enumext_level: _tl }
      }
      {
        \tl_gset:Nn \g__enumext_item_symbol_aux_tl {#1}
      }
    \tl_if_novalue:nTF {#2}
      {
        \dim_set_eq:cc
          { l__enumext_item_symbol_sep_ \__enumext_level: _dim }
          { l__enumext_labelsep_ \__enumext_level: _dim }
      }
      {
        \dim_set:cn { l__enumext_item_symbol_sep_ \__enumext_level: _dim } {#2}
      }
    \bool_if:NT \l__enumext_check_answers_bool
      {
        \int_gincr:N \g__enumext_item_number_int
        \bool_set_true:N \l__enumext_item_number_bool
      }
    \bool_set_true:c { l__enumext_wrap_label_ \__enumext_level: _bool }
    \__enumext_item_std:w \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
  }
```

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

```
\cs_new_protected:Nn \__enumext_item_starred_exec:
  {
    \tl_if_empty:cF { l__enumext_item_symbol_ \__enumext_level: _tl }
      {
        \mode_leave_vertical:
        \skip_horizontal:n { -\dim_use:c { l__enumext_item_symbol_sep_ \__enumext_level: _dim } }
        \hbox_overlap_left:n { \g__enumext_item_symbol_aux_tl }
        \skip_horizontal:n { \dim_use:c { l__enumext_item_symbol_sep_ \__enumext_level: _dim } }
      }
  }
```

(*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 (§13.39).

```
\cs_new_protected:Nn \__enumext_redefine_item:
  {
    \RenewDocumentCommand \item { s o o }
      {
        \bool_if:nTF {##1}
          {
            \__enumext_item_starred_exec:nn {##2} {##3}
          }
          { \__enumext_default_item:n {##2} }
      }
  }
```

(*End of definition for* __enumext_redefine_item:.)

__enumext_make_label:
__enumext_make_label_std:
__enumext_make_label_box:

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 (§13.39).

```
\cs_new_protected:Nn \__enumext_make_label:
```

```
  {
    \IfDocumentMetadataTF
      {
        \__enumext_make_label_box:
      }
      {
        \bool_if:NTF \l__enumext_mode_box_bool
          {
             \__enumext_make_label_box:
          }
          {
             \__enumext_make_label_std:
          }
      }
  }
```

Standard definition when `\DocumentMetadata` is not active.

```
\cs_new_protected:Nn \__enumext_make_label_std:
  {
    \RenewDocumentCommand \makelabel { m }
      {
        \tl_use:c { l__enumext_label_fill_left_ \__enumext_level: _tl }
        \__enumext_item_starred_exec:
        \tl_use:c { l__enumext_label_font_style_ \__enumext_level: _tl }
        \bool_if:cTF { l__enumext_wrap_label_ \__enumext_level: _bool }
          {
            \use:c { __enumext_wrapper_label_ \__enumext_level: :n } { ##1 }
          }
          { ##1 }
        \tl_use:c { l__enumext_label_fill_right_ \__enumext_level: _tl }
        \tl_gclear:N \g__enumext_item_symbol_aux_tl
      }
  }
```

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

Here it is necessary to use `\strut\smash` to maintain text *alignment* in case the user wants to use `\labelbx` for example. In my experiments with *mimicking* the `description` environment it was the only way out and it seems to have no adverse effects and may serve in the future as a basis for a more generic `list` environment package than enumext.

```
\cs_new_protected:Nn \__enumext_make_label_box:
  {
    \RenewDocumentCommand \makelabel { m }
      {
        \strut\smash
          {
            \makebox
              [ \dim_use:c { l__enumext_labelwidth_ \__enumext_level: _dim } ]
              [ \str_use:c { l__enumext_align_label_pos_ \__enumext_level: _str } ]
              {
                \__enumext_item_starred_exec:
                \tl_use:c { l__enumext_label_font_style_ \__enumext_level: _tl }
                \bool_if:cTF { l__enumext_wrap_label_ \__enumext_level: _bool }
                  {
                    \use:c { __enumext_wrapper_label_ \__enumext_level: :n } { ##1 }
                  }
                  { ##1 }
                \tl_gclear:N \g__enumext_item_symbol_aux_tl
              }
          } % close smash
      }
  }
```

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

13.35 Setting `item-sym*` and `item-pos*` keys

In order to have a cleaner implementation of `\item*` for the `enumext` and `enumext*` environments it is best to define a couple of keys that allow us to control and set by default the ⟨*symbol*⟩ and its ⟨*offset*⟩.

`item-sym*`
`item-pos*`

Define and set `item-sym*` and `item-pos*` keys for `enumext` and `enumext*`.

```
\cs_set_protected:Npn \__enumext_tmp:nn #1 #2
  {
    \keys_define:nn { enumext / #1 }
```

```
      {
        item-sym* .tl_set:c  = { l__enumext_item_symbol_#2_tl },
        item-sym* .value_required:n = true,
        item-sym* .initial:n  = {\textborn},
        item-pos* .dim_set:c  = { l__enumext_item_symbol_sep_#2_dim },
        item-pos* .value_required:n = true,
      }
  }
\clist_map_inline:nn
  {
    {level-1}{i}, {level-2}{ii}, {level-3}{iii}, {level-4}{iv}, {enumext*}{vii}
  }
  { \__enumext_tmp:nn #1 }
```

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

13.36 Handling unknown keys

At this point in the code I already know that I will NOT add more ⟨*keys*⟩ for and since I have already been quite *paranoid and restrictive* with the definitions of environments and commands, the only thing left to do is do it with the ⟨*keys*⟩ (you have to be consistent in life).

Well, the paragraph above is not so real, after all I had to add more ⟨*keys*⟩ than I had planned, not everything turns out the way one thinks in life.

13.36.1 Handling unknown keys for keyans, keyans* and keyanspic

unknown
__enumext_keyans_unknown_keys:n
__enumext_keyans_unknown_keys:nn

Define and set unknown key for keyans, keyans* and keyanspic environments. Here it is necessary to set `\l__enumext_envir_name_tl` in case an unknown key is passed using `\setenumext`.

```
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \keys_define:nn { enumext / #1 }
      {
        unknown .code:n = {
                            \tl_set:Nn \l__enumext_envir_name_tl {#1}
                            \__enumext_keyans_unknown_keys:n {##1}
                          },
      }
  }
\clist_map_inline:nn { keyans, keyans*, keyanspic } { \__enumext_tmp:n {#1} }
```

Internal functions for handling unknown key.

```
\cs_new_protected:Npn \__enumext_keyans_unknown_keys:n #1
  {
    \exp_args:NV \__enumext_keyans_unknown_keys:nn \l_keys_key_str {#1}
  }
\cs_new_protected:Npn \__enumext_keyans_unknown_keys:nn #1#2
  {
    \tl_if_blank:nTF {#2}
      {
        \msg_error:nne { enumext } { keyans-unknown-key } {#1}
      }
      {
        \msg_error:nnee { enumext } { keyans-unknown-key-value } {#1} {#2}
      }
  }
```

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

13.36.2 Handling unknown keys for enumext*

unknown
__enumext_starred_unknown_keys:n
__enumext_starred_unknown_keys:nn

Define and set unknown key for enumext* environment.

```
\keys_define:nn { enumext / enumext* }
  {
    unknown .code:n = { \__enumext_starred_unknown_keys:n {#1} },
  }
```

Internal functions for handling unknown key.

```
\cs_new_protected:Npn \__enumext_starred_unknown_keys:n #1
  {
    \exp_args:NV \__enumext_starred_unknown_keys:nn \l_keys_key_str {#1}
  }
\cs_new_protected:Npn \__enumext_starred_unknown_keys:nn #1#2
  {
    \tl_if_blank:nTF {#2}
```

```
      {
        \msg_error:nnn { enumext } { starred-unknown-key } {#1}
      }
      {
        \msg_error:nnnn { enumext } { starred-unknown-key-value } {#1} {#2}
      }
  }
```

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

13.36.3 Handling unknown keys for enumext

unknown

Defines and set the key unknown for enumext environment.

__enumext_standar_unknown_keys:n
__enumext_standar_unknown_keys:nn

```
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \keys_define:nn { enumext / #1 }
      {
        unknown .code:n = { \__enumext_standar_unknown_keys:n {##1} },
      }
  }
\clist_map_inline:nn { level-1,level-2,level-3,level-4 } { \__enumext_tmp:n {#1} }
```

Internal functions for handling unknown key.

```
\cs_new_protected:Npn \__enumext_standar_unknown_keys:n #1
  {
    \exp_args:NV \__enumext_standar_unknown_keys:nn \l_keys_key_str {#1}
  }
\cs_new_protected:Npn \__enumext_standar_unknown_keys:nn #1#2
  {
    \tl_if_blank:nTF {#2}
      {
        \msg_error:nnn { enumext } { standar-unknown-key } {#1}
      }
      {
        \msg_error:nnnn { enumext } { standar-unknown-key-value } {#1} {#2}
      }
  }
```

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

13.37 Redefining \item and \makelabel in keyans

The \item and \item[⟨*custom*⟩] commands work in the usual way in keyans, but the \item* and \item*[⟨*content*⟩] commands *store* the current ⟨*label*⟩ next to the ⟨*content*⟩ if it is present in the *sequence* and *prop list* defined by save-ans key.

__enumext_keyans_default_item:n

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

```
\cs_new_protected:Npn \__enumext_keyans_default_item:n #1
  {
    \tl_if_novalue:nTF { #1 }
      {
        \bool_set_true:N \l__enumext_wrap_label_v_bool
        \__enumext_item_std:w \tl_use:N \l__enumext_fake_item_indent_v_tl
      }
      {
        \bool_set_eq:NN \l__enumext_wrap_label_v_bool \l__enumext_wrap_label_opt_v_bool
        \__enumext_item_std:w [#1] \tl_use:N \l__enumext_fake_item_indent_v_tl
      }
  }
```

(*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.

```
\cs_new_protected:Npn \__enumext_keyans_starred_item:n #1
  {
    \__enumext_keyans_save_item_opt:n { #1 }
    \bool_set_true:N \l__enumext_wrap_label_v_bool
    \__enumext_item_std:w \tl_use:N \l__enumext_fake_item_indent_v_tl
    \__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.

```
    \__enumext_keyans_addto_prop:n { #1 }
    \__enumext_keyans_store_ref:
    \__enumext_keyans_addto_seq:n { #1 }
    \int_gincr:N \g__enumext_check_starred_cmd_int
  }
```

(*End of definition for* __enumext_keyans_starred_item:n.)

\item*
__enumext_keyans_redefine_item:

The function __enumext_keyans_redefine_item: is responsible for adding the *starred argument* and *optional argument* by the __enumext_list_arg_two_v: function in the definition of the keyans environment. Here we will set to true the variable \l__enumext_item_wrap_key_bool used by the wrap-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 (§13.38).

```
\cs_new_protected:Nn \__enumext_keyans_redefine_item:
  {
    \RenewDocumentCommand \item { s o }
      {
        \bool_if:nTF {##1}
          {
            \bool_set_true:N \l__enumext_item_wrap_key_bool % wrap-ans*
            \peek_remove_spaces:n
              {
                \__enumext_keyans_starred_item:n {##2}
              }
          }
          {
            \bool_set_false:N \l__enumext_item_wrap_key_bool
            \__enumext_keyans_default_item:n {##2}
          }
      }
  }
```

(*End of definition for* \item* *and* __enumext_keyans_redefine_item:. *This function is documented on page* 16.)

__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 (§13.38).

```
\cs_new_protected:Nn \__enumext_keyans_make_label:
  {
    \IfDocumentMetadataTF
      {
        \__enumext_keyans_make_label_box:
      }
      {
        \bool_if:NTF \l__enumext_mode_box_bool
          {
            \__enumext_keyans_make_label_box:
          }
          {
            \__enumext_keyans_make_label_std:
          }
      }
  }
```

We added conditionals to the __enumext_keyans_wraper_label:n function to handle the keys wrap-ans*, wrap-label and wrap-label*.

```
\cs_new_protected:Npn \__enumext_keyans_wrapper_label:n #1
  {
    \bool_lazy_all:nT
      {
        { \bool_if_p:N \l__enumext_wrap_label_v_bool         }
        { \bool_if_p:N \l__enumext_show_answer_bool          }
        { \bool_if_p:N \l__enumext_item_wrap_key_bool        }
        { \cs_if_exist_p:N \__enumext_keyans_wrapper_item_v:n }
      }
      {
```

```
      \cs_set_eq:NN \__enumext_wrapper_label_v:n \__enumext_keyans_wrapper_item_v:n
    }
  \bool_if:NTF \l__enumext_wrap_label_v_bool
    {
      \__enumext_wrapper_label_v:n { #1 }
    }
    { #1 }
}
```

Standard definition when \DocumentMetadata is not active.

```
\cs_new_protected:Nn \__enumext_keyans_make_label_std:
{
  \RenewDocumentCommand \makelabel { m }
    {
      \tl_use:N \l__enumext_label_fill_left_v_tl
      \__enumext_keyans_show_ans:
      \__enumext_keyans_show_pos:
      \tl_use:N \l__enumext_label_font_style_v_tl
      \__enumext_keyans_wrapper_label:n { ##1 }
      \tl_use:N \l__enumext_label_fill_right_v_tl
    }
}
```

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

```
\cs_new_protected:Nn \__enumext_keyans_make_label_box:
{
  \RenewDocumentCommand \makelabel { m }
    {
      \strut\smash
        {
          \makebox[ \l__enumext_labelwidth_v_dim ][ \l__enumext_align_label_pos_v_str ]
            {
              \__enumext_keyans_show_ans:
              \__enumext_keyans_show_pos:
              \tl_use:N \l__enumext_label_font_style_v_tl
              \__enumext_keyans_wrapper_label:n { ##1 }
            }
        }
    }
}
```

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

13.38 Second argument of the lists

At this point of the code we have already programmed most the necessary tools to create a custom list environment, remember that the function __enumext_start_list:nn takes two arguments, the first one we have ready, the second one we will define for all the levels of the environment enumext and the environment keyans.

13.38.1 Calculation of \leftmargin and \itemindent

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

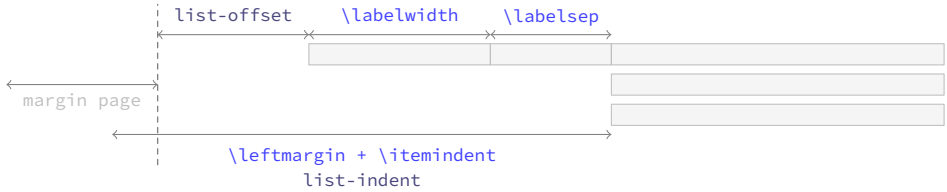

Figure 9: Representation of standard horizontal lengths in list environment.

The idea is to have control over these margins so that our list does not overlap the left margin of the page. The *key* relationship is that the right edge of the \labelsep equals the right edge of the \itemindent, so that the left edge of the *label box* is at \leftmargin+\itemindent minus \labelwidth+\labelsep. Thus, the handling of the margins by the package will be as shown in the figure 10.
Where the default values will look like in the figure 11.

__enumext_calc_hspace:NNNNNNN
__enumext_calc_hspace:ccccccc

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

```
#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
```

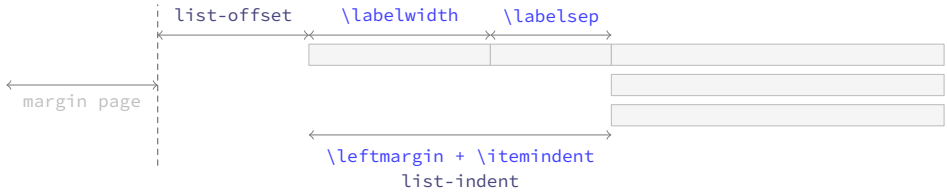

Figure 10: Representation of horizontal lengths concept in list in enumext.

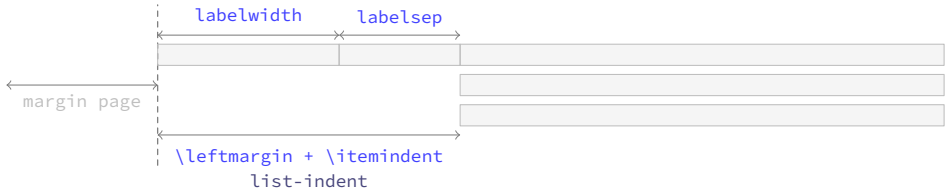

Figure 11: Default horizontal lengths in enumext.

```
#5: \l__enumext_leftmargin_X_dim       #6: \l__enumext_itemindent_X_dim
#7: \l__enumext_leftmargin_tmp_X_bool
```

And returns the *"adjusted"* values of \leftmargin and \itemindent.

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

```
\cs_new_protected:Npn \__enumext_calc_hspace:NNNNNNN #1 #2 #3 #4 #5 #6 #7
  {
    \dim_compare:nNnT { #1 } < { \c_zero_dim }
      {
        \msg_warning:nnnV { enumext } { width-non-positive }{ labelwidth }{ #1 }
        \dim_set:Nn #1 { \dim_abs:n { #1 } }
      }
    \dim_compare:nNnT { #2 } < { \c_zero_dim }
      {
        \msg_warning:nnnV { enumext } { width-negative }{ labelsep }{ #2 }
        \dim_set:Nn #2 { \dim_abs:n { #2 } }
      }
```

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

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

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

```
    \dim_compare:nNnTF { #4 } < { \c_zero_dim }
      {
        \dim_set:Nn #6 { #1 + #2 - #4}
        \dim_set:Nn #5 { #1 + #2 + #3 - #6 }
      }
      {
        \dim_compare:nNnT { #4 } = { #1 + #2 }
          { \dim_set:Nn #6 { \c_zero_dim } }
        \dim_compare:nNnT { #4 } < { #1 + #2 }
          { \dim_set:Nn #6 { #1 + #2 - #4} }
        \dim_compare:nNnT { #4 } > { #1 + #2 }
          {
            \dim_set:Nn #6 { -#1 - #2 + #4}
            \dim_set:Nn #6 { #6*-1}
          }
        \dim_set:Nn #5 { #1 + #2 + #3 - #6 }
      }
  }
\cs_generate_variant:Nn \__enumext_calc_hspace:NNNNNNN { ccccccc }
```

(*End of definition for* __enumext_calc_hspace:NNNNNNN.)

13.38.2 Setting second argument of the lists

__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:

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.

```
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \cs_new_protected:cpn { __enumext_list_arg_two_#1: }
```

```
      {
        \__enumext_calc_hspace:ccccccc
          { l__enumext_labelwidth_#1_dim } { l__enumext_labelsep_#1_dim }
          { l__enumext_listoffset_#1_dim } { l__enumext_leftmargin_tmp_#1_dim }
          { l__enumext_leftmargin_#1_dim } { l__enumext_itemindent_#1_dim }
          { l__enumext_leftmargin_tmp_#1_bool }
        \clist_map_inline:nn
          { labelsep, labelwidth, itemindent, leftmargin, rightmargin, listparindent }
          { \dim_set_eq:cc {####1} { l__enumext_####1_#1_dim } }
        \clist_map_inline:nn { topsep, parsep, partopsep, itemsep }
          { \skip_set_eq:cc {####1} { l__enumext_####1_#1_skip } }
        \usecounter { enumX#1 }
        \setcounter { enumX#1 } { \int_eval:n { \int_use:c { l__enumext_start_#1_int } - 1 } }
        \str_if_eq:nnTF {#1} { v }
          {
            \__enumext_keyans_redefine_item:
            \__enumext_keyans_make_label:
            \__enumext_keyans_ref:
            \__enumext_keyans_fake_item_indent:
            \bool_if:cT { l__enumext_show_length_#1_bool }
              {
                \msg_term:nnnn { enumext } { list-lengths-not-nested } { v } { keyans }
              }
          }
          {
            \__enumext_redefine_item:
            \__enumext_make_label:
            \__enumext_standar_ref:
            \__enumext_fake_item_indent:
            \bool_if:cT { l__enumext_show_length_#1_bool }
              {
                \msg_term:nnne { enumext } { list-lengths } {#1}
                  { \int_use:N \l__enumext_level_int }
              }
          }
      }
  }
\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 `lisparindent` and `parsep` to set the value of `\parskip` locally.

```
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \cs_new_protected:cpn { __enumext_list_arg_two_#1: }
      {
        \bool_set_true:c { l__enumext_leftmargin_tmp_#1_bool }
        \dim_zero:c { l__enumext_leftmargin_tmp_#1_dim }
        \__enumext_calc_hspace:ccccccc
          { l__enumext_labelwidth_#1_dim } { l__enumext_labelsep_#1_dim }
          { l__enumext_listoffset_#1_dim } { l__enumext_leftmargin_tmp_#1_dim }
          { l__enumext_leftmargin_#1_dim } { l__enumext_itemindent_#1_dim }
          { l__enumext_leftmargin_tmp_#1_bool }
        \clist_map_inline:nn
          { labelsep, labelwidth, itemindent, leftmargin, rightmargin, listparindent }
          { \dim_set_eq:cc {####1} { l__enumext_####1_#1_dim } }
        \clist_map_inline:nn { topsep, parsep, partopsep, itemsep }
          { \skip_set_eq:cc {####1} { l__enumext_####1_#1_skip } }
        \skip_set_eq:Nc \parsep  { l__enumext_itemsep_#1_skip }
        \skip_zero:N \partopsep
        \usecounter { enumX#1 }
        \setcounter { enumX#1 } { \int_eval:n { \int_use:c { l__enumext_start_#1_int } - 1 } }
        \__enumext_starred_ref:
        \str_if_eq:nnTF {#1} { vii }
          {
            \__enumext_fake_item_indent_vii:
            \bool_if:cT { l__enumext_show_length_vii_bool }
              { \msg_term:nnnn { enumext } { list-lengths-not-nested } { vii } { enumext* } }
```

```
            }
            {
              \__enumext_fake_item_indent_viii:
              \bool_if:cT { l__enumext_show_length_#1_bool }
                { \msg_term:nnnn { enumext } { list-lengths-not-nested } { #1 } { keyans* } }
            }
        }
    }
\clist_map_inline:nn { vii, viii } { \__enumext_tmp:n {#1} }
```

(*End of definition for* `\__enumext_list_arg_two_vii:` *and* `\__enumext_list_arg_two_viii:`.)

13.39 The environment enumext

`\__enumext_safe_exec:`

The `\__enumext_safe_exec:` function first call the function `\__enumext_is_not_nested:` which sets `\g__enumext_standar_bool` to *"true"* if we are NOT nested within `enumext*`, then call the function `\__enumext_internal_mini_page:` to create the environment `__enumext_mini_page`, we will increment `\l__enumext_level_int` to restrict nesting of the environment, set `\l__enumext_standar_bool` to *"true"* and finally call the function `\__enumext_is_on_first_level:` which sets `\l__enumext_standar_-first_bool` to *"true"* only if the environment is NOT nested and we are at the *"first level"*.

```
\cs_new_protected:Nn \__enumext_safe_exec:
  {
    \__enumext_is_not_nested:
    \__enumext_internal_mini_page:
    \int_incr:N \l__enumext_level_int
    \int_compare:nNnT { \l__enumext_level_int } > { 4 }
      { \msg_fatal:nn { enumext } { list-too-deep } }
    \bool_set_true:N \l__enumext_standar_bool
    \bool_set_false:N \l__enumext_starred_bool
    \__enumext_is_on_first_level:
  }
```

(*End of definition for* `\__enumext_safe_exec:`.)

`\__enumext_parse_keys:n`

The `\__enumext_parse_store_keys:n` function first we will clear the variable `\l__enumext_series_-str` used by the key `series` and then we check if we are at the *"first level"*, if so we process the ⟨*keys*⟩ and then execute the function `\__enumext_parse_series:n` used by the key `series` and call the function `\__enumext_nested_base_line_fix:` used by the key `base-fix`, otherwise we will pass the ⟨*keys*⟩ to the inner levels of the environment then we execute the function `\__enumext_store_active_keys:n` and reprocess the ⟨*keys*⟩ to pass them to the *sequence* if the key `save-key` is not active.

```
\cs_new_protected:Npn \__enumext_parse_keys:n #1
  {
    \tl_if_novalue:nF {#1}
      {
        \str_clear:N \l__enumext_series_str
        \int_compare:nNnTF { \l__enumext_level_int } = { 1 }
          {
            \keys_set:nn { enumext / level-1 } {#1}
            \__enumext_parse_series:n {#1}
            \__enumext_nested_base_line_fix:
          }
          {
            \exp_args:Ne \keys_set:nn
              { enumext / level-\int_use:N \l__enumext_level_int } {#1}
          }
        \__enumext_store_active_keys:n {#1}
      }
  }
```

(*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*`.

```
\cs_new_protected:Nn \__enumext_start_store_level:
  {
    \bool_lazy_all:nT
      {
        { \bool_if_p:N \l__enumext_store_active_bool }
        { \bool_not_p:n { \l__enumext_keyans_env_bool } }
        { \bool_if_p:N \g__enumext_standar_bool }
      }
```

```
      {
        \int_compare:nNnT { \l__enumext_level_int } > { 1 }
          {
            \bool_set_true:c { l__enumext_store_upper_level_ \__enumext_level: _bool }
            \__enumext_store_level_open:
          }
      }
```

If enumext are nested in enumext* add __enumext_store_level_open: to preserve the *"storing structure"*.

```
    \bool_lazy_all:nT
      {
        { \bool_if_p:N \l__enumext_store_active_bool }
        { \bool_not_p:n { \l__enumext_keyans_env_bool } }
        { \int_compare_p:nNn { \l__enumext_level_h_int } = { 1 } }
      }
      {
        \int_compare:nNnT { \l__enumext_level_int } > { 0 }
          {
            \bool_set_true:c { l__enumext_store_upper_level_ \__enumext_level: _bool }
            \__enumext_store_level_open:
          }
      }
  }
```

(*End of definition for* __enumext_start_store_level:.)

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

```
\cs_new_protected:Nn \__enumext_stop_store_level:
  {
    \bool_if:cT { l__enumext_store_upper_level_ \__enumext_level: _bool }
      {
        \__enumext_store_level_close:
      }
  }
```

(*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.

```
\cs_new_protected:Nn \__enumext_multicols_start:
  {
    \int_compare:nNnT
      { \int_use:c { l__enumext_columns_ \__enumext_level: _int } } > { 1 }
      {
        \dim_compare:nNnT
          { \dim_use:c { l__enumext_columns_sep_ \__enumext_level: _dim } } = { \c_zero_dim }
          {
            \dim_set:cn { l__enumext_columns_sep_ \__enumext_level: _dim }
              {
                ( \dim_use:c { l__enumext_labelwidth_ \__enumext_level: _dim }
                  + \dim_use:c { l__enumext_labelsep_ \__enumext_level: _dim }
                ) / \int_use:c { l__enumext_columns_ \__enumext_level: _int }
                - \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim }
              }
          }
        \dim_set_eq:Nc \columnsep { l__enumext_columns_sep_ \__enumext_level: _dim  }
        \int_compare:nNnT { \l__enumext_level_int } > { 1 }
          {
            \dim_zero:N \columnseprule
          }
```

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.

```
        \bool_if:cF { l__enumext_minipage_active_ \__enumext_level: _bool }
          {
            \skip_zero:N \multicolsep
            \__enumext_multi_addvspace:
          }
        \raggedcolumns
        \begin{multicols}{ \int_use:c { l__enumext_columns_ \__enumext_level: _int } }
```

```
      }
  }
```

(*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:`.

```
\cs_new_protected:Nn \__enumext_multicols_stop:
  {
    \int_compare:nNnTF
      { \int_use:c { l__enumext_columns_ \__enumext_level: _int } } > { 1 }
      {
        \__enumext_stop_list:
        \__enumext_stop_store_level:
        \end{multicols}
        \__enumext_unskip_unkern:
        \__enumext_unskip_unkern:
        \par\addvspace{ \skip_use:c { l__enumext_multicols_below_ \__enumext_level: _skip } }
      }
      {
        \__enumext_stop_list:
        \__enumext_stop_store_level:
      }
  }
```

(*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.

```
\cs_new_protected:Nn \__enumext_before_list:
  {
    \__enumext_vspace_above:
    \__enumext_before_args_exec:
    \__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.

```
    \dim_compare:nNnT
      { \dim_use:c { l__enumext_minipage_right_ \__enumext_level: _dim } } > { \c_zero_dim }
      {
        \dim_set:cn { l__enumext_minipage_left_ \__enumext_level: _dim }
          {
            \linewidth
            - \dim_use:c { l__enumext_minipage_right_ \__enumext_level: _dim }
            - \dim_use:c { l__enumext_minipage_hsep_ \__enumext_level: _dim }
          }
```

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.

```
        \bool_set_true:c { l__enumext_minipage_active_ \__enumext_level: _bool }
        \int_gincr:N \g__enumext_minipage_stat_int
        \__enumext_minipage_add_space:
        \noindent
        \__enumext_mini_page{ \dim_use:c { l__enumext_minipage_left_ \__enumext_level: _dim } }
      }
    \__enumext_multicols_start:
  }
```

(*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.

```
\cs_new_protected:Nn \__enumext_second_part:
  {
    \bool_if:cTF { l__enumext_minipage_active_ \__enumext_level: _bool }
      {
        \int_compare:nNnT { \g__enumext_minipage_stat_int } = { 1 }
          {
            \msg_warning:nn { enumext } { missing-miniright }
            \miniright
          }
        \int_gzero:N \g__enumext_minipage_stat_int
        \__enumext_unskip_unkern: % remove topsep + [partopsep]
        \end__enumext_mini_page
      }
      {
        \__enumext_multicols_stop:
      }
```

Now we will execute the functions __enumext_after_stop_list: used by the key after, __enumext_check_ans_key_hook: used by the key check-ans, __enumext_vspace_below: used by the keys below and below*. Finally set \l__enumext_standar_bool to false and call the function __enumext_resume_save_counter: used by the series, resume and resume* keys.

```
    \__enumext_after_stop_list:
    \__enumext_check_ans_key_hook:
    \__enumext_vspace_below:
    \bool_set_false:N \l__enumext_standar_bool
    \__enumext_resume_save_counter:
  }
```

(*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.

```
\cs_new_protected:Nn \__enumext_set_item_width:
  {
    \dim_set:Nn \itemwidth { \linewidth }
    \dim_compare:nT
      {
        \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim } != \c_zero_dim
      }
      {
        \dim_sub:Nn \itemwidth
          {
            \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim }
          }
      }
  }
```

(*End of definition for* __enumext_set_item_width:.)

enumext

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

```
\NewDocumentEnvironment{enumext}{ O{} }
  {
    \__enumext_safe_exec:
    \__enumext_parse_keys:n {#1}
    \__enumext_before_list:
    \__enumext_start_store_level:
    \__enumext_start_list:nn
      { \tl_use:c { l__enumext_label_ \__enumext_level: _tl } }
      {
        \use:c { __enumext_list_arg_two_ \__enumext_level: : }
        \__enumext_before_keys_exec:
      }
    \__enumext_set_item_width:
    \__enumext_after_args_exec:
  }
  {
```

```
    \__enumext_second_part:
  }
```

(*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`.

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

13.40 The environment keyans

The environment `keyans` also based on lists. The main differences with the `enumext` environment are the *nesting* and the way the *answers* (choice) will be stored and checked, this environment is intended exclusively for *"multiple choice questions"*.

`\__enumext_keyans_safe_exec:`

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

```
\cs_new_protected:Nn \__enumext_keyans_safe_exec:
  {
    \bool_if:NF \l__enumext_store_active_bool
      {
        \msg_error:nnnn { enumext } { wrong-place }{ keyans }{ save-ans }
      }
    \int_incr:N \l__enumext_keyans_level_int
    \bool_set_true:N \l__enumext_keyans_env_bool
    \__enumext_keyans_name_and_start:
    % Set false for interfering with enumext nested in keyans (yes, its possible and crayze)
    \bool_set_false:N \l__enumext_store_active_bool
    \int_compare:nNnT { \l__enumext_keyans_level_int } > { 1 }
      {
        \msg_error:nn { enumext } { keyans-nested }
      }
    \int_compare:nNnT { \l__enumext_level_int } > { 1 }
      {
        \msg_error:nn { enumext } { keyans-wrong-level }
      }
  }
```

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

`\__enumext_keyans_parse_keys:n`

Parse `[`⟨*key* = *val*⟩`]` for `keyans` environment.

```
\cs_new_protected:Npn \__enumext_keyans_parse_keys:n #1
  {
    \keys_set:nn { enumext / keyans } {#1}
  }
```

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

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

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

```
\cs_new_protected:Nn \__enumext_before_list_v:
  {
    \__enumext_vspace_above_v:
    \__enumext_before_args_exec_v:
    \dim_compare:nNnT { \l__enumext_minipage_right_v_dim } > { \c_zero_dim }
      {
        \dim_set:Nn \l__enumext_minipage_left_v_dim
          {
            \linewidth - \l__enumext_minipage_right_v_dim - \l__enumext_minipage_hsep_v_dim
          }
        \bool_set_true:N \l__enumext_minipage_active_v_bool
        \int_gincr:N \g__enumext_minipage_stat_int
        \__enumext_keyans_minipage_add_space:
        \__enumext_mini_page{ \l__enumext_minipage_left_v_dim }
      }
    \__enumext_keyans_multicols_start:
  }
\cs_new_protected:Nn \__enumext_keyans_multicols_start:
  {
```

```
    \int_compare:nNnT { \l__enumext_columns_v_int } > { 1 }
      {
        \dim_compare:nNnT { \l__enumext_columns_sep_v_dim } = { \c_zero_dim }
          {
            \dim_set:Nn \l__enumext_columns_sep_v_dim
              {
                (
                  \l__enumext_labelwidth_v_dim + \l__enumext_labelsep_v_dim
                ) / \l__enumext_columns_v_int
               - \l__enumext_listoffset_v_dim
              }
          }
        \dim_set_eq:NN \columnsep \l__enumext_columns_sep_v_dim
        \dim_zero:N \columnseprule % no rule here
        \bool_if:NF \l__enumext_minipage_active_v_bool
          {
            \skip_zero:N \multicolsep
            \__enumext_keyans_multi_addvspace:
          }
        \raggedcolumns
        \begin{multicols}{ \l__enumext_columns_v_int }
      }
  }
\cs_new_protected:Nn \__enumext_keyans_multicols_stop:
  {
    \int_compare:nNnTF { \l__enumext_columns_v_int } > { 1 }
      {
        \__enumext_stop_list:
        \end{multicols}
        \__enumext_unskip_unkern:
        \__enumext_unskip_unkern:
        \par\addvspace{ \l__enumext_multicols_below_v_skip }
      }
      {
        \__enumext_stop_list:
      }
  }
\cs_new_protected:Nn \__enumext_second_part_v:
  {
    \bool_if:NTF \l__enumext_minipage_active_v_bool
      {
        \int_compare:nNnT { \g__enumext_minipage_stat_int } = { 1 }
          {
            \msg_warning:nn { enumext } { missing-miniright }
            \miniright
          }
        \int_gzero:N \g__enumext_minipage_stat_int
        \__enumext_unskip_unkern: % remove \topsep + [\partopsep]
        \end__enumext_mini_page
        \par\addvspace{ \l__enumext_minipage_after_skip }
      }
      {
        \__enumext_keyans_multicols_stop:
      }
    \bool_set_false:N \l__enumext_keyans_env_bool
    \__enumext_after_stop_list_v:
    \__enumext_vspace_below_v:
  }
```

(*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.

```
\cs_new_protected:Nn \__enumext_keyans_set_item_width:
  {
    \dim_set:Nn \itemwidth { \linewidth }
    \dim_compare:nT
      {
        \l__enumext_listoffset_v_dim != \c_zero_dim
      }
      {
```

```
      \dim_sub:Nn \itemwidth { \l__enumext_listoffset_v_dim }
    }
  }
```

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

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

```
\NewDocumentEnvironment{keyans}{ O{} }
  {
    \__enumext_keyans_safe_exec:
    \__enumext_keyans_parse_keys:n {#1}
    \__enumext_before_list_v:
    \__enumext_start_list:nn
      { \tl_use:N \l__enumext_label_v_tl }
      {
        \__enumext_list_arg_two_v:
        \__enumext_before_keys_exec_v:
      }
    \__enumext_keyans_set_item_width:
    \__enumext_after_args_exec_v:
  }
  {
    \__enumext_check_starred_cmd:n { item }
    \__enumext_second_part_v:
  }
```

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

13.41 Tagging PDF support for non-standart list environments

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

To maintain a correct `list` structure when `\DocumentMetadata` is active, it is necessary to do some things manually using `tagpdf`[17] and `ltsockets`[19]. This implementation is an adaptation of my answer thanks to Ulrike Fischer's comments in How can I modify my `\item` redefinition to be compatible with `tagging-pdf`.

13.41.1 Socket for tagging support in enumext* and keyans*

start-list-tags
stop-start-tags
stop-list-tags
__enumext_start_list_tag:n
__enumext_stop_start_list_tag:
__enumext_stop_list_tag:n

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

```
\socket_new:nn {tagsupport/__enumext/starred}{ 1 }
\socket_new_plug:nnn {tagsupport/__enumext/starred} {start-list-tags}
  {
    \tag_resume:n {#1}
    \tag_mc_end_push:
      \tag_struct_begin:n {tag=LI}
        \tag_struct_begin:n {tag=Lbl}
           \tag_mc_begin:n {tag=Lbl}
  }
\socket_new_plug:nnn {tagsupport/__enumext/starred} {stop-start-tags}
  {
           \tag_mc_end:
        \tag_struct_end:n {tag=Lbl}
        \tag_struct_begin:n {tag=LBody}
          \tag_struct_begin:n {tag=text-unit}
            \tag_struct_begin:n {tag=text}
  }
\socket_new_plug:nnn {tagsupport/__enumext/starred} {stop-list-tags}
  {
            \tag_struct_end:n {tag=text}
          \tag_struct_end:n {tag=text-unit}
        \tag_struct_end:n {tag=LBody}
      \tag_struct_end:n {tag=LI}
    \tag_mc_begin_pop:n {}
    \tag_suspend:n {#1}
  }
```

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

```
\cs_new_protected_nopar:Npn \__enumext_start_list_tag:n #1
  {
```

```
    \IfDocumentMetadataTF
      {
        \socket_assign_plug:nn {tagsupport/__enumext/starred} {start-list-tags}
        \socket_use:nn {tagsupport/__enumext/starred} {#1}
      } {}
  }
\cs_new_protected_nopar:Nn \__enumext_stop_start_list_tag:
  {
    \IfDocumentMetadataTF
      {
        \socket_assign_plug:nn {tagsupport/__enumext/starred} {stop-start-tags}
        \socket_use:nn {tagsupport/__enumext/starred} { }
      } {}
  }
\cs_new_protected_nopar:Npn \__enumext_stop_list_tag:n #1
  {
    \IfDocumentMetadataTF
      {
        \socket_assign_plug:nn {tagsupport/__enumext/starred} {stop-list-tags}
        \socket_use:nn {tagsupport/__enumext/starred} {#1}
      } {}
  }
```

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

13.41.2 Socket for tagging support in keyanspic

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:

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

```
\socket_new:nn {tagsupport/__enumext/keyanspic}{ 0 }
\socket_new_plug:nnn {tagsupport/__enumext/keyanspic} {start-list-tags}
  {
    \tag_resume:n {keyanspic}
    \tag_mc_end_push:
      \tag_struct_begin:n {tag=LI}
        \tag_struct_begin:n {tag=Lbl}
          \tag_mc_begin:n {tag=Lbl}
  }
\socket_new_plug:nnn {tagsupport/__enumext/keyanspic} {stop-start-tags}
  {
          \tag_mc_end:
        \tag_struct_end:n {tag=Lbl}
        \tag_struct_begin:n {tag=LBody}
          \tag_struct_begin:n {tag=text-unit}
            \tag_struct_begin:n {tag=text}
              \tag_mc_begin:n {tag=text}
  }
\socket_new_plug:nnn {tagsupport/__enumext/keyanspic} {stop-list-tags}
  {
              \tag_mc_end:
            \tag_struct_end:n {tag=text}
          \tag_struct_end:n {tag=text-unit}
        \tag_struct_end:n {tag=LBody}
      \tag_struct_end:n {tag=LI}
    \tag_mc_begin_pop:n {}
    \tag_suspend:n {keyanspic}
  }
```

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

```
\cs_new_protected_nopar:Nn \__enumext_anspic_start_list_tag:
  {
    \IfDocumentMetadataTF
      {
        \socket_assign_plug:nn {tagsupport/__enumext/keyanspic} {start-list-tags}
        \socket_use:n {tagsupport/__enumext/keyanspic}
      } {}
  }
\cs_new_protected_nopar:Nn \__enumext_anspic_stop_start_list_tag:
  {
    \IfDocumentMetadataTF
      {
        \socket_assign_plug:nn {tagsupport/__enumext/keyanspic} {stop-start-tags}
        \socket_use:n {tagsupport/__enumext/keyanspic}
      } {}
```

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```
    }
\cs_new_protected_nopar:Nn \__enumext_anspic_stop_list_tag:
  {
    \IfDocumentMetadataTF
      {
        \socket_assign_plug:nn {tagsupport/__enumext/keyanspic} {stop-list-tags}
        \socket_use:n {tagsupport/__enumext/keyanspic}
      } {}
  }
```

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

13.42 The environment keyanspic and \anspic

The keyanspic environment is a list based environment that uses the same configuration for *"spacing"* and ⟨*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.

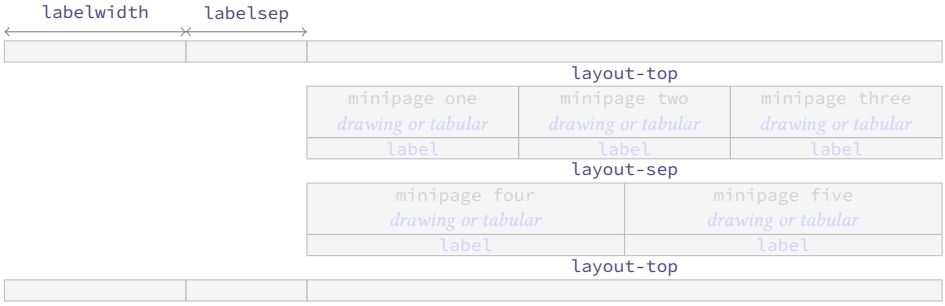

Figure 12: Representation of the keyanspic spacing in enumext.

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?.

13.42.1 The environment keyanspic

label-pos
label-sep
layout-sty
layout-sep
layout-top
mark-ans
mark-pos
mark-sep
save-sep
wrap-opt
wrap-ans*
show-ans
show-pos

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.

```
\keys_define:nn { enumext / keyanspic }
  {
    label-pos .choice:,
    label-pos / above   .code:n =
                              \bool_set_true:N \l__enumext_anspic_label_above_bool
                              \str_set:Nn \l__enumext_anspic_mini_pos_str { t },
    label-pos / below   .code:n =
                              \bool_set_false:N \l__enumext_anspic_label_above_bool
                              \str_set:Nn \l__enumext_anspic_mini_pos_str { b },
    label-pos / unknown .code:n =
                              \msg_error:nneee { enumext } { unknown-choice }
                                { label-pos } { above,~ below } { \exp_not:n {#1} },
    label-pos  .initial:n        = below,
    label-pos  .value_required:n = true,
    label-sep  .skip_set:N       = \l__enumext_anspic_label_sep_skip,
    label-sep  .value_required:n = true,
    layout-sty .tl_set:N         = \l__enumext_anspic_layout_style_tl,
    layout-sty .value_required:n = true,
    layout-sep .code:n           = \keys_set:nn { enumext / keyans } { parsep = #1 },
    layout-sep .value_required:n = true,
    layout-top .code:n           = \keys_set:nn { enumext / keyans } { topsep = #1 },
    layout-top .value_required:n = true,
    mark-ans   .code:n           = \keys_set:nn { enumext / keyans } { mark-ans = #1 },
    mark-ans   .value_required:n = true,
    mark-pos   .code:n           = \keys_set:nn { enumext / keyans } { mark-pos = #1 },
    mark-pos   .value_required:n = true,
```

```
    mark-sep    .code:n           = \keys_set:nn { enumext / keyans } { mark-sep = #1 },
    mark-sep    .value_required:n = true,
    save-sep    .code:n           = \keys_set:nn { enumext / keyans } { save-sep = #1 },
    save-sep    .value_required:n = true,
    wrap-opt    .code:n           = \keys_set:nn { enumext / keyans } { wrap-opt = #1 },
    wrap-opt    .value_required:n = true,
    wrap-ans*    .code:n           = \keys_set:nn { enumext / keyans } { wrap-ans* = #1 },
    wrap-ans*    .value_required:n = true,
    show-ans    .code:n           = \keys_set:nn { enumext / keyans } { show-ans = #1 },
    show-ans    .value_required:n = true,
    show-pos    .code:n           = \keys_set:nn { enumext / keyans } { show-pos = #1 },
    show-pos    .value_required:n = true,
    unknown     .code:n           = {
                                      \tl_set:Nn \l__enumext_envir_name_tl { keyanspic }
                                      \__enumext_keyans_unknown_keys:n {#1}
                                    },
  }
```

(*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.

```
\cs_new_protected:Nn \__enumext_keyans_pic_safe_exec:
  {
    \int_incr:N \l__enumext_keyans_pic_level_int
    \int_compare:nNnT { \l__enumext_keyans_pic_level_int } > { 1 }
      {
        \msg_error:nn { enumext } { keyanspic-nested }
      }
    \__enumext_keyans_name_and_start:
  }
```

Parse `[`⟨*key* = *val*⟩`]` for `keyanspic` environment.

```
\cs_new_protected:Npn \__enumext_keyans_pic_parse_keys:n #1
  {
    \tl_if_novalue:nF {#1}
      {
        \keys_set:nn { enumext / keyanspic } {#1}
      }
  }
```

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

```
\cs_new_protected:Npn \__enumext_keyans_pic_skip_abs:N #1
  {
    \dim_compare:nNnT { #1 } < { \c_zero_dim }
      {
        \skip_set:Nn #1 { -#1 }
      }
  }
```

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.

```
\cs_new_protected:Npn \__enumext_keyans_pic_arg_two:
  {
    \bool_set_false:N \l__enumext_leftmargin_tmp_v_bool
    \__enumext_list_arg_two_v:
    \__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*.

```
    \bool_if:NF \l__enumext_anspic_label_above_bool
      {
        \stepcounter { enumXv }
        \hbox_set:Nn \l__enumext_anspic_label_box { \l__enumext_label_v_tl }
        \dim_set:Nn \l__enumext_anspic_label_htdp_dim
          {
```

```
4228              \box_ht_plus_dp:N \l__enumext_anspic_label_box
4229            }
4230          \skip_add:Nn \parsep
4231            {
4232              \l__enumext_anspic_label_htdp_dim
4233              + \box_dp:N \strutbox
4234              + \l__enumext_anspic_label_sep_skip
4235            }
4236        }
```

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.

```
4237      \dim_add:Nn \leftmargin { -\l__enumext_labelwidth_v_dim - \l__enumext_labelsep_v_dim }
4238      \ignorespaces
4239      \skip_add:Nn \topsep { 0.5\box_dp:N \strutbox }
4240      \dim_zero:N  \listparindent
4241      \skip_zero:N \partopsep
4242      \skip_zero:N \itemsep
4243    }
```

(*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.

```
4244 \NewDocumentEnvironment{keyanspic}{ o }
4245   {
4246     \__enumext_keyans_pic_safe_exec:
4247     \__enumext_keyans_pic_parse_keys:n {#1}
4248     \begin{list} { } { \__enumext_keyans_pic_arg_two: }
4249     \IfDocumentMetadataTF
4250       {
4251         \tag_suspend:n {list}
4252       }{}
4253     \item[] \scan_stop:
4254     \RenewDocumentCommand \item {}
4255       {
4256         \msg_error:nn { enumext } { keyanspic-item-cmd }
4257       }
4258     \IfDocumentMetadataTF
4259       {
4260         \tag_resume:n {keyanspic}
4261         \tag_tool:n {para/tagging=false}
4262         \tag_suspend:n {keyanspic}
4263       } { }
4264   }
```

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.

```
4265   {
4266     \IfDocumentMetadataTF
4267       {
4268         \tag_resume:n {keyanspic}
4269         \tag_mc_end_push:
4270         \tag_struct_begin:n {tag=L,attribute=enumerate}
4271       } { }
4272     \__enumext_anspic_exec:
4273     \IfDocumentMetadataTF
4274       {
4275         \tag_suspend:n {keyanspic}
4276       } { }
4277     \end{list}
4278     \IfDocumentMetadataTF
4279       {
4280         \tag_struct_end:n {tag=L}
4281         \tag_mc_begin_pop:n {}
4282         \tag_struct_end:n {tag=L}
4283         \tag_mc_begin_pop:n {}
4284       } { }
```

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

```
    \__enumext_check_starred_cmd:n { anspic }
    \setcounter { enumXvi } { 0 }
    \bool_if:NTF \l__enumext_anspic_label_above_bool
      {
        \par\addvspace{ 0.5\box_dp:N \strutbox }
      }
      {
        \par
        \addvspace
          {
            \dim_eval:n
              {
                \l__enumext_anspic_label_htdp_dim + \box_ht_plus_dp:N \strutbox
                + \l__enumext_anspic_label_sep_skip + \l__enumext_topsep_v_skip
              }
          }
      }
  }
```

(*End of definition for* keyanspic. *This function is documented on page* 16.)

13.42.2 The command \anspic

The \anspic command take three arguments, the *starred versions* \anspic*[⟨*content*⟩] *store* the current ⟨*label*⟩ next to the *optional argument* [⟨*content*⟩] in the *sequence* and *prop list* defined by save-ans key. The third *mandatory argument* {⟨*drawing or tabular*⟩} is NOT *stored* in the *sequence* or *prop list.*

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

\anspic
__enumext_anspic_body_dim:n
__enumext_anspic_label:nn
__enumext_anspic_label_pos:nnn
__enumext_anspic_args:nnn
__enumext_anspic_print:n
__enumext_anspic_print:e
__enumext_anspic_print:V
__enumext_anspic_row:n
__enumext_anspic_exec:

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

```
\NewDocumentCommand \anspic { s o +m }
  {
    \bool_if:NF \l__enumext_store_active_bool
      {
        \msg_error:nnnn { enumext } { wrong-place }{ keyanspic }{ save-ans }
      }
    \int_compare:nNnT { \l__enumext_level_int } > { 1 }
      {
        \msg_error:nn { enumext } { keyanspic-wrong-level }
      }
    \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
      {
        \msg_error:nnnn { enumext } { command-wrong-place }{ anspic }{ keyans }
      }
    \seq_put_right:Nn \l__enumext_anspic_args_seq
      {
        \__enumext_anspic_args:nnn { #1 } { #2 } { #3 }
      }
  }
```

The __enumext_anspic_body_dim:n function will set the value of \l__enumext_anspic_body_htdp_dim equal to the "height plus depth" of the *mandatory argument* if the key label-pos is set "below".

```
\cs_new_protected:Npn \__enumext_anspic_body_dim:n #1
  {
    \bool_if:NF \l__enumext_anspic_label_above_bool
      {
        \IfDocumentMetadataTF
          {
            \tag_suspend:n {keyanspic}
          } { }
        \vbox_set:Nn \l__enumext_anspic_body_box { #1 }
        \dim_set:Nn \l__enumext_anspic_body_htdp_dim
          {
            \box_ht_plus_dp:N \l__enumext_anspic_body_box
```

```
      }
    \IfDocumentMetadataTF
      {
        \tag_resume:n {keyanspic}
      } { }
  }
}
```

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.

```
\cs_new_protected:Npn \__enumext_anspic_label:nn #1 #2
  {
    \makebox[ \l__enumext_anspic_mini_width_dim ][ c ]
      {
        \bool_if:nTF { #1 }
          {
            \bool_set_true:N \l__enumext_item_wrap_key_bool
            \bool_set_true:N \l__enumext_wrap_label_v_bool
            \__enumext_keyans_save_item_opt:n { #2 }
            \__enumext_keyans_addto_prop:n { #2 }
            \__enumext_keyans_store_ref:
            \__enumext_keyans_addto_seq:n { #2 }
            \int_gincr:N \g__enumext_check_starred_cmd_int
            \__enumext_keyans_show_ans:
            \__enumext_keyans_show_pos:
            \makebox[ \l__enumext_labelwidth_v_dim ][c]
              {
                \tl_use:N \l__enumext_label_font_style_v_tl
                \__enumext_keyans_wrapper_label:n { \l__enumext_label_vi_tl }
              }
            \skip_horizontal:n { \l__enumext_labelsep_v_dim }
            \__enumext_keyans_show_item_opt:
          }
          {
            \bool_set_false:N \l__enumext_item_wrap_key_bool
            \tl_use:N \l__enumext_label_font_style_v_tl
            \__enumext_wrapper_label_v:n { \l__enumext_label_vi_tl }
          }
      }
  }
```

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.

```
\cs_new_protected:Npn \__enumext_anspic_label_pos:nnn #1 #2 #3
  {
    \stepcounter { enumXvi }
    \__enumext_anspic_body_dim:n { #3 }
    \bool_if:NTF \l__enumext_anspic_label_above_bool
      {
        \__enumext_anspic_label:nn { #1 } { #2 }
      }
      {
        \raisebox
          {
            -\dim_eval:n
              {
                \l__enumext_anspic_label_htdp_dim
                + \l__enumext_anspic_body_htdp_dim
                + \box_dp:N \strutbox
                + \l__enumext_anspic_label_sep_skip
              }
          }
          [ 0pt ] [ 0pt ]
          {
            \__enumext_anspic_label:nn { #1 } { #2 }
          }
      }
  }
%
```

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.

```
\cs_new_protected:Nn \__enumext_anspic_args:nnn
  {
    \__enumext_anspic_start_list_tag:
    \__enumext_anspic_label_pos:nnn { #1 } { #2 } { #3 }
    \__enumext_anspic_stop_start_list_tag:
    \bool_if:NTF \l__enumext_anspic_label_above_bool
      {
        \\[\l__enumext_anspic_label_sep_skip] #3
      }
      {
        \\ #3
      }
    \__enumext_anspic_stop_list_tag:
  }
```

The value {⟨*n° upper, n° lower*⟩} 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.

```
\cs_new_protected:Nn \__enumext_anspic_print:n
  {
    \clist_map_function:nN { #1 } \__enumext_anspic_row:n
  }
\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.

```
\cs_new_protected:Nn \__enumext_anspic_row:n
  {
    \dim_set:Nn \l__enumext_anspic_mini_width_dim { \linewidth / #1 }
    \int_set:Nn \l__enumext_anspic_above_int { \l__enumext_anspic_below_int }
    \int_set:Nn \l__enumext_anspic_below_int { \l__enumext_anspic_above_int + #1 }
    \int_step_inline:nnn
      { \l__enumext_anspic_above_int + 1 }
      { \l__enumext_anspic_below_int }
      {
        \IfDocumentMetadataTF
          {
            \tag_suspend:n {minipage}
          } { }
        \begin{minipage}[ \l__enumext_anspic_mini_pos_str ]{ \l__enumext_anspic_mini_width_dim }
          \centering
          \seq_item:Nn \l__enumext_anspic_args_seq { ##1 }
        \end{minipage}
        \IfDocumentMetadataTF
          {
            \tag_resume:n {minipage}
          } { }
      }
    \par
  }
```

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*.

```
\cs_new_protected:Nn \__enumext_anspic_exec:
  {
    \tl_if_empty:NTF \l__enumext_anspic_layout_style_tl
      {
        \__enumext_anspic_print:e { \seq_count:N \l__enumext_anspic_args_seq }
      }
      {
        \__enumext_anspic_print:V \l__enumext_anspic_layout_style_tl
      }
  }
```

(*End of definition for* \anspic *and others. This function is documented on page 17.*)

13.43 The horizontal environments

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

To achieve the *horizontal list environments* we will capture the `\item` command and the ⟨*content*⟩ of this in *horizontal box* using `\makebox` for the `label` and a `minipage` environment for the ⟨*content*⟩ passed to `\item`, we will also add the *optional argument* (⟨*number*⟩) 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* (⟨*number*⟩).

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 LaTeX and any environment defined using base `list` environment, including: `itemize`, `enumerate`, `description`, `quote`, `quotation`, `verse`, `center`, `flushleft`, `flushright`, `verbatim`, `tabbing`, `trivlist`, `list` and all environments created with `\newtheorem`.

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

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

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

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

13.43.1 Functions for item box width

`\__enumext_starred_columns_set_vii:`
`\__enumext_starred_columns_set_viii:`

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

```
\cs_new_protected:Nn \__enumext_starred_columns_set_vii:
  {
    \dim_compare:nNnT { \l__enumext_columns_sep_vii_dim } = { \c_zero_dim }
      {
        \dim_set:Nn \l__enumext_columns_sep_vii_dim
          {
            ( \l__enumext_labelwidth_vii_dim + \l__enumext_labelsep_vii_dim )
            / \l__enumext_columns_vii_int
          }
      }
    \int_set:Nn \l__enumext_tmpa_vii_int { \l__enumext_columns_vii_int - 1 }
    \dim_set:Nn \l__enumext_item_width_vii_dim
      {
        ( \linewidth - \l__enumext_columns_sep_vii_dim * \l__enumext_tmpa_vii_int )
        / \l__enumext_columns_vii_int
        - \l__enumext_labelwidth_vii_dim
        - \l__enumext_labelsep_vii_dim
      }
```

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

```
    \dim_compare:nNnT { \l__enumext_rightmargin_vii_dim } > { \c_zero_dim }
      {
        \dim_sub:Nn \l__enumext_item_width_vii_dim
          {
            ( \l__enumext_rightmargin_vii_dim * \l__enumext_tmpa_vii_int )
            / \l__enumext_columns_vii_int
          }
        \dim_add:Nn \l__enumext_columns_sep_vii_dim
          {
            \l__enumext_rightmargin_vii_dim
          }
      }
  }
```

Same implementation for the `keyans*` environment.

```
\cs_new_protected:Nn \__enumext_starred_columns_set_viii:
  {
    \dim_compare:nNnT { \l__enumext_columns_sep_viii_dim } = { \c_zero_dim }
      {
        \dim_set:Nn \l__enumext_columns_sep_viii_dim
          {
            ( \l__enumext_labelwidth_viii_dim + \l__enumext_labelsep_viii_dim )
            / \l__enumext_columns_viii_int
          }
      }
```

```
    \int_set:Nn \l__enumext_tmpa_viii_int { \l__enumext_columns_viii_int - 1 }
    \dim_set:Nn \l__enumext_item_width_viii_dim
      {
        ( \linewidth - \l__enumext_columns_sep_viii_dim * \l__enumext_tmpa_viii_int )
        / \l__enumext_columns_viii_int
        - \l__enumext_labelwidth_viii_dim
        - \l__enumext_labelsep_viii_dim
      }
    \dim_compare:nNnT { \l__enumext_rightmargin_viii_dim } > { \c_zero_dim }
      {
        \dim_sub:Nn \l__enumext_item_width_viii_dim
          {
            ( \l__enumext_rightmargin_viii_dim * \l__enumext_tmpa_vii_int )
            / \l__enumext_columns_viii_int
          }
        \dim_add:Nn \l__enumext_columns_sep_viii_dim
          {
            \l__enumext_rightmargin_viii_dim
          }
      }
  }
```

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

13.43.2 Functions for join item columns

`\__enumext_starred_joined_item_vii:n`
`\__enumext_starred_joined_item_viii:n`

The functions `\__enumext_starred_joined_item_vii:n` and `\__enumext_starred_joined_item_viii:n` will set the *width* of the box in which the ⟨*content*⟩ passed to `\item`(⟨*columns*⟩) will be stored together with the value of `\itemwidth` for the `enumext*` environment.

```
\cs_new_protected:Npn \__enumext_starred_joined_item_vii:n #1
  {
    \int_set:Nn \l__enumext_joined_item_vii_int {#1}
    \int_compare:nNnT { \l__enumext_joined_item_vii_int } > { \l__enumext_columns_vii_int }
      {
        \msg_warning:nnee { enumext } { item-joined }
          { \int_use:N \l__enumext_joined_item_vii_int }
          { \int_use:N \l__enumext_columns_vii_int }
        \int_set:Nn \l__enumext_joined_item_vii_int
          {
            \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1
          }
      }
    \int_compare:nNnT
      { \l__enumext_joined_item_vii_int }
        >
      { \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1 }
      {
        \msg_warning:nnee { enumext } { item-joined-columns }
          { \int_use:N \l__enumext_joined_item_vii_int }
          {
            \int_eval:n
              { \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1 }
          }
        \int_set:Nn \l__enumext_joined_item_vii_int
          {
            \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + 1
          }
      }
    \int_compare:nNnTF { \l__enumext_joined_item_vii_int } > { 1 }
      {
        \int_set_eq:NN \l__enumext_joined_item_aux_vii_int \l__enumext_joined_item_vii_int
        \int_decr:N \l__enumext_joined_item_aux_vii_int
        \int_add:Nn \l__enumext_item_column_pos_vii_int { \l__enumext_joined_item_aux_vii_int }
        \int_gadd:Nn \g__enumext_item_count_all_vii_int { \l__enumext_joined_item_aux_vii_int }
        \dim_set:Nn \l__enumext_joined_width_vii_dim
          {
            \l__enumext_item_width_vii_dim * \l__enumext_joined_item_vii_int
            + (  \l__enumext_labelwidth_vii_dim + \l__enumext_labelsep_vii_dim
               + \l__enumext_columns_sep_vii_dim
              )*\l__enumext_joined_item_aux_vii_int
          }
        \dim_set_eq:NN \itemwidth \l__enumext_joined_width_vii_dim
```

```
      }
      {
        \dim_set_eq:NN \l__enumext_joined_width_vii_dim \l__enumext_item_width_vii_dim
        \dim_set_eq:NN \itemwidth \l__enumext_item_width_vii_dim
      }
  }
```

Same implementation for the keyans* environment.

```
\cs_new_protected:Npn \__enumext_starred_joined_item_viii:n #1
  {
    \int_set:Nn \l__enumext_joined_item_viii_int {#1}
    \int_compare:nNnT { \l__enumext_joined_item_viii_int } > { \l__enumext_columns_viii_int }
      {
        \msg_warning:nnee { enumext } { item-joined }
          { \int_use:N \l__enumext_joined_item_viii_int }
          { \int_use:N \l__enumext_columns_viii_int }
        \int_set:Nn \l__enumext_joined_item_viii_int
          {
            \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1
          }
      }
    \int_compare:nNnT
      { \l__enumext_joined_item_viii_int }
        >
      { \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1 }
      {
        \msg_warning:nnee { enumext } { item-joined-columns }
          { \int_use:N \l__enumext_joined_item_viii_int }
          {
            \int_eval:n
              { \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1 }
          }
        \int_set:Nn \l__enumext_joined_item_viii_int
          {
            \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + 1
          }
      }
    \int_compare:nNnTF { \l__enumext_joined_item_viii_int } > { 1 }
      {
        \int_set_eq:NN \l__enumext_joined_item_aux_viii_int \l__enumext_joined_item_viii_int
        \int_decr:N \l__enumext_joined_item_aux_viii_int
        \int_add:Nn \l__enumext_item_column_pos_viii_int { \l__enumext_joined_item_aux_viii_int }
        \int_gadd:Nn \g__enumext_item_count_all_viii_int { \l__enumext_joined_item_aux_viii_int }
        \dim_set:Nn \l__enumext_joined_width_viii_dim
          {
            \l__enumext_item_width_viii_dim * \l__enumext_joined_item_viii_int
            + ( \l__enumext_labelwidth_viii_dim + \l__enumext_labelsep_viii_dim
                + \l__enumext_columns_sep_viii_dim
              )*\l__enumext_joined_item_aux_viii_int
          }
        \dim_set_eq:NN \itemwidth \l__enumext_joined_width_viii_dim
      }
      {
        \dim_set_eq:NN \l__enumext_joined_width_viii_dim \l__enumext_item_width_viii_dim
        \dim_set_eq:NN \itemwidth \l__enumext_item_width_viii_dim
      }
  }
```

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

13.43.3 Functions for `mini-env`, `mini-right` and `mini-right*` keys

`\__enumext_start_mini_vii:`
`\__enumext_stop_mini_vii:`

The implementation of the mini-env key support is almost identical to the one used in the enumext and keyans environments, the difference is that the `__enumext_mini_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`.

```
\cs_new_protected:Nn \__enumext_start_mini_vii:
  {
    \dim_compare:nNnT { \l__enumext_minipage_right_vii_dim } > { \c_zero_dim }
      {
        \dim_set:Nn \l__enumext_minipage_left_vii_dim
          {
```

```
            \linewidth
            - \l__enumext_minipage_right_vii_dim
            - \l__enumext_minipage_hsep_vii_dim
          }
        \bool_set_true:N \l__enumext_minipage_active_vii_bool
        \dim_gset_eq:NN
          \g__enumext_minipage_right_vii_dim
          \l__enumext_minipage_right_vii_dim
        \__enumext_mini_addvspace_vii:
        \nointerlineskip\noindent
        \__enumext_mini_page{ \l__enumext_minipage_left_vii_dim }
      }
  }
```

The function `\__enumext_stop_mini_vii:` closes the `__enumext_mini_page` environment on the *"left side"*, applies `\hfill` and set the variable `\g__enumext_minipage_active_vii_bool` to *"true"* which will be used in the function `\__enumext_after_env:nn` to execute the `minipage` on the *"right side"*. At this point we will execute the `\__enumext_stop_list:` and `\__enumext_stop_store_level_vii:` functions stopping the `list` environment and the level saving mechanism for storage in *sequence* of the `\anskey` command and `anskey*` environment. This function is passed to the `\__enumext_after_list_vii:` function in the second part of the `enumext*` environment definition (§13.44).

```
\cs_new_protected:Nn \__enumext_stop_mini_vii:
  {
    \bool_if:NTF \l__enumext_minipage_active_vii_bool
      {
        \__enumext_stop_list:
        \__enumext_stop_store_level_vii:
        \IfDocumentMetadataTF { \tag_resume:n {enumext*} } { }
        \end__enumext_mini_page
        \hfill
        \bool_gset_true:N \g__enumext_minipage_active_vii_bool
      }
      {
        \__enumext_stop_list:
        \__enumext_stop_store_level_vii:
      }
  }
```

(*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.

```
\__enumext_after_env:nn {enumext*}
  {
    \bool_if:NT \g__enumext_minipage_active_vii_bool
      {
        \__enumext_minipage:w [ t ] { \g__enumext_minipage_right_vii_dim }
          \legacy_if_gset_false:n { @minipage }
          \skip_vertical:N \c_zero_skip
          \par\addvspace { \g__enumext_minipage_right_skip }
          \bool_if:NF \g__enumext_minipage_center_vii_bool
            {
              \tl_put_left:Nn \g__enumext_miniright_code_vii_tl
                {
                  \centering
                }
            }
          \vbox_set_top:Nn \l__enumext_miniright_code_vii_box
            {
              \tl_use:N \g__enumext_miniright_code_vii_tl
            }
          \box_use_drop:N \l__enumext_miniright_code_vii_box
          \skip_vertical:N \c_zero_skip
        \__enumext_endminipage:
        \par\addvspace{ \g__enumext_minipage_after_skip }
      }
    \bool_gset_false:N \g__enumext_minipage_active_vii_bool
    \bool_gset_true:N \g__enumext_minipage_center_vii_bool
    \tl_gclear:N \g__enumext_miniright_code_vii_tl
    \dim_gzero:N \g__enumext_minipage_right_vii_dim
```

```
    \bool_gset_false:N \g__enumext_starred_bool
  }
```

__enumext_start_mini_viii:
__enumext_stop_mini_viii:

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

```
\cs_new_protected:Nn \__enumext_start_mini_viii:
  {
    \dim_compare:nNnT { \l__enumext_minipage_right_viii_dim } > { \c_zero_dim }
      {
        \dim_set:Nn \l__enumext_minipage_left_viii_dim
          {
            \linewidth
            - \l__enumext_minipage_right_viii_dim
            - \l__enumext_minipage_hsep_viii_dim
          }
        \bool_set_true:N \l__enumext_minipage_active_viii_bool
        \dim_gset_eq:NN
          \g__enumext_minipage_right_viii_dim
          \l__enumext_minipage_right_viii_dim
        \__enumext_mini_addvspace_viii:
        \nointerlineskip\noindent
        \__enumext_mini_page{ \l__enumext_minipage_left_viii_dim }
      }
   }
\cs_new_protected:Nn \__enumext_stop_mini_viii:
  {
    \bool_if:NTF \l__enumext_minipage_active_viii_bool
      {
        \__enumext_stop_list:
        \IfDocumentMetadataTF { \tag_resume:n {keyans*} } { }
        \end__enumext_mini_page
        \hfill
        \bool_gset_true:N \g__enumext_minipage_active_viii_bool
      }
      {
        \__enumext_stop_list:
      }
   }
\__enumext_after_env:nn {keyans*}
  {
    \bool_if:NT \g__enumext_minipage_active_viii_bool
      {
        \__enumext_mini_page{ \g__enumext_minipage_right_viii_dim }
          \par\addvspace { \g__enumext_minipage_right_skip }
          \bool_if:NF \g__enumext_minipage_center_viii_bool
            {
              \tl_put_left:Nn \g__enumext_miniright_code_viii_tl
                {
                  \centering
                }
            }
          \vbox_set_top:Nn \l__enumext_miniright_code_viii_box
            {
              \tl_use:N \g__enumext_miniright_code_viii_tl
            }
          \box_use_drop:N \l__enumext_miniright_code_viii_box
        \end__enumext_mini_page
        \par\addvspace{ \g__enumext_minipage_after_skip }
      }
    \bool_gset_false:N \g__enumext_minipage_active_viii_bool
    \bool_gset_true:N \g__enumext_minipage_center_viii_bool
    \tl_gclear:N \g__enumext_miniright_code_viii_tl
    \dim_gzero:N \g__enumext_minipage_right_viii_dim
  }
```

(*End of definition for* `\__enumext_start_mini_viii:` *and* `\__enumext_stop_mini_viii:`.)

13.44 The environment enumext*

enumext*

First we will generate the environment and we will give a temporary definition to `\__enumext_stop_item_tmp_vii:` equal to `\__enumext_first_item_tmp_vii:` and next to `\item` equal to `\__enumext_start_item_tmp_vii:` which we will redefine later. Unlike the implementation used by the shortlst

package, we will not set the values of \rightskip and \@rightskip equal to \@flushglue whose value is 0.0pt plus 1.0 fil, in the tests I have performed this fails in some circumstances and different results are obtained when using pdfTEX and LuaTEX.

```
\NewDocumentEnvironment{enumext*}{ o }
  {
    \__enumext_safe_exec_vii:
    \__enumext_parse_keys_vii:n {#1}
    \__enumext_before_list_vii:
    \__enumext_start_store_level_vii:
    \__enumext_start_list:nn { }
      {
        \__enumext_list_arg_two_vii:
        \__enumext_before_keys_exec_vii:
      }
    \IfDocumentMetadataTF { \tag_suspend:n {enumext*} } { }
    \__enumext_starred_columns_set_vii:
    \item[] \scan_stop:
    \cs_set_eq:NN \__enumext_stop_item_tmp_vii: \__enumext_first_item_tmp_vii:
    \cs_set_eq:NN \item \__enumext_start_item_tmp_vii:
    \ignorespaces
  }
  {
    \IfDocumentMetadataTF { \tag_struct_end:n {tag=text-unit} } { }
    \__enumext_stop_item_tmp_vii:
    \__enumext_remove_extra_parsep_vii:
    \__enumext_after_list_vii:
  }
```

(*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.

```
\cs_new_protected:Nn \__enumext_safe_exec_vii:
  {
    \__enumext_is_not_nested:
    \__enumext_internal_mini_page:
    \int_incr:N \l__enumext_level_h_int
    \int_compare:nNnT { \l__enumext_level_h_int } > { 1 }
      {
        \msg_error:nn { enumext } { nested }
      }
    \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
      {
        \msg_error:nnn { enumext } { nested-horizontal } { keyans*}
      }
    \bool_set_true:N \l__enumext_starred_bool
    \bool_set_false:N \l__enumext_standar_bool
    \__enumext_is_on_first_level:
  }
```

(*End of definition for* __enumext_safe_exec_vii:.)

__enumext_parse_keys_vii:n

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

```
\cs_new_protected:Npn \__enumext_parse_keys_vii:n #1
  {
    \tl_if_novalue:nF {#1}
      {
        \str_clear:N \l__enumext_series_str
        \keys_set:nn { enumext / enumext* } {#1}
        \__enumext_parse_series:n {#1}
        \__enumext_store_active_keys_vii:n {#1}
      }
  }
```

(*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*`.

```
\cs_new_protected:Nn \__enumext_before_list_vii:
  {
    \__enumext_vspace_above_vii:
    \__enumext_check_ans_active:
    \__enumext_before_args_exec_vii:
    \__enumext_start_mini_vii:
  }
```

(*End of definition for* `\__enumext_before_list_vii:`.)

`\__enumext_after_list_vii:` The function `\__enumext_after_list_vii:` first calls the function `\__enumext_stop_mini_vii:` which internally calls `\__enumext_stop_list:` and `\__enumext_stop_store_level_vii:` (§13.43.3) used by the keys `mini-env`, `mini-right` and `mini-right*`, then to the functions `\__enumext_after_stop_list_vii:` used by the key `after`, `\__enumext_check_ans_key_hook:` used by the key `check-ans`, `\__enumext_vspace_below_vii:` used by the keys `below` and `below*`. Finally set `\l__enumext_starred_bool` to false and call the `\__enumext_resume_save_counter:` function used by the `series`, `resume` and `resume*` keys.

```
\cs_new_protected:Nn \__enumext_after_list_vii:
  {
    \__enumext_stop_mini_vii:
    \__enumext_after_stop_list_vii:
    \__enumext_check_ans_key_hook:
    \__enumext_vspace_below_vii:
    \bool_set_false:N \l__enumext_starred_bool
    \__enumext_resume_save_counter:
  }
```

(*End of definition for* `\__enumext_after_list_vii:`.)

`\__enumext_start_store_level_vii:` `\__enumext_stop_store_level_vii:` The `\__enumext_start_store_level_vii:` and `\__enumext_stop_store_level_vii:` functions activate the *"storing structure"* mechanism in *sequence* for `\anskey` command and `anskey*` environment if `enumext*` are nested in `enumext`.

```
\cs_new_protected:Nn \__enumext_start_store_level_vii:
  {
    \bool_if:NT \l__enumext_store_active_bool
      {
        \int_compare:nNnT { \l__enumext_level_int } > { 0 }
          {
            \__enumext_store_level_open_vii:
          }
      }
  }
\cs_new_protected:Nn \__enumext_stop_store_level_vii:
  {
    \bool_if:NT \l__enumext_store_active_bool
      {
        \int_compare:nNnT { \l__enumext_level_int } > { 0 }
          {
            \__enumext_store_level_close_vii:
          }
      }
  }
```

(*End of definition for* `\__enumext_start_store_level_vii:` *and* `\__enumext_stop_store_level_vii:`.)

13.44.1 The command `\item` in `enumext*`

`\__enumext_first_item_tmp_vii:` The `\__enumext_first_item_tmp_vii:` function will remove horizontal space equal to `\labelwidth` plus `\labelsep` to the left of the *"first"* `\item` in the environment at the point of execution of this function, where it is equal to the `\__enumext_stop_item_tmp_vii:` function inside the environment body definition.

```
\cs_new_protected_nopar:Nn \__enumext_first_item_tmp_vii:
  {
    \skip_horizontal:n
      {
        -\l__enumext_labelwidth_vii_dim - \l__enumext_labelsep_vii_dim
```

```
4826        }
4827      \ignorespaces
4828    }
```

(*End of definition for* `\__enumext_first_item_tmp_vii:`.)

`\__enumext_start_item_tmp_vii:`
`\__enumext_item_peek_args_vii:`
`\__enumext_joined_item_vii:w`
`\__enumext_standar_item_vii:w`
`\__enumext_starred_item_vii:w`
`\__enumext_starred_item_vii_aux_i:w`
`\__enumext_starred_item_vii_aux_ii:w`
`\__enumext_starred_item_vii_aux_iii:w`

First we will call the function `\__enumext_stop_item_tmp_vii:` that we will redefine later, we will increment the value of `\l__enumext_item_column_pos_vii_int` that will count the item's by rows and the value of `\g__enumext_item_count_all_vii_int` that will count the total of item's in the environment. After that we will call the function `\__enumext_item_peek_args_vii:` that will handle the arguments passed to `\item`.

```
4829 \cs_new_protected_nopar:Nn \__enumext_start_item_tmp_vii:
4830   {
4831     \__enumext_stop_item_tmp_vii:
4832     \int_incr:N \l__enumext_item_column_pos_vii_int
4833     \int_gincr:N \g__enumext_item_count_all_vii_int
4834     \__enumext_item_peek_args_vii:
4835   }
```

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)`.

```
4836 \cs_new_protected:Nn \__enumext_item_peek_args_vii:
4837   {
4838     \peek_meaning:NTF (
4839       { \__enumext_joined_item_vii:w }
4840       { \__enumext_joined_item_vii:w (1) }
4841   }
```

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`.

```
4842 \cs_new_protected:Npn \__enumext_joined_item_vii:w (#1)
4843   {
4844     \__enumext_starred_joined_item_vii:n {#1}
4845     \peek_meaning_remove:NTF *
4846       { \__enumext_starred_item_vii:w  }
4847       { \__enumext_standar_item_vii:w }
4848   }
```

The function `\__enumext_standar_item_vii:w` will first look for the argument "`[`", if present it will set the state of the variable `\l__enumext_wrap_label_opt_vii_bool` equal to the state of the variable `\l__enumext_wrap_label_opt_vii_bool` handled by the key `wrap-label*` and finally execute the *non-enumerated* version `\item`[⟨*custom*⟩] by means of the function `\__enumext_start_item_vii:w`, otherwise we will set the value of the variable `\l__enumext_wrap_label_vii_bool` handled by the `wrap-label` key to true and set the switch `\if@noitemarg` to true to execute the enumerated version of `\item` by means of the function `\__enumext_start_item_vii:w` [`\l__enumext_label_vii_tl`].

```
4849 \cs_new_protected:Npn \__enumext_standar_item_vii:w
4850   {
4851     \bool_set_false:N \l__enumext_item_starred_vii_bool
4852     \peek_meaning:NTF [
4853       {
4854         \bool_set_eq:NN \l__enumext_wrap_label_vii_bool \l__enumext_wrap_label_opt_vii_bool
4855         \__enumext_start_item_vii:w
4856       }
4857       {
4858         \bool_set_true:N \l__enumext_wrap_label_vii_bool
4859         \legacy_if_set_true:n { @noitemarg }
4860         \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ] \ignorespaces
4861       }
4862   }
```

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

```
4863 \cs_new_protected:Npn \__enumext_starred_item_vii:w
4864   {
4865     \bool_set_true:N \l__enumext_item_starred_vii_bool
4866     \bool_set_true:N \l__enumext_wrap_label_vii_bool
4867     \peek_meaning:NTF [
4868       { \__enumext_starred_item_vii_aux_i:w }
```

```
      { \__enumext_starred_item_vii_aux_ii:w }
  }
\cs_new_protected:Npn \__enumext_starred_item_vii_aux_i:w [#1]
  {
    \tl_gset:Nn \g__enumext_item_symbol_aux_vii_tl {#1}
    \__enumext_starred_item_vii_aux_ii:w
  }
\cs_new_protected:Npn \__enumext_starred_item_vii_aux_ii:w
  {
    \peek_meaning:NTF [
      { \__enumext_starred_item_vii_aux_iii:w }
      {
        \dim_set_eq:NN \l__enumext_item_symbol_sep_vii_dim \l__enumext_labelsep_vii_dim
        \legacy_if_set_true:n { @noitemarg }
        \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ] \ignorespaces
      }
  }
\cs_new_protected:Npn \__enumext_starred_item_vii_aux_iii:w [#1]
  {
    \dim_set:Nn \l__enumext_item_symbol_sep_vii_dim {#1}
    \legacy_if_set_true:n { @noitemarg }
    \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ] \ignorespaces
  }
```

(*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*[`⟨*symbol*⟩`][`⟨*offset*⟩`]` 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`

```
\cs_new_protected_nopar:Npn \__enumext_fake_make_label_vii:n #1
  {
    \legacy_if:nT { @noitemarg }
      {
        \legacy_if_set_false:n { @noitemarg }
        \legacy_if:nT { @nmbrlist }
          {
            \IfDocumentMetadataTF
              {
                \bool_if:NT \l__enumext_hyperref_bool
                  {
                    \legacy_if_set_true:n { @hyper@item }
                  }
              } { }
            \refstepcounter{enumXvii}
            \bool_if:NT \l__enumext_check_answers_bool
              {
                \int_gincr:N \g__enumext_item_number_int
                \bool_set_true:N \l__enumext_item_number_bool
              }
          }
      }
    \bool_if:NT \l__enumext_item_starred_vii_bool
      {
        \tl_if_blank:VT \g__enumext_item_symbol_aux_vii_tl
          {
            \tl_gset_eq:NN
              \g__enumext_item_symbol_aux_vii_tl \l__enumext_item_symbol_vii_tl
          }
        \mode_leave_vertical:
        \skip_horizontal:n { -\l__enumext_item_symbol_sep_vii_dim }
        \hbox_overlap_left:n { \g__enumext_item_symbol_aux_vii_tl }
        \skip_horizontal:N \l__enumext_item_symbol_sep_vii_dim
```

```
      \tl_gclear:N \g__enumext_item_symbol_aux_vii_tl
    }
  \makebox[ \l__enumext_labelwidth_vii_dim ][ \l__enumext_align_label_vii_str ]
    {
      \tl_use:N \l__enumext_label_font_style_vii_tl
      \bool_if:NTF \l__enumext_wrap_label_vii_bool
        {
          \__enumext_wrapper_label_vii:n {#1}
        }
        { #1 }
    }
  \skip_horizontal:N \l__enumext_labelsep_vii_dim \ignorespaces
}
```

(*End of definition for* `\__enumext_fake_make_label_vii:n`.)

13.44.2 Real definition of `\item` in enumext*

The functions `\__enumext_start_item_vii:w` and `\__enumext_stop_item_vii:` executing the true definition of `\item` inside the `enumext*` environment, unlike the implementation in `shortlst` we will NOT use an extra group and the plain form of the `lrbox` environment.

`\__enumext_start_item_vii:w`
`\__enumext_stop_item_vii:`

The first thing we will do is set the value of `\__enumext_stop_item_tmp_vii:` equal to `\__enumext_stop_item_vii:` which we will define later, after that we will start capturing `\item` and *"item content"* in a *horizontal box* where the width will be `\itemwidth` plus `\labelwidth` plus `\labelsep`.

```
\cs_new_protected_nopar:Npn \__enumext_start_item_vii:w [#1]
  {
    \cs_set_eq:NN \__enumext_stop_item_tmp_vii: \__enumext_stop_item_vii:
    \hbox_set_to_wd:Nnw \l__enumext_item_text_vii_box
      {
        \l__enumext_joined_width_vii_dim
        + \l__enumext_labelwidth_vii_dim
        + \l__enumext_labelsep_vii_dim
      }
```

Redefine the `\footnote` command.

```
    \__enumext_renew_footnote_starred:
```

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

```
    \__enumext_start_list_tag:n {enumext*}
    \__enumext_fake_make_label_vii:n {#1}
    \__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.

```
    \__enumext_minipage:w [ t ]{ \l__enumext_joined_width_vii_dim }
      \dim_set_eq:NN \parindent \l__enumext_listparindent_vii_dim
      \skip_set_eq:NN \parskip \l__enumext_parsep_vii_skip
      \__enumext_unskip_unkern:
      \__enumext_unskip_unkern:
      \skip_horizontal:n { -\l__enumext_listparindent_vii_dim } \ignorespaces
      \tl_use:N \l__enumext_fake_item_indent_vii_tl
      \tl_use:N \l__enumext_after_list_args_vii_tl
  }
```

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*.

```
\cs_new_protected_nopar:Nn \__enumext_stop_item_vii:
  {
    \__enumext_endminipage:
    \__enumext_stop_list_tag:n {enumext*}
    \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*,.

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

```
    \int_compare:nNnTF
      { \l__enumext_item_column_pos_vii_int } = { \l__enumext_columns_vii_int }
      {
        \par\noindent
        \int_zero:N \l__enumext_item_column_pos_vii_int
      }
      {
        \skip_horizontal:N \l__enumext_columns_sep_vii_dim
      }
  }
```

(*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 `\removelastskip` 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*⟩.

```
\cs_new_protected:Nn \__enumext_remove_extra_parsep_vii:
  {
    \int_compare:nNnT
      {
        \int_mod:nn
          {  \g__enumext_item_count_all_vii_int } { \l__enumext_columns_vii_int }
      }
      =
      { 0 }
      {
        \para_end:
        \skip_vertical:n { -\l__enumext_itemsep_vii_skip }
        \skip_vertical:N \c_zero_skip
        \int_gzero:N \g__enumext_item_count_all_vii_int
      }
  }
```

(*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`.

```
\__enumext_after_env:nn {enumext*}
  {
    \__enumext_execute_after_env:
  }
```

13.45 The environment keyans*

`keyans*` The implementation of `keyans*` environment is the similar as that used by the `enumext*` environment except for the `\__enumext_check_starred_cmd:n` function added in the second part.

```
\NewDocumentEnvironment{keyans*}{ o }
  {
    \__enumext_safe_exec_viii:
    \__enumext_parse_keys_viii:n {#1}
    \__enumext_before_list_viii:
    \__enumext_start_list:nn { }
      {
        \__enumext_list_arg_two_viii:
        \__enumext_before_keys_exec_viii:
      }
    \IfDocumentMetadataTF { \tag_suspend:n {keyans*} } { }
    \__enumext_starred_columns_set_viii:
    \item[] \scan_stop:
    \cs_set_eq:NN \__enumext_stop_item_tmp_viii: \__enumext_first_item_tmp_viii:
    \cs_set_eq:NN \item \__enumext_start_item_tmp_viii:
    \ignorespaces
  }
  {
    \IfDocumentMetadataTF { \tag_struct_end:n {tag=text-unit} } { }
    \__enumext_stop_item_tmp_viii:
    \__enumext_remove_extra_parsep_viii:
    \__enumext_check_starred_cmd:n { item }
```

```
    \__enumext_after_list_viii:
  }
```

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

`\__enumext_safe_exec_viii:` The `\__enumext_safe_exec_viii:` function will first check if the `save-ans` key is active and only when this is true the environment will be available, it will increment the value of `\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.

```
\cs_new_protected:Nn \__enumext_safe_exec_viii:
  {
    \bool_if:NF \l__enumext_store_active_bool
      {
        \msg_error:nnnn { enumext } { wrong-place }{ keyans* }{ save-ans }
      }
    \int_incr:N \l__enumext_keyans_level_h_int
    \int_compare:nNnT { \l__enumext_keyans_level_h_int } > { 1 }
      {
        \msg_error:nn { enumext } { nested }
      }
    \__enumext_keyans_name_and_start:
    \bool_if:NT \l__enumext_starred_bool
      {
        \msg_error:nnn { enumext } { nested-horizontal } { enumext* }
      }
    \bool_set_true:N \l__enumext_starred_bool
    % Set false for interfering with enumext nested in keyans* (yes, its possible and crayze)
    \bool_set_false:N \l__enumext_store_active_bool
    \int_compare:nNnT { \l__enumext_level_int } > { 1 }
      {
        \msg_error:nn { enumext } { keyans-wrong-level }
      }
  }
```

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

`\__enumext_parse_keys_viii:n` Parse `[`⟨*key* = *val*⟩`]` for `keyans*`.

```
\cs_new_protected:Npn \__enumext_parse_keys_viii:n #1
  {
    \tl_if_novalue:nF {#1}
      {
        \keys_set:nn { enumext / keyans* } {#1}
      }
  }
```

(*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`.

```
\cs_new_protected:Nn \__enumext_before_list_viii:
  {
    \__enumext_vspace_above_viii:
    \__enumext_before_args_exec_viii:
    \__enumext_start_mini_viii:
  }
```

(*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.

```
\cs_new_protected:Nn \__enumext_after_list_viii:
  {
    \__enumext_stop_mini_viii:
    \__enumext_after_stop_list_viii:
    \__enumext_vspace_below_viii:
  }
```

(*End of definition for* `\__enumext_after_list_viii:`.)

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13.45.1 The command \item in keyans*

The idea here is to make the \item command behave in the same way as in the keyans environment with the difference of the *optional argument* (⟨*number*⟩) which works in the same way as in the enumext* environment. In simple terms we want to store the ⟨*label*⟩ next to the [⟨*content*⟩] if it is present in the *sequence* and *prop list* defined by save-ans key for \item*, \item*[⟨*content*⟩], \item(⟨*number*⟩)* and \item(⟨*number*⟩)*[⟨*content*⟩] commands.

__enumext_first_item_tmp_viii:

The __enumext_first_item_tmp_viii: function will remove horizontal space equal to \labelwidth plus \labelsep to the left of the *"first"* \item in the environment at the point of execution of this function, where it is equal to the __enumext_stop_item_tmp_viii: function inside the environment body definition.

```
\cs_new_protected_nopar:Nn \__enumext_first_item_tmp_viii:
  {
    \skip_horizontal:n
      {
        -\l__enumext_labelwidth_viii_dim - \l__enumext_labelsep_viii_dim
      }
    \ignorespaces
  }
```

(*End of definition for* __enumext_first_item_tmp_viii:.)

__enumext_start_item_tmp_viii:
__enumext_item_peek_args_viii:
__enumext_joined_item_viii:w
__enumext_standar_item_viii:w

First we will call the function __enumext_stop_item_tmp_viii: that we will redefine later, we will increment the value of \l__enumext_item_column_pos_viii_int that will count the item's by rows and the value of \g__enumext_item_count_all_viii_int that will count the total of item's in the environment. After that we will call the function __enumext_item_peek_args_viii: that will handle the arguments passed to \item.

```
\cs_new_protected_nopar:Nn \__enumext_start_item_tmp_viii:
  {
    \__enumext_stop_item_tmp_viii:
    \int_incr:N \l__enumext_item_column_pos_viii_int
    \int_gincr:N \g__enumext_item_count_all_viii_int
    \__enumext_item_peek_args_viii:
  }
```

The function __enumext_item_peek_args_viii: will handle the \item(⟨*number*⟩). Look for the argument "(", if it is present we will call the function __enumext_joined_item_viii:w (⟨*number*⟩), which is in charge of joining the item's in the same row, in case they are not present we will set the default value (1).

```
\cs_new_protected:Nn \__enumext_item_peek_args_viii:
  {
    \peek_meaning:NTF (
      { \__enumext_joined_item_viii:w }
      { \__enumext_joined_item_viii:w (1) }
  }
```

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.

```
\cs_new_protected:Npn \__enumext_joined_item_viii:w (#1)
  {
    \__enumext_starred_joined_item_viii:n {#1}
    \peek_meaning_remove:NTF *
      { \__enumext_starred_item_viii:w }
      { \__enumext_standar_item_viii:w }
  }
```

The function __enumext_standar_item_viii:w will first look for the argument "[", if present it will set the state of the variable \l__enumext_wrap_label_opt_viii_bool equal to the state of the variable \l__enumext_wrap_label_opt_viii_bool handled by the key wrap-label* and finally execute the *non-enumerated* version \item[⟨*custom*⟩] by means of the function __enumext_start_item_viii:w, otherwise we will set the value of the variable \l__enumext_wrap_label_viii_bool handled by the wrap-label key to true and set the switch \if@noitemarg to true to execute the enumerated version of \item by means of the function __enumext_start_item_viii:w [\l__enumext_label_viii_tl].

```
\cs_new_protected:Npn \__enumext_standar_item_viii:w
  {
    \bool_set_false:N \l__enumext_item_starred_viii_bool
    \bool_set_false:N \l__enumext_item_wrap_key_bool
    \peek_meaning:NTF [
      {
        \bool_set_eq:NN \l__enumext_wrap_label_viii_bool \l__enumext_wrap_label_opt_viii_bool
```

```
      \__enumext_start_item_viii:w
    }
    {
      \bool_set_true:N \l__enumext_wrap_label_viii_bool
      \legacy_if_set_true:n { @noitemarg }
      \__enumext_start_item_viii:w [ \l__enumext_label_viii_tl ] \ignorespaces
    }
}
```

(*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*⟩`]`.

```
\cs_new_protected:Npn \__enumext_starred_item_viii:w
  {
    \bool_set_true:N \l__enumext_item_starred_viii_bool
    \bool_set_true:N \l__enumext_item_wrap_key_bool
    \bool_set_true:N \l__enumext_wrap_label_viii_bool
    \peek_meaning:NTF [
      { \__enumext_starred_item_viii_aux_i:w }
      { \__enumext_starred_item_viii_aux_ii:w }
  }
```

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`.

```
\cs_new_protected:Npn \__enumext_starred_item_viii_aux_i:w [#1]
  {
    \tl_clear:N \l__enumext_store_current_label_tl
    \tl_if_novalue:nF { #1 }
      {
        \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_viii_tl
          {
            \tl_put_right:NV \l__enumext_store_current_label_tl \l__enumext_store_keyans_item_opt
            \tl_put_right:Nn \l__enumext_store_current_label_tl { #1 }
          }
        \tl_set:Nn \l__enumext_store_current_opt_arg_tl { #1 }
      }
    \__enumext_starred_item_viii_aux_ii:w
  }
\cs_new_protected:Npn \__enumext_starred_item_viii_aux_ii:w
  {
    \legacy_if_set_true:n { @noitemarg }
    \__enumext_start_item_viii:w [ \l__enumext_label_viii_tl ] \ignorespaces
  }
```

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.

```
\cs_new_protected:Nn \__enumext_keyans_starred_item_star:
  {
    \tl_put_left:Ne \l__enumext_store_current_label_tl { \l__enumext_label_viii_tl }
    \__enumext_store_addto_prop:V \l__enumext_store_current_label_tl
    \__enumext_keyans_store_ref:
    \tl_put_left:Nn \l__enumext_store_current_label_tl { \item }
    \__enumext_keyans_addto_seq_link:
    \int_gincr:N \g__enumext_check_starred_cmd_int
    \dim_compare:nNnT { \l__enumext_mark_sym_sep_viii_dim } = { \c_zero_dim }
      {
        \dim_set:Nn \l__enumext_mark_sym_sep_viii_dim { \l__enumext_labelsep_viii_dim }
      }
    \bool_if:NT \l__enumext_show_answer_bool
      {
        \tl_set_eq:NN \l__enumext_mark_answer_sym_tl \l__enumext_mark_answer_sym_viii_tl
        \str_set_eq:NN \l__enumext_mark_position_str \l__enumext_mark_position_viii_str
        \__enumext_print_keyans_box:NN
          \l__enumext_labelwidth_viii_dim \l__enumext_mark_sym_sep_viii_dim
      }
    \bool_if:NT \l__enumext_show_position_bool
```

```
      {
        \tl_set:Ne \l__enumext_mark_answer_sym_tl
          {
            \group_begin:
              \exp_not:N \normalfont
              \exp_not:N \footnotesize [ \int_eval:n
                {
                  \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
                }
               ]
            \group_end:
          }
        \str_set_eq:NN \l__enumext_mark_position_str \l__enumext_mark_position_viii_str
        \__enumext_print_keyans_box:NN
          \l__enumext_labelwidth_viii_dim \l__enumext_mark_sym_sep_viii_dim
      }
  }
```

(*End of definition for* `\__enumext_starred_item_viii:w` *and others.*)

`\__enumext_keyans_wraper_label_viii:n`
`\__enumext_fake_make_label_viii:n`

The implementation at this is very similar to that of the `enumext*` environment.

```
\cs_new_protected:Npn \__enumext_keyans_wraper_label_viii:n #1
  {
    \bool_lazy_all:nT
      {
        { \bool_if_p:N \l__enumext_wrap_label_viii_bool         }
        { \bool_if_p:N \l__enumext_show_answer_bool             }
        { \bool_if_p:N \l__enumext_item_wrap_key_bool           }
        { \cs_if_exist_p:N \__enumext_keyans_wrapper_item_viii:n }
      }
      {
        \cs_set_eq:NN
          \__enumext_wrapper_label_viii:n \__enumext_keyans_wrapper_item_viii:n
      }
    \bool_if:NTF \l__enumext_wrap_label_viii_bool
      {
        \__enumext_wrapper_label_viii:n {#1}
      }
      { #1 }
  }
\cs_new_protected_nopar:Npn \__enumext_fake_make_label_viii:n #1
  {
    \legacy_if:nT { @noitemarg }
      {
        \legacy_if_set_false:n { @noitemarg }
        \legacy_if:nT { @nmbrlist }
          {
            \refstepcounter{enumXviii}
          }
      }
    \bool_if:NT \l__enumext_item_starred_viii_bool
      {
        \__enumext_keyans_starred_item_star:
      }
    \makebox[ \l__enumext_labelwidth_viii_dim ][ \l__enumext_align_label_viii_str ]
      {
        \tl_use:N \l__enumext_label_font_style_viii_tl
        \__enumext_keyans_wraper_label_viii:n {#1}
      }
    \skip_horizontal:N \l__enumext_labelsep_viii_dim \ignorespaces
  }
```

(*End of definition for* `\__enumext_keyans_wraper_label_viii:n` *and* `\__enumext_fake_make_label_viii:n`.)

13.45.2 Real definition of `\item` in keyans*

`\__enumext_start_item_viii:w`
`\__enumext_stop_item_viii:`

The implementation at this is very similar to that of the `enumext*` environment.

```
\cs_new_protected_nopar:Npn \__enumext_start_item_viii:w [#1]
  {
    \cs_set_eq:NN \__enumext_stop_item_tmp_viii: \__enumext_stop_item_viii:
    \hbox_set_to_wd:Nnw \l__enumext_item_text_viii_box
      {
```

```
      \l__enumext_joined_width_viii_dim
      + \l__enumext_labelwidth_viii_dim
      + \l__enumext_labelsep_viii_dim
    }
    \__enumext_renew_footnote_starred:
    \__enumext_start_list_tag:n {keyans*}
    \__enumext_fake_make_label_viii:n {#1}
    \__enumext_stop_start_list_tag:
    \__enumext_minipage:w [ t ]{ \l__enumext_joined_width_viii_dim  }
      \dim_set_eq:NN \parindent \l__enumext_listparindent_viii_dim
      \skip_set_eq:NN \parskip \l__enumext_parsep_viii_skip
      \__enumext_unskip_unkern:
      \__enumext_unskip_unkern:
      \skip_horizontal:n { -\l__enumext_listparindent_viii_dim } \ignorespaces
      \tl_use:N \l__enumext_fake_item_indent_viii_tl
      \bool_if:NT \l__enumext_item_starred_viii_bool
        {
          \__enumext_keyans_show_item_opt_viii:
        }
      \tl_use:N \l__enumext_after_list_args_viii_tl
  }
\cs_new_protected_nopar:Nn \__enumext_stop_item_viii:
  {
      \__enumext_endminipage:
    \__enumext_stop_list_tag:n {keyans*}
    \hbox_set_end:
    \int_set:Nn \hbadness { 10000 }
    \box_use_drop:N \l__enumext_item_text_viii_box
    \int_compare:nNnTF
      { \l__enumext_item_column_pos_viii_int } = { \l__enumext_columns_viii_int }
      {
        \par\noindent
        \int_zero:N \l__enumext_item_column_pos_viii_int
      }
      {
        \skip_horizontal:N \l__enumext_columns_sep_viii_dim
      }
  }
```

(*End of definition for* `\__enumext_start_item_viii:w` *and* `\__enumext_stop_item_viii:`.)

`\__enumext_remove_extra_parsep_viii:`

The implementation at this is very similar to that of the `enumext*` environment.

```
\cs_new_protected:Nn \__enumext_remove_extra_parsep_viii:
  {
    \int_compare:nNnT
      {
        \int_mod:nn
          { \g__enumext_item_count_all_viii_int }
          { \l__enumext_columns_viii_int }
      }
      =
      { 0 }
      {
        \para_end:
        \skip_vertical:n { -\l__enumext_itemsep_viii_skip }
        \skip_vertical:N \c_zero_skip
        \int_gzero:N \g__enumext_item_count_all_viii_int
      }
  }
```

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

13.46 The command \getkeyans

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

The `\getkeyans` command takes a *mandatory argument* of the form {⟨*store name* : *position*⟩}. Retrieve a *"single content"* stored by `\anskey`, `\anspic*` and `\item*` and `anskey*` from *prop list* defined by `save-ans` key.

```
\NewDocumentCommand \getkeyans { m }
  {
    \exp_args:Ne \__enumext_getkeyans_aux:n
      { \tl_to_str:e { \text_expand:n {#1} } }
  }
```

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

```
\cs_new_protected:Npn \__enumext_getkeyans_aux:n #1
  {
    \str_if_in:nnTF {#1} { : }
      {
        \use:e
          {
            \cs_set:Npn \exp_not:N \__enumext_tmp:w ##1 \c_colon_str ##2 \scan_stop:
              { {##1} {##2} }
          }
        \exp_after:wN \__enumext_getkeyans:nn \__enumext_tmp:w #1 \scan_stop:
      }
      { \msg_error:nnn { enumext } { missing-colon } {#1} }
  }
```

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*.

```
\cs_new_protected:Npn \__enumext_getkeyans:nn #1 #2
  {
    \prop_if_exist:cTF { g__enumext_#1_prop }
      {
        \prop_item:cn { g__enumext_#1_prop }{#2}
      }
      {
        \msg_error:nnn { enumext } { undefined-storage-anskey } {#1}
      }
  }
```

(*End of definition for* \getkeyans , __enumext_getkeyans_aux:n , *and* __enumext_getkeyans:nn. *This function is documented on page* 18.)

13.47 The command \printkeyans

The \printkeyans command prints *"all stored content"* in the *sequence* defined by the save-ans key.
The first thing we will do is define a set of ⟨*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*⟩].

```
\keys_define:nn  { enumext / print }
  {
    print*  .code:n     = \keys_precompile:neN { enumext / enumext* }
                            { \__enumext_filter_save_key:n {#1} }
                            \l__enumext_print_keyans_starred_tl, % starred cmd
    print*  .initial:n  = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
                            rightmargin=0pt, listparindent=0pt, nosep, label=\arabic*.,
                            columns=2, first=\small, font=\small },
    print-1 .code:n     = \keys_precompile:neN { enumext / level-1 }
                            { \__enumext_filter_save_key:n {#1} }
                            \l__enumext_print_keyans_i_tl,
    print-1 .initial:n  = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
                            rightmargin=0pt, listparindent=0pt, nosep, label=\arabic*.,
                            columns=2, first=\small, font=\small },
    print-2 .code:n     = \keys_precompile:neN { enumext / level-2 }
                            { \__enumext_filter_save_key:n {#1} }
                            \l__enumext_print_keyans_ii_tl,
    print-2 .initial:n  = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
                            rightmargin=0pt, listparindent=0pt,  nosep, label=(\alph*),
                            first=\small, font=\small },
    print-3 .code:n     = \keys_precompile:neN { enumext / level-3 }
                            { \__enumext_filter_save_key:n {#1} }
                            \l__enumext_print_keyans_iii_tl,
    print-3 .initial:n  = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
                            rightmargin=0pt, listparindent=0pt, nosep, label=\roman*.,
                            first=\small, font=\small },
    print-4 .code:n     = \keys_precompile:neN { enumext / level-4 }
```

```
                                { \__enumext_filter_save_key:n {#1} }
                                \l__enumext_print_keyans_iv_tl,
    print-4 .initial:n  = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
                            rightmargin=0pt, listparindent=0pt, nosep, label=\Alph*.,
                            first=\small, font=\small },
    print-* .code:n     = \keys_precompile:neN { enumext / enumext* }
                            { \__enumext_filter_save_key:n {#1} }
                            \l__enumext_print_keyans_vii_tl, % starred nested
    print-* .initial:n  = { labelwidth=0pt, labelsep=0.3333em, itemindent=0pt, list-offset=0pt,
                            rightmargin=0pt, listparindent=0pt, nosep, label=\arabic*.,
                            first=\small, font=\small },
}
```

The reason for storing ⟨*keys*⟩ in token lists using `\keys_precompile:neN` is because the keys are set via `\setenumext` but are later executed by running the command `\printkeyans` and they are not handled directly by its *optional argument*, except those related to the *first* opening level.

`\printkeyans` `\__enumext_printkeyans:nnn`

Create a user command to print *"all stored content"* in *sequence* for `\anskey`, `anskey*`, `\item*` and `\anspic*`. Within a group we will run our *"precompiled keys"* and then call the internal function `\__enumext_printkeyans:nnn`.

```
\NewDocumentCommand \printkeyans { s O{} m }
  {
    \group_begin:
      \tl_use:N \l__enumext_print_keyans_i_tl
      \tl_use:N \l__enumext_print_keyans_ii_tl
      \tl_use:N \l__enumext_print_keyans_iii_tl
      \tl_use:N \l__enumext_print_keyans_iv_tl
      \tl_use:N \l__enumext_print_keyans_vii_tl
      \__enumext_printkeyans:nnn { #1 } { #2 } { #3 }
    \group_end:
  }
```

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.

```
\cs_new_protected:Npn \__enumext_printkeyans:nnn #1 #2 #3
  {
    \seq_if_exist:cTF { g__enumext_#3_seq }
      {
        \seq_if_empty:cF { g__enumext_#3_seq }
          {
```

If the *starred argument* '`*`' is present we will check that the environment `enumext*` is not saved in the *sequence*, then execute the variable `\l__enumext_print_keyans_starred_tl` that contains the default ⟨*keys*⟩ for the environment `enumext*`, we set `\l__enumext_base_line_fix_bool` and `\l__enumext_print_keyans_star_bool` to true for *baseline correction*, open the `enumext*` environment passing the *optional argument* and map the *sequence*, then set `\l__enumext_base_line_fix_bool` and `\l__enumext_print_keyans_star_bool` to false.

```
            \bool_if:nTF {#1}
              {
                \seq_if_in:cnTF { g__enumext_#3_seq } { \end{enumext*} }
                  {
                    \msg_error:nnnn { enumext } { print-starred } {#3} { enumext* }
                  }
                  {
                    \tl_use:N \l__enumext_print_keyans_starred_tl
                    \bool_set_true:N \l__enumext_base_line_fix_bool
                    \bool_set_true:N \l__enumext_print_keyans_star_bool
                    \begin{enumext*}[#2]
                      \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
                    \end{enumext*}
                    \bool_set_false:N \l__enumext_base_line_fix_bool
                    \bool_set_false:N \l__enumext_print_keyans_star_bool
                  }
              }
```

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

```
              {
                \begin{enumext}[#2]
                  \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
                \end{enumext}
              }
```

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```
5378            }
5379        }
5380        {
5381          \msg_error:nnn { enumext } { undefined-storage-anskey } {#3}
5382        }
5383    }
```

(*End of definition for* `\printkeyans` *and* `\__enumext_printkeyans:nnn`. *This function is documented on page* 19.)

13.48 The command `\setenumext`

The command `\setenumext` will be in charge of managing the ⟨*keys*⟩ passed to all environments and to the `\printkeyans` command. We must take precautions with the `enumext*` environment and *"first level"* of the `enumext` environment so as not to capture ⟨*keys*⟩ that complicate us.

`\__enumext_filter_first_level:n`
`\__enumext_filter_first_level_key:n`
`\__enumext_filter_first_level_pair:nn`

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`.

```
5384 \cs_new:Npn \__enumext_filter_first_level:n #1
5385   {
5386     \use:e
5387       {
5388         \keyval_parse:NNn
5389           \__enumext_filter_first_level_key:n
5390           \__enumext_filter_first_level_pair:nn {#1}
5391       }
5392   }
```

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*`.

```
5393 \cs_new:Npn \__enumext_filter_first_level_key:n #1
5394   {
5395     \str_case:nnF {#1}
5396       {
5397         { resume   } {}
5398         { resume*  } {}
5399       }
5400       { , { \exp_not:n {#1} } }
5401   }
```

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.

```
5402 \cs_new:Npn \__enumext_filter_first_level_pair:nn #1#2
5403   {
5404     \str_case:nnF {#1}
5405       {
5406         { series } {}
5407         { resume } {}
5408         { save-ans } {}
5409       }
5410       { , { \exp_not:n {#1} } = { \exp_not:n {#2} } }
5411   }
```

(*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`.

```
5412 \keys_define:nn { enumext / meta-families }
5413   {
5414     enumext-1 .code:n =
5415                 {
5416                   \keys_set:ne { enumext / level-1 }
5417                     {
5418                       \__enumext_filter_first_level:n {#1}
5419                     }
5420                 } ,
5421     enumext-2 .code:n = { \keys_set:nn { enumext / level-2 } {#1} } ,
5422     enumext-3 .code:n = { \keys_set:nn { enumext / level-3 } {#1} } ,
5423     enumext-4 .code:n = { \keys_set:nn { enumext / level-4 } {#1} } ,
5424     keyans    .code:n = { \keys_set:nn { enumext / keyans  } {#1} } ,
5425     enumext*  .code:n =
5426                 {
5427                   \keys_set:ne { enumext / enumext* }
5428                     {
```

```
                    \__enumext_filter_first_level:n {#1}
                  }
              } ,
    keyans*   .code:n = { \keys_set:nn { enumext / keyans* } {#1} } ,
    print*    .code:n = { \keys_set:nn { enumext / print   } { print*  = {#1} } } ,
    print-1   .code:n = { \keys_set:nn { enumext / print   } { print-1 = {#1} } } ,
    print-2   .code:n = { \keys_set:nn { enumext / print   } { print-2 = {#1} } } ,
    print-3   .code:n = { \keys_set:nn { enumext / print   } { print-3 = {#1} } } ,
    print-4   .code:n = { \keys_set:nn { enumext / print   } { print-4 = {#1} } } ,
    print-*   .code:n = { \keys_set:nn { enumext / print   } { print-* = {#1} } } ,
    unknown   .code:n = { \msg_error:nn { enumext } { unknown-key-family } } ,
  }
```

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

```
\seq_const_from_clist:Nn \c__enumext_all_families_seq
  {
    enumext-1, enumext-2, enumext-3, enumext-4, keyans, enumext*,
    keyans*, print-1, print-2, print-3, print-4, print-*, print*,
  }
```

`\setenumext`
`\__enumext_set_parse:n`
`\__enumext_set_error:nn`

Now we define the user command `\setenumext`.

```
\NewDocumentCommand \setenumext { O{enumext,1} +m }
  {
    \seq_clear:N \l__enumext_setkey_tmpa_seq
    \seq_set_from_clist:Nn \l__enumext_setkey_tmpb_seq {#1}
    \int_set:Nn \l__enumext_setkey_tmpa_int
      {
        \seq_count:N \l__enumext_setkey_tmpb_seq
      }
    \int_compare:nNnTF { \l__enumext_setkey_tmpa_int } > { 1 }
      {
        \seq_pop_left:NN \l__enumext_setkey_tmpb_seq \l__enumext_setkey_tmpa_tl
        \seq_map_function:NN \l__enumext_setkey_tmpb_seq \__enumext_set_parse:n
        \seq_set_map_e:NNn \l__enumext_setkey_tmpa_seq \l__enumext_setkey_tmpa_seq
          {
            \tl_use:N \l__enumext_setkey_tmpa_tl - ##1
          }
      }
      {
        \seq_put_right:Ne \l__enumext_setkey_tmpa_seq { \tl_trim_spaces:n {#1} }
      }
    \seq_if_empty:NTF \l__enumext_setkey_tmpa_seq
      { \seq_map_inline:Nn \c__enumext_all_families_seq }
      { \seq_map_inline:Nn \l__enumext_setkey_tmpa_seq }
      {
        \keys_set:nn { enumext / meta-families } { ##1 = {#2} }
      }
  }
```

Internal functions used by the `\setenumext` command.

```
\cs_new_protected:Npn \__enumext_set_parse:n #1
  {
    \tl_set:Ne \l__enumext_setkey_tmpb_tl { \tl_trim_spaces:n {#1} }
    \clist_map_inline:nn { 0, 1, 2, 3, 4, * } % <- max level
      { \tl_remove_all:Nn \l__enumext_setkey_tmpb_tl {##1} }
    \tl_if_empty:NTF \l__enumext_setkey_tmpb_tl
      {
        \seq_put_right:Ne \l__enumext_setkey_tmpa_seq
          { \tl_trim_spaces:n {#1} }
      }
      { \__enumext_set_error:nn {#1} { } }
  }
\cs_new_protected:Npn \__enumext_set_error:nn #1 #2
  { \msg_error:nnn { enumext } { invalid-key } {#1} {#2} }
```

(*End of definition for* `\setenumext`, `\__enumext_set_parse:n`, *and* `\__enumext_set_error:nn`. *This function is documented on page 6.*)

13.49 The command `\setenumextmeta`

The command `\setenumextmeta` will be responsible for adding new *"meta-keys"* for the `enumext` and `enumext*` environments. The implementation code was given by Jonathan P. Spratte (`@Skillmon`) answer in Add `.meta` key to existing keys (l3keys).

\setenumextmeta
\c__enumext_meta_paths_prop
__enumext_add_meta_key:nnn
__enumext_def_meta_key:nnn
__enumext_def_meta_key:Vnn

First we will create a prop list `\c__enumext_meta_paths_prop` to handle the *optional argument*.

```
\prop_const_from_keyval:Nn \c__enumext_meta_paths_prop
  {
    {enumext,1} = level-1,
    {enumext,2} = level-2,
    {enumext,3} = level-3,
    {enumext,4} = level-4,
    {enumext*}  = enumext*
  }
```

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

```
\NewDocumentCommand \setenumextmeta { s O{enumext,1} m +m }
  {
    \str_if_eq:eeTF { \tl_trim_spaces:n {#3} } { unknown }
      { \msg_error:nn { enumext } { prohibited-unknown } }
      {
        \bool_if:nTF {#1}
          {
            \int_step_inline:nn { 4 }
              { \__enumext_add_meta_key:nnn { enumext, ##1 } {#3} {#4} }
            \__enumext_add_meta_key:nnn { enumext* } {#3} {#4}
          }
          { \__enumext_add_meta_key:nnn {#2} {#3} {#4} }
      }
  }
```

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

```
\cs_new_protected:Npn \__enumext_add_meta_key:nnn #1
  {
    \tl_set:Nn \l__enumext_meta_path_tl {#1}
    \tl_replace_all:Nnn \l__enumext_meta_path_tl { ~ } {}
    \prop_get:NVNTF
      \c__enumext_meta_paths_prop \l__enumext_meta_path_tl \l__enumext_meta_path_tl
      { \__enumext_def_meta_key:Vnn \l__enumext_meta_path_tl }
      {
        \msg_error:nnn { enumext } { unknown-set } {#1}
        \use_none:nn
      }
  }
\cs_new_protected:Npn \__enumext_def_meta_key:nnn #1#2#3
  {
    \bool_lazy_or:nnTF
      { \keys_if_exist_p:nn { enumext / #1 } {#2} }
      { \keys_if_exist_p:nn { enumext / enumext* } {#2} }
      { \msg_error:nnn { enumext } { already-defined } {#2} }
      {
        \keys_define:nn { enumext / #1 }
          {
            #2 .meta:n = {#3},
            #2 .value_forbidden:n = true
          }
      }
  }
\cs_generate_variant:Nn \__enumext_def_meta_key:nnn { V }
```

(*End of definition for* `\setenumextmeta` *and others. This function is documented on page 6.*)

13.50 The command \foreachkeyans

The command `\foreachkeyans` will execute a *loop* over the *prop list* and return its contents. The implementation code is adapted from the answer provided by Enrico Gregorio (`@egreg`) in Expand a `.cs` defined by key inside the function.

\foreachkeyans
__enumext_parse_foreach_keys:nn
__enumext_parse_foreach_keys:n
__enumext_foreach_keyans:nn
__enumext_foreach_add_body:n

We define a set of ⟨*keys*⟩ for command and we will save the default values of these in `\g__enumext_foreach_default_keys_tl` to avoid the use of group.

```
\keys_define:nn { enumext / foreach }
  {
    before  .tl_set:N  = \l__enumext_foreach_before_tl,
    before  .value_required:n = true,
    after   .tl_set:N  = \l__enumext_foreach_after_tl,
    after   .value_required:n = true,
```

```
    start   .int_set:N = \l__enumext_foreach_start_int,
    start   .value_required:n = true,
    stop    .int_set:N = \l__enumext_foreach_stop_int,
    stop    .value_required:n = true,
    step    .int_set:N = \l__enumext_foreach_step_int,
    step    .value_required:n = true,
    wrapper .cs_set_protected:Np = \__enumext_foreach_wrapper:n #1,
    wrapper .value_required:n = true,
    sep     .tl_set:N  = \l__enumext_foreach_sep_tl,
    sep     .value_required:n = true,
    unknown .code:n    = { \__enumext_parse_foreach_keys:n {#1} }
  }
\keys_precompile:nnN { enumext / foreach }
  {
    before={},after={},start=1,step=1,stop=0,wrapper=#1,sep={; }
  }
  \l__enumext_foreach_default_keys_tl
```

Functions for handling unknown ⟨*keys*⟩.

```
\cs_new_protected:Npn \__enumext_parse_foreach_keys:nn #1#2
  {
    \tl_if_blank:nTF {#2}
      {
        \msg_error:nnn { enumext } { for-key-unknown } {#1}
      }
      {
        \msg_error:nnnn { enumext } { for-key-value-unknown } {#1} {#2}
      }
  }
\cs_new_protected:Npn \__enumext_parse_foreach_keys:n #1
  {
    \exp_args:NV \__enumext_parse_foreach_keys:nn \l_keys_key_str {#1}
  }
```

We create the command.

```
\NewDocumentCommand \foreachkeyans { +O{} m }
  {
    \__enumext_foreach_keyans:nn {#1} {#2}
  }
```

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

```
\cs_new_protected:Npn \__enumext_foreach_keyans:nn #1 #2
  {
    \tl_use:N \l__enumext_foreach_default_keys_tl
    \keys_set:nn { enumext / foreach } {#1}
    \tl_set:Nn \l__enumext_foreach_name_prop_tl {#2}
    \prop_if_exist:cF { g__enumext_#2_prop }
      {
        \msg_error:nnn { enumext } { undefined-storage-anskey } {#2}
      }
    \int_compare:nNnT { \l__enumext_foreach_stop_int } = { 0 }
      {
        \int_set:Nn \l__enumext_foreach_stop_int
          { \prop_count:c { g__enumext_#2_prop } }
      }
    \seq_clear:N \l__enumext_foreach_print_seq
    \int_step_function:nnnN
      { \l__enumext_foreach_start_int }
      { \l__enumext_foreach_step_int }
      { \l__enumext_foreach_stop_int }
      \__enumext_foreach_add_body:n
      \seq_use:NV \l__enumext_foreach_print_seq \l__enumext_foreach_sep_tl
  }
\cs_new_protected:Npn \__enumext_foreach_add_body:n #1
  {
    \seq_put_right:Ne \l__enumext_foreach_print_seq
      {
        \exp_not:V \l__enumext_foreach_before_tl
        \__enumext_foreach_wrapper:n
          {
            \prop_item:cn { g__enumext_ \l__enumext_foreach_name_prop_tl _prop }{#1}
```

```
5607            }
5608          \exp_not:V \l__enumext_foreach_after_tl
5609        }
5610    }
```

(*End of definition for* `\foreachkeyans` *and others. This function is documented on page 18.*)

13.51 Messages

Message used by package-load for `multicol` and `hyperref` packages.

```
5611 \msg_new:nnn { enumext } { package-load }
5612   {
5613     The ~ '#1' ~ package ~ is ~ already ~ loaded.
5614   }
5615 \msg_new:nnn { enumext } { package-not-load }
5616   {
5617     The ~ '#1' ~ package ~ will ~ be ~ loaded ~ as ~ a ~ dependency.
5618   }
5619 \msg_new:nnn { enumext } { package-load-foot }
5620   {
5621     The ~ '#1' ~ package ~ is ~ loaded ~ with ~ the ~ option ~ '#2'.
5622   }
```

Message used in the creation of counters by enumext package.

```
5623 \msg_new:nnn { enumext } { counters }
5624   {
5625     The ~ counter ~ '#1' ~ is ~ already ~ defined ~ by ~ some ~ \\
5626     package ~ or ~ macro, ~ it ~ cannot ~ be ~ continued.
5627   }
```

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

```
5628 \msg_new:nnn { enumext } { unknown-choice }
5629   {
5630     The ~ value ~ '#3' ~ for ~ '#1' ~ key ~ is ~ invalid ~ use ~ ('#2').
5631   }
```

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

```
5632 \msg_new:nnnn { enumext } { anskey-env-error }
5633   {
5634     The ~ '#1' ~ environment ~is ~ reserved ~ by ~\\
5635     'enumext' ~ package, ~ It~ is~ already~ defined.
5636   }
5637   {
5638     The ~ anskey* ~ environment ~ is ~ defined ~ internally ~
5639     for ~ the ~ 'save-ans' ~ key.\\
5640   }
```

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

```
5641 \msg_new:nnn { enumext } { store-prop }
5642   {
5643     * ~ Package ~ enumext: ~ Creating ~
5644      \c_backslash_str g__enumext_#1_prop ~ \msg_line_context:.
5645   }
5646 \msg_new:nnn { enumext } { store-seq }
5647   {
5648     * ~ Package ~ enumext: ~ Creating ~
5649     \c_backslash_str g__enumext_#1_seq ~ \msg_line_context:.
5650   }
5651 \msg_new:nnn { enumext } { store-int }
5652   {
5653     * ~ Package ~ enumext: ~ Creating ~
5654     \c_backslash_str g__enumext_resume_#1_int ~ \msg_line_context:.
5655   }
5656 \msg_new:nnn { enumext } { prop-seq-int-hook }
5657   {
5658     * ~ Package ~ enumext: ~ Elements ~ in ~
5659     \c_backslash_str g__enumext_#1_prop ~ = ~ #2.\\
5660     * ~ Package ~ enumext: ~ Elements ~ in ~
5661     \c_backslash_str g__enumext_#1_seq ~ = ~ #3.\\
5662     * ~ Package ~ enumext: ~ Value ~ off ~
5663     \c_backslash_str g__enumext_resume_#1_int ~ = ~ #4.
5664   }
5665 \msg_new:nnn { enumext } { item-answer-hook }
```

```
  {
    * ~ Package ~ enumext: ~ Value ~ off ~
    \c_backslash_str g__enumext_item_number_int ~ = ~ #1.\\
    * ~ Package ~ enumext: ~ Value ~ off ~
    \c_backslash_str g__enumext_item_anskey_int ~ = ~ #2.\\
    * ~ Package ~ enumext: ~ Difference ~ item_number_int ~ - ~ item_anskey_int ~ = ~ #3.
  }
```

Message used by [⟨*key* = *val*⟩] system and `\setenumext` command.

```
\msg_new:nnn { enumext } { invalid-key }
  {
    The ~ key ~ '#1' ~ is ~ not ~ know ~ the ~ level ~ #2.
  }
\msg_new:nnn { enumext } { unknown-key-family }
  {
    Unknown~key~family~`\l_keys_key_str'~for~enumext.
  }
```

Messages used in length calculation.

```
\msg_new:nnn { enumext } { width-negative }
  {
    Ignoring ~ negative ~ value ~ '#1=#2' ~ \msg_line_context:.\\
    The ~ key ~ '#1'~ accepts ~ values  ~ >= ~ 0pt.
  }
\msg_new:nnn { enumext } { width-zero }
  {
    Invalid ~ '#1=#2' ~ \msg_line_context:.\\
    The ~ key ~ '#1'~ accepts ~ values  ~ > ~ 0pt.
  }
```

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

```
\msg_new:nnn { enumext } { list-lengths }
  {
    **** ~ Lengths ~ used ~ by ~ 'enumext' ~ level ~ '#2' ~ \msg_line_context:~\c_space_tl ****\\
    \__enumext_show_length:nnn { dim  } { labelsep      } {#1}
    \__enumext_show_length:nnn { dim  } { labelwidth    } {#1}
    \__enumext_show_length:nnn { dim  } { itemindent    } {#1}
    \__enumext_show_length:nnn { dim  } { leftmargin    } {#1}
    \__enumext_show_length:nnn { dim  } { rightmargin   } {#1}
    \__enumext_show_length:nnn { dim  } { listparindent } {#1}
    \__enumext_show_length:nnn { skip } { topsep    } {#1}
    \__enumext_show_length:nnn { skip } { parsep    } {#1}
    \__enumext_show_length:nnn { skip } { partopsep } {#1}
    \__enumext_show_length:nnn { skip } { itemsep   } {#1}
    **************************************************
  }
```

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

```
\msg_new:nnn { enumext } { list-lengths-not-nested }
  {
    **** ~ Lengths ~ used ~ by ~ '#2' ~ environment ~ \msg_line_context:~\c_space_tl ****\\
    \__enumext_show_length:nnn { dim  } { labelsep      } {#1}
    \__enumext_show_length:nnn { dim  } { labelwidth    } {#1}
    \__enumext_show_length:nnn { dim  } { itemindent    } {#1}
    \__enumext_show_length:nnn { dim  } { leftmargin    } {#1}
    \__enumext_show_length:nnn { dim  } { rightmargin   } {#1}
    \__enumext_show_length:nnn { dim  } { listparindent } {#1}
    \__enumext_show_length:nnn { skip } { topsep    } {#1}
    \__enumext_show_length:nnn { skip } { parsep    } {#1}
    \__enumext_show_length:nnn { skip } { partopsep } {#1}
    \__enumext_show_length:nnn { skip } { itemsep   } {#1}
    **************************************************
  }
```

Messages used by `ref` key.

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

Messages used by `save-ans` key.

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

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```
  }
\msg_new:nnn { enumext } { save-ans-log }
  {
    * ~ Package ~ enumext: ~ Start ~ #1\c_space_tl with ~ save-ans=#2 ~ \msg_line_context:.
  }
\msg_new:nnn { enumext } { save-ans-log-hook }
  {
    * ~ Package ~ enumext: ~ Stop ~ #1\c_space_tl with ~ save-ans=#2 ~ \msg_line_context:.
  }
\msg_new:nnn { enumext } { save-ans-hook }
  {
    Stop ~ storing ~ for ~ 'save-ans=#1' ~ \msg_line_context:.
  }
```

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

```
\msg_new:nnn { enumext } { need-save-ans }
  {
    Key ~ '#1'~ works ~ only ~ with ~ the ~ 'save-ans' ~ key ~ in ~ '#2'~ \msg_line_context:.
  }
\msg_new:nnn { enumext } { items-same-answer }
  {
    ****************************************\\
    * ~ Package ~ enumext: ~ Checking ~ answers ~ in ~ '#1' ~
    for ~ \c_left_brace_str #2 \c_right_brace_str\\
    * ~ started ~ #3 ~ and ~ close ~ \msg_line_context: : ~
    'OK', ~ all ~ items ~ with ~ answer.\\
    ****************************************
  }
\msg_new:nnn { enumext } { item-greater-answer }
  {
    Checking ~ answers ~ in ~ '#1' ~ for ~ \c_left_brace_str #2 \c_right_brace_str\\
    started ~ #3 ~ and ~ close ~ \msg_line_context: : ~'NOT ~ OK'\\
    Items ~ > ~ Answers.
  }
\msg_new:nnn { enumext } { item-less-answer }
  {
    Checking ~ answers ~ in ~ '#1' ~ for ~ \c_left_brace_str #2 \c_right_brace_str\\
    started ~ #3 ~ and ~ close ~ \msg_line_context: : ~'NOT ~ OK'\\
    Items ~ < ~ Answers.
  }
```

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

```
\msg_new:nnn { enumext } { missing-starred }
  {
    Missing ~ '\c_backslash_str #1*' ~ #2.
  }
\msg_new:nnn { enumext } { many-starred }
  {
    Many ~ '\c_backslash_str #1*' ~ #2.
  }
```

Messages used by \printkeyans* command.

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

Message for the nesting depth of the environment enumext.

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

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

```
\msg_new:nnn { enumext } { anskey-unnumber-item }
  {
    Can't ~ store ~ with ~ a ~ unnumbered ~ \c_backslash_str item ~ \msg_line_context:.
  }
\msg_new:nnn { enumext } { anskey-already-stored }
  {
    Content ~ already ~ stored ~ for ~ this ~ \c_backslash_str item ~ \msg_line_context:.
```

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```
  }
\msg_new:nnn { enumext } { anskey-empty-arg }
  {
    Can't ~ store ~ empty ~ content ~ \msg_line_context:.
  }
\msg_new:nnn { enumext } { anskey-wrong-place }
  {
    Wrong ~ place ~ for ~ command ~ '\c_backslash_str #1' ~ \msg_line_context:.~ \\
    '\c_backslash_str #1' ~ works ~ in ~ the ~ environment ~ '#2'.
  }
\msg_new:nnn { enumext } { anskey-nested }
  {
    The ~ command ~ \c_backslash_str anskey~ can't ~ be ~ nested ~ \msg_line_context:.
  }
\msg_new:nnn { enumext } { anskey-math-mode }
  {
    #1 ~ can't ~ work ~ in ~ math ~ mode ~ \msg_line_context:.
  }
\msg_new:nnn { enumext } { anskey-env-wrong }
  {
    The ~ environment ~ anskey* ~ cannot ~ use ~ in ~ '#1' ~ \msg_line_context:.
  }
\msg_new:nnn { enumext } { anspic-wrong-place }
  {
    Wrong ~ place ~ for ~ command ~ '\c_backslash_str #1' ~ \msg_line_context:.~ \\
    '\c_backslash_str #1' ~ works ~ in ~ the ~ environment ~ '#2'.
  }
\msg_new:nnn { enumext } { command-wrong-place }
  {
    Wrong ~ place ~ for ~ command ~ '\c_backslash_str #1' ~ \msg_line_context:.~ \\
    '\c_backslash_str #1' ~ works ~ outside ~ the ~ environment ~ '#2'.
  }
\msg_new:nnnn { enumext } { anskey-env-key-unknown }
  {
    The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment~
    'anskey*' ~ and ~ is ~ being ~ ignored.
  }
  {
    The ~ environment ~ 'anskey*' ~ does ~ not ~ have ~ a ~ key ~ called ~'#1'.\\
    Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
  }
\msg_new:nnnn { enumext } { anskey-env-key-value-unknown }
  {
    The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~
    'anskey*' ~ and ~ is ~ being ~ ignored.
  }
  {
    The ~ environment ~ 'anskey*' ~ does ~ not ~ have ~ a ~ key ~ called ~'#1'.\\
    Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
  }
\msg_new:nnnn { enumext } { anskey-cmd-key-unknown }
  { The ~ key ~'#1'~ is ~ unknown ~ by ~ '\c_backslash_str anskey' ~ and ~ is ~ being ~ ignored.}
  {
    The ~ command ~'\c_backslash_str anskey' ~ does ~ not ~ have ~ a ~ key ~ called ~'#1'.\\
    Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
  }
\msg_new:nnnn { enumext } { anskey-cmd-key-value-unknown }
  { The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ '\c_backslash_str anskey' ~ and ~ is ~ being ~ ignor
  {
    The ~ command ~ '\c_backslash_str anskey' ~ does ~ not ~ have ~ a ~ key ~ called ~'#1'.\\
    Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
  }
```

Messages used by keyans, keyans* and keyanspic environment.

```
\msg_new:nnn { enumext } { keyans-nested }
  {
    The ~ environment ~ 'keyans' ~ can't ~ be  ~ nested  ~ \msg_line_context:.
  }
\msg_new:nnn { enumext } { keyans-wrong-level }
  {
    Wrong ~ level ~ position ~ for ~ 'keyans' ~ \msg_line_context:.~ \\
    The ~ environment ~ 'keyans' ~ can ~ only ~ be ~ in ~ the ~ first ~ level.
```

```
  }
\msg_new:nnn { enumext } { wrong-place }
  {
    Wrong ~ place ~ for ~ '#1' ~ environment ~\msg_line_context:.~ \\
    '#1' ~ is ~ only ~ found ~ with ~ '#2' ~  in  ~  'enumext.
  }
\msg_new:nnn { enumext } { keyanspic-nested }
  {
    The ~ environment ~ 'keyanspic' ~ can't ~ be  ~ nested~ \msg_line_context:.~.
  }
\msg_new:nnn { enumext } { keyanspic-wrong-level }
  {
    Wrong ~ level ~ position ~ for ~ 'keyanspic' ~ \msg_line_context:.~ \\
    The ~ environment ~ 'keyans' ~ can ~ only ~ be ~ in ~ the ~ first ~ level.
  }
\msg_new:nnn { enumext } { keyanspic-item-cmd }
  {
    Can't ~ use  ~ \c_backslash_str item ~ in ~ keyanspic ~ \msg_line_context:.
  }
\msg_new:nnnn { enumext } { keyans-unknown-key }
  {
    The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment~
    '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
  }
  {
    The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
    ~ have ~ a ~ key ~ called ~'#1'.\\
    Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
  }
\msg_new:nnnn { enumext } { keyans-unknown-key-value }
  {
    The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~
    '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
  }
  {
    The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
    ~ have ~ a ~ key ~ called ~'#1'.\\
    Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
  }
```

Message used by unknown ⟨*keys*⟩ in `enumext*`. environment.

```
\msg_new:nnnn { enumext } { starred-unknown-key }
  {
    The ~ key ~ '#1' ~ is ~ unknown ~ by ~ environment~
    '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
  }
  {
    The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
    ~ have ~ a ~ key ~ called ~'#1'.\\
    Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
  }
\msg_new:nnnn { enumext } { starred-unknown-key-value }
  {
    The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~
    '\l__enumext_envir_name_tl' ~ and ~ is ~ being ~ ignored.
  }
  {
    The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
    ~ have ~ a ~ key ~ called ~'#1'.\\
    Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
  }
```

Message used by unknown ⟨*keys*⟩ in `enumext` environment.

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

```
  }
\msg_new:nnnn { enumext } { standar-unknown-key-value }
  {
    The ~ key ~ '#1=#2' ~ is ~ unknown ~ by ~ environment ~ '\l__enumext_envir_name_tl' \c_space_
    ~ on ~ level ~ \int_use:N \l__enumext_level_int \c_space_tl and ~ is ~ being ~ ignored.
  }
  {
    The ~ environment ~ '\l__enumext_envir_name_tl' ~ does ~ not
    ~ have ~ a ~ key ~ called ~'#1' ~ on ~ level ~ \int_use:N \l__enumext_level_int.\\
    Check ~ that ~ you ~ have ~ spelled ~ the ~ key ~ name ~ correctly.
  }
```

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

```
\msg_new:nnnn { enumext } { for-key-unknown }
  { The~key~'#1'~is~unknown~by~'\c_backslash_str foreachkeyans'~and~is~being~ignored.}
  {
    The~command~'\c_backslash_str foreachkeyans'~does~not~have~a~key~called~'#1'.\\
    Check~that~you~have~spelled~the~key~name~correctly.
  }
\msg_new:nnnn { enumext } { for-key-value-unknown }
  { The~key~'#1=#2'~is~unknown~by~'\c_backslash_str foreachkeyans'~and~is~being~ignored. }
  {
    The~command~'\c_backslash_str foreachkeyans'~does~not~have~a~key~called~'#1'.\\
    Check~that~you~have~spelled~the~key~name~correctly.
  }
```

Messages used by `\getkeyans` command.

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

Messages used by `\miniright` command.

```
\msg_new:nnn { enumext } { missing-miniright }
  {
    Missing ~ '\c_backslash_str miniright' ~ in ~ \msg_line_context:.\\
    The ~ key ~ 'mini-env' ~ need ~ '\c_backslash_str miniright'.
  }
\msg_new:nnn { enumext } { wrong-miniright-place }
  {
    Wrong ~ place ~ for ~ '\c_backslash_str miniright' ~ \msg_line_context:.~ \\
    Works ~ in ~ 'enumext' ~ and ~ 'keyans' ~ with ~ key ~ 'mini-env'.
  }
\msg_new:nnn { enumext } { wrong-miniright-use }
  {
    Wrong ~ use ~ for ~ '\c_backslash_str miniright' ~ \msg_line_context:.~ \\
    '\c_backslash_str miniright' ~ need ~ a ~ key ~ 'mini-env'.
  }
\msg_new:nnn { enumext } { wrong-miniright-starred }
  {
    Can't ~ use  ~ \c_backslash_str miniright ~ in ~ starred ~ environments ~ \msg_line_context:.
  }
\msg_new:nnn { enumext } { many-miniright-used }
  {
    Can't ~ use  ~ \c_backslash_str miniright ~ more ~ than ~ once ~  \msg_line_context:.
  }
```

Messages used by `\setenumextmeta` command.

```
\msg_new:nnn { enumext } { unknown-set }
  {
    Argument ~ [#1] ~ is ~ unknown ~ by ~  \c_backslash_str setenumextmeta ~ \msg_line_context:.
  }
\msg_new:nnn { enumext } { already-defined }
  {
    The ~ key ~ '#1' ~ is ~ already ~ defined ~ \msg_line_context:.
  }
\msg_new:nnn { enumext } { prohibited-unknown }
  {
    The ~ name ~ 'unknown' ~ can't ~ be ~ chosen~ for ~ a ~ meta ~ key ~ \msg_line_context:.
  }
```

Messages used by `enumext*` and `keyans*` environments.

```
\msg_new:nnn { enumext } { nested }
```

```
5992   {
5993     The ~ environment ~ \l__enumext_envir_name_tl \c_space_tl can't ~ be ~ nested ~ \msg_line_cont
5994   }
5995 \msg_new:nnn { enumext } { nested-horizontal }
5996   {
5997     The ~ environment ~ \l__enumext_envir_name_tl \c_space_tl can't ~ be ~ nested ~ in ~ '#1' ~
5998   }
5999 \msg_new:nnn { enumext } { item-joined }
6000   {
6001     Items ~ joined ~ (#1) ~ > ~ #2  ~ columns ~\msg_line_context:.
6002   }
6003 \msg_new:nnn { enumext } { item-joined-columns }
6004   {
6005     Not ~ space ~ to ~ join ~ items ~ (#1) ~ > ~ #2 ~\msg_line_context:.
6006   }
```

13.52 Finish package

Finish package implementation.

```
6007 \file_input_stop:
6008 ⟨/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

* 232
\+ 224
\- 224
\\ 240, 2963, 4404, 4407, 5625, 5634, 5639, 5659, 5661, 5668, 5670, 5683, 5688, 5693, 5708, 5747, 5749, 5751, 5756, 5757, 5762, 5763, 5781, 5798, 5815, 5820, 5829, 5838, 5844, 5850, 5859, 5864, 5873, 5887, 5897, 5907, 5917, 5927, 5937, 5943, 5949, 5958, 5963, 5968

A

above 1721
above* 1721
\addvspace 1288, 1316, 1359, 1362, 1530, 1533, 1630, 1636, 1674, 1680, 1701, 1707, 3832, 3993, 4011, 4289, 4293, 4652, 4667, 4713, 4727
after 1118
align 669
\Alph *43*, *48*
\Alph 611, 739, 783, 847, 5330
\alph *43*, *48*
\alph 612, 737, 5318
\anskey *13*, *82*, *84*, 2781
anskey* *14*, 2891
\anspic *17*, *112*, *115*, 4303
\anspic* *75*
\arabic *35*, *43*
\arabic 610, 736, 782, 5306, 5312, 5336

B

base-fix 976
\baselineskip *56*
\baselineskip 992, 1003
before 1118
before* 1118
below 1721
below* 1721
bool commands:
\bool_gset_false:N 353, 354, 355, 3067, 3069, 4669, 4673, 4729
\bool_gset_true:N 261, 271, 1221, 2214, 2220, 4638, 4670, 4702, 4730
\bool_if:NTF . 404, 414, 431, 505, 512, 521, 528, 542, 555, 1743, 1757, 1770, 1781, 1792, 1803, 1814, 1825, 1874, 1891, 1896, 1904, 1931, 1969, 1974, 1981, 1985, 2007, 2012, 2020, 2027, 2058, 2066, 2159, 2402, 2412, 2492, 2516, 2523, 2547, 2645, 2667, 2707, 2731, 2735, 2785, 2804, 2828, 2882, 2893, 2982, 3019, 3083, 3115, 3130, 3202, 3318, 3352, 3388, 3404, 3425, 3564, 3585, 3673, 3683, 3716, 3721, 3787, 3813, 3863, 3921, 3976, 4001, 4222, 4287, 4305, 4324, 4375, 4402, 4631, 4647, 4653, 4696, 4710, 4714, 4803, 4813, 4901, 4907, 4914, 4930, 5023, 5033, 5147, 5154, 5185, 5201, 5232
\bool_if:nTF 1681, 1708, 3374, 3543, 3631, 4345, 5356, 5500
\bool_if_p:N 280, 295, 986, 987, 999, 1000, 1653, 2038, 2039, 2047, 2048, 2172, 2198, 2211, 2212, 2217, 2218, 2580, 2590, 2602, 2617, 2618, 2652, 2693, 2694, 3005, 3189, 3190, 3219, 3220, 3232, 3233, 3273, 3274, 3293, 3294, 3577, 3578, 3579, 3760, 3762, 3773, 5176, 5177, 5178
\bool_lazy_all:nTF 278, 293, 984, 2170, 2196, 2578, 2587, 2600, 2615, 3271, 3291, 3575, 3758, 3771, 5174
\bool_lazy_and:nnTF 257, 267, 998, 1645, 1652, 2037, 2046, 2210, 2216, 2651, 2658, 2692, 2846, 2858, 3004, 3010, 3188
\bool_lazy_or:nnTF . . 2099, 2106, 3218, 3231, 5523
\bool_new:N 30, 31, 32, 33, 34, 35, 36, 37, 60, 69, 93, 98, 99, 104, 105, 108, 127, 139, 140, 147, 153, 154, 156, 160, 162, 163, 180, 192, 194
\bool_not_p:n 258, 268, 988, 1654, 2589, 2653, 2659, 3006, 3011, 3761, 3774
\bool_set_eq:NN 3327, 3524, 4854, 5098
\bool_set_false:N 411, 1010, 2144, 2145, 2177, 2182, 2186, 2190, 2203, 2946, 3552, 3735, 3880, 3929, 4016, 4158, 4219, 4365, 4772, 4798, 4851, 5039, 5094, 5095, 5369, 5370
\bool_set_true:N . 285, 286, 300, 301, 396, 399, 662, 1025, 1727, 1732, 1994, 2116, 2117, 2434, 2442, 2947, 3321, 3323, 3355, 3357, 3520, 3531, 3545, 3696, 3734, 3767, 3780, 3853, 3926, 3953, 4155, 4347, 4348, 4620, 4685, 4771, 4858, 4865, 4866, 4910, 5037, 5102, 5109, 5110, 5111, 5364, 5365
box commands:
\box_dp:N . . 1576, 1577, 1580, 1587, 1600, 1608, 1614, 1622, 4233, 4239, 4289, 4386
\box_ht:N . . 1359, 1362, 1373, 1374, 1385, 1387, 1402, 1405, 1413, 1414, 1425, 1427, 1442, 1445, 1452, 1453, 1464, 1466, 1481, 1484, 1530, 1533, 1541, 1542, 1550, 1551, 1563, 1565
\box_ht_plus_dp:N 4228, 4297, 4333
\box_new:N 66, 149, 150, 187, 193
\box_use_drop:N 4664, 4725, 4966, 5244
\box_wd:N 618
break-col 2751

C

\c 232, 233, 883, 885, 897, 899
\catcode 2963
\cB 233
\cE 233
\centering 1683, 1710, 4430, 4657, 4718
check-ans 2136
Document class:
article *49*
clist commands:
\clist_const:Nn 199
\clist_map_function:nN 4413
\clist_map_inline:Nn . 668, 931, 1117, 1132, 1213, 1737
\clist_map_inline:nn . 45, 56, 74, 82, 95, 107, 142, 171, 198, 646, 699, 719, 1030, 1051, 1227, 1843, 2083, 2150, 2329, 2399, 2431, 2575, 3124, 3446, 3461, 3501, 3660, 3663, 3691, 3703, 3706, 3726, 5476
\columnbreak *82*
\columnbreak 2655
columns 1197
columns-sep 1197
\columnsep *105*

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\columnsep 3808, 3974
\columnseprule *105*
\columnseprule 3811, 3975
Commands provide by enumext:
\anskey . *32*, *71*, *72*, *78*, *79*, *81*, *83–85*, *91*, *104*, *105*, *124*, *133*, *135*, *142*
\anspic* *32*, *33*, *75*, *79*, *91*, *92*, *115*, *133*, *135*
\anspic *33*, *79*, *112*, *115*, *142*
\foreachkeyans *138*, *145*
\getkeyans *79*, *133*, *145*
\item* *32*, *33*, *75*, *79*, *91*, *92*, *95*, *99*, *125*, *126*, *131*, *133*, *135*
\item *95*, *99*, *119*, *125*, *127*, *130*
\miniright *31*, *54*, *62*, *63*, *106*, *107*, *145*
\printkeyans* *134*
\printkeyans *32*, *79*, *134*, *135*
\setenumextmeta *137*, *145*
\setenumext *32*, *135–137*, *141*
Counters defined by enumext:
enumXiii *30*, *42*
enumXii *30*, *42*
enumXiv *30*, *42*
enumXi *30*, *42*
enumXviii *30*, *42*
enumXvii *30*, *42*, *126*
enumXvi *30*, *42*
enumXv *30*, *42*
cs commands:
\cs_generate_variant:Nn . 204, 205, 620, 636, 889, 905, 2484, 2489, 2565, 2899, 3650, 4415, 5535
\cs_if_exist:NTF 590
\cs_if_exist_p:N 3580, 5179
\cs_if_free:NTF 2850, 2862
\cs_new:Nn 218
\cs_new:Npn . 236, 1844, 1853, 1861, 2446, 2455, 2463, 5384, 5393, 5402
\cs_new_eq:NN . 380, 381, 386, 387, 416, 417, 420, 421
\cs_new_protected:Nn . 228, 242, 250, 276, 309, 339, 345, 351, 357, 363, 371, 391, 439, 443, 461, 473, 491, 503, 519, 535, 548, 569, 759, 820, 869, 982, 1133, 1137, 1141, 1145, 1149, 1153, 1157, 1161, 1165, 1169, 1173, 1177, 1181, 1185, 1189, 1193, 1228, 1240, 1273, 1290, 1301, 1318, 1344, 1365, 1490, 1516, 1536, 1569, 1591, 1626, 1632, 1738, 1752, 1766, 1777, 1788, 1799, 1810, 1821, 1902, 2005, 2018, 2035, 2056, 2084, 2089, 2114, 2155, 2165, 2208, 2223, 2230, 2239, 2244, 2249, 2254, 2263, 2268, 2273, 2490, 2514, 2521, 2545, 2552, 2566, 2802, 2821, 2837, 2900, 2936, 2967, 3002, 3044, 3065, 3073, 3113, 3128, 3156, 3186, 3214, 3227, 3240, 3269, 3282, 3360, 3370, 3381, 3397, 3413, 3539, 3557, 3591, 3603, 3727, 3756, 3785, 3792, 3822, 3839, 3861, 3883, 3919, 3943, 3960, 3985, 3999, 4020, 4194, 4397, 4411, 4416, 4440, 4450, 4481, 4610, 4629, 4675, 4694, 4758, 4785, 4792, 4801, 4811, 4836, 4977, 5021, 5052, 5058, 5079, 5135, 5255
\cs_new_protected:Npn 206, 210, 214, 424, 588, 605, 615, 621, 740, 784, 852, 876, 890, 1665, 1694, 1870, 1889, 1959, 1992, 2094, 2278, 2400, 2410, 2432, 2440, 2476, 2485, 2641, 2704, 2729, 2767, 2771, 2891, 2922, 2926, 2957, 3093, 3166, 3207, 3314, 3333, 3462, 3466, 3480, 3484, 3502, 3506, 3516, 3528, 3573, 3619, 3653, 3694, 3738, 3939, 4203, 4210, 4217, 4322, 4341, 4371, 4512, 4561, 4775, 4842, 4849, 4863, 4871, 4876, 4886, 5045, 5085, 5092, 5107, 5116, 5130, 5172, 5277, 5290, 5350, 5473, 5485, 5509, 5521, 5559, 5569, 5577, 5599
\cs_new_protected_nopar:Nn . . . 4083, 4127, 4135, 4143, 4821, 4829, 4960, 5064, 5072, 5238
\cs_new_protected_nopar:Npn . . 4075, 4091, 4892, 4938, 5191, 5212
\cs_set:Npn 2576, 2613, 5283
\cs_set_eq:NN . . 3583, 4748, 4749, 4940, 5010, 5011, 5182, 5214
\cs_set_protected:Nn 1056, 1072, 1085, 1097
\cs_set_protected:Npn . 41, 50, 67, 75, 90, 96, 135, 167, 178, 637, 647, 669, 704, 720, 766, 906, 932, 1012, 1035, 1109, 1118, 1197, 1214, 1721, 1832, 2075, 2136, 2295, 2330, 2418, 2568, 3117, 3435, 3451, 3494, 3651, 3692
\cs_to_str:N 607, 630
\cs_undefine:N 2839, 2840, 2841, 2842

D

\d 224
\DeclareDocumentEnvironment 573
dim commands:
\dim_abs:n 3624, 3629
\dim_add:Nn 3266, 4237, 4475, 4506
\dim_compare:nNnTF . . 1058, 1074, 1087, 1099, 1377, 1389, 1417, 1429, 1456, 1468, 1545, 1553, 1667, 1696, 2709, 2717, 3261, 3621, 3626, 3632, 3638, 3640, 3642, 3797, 3844, 3947, 3964, 4212, 4452, 4468, 4483, 4499, 4612, 4677, 5143
\dim_compare:nTF 2677, 3032, 3886, 4023
\dim_eval:n 992, 4295, 4382
\dim_gset_eq:NN 4621, 4686
\dim_gzero:N 3071, 4672, 4732
\dim_new:N . 63, 70, 71, 72, 92, 131, 132, 144, 151, 152, 186, 188, 189, 195
\dim_set:Nn . 618, 1026, 2711, 2719, 3248, 3252, 3257, 3263, 3350, 3624, 3629, 3631, 3634, 3635, 3639, 3641, 3644, 3645, 3647, 3800, 3847, 3885, 3949, 3966, 4022, 4226, 4331, 4418, 4454, 4461, 4485, 4492, 4547, 4596, 4614, 4679, 4888, 5145
\dim_set_eq:NN 727, 773, 844, 3345, 3662, 3705, 3808, 3974, 4554, 4557, 4558, 4603, 4606, 4607, 4881, 4952, 5226
\dim_sub:Nn 3891, 4028, 4470, 4501
\dim_use:N . 1059, 1067, 1668, 1678, 2555, 2558, 2563, 2721, 3365, 3367, 3420, 3798, 3802, 3803, 3805, 3845, 3850, 3851, 3857, 3888, 3893
\dim_zero:N 3697, 3811, 3975, 4240
\dim_zero_new:N 587
\c_zero_dim 1061, 1075, 1088, 1100, 1668, 1696, 2679, 2709, 2717, 3034, 3248, 3261, 3621, 3626, 3632, 3639, 3798, 3845, 3888, 3947, 3964, 4025, 4212, 4452, 4468, 4483, 4499, 4612, 4677, 5143
\dimeval 2364

E

\end . . . 2518, 2549, 3829, 3990, 4277, 4432, 5358, 5368, 5376
end internal commands:
\end__enumext_mini_page . 1676, 1703, 3872, 4010, 4636, 4700, 4726
\endgroup 2963
\endlist 381
\endminipage 387
enumext *5*, 3897
enumext internal commands:
\l__enumext__resume_name_tl *67*
__enumext_add_meta_key:nnn . . . *138*, 5487, 5503, 5504, 5506, 5509
__enumext_add_pre_parsep: . *55*, 1238, 1240, 1240

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__enumext_after_args_exec: 53, 1133, 1145, 3910
__enumext_after_args_exec_v: 1149, 1161, 4043
__enumext_after_args_exec_vii: . . 1165, 1189
__enumext_after_args_exec_viii: 1193
__enumext_after_env:nn 88, 89, 91, 108, 121, 128, 210, 210, 561, 565, 2977, 3915, 4645, 4708, 4993
__enumext_after_hyperref: . . . 38, 389, 389, 391
\l__enumext_after_list_args_v_tl 1163
\l__enumext_after_list_args_vii_tl 1191, 4958
\l__enumext_after_list_args_viii_tl . . 1195, 5236
__enumext_after_list_vii: 121, 124, 4756, 4792, 4792
__enumext_after_list_viii: . . . 129, 5019, 5058, 5058
__enumext_after_stop_list: 53, 107, 1133, 1141, 3877
__enumext_after_stop_list_v: 1149, 1157, 4017
\l__enumext_after_stop_list_v_tl 1159
__enumext_after_stop_list_vii: . . 124, 1165, 1181, 4795
\l__enumext_after_stop_list_vii_tl . . . 1183
__enumext_after_stop_list_viii: . 1185, 5061
\l__enumext_after_stop_list_viii_tl . . . 1187
\l__enumext_align_label_pos_v_str 3244, 3609
\l__enumext_align_label_pos_X_str 75
\l__enumext_align_label_vii_str 4927
\l__enumext_align_label_viii_str 5205
\l__enumext_align_label_X_str 178
\c__enumext_all_envs_clist . 199, 668, 931, 1117, 1132, 1213, 1737
\c__enumext_all_families_seq . . 137, 5441, 5467
\l__enumext_anskey_env_bool 36, 87, 30, 286, 301, 2893
__enumext_anskey_env_clean_vars: . 90, 2998, 3002, 3065
__enumext_anskey_env_define_keys: 87, 2891, 2900, 2971
__enumext_anskey_env_exec: 88, 2896, 2967, 2967
__enumext_anskey_env_make:n 71, 87, 2119, 2891, 2891, 2899
__enumext_anskey_env_reset_keys: 88, 89, 2891, 2936, 2999
__enumext_anskey_env_save_keys: . . 89, 2979, 3002, 3002
__enumext_anskey_env_store: . . 90, 2995, 3002, 3044
__enumext_anskey_env_unknown:n 87, 2891, 2919, 2922
__enumext_anskey_env_unknown:nn . 2891, 2924, 2926
\l__enumext_anskey_level_int . . 24, 2823, 2824
__enumext_anskey_safe_inner: . 85, 2796, 2802, 2821
__enumext_anskey_safe_inner:n 85
__enumext_anskey_safe_outer: . 85, 2783, 2802, 2802
__enumext_anskey_show_wrap_arg:n . 83, 2704, 2704, 2733, 2748
__enumext_anskey_show_wrap_left:n 84, 2649, 2729, 2729
__enumext_anskey_unknown:n 84, 2751, 2765, 2767
__enumext_anskey_unknown:nn . 2751, 2769, 2771
__enumext_anskey_wrapper:n 2361, 2727
\l__enumext_anspic_above_int . 143, 4419, 4420, 4422
__enumext_anspic_args:nnn 115, 117, 4303, 4319, 4397
\l__enumext_anspic_args_seq 115, 117, 143, 4317, 4431, 4444
\l__enumext_anspic_below_int . 143, 4419, 4420, 4423
\l__enumext_anspic_body_box . . . 143, 4330, 4333
__enumext_anspic_body_dim:n . . 115, 4303, 4322, 4374
\l__enumext_anspic_body_htdp_dim . . 115, 143, 4331, 4385
__enumext_anspic_exec: 4303
__enumext_anspic_exec: . . . 114, 117, 4272, 4440
__enumext_anspic_label:nn 116, 4303, 4341, 4377, 4392
\l__enumext_anspic_label_above_bool . . . 143, 4155, 4158, 4222, 4287, 4324, 4375, 4402
\l__enumext_anspic_label_box . . 143, 4225, 4228
\l__enumext_anspic_label_htdp_dim . 113, 143, 4226, 4232, 4297, 4384
__enumext_anspic_label_pos:nnn . . 116, 4303, 4371, 4400
\l__enumext_anspic_label_sep_skip 4165, 4234, 4298, 4387, 4404
\l__enumext_anspic_layout_style_tl 4167, 4442, 4447
\l__enumext_anspic_mini_pos_str . . 143, 4156, 4159, 4429
\l__enumext_anspic_mini_width_dim 143, 4343, 4418, 4429
__enumext_anspic_print:n 117, 4303, 4411, 4415, 4444, 4447
__enumext_anspic_row:n . . 117, 4303, 4413, 4416
__enumext_anspic_start_list_tag: 4099, 4127, 4399
__enumext_anspic_stop_list_tag: . 4099, 4143, 4409
__enumext_anspic_stop_start_list_tag: 4099, 4135, 4401
__enumext_at_begin_document:n . . 38, 206, 206, 378, 384
\l__enumext_base_line_fix_bool 50, 135, 978, 987, 1010, 5364, 5369
__enumext_before_args_exec: 53, 106, 124, 1133, 1133, 3842
__enumext_before_args_exec_v: 1149, 1149, 3946
__enumext_before_args_exec_vii: . 1165, 1165, 4789
__enumext_before_args_exec_viii: 1169, 5055
__enumext_before_env:nn 87, 210, 214, 2844, 2856, 2868, 2969
__enumext_before_keys_exec: . . 53, 1133, 1137, 3907
__enumext_before_keys_exec_v: 1149, 1153, 4040
__enumext_before_keys_exec_vii 1165
__enumext_before_keys_exec_vii: . 1173, 4743
__enumext_before_keys_exec_viii: 1177, 5005
__enumext_before_list: . . 106, 3839, 3839, 3901
__enumext_before_list_v: . . . 3943, 3943, 4035
__enumext_before_list_vii: . . 124, 4738, 4785, 4785
__enumext_before_list_viii: . . 129, 5001, 5052,

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5052
\l__enumext_before_no_starred_key_v_tl 1155
\l__enumext_before_no_starred_key_vii_tl 1175
\l__enumext_before_no_starred_key_viii_tl 1179
\l__enumext_before_starred_key_v_tl . . . 1151
\l__enumext_before_starred_key_vii_tl . 1167
\l__enumext_before_starred_key_viii_tl 1171
__enumext_calc_hspace:NNNNNNN *101*, 3619, 3619, 3650, 3655, 3698
__enumext_check_ans_active: *73*, *106*, *124*, 2155, 2155, 3843, 4788
\g__enumext_check_ans_item_tl *93*
\g__enumext_check_ans_key_bool *74*, *75*, 153, 353, 2214, 2220, 3083
\l__enumext_check_ans_key_bool *74*, 2140, 2145, 2211, 2217
__enumext_check_ans_key_hook: . . *74*, *107*, *124*, 2208, 2208, 3878, 4796
__enumext_check_ans_level: *73*, 2155, 2161, 2165
__enumext_check_ans_log: *74*, *75*, *90*, 2254, 2254, 3087
__enumext_check_ans_log_msg_greater: 2254, 2260, 2273
__enumext_check_ans_log_msg_less: 2254, 2258, 2263
__enumext_check_ans_log_msg_same_ok: 2254, 2259, 2268
__enumext_check_ans_msg_greater: 2230, 2236, 2249
__enumext_check_ans_msg_less: 2230, 2234, 2239
__enumext_check_ans_msg_same_ok: 2230, 2235, 2244
__enumext_check_ans_show: . . *74*, *90*, 2230, 2230, 3085
\l__enumext_check_answers_bool *71*, *73*, *85*, *95*, *96*, 153, 2117, 2144, 2159, 2492, 2516, 2523, 2547, 2785, 2982, 3202, 3318, 3352, 4907
__enumext_check_starred_cmd:n *36*, *75*, *93*, *128*, 2278, 2278, 4046, 4285, 5018
\g__enumext_check_starred_cmd_int . *100*, 153, 2281, 2287, 2292, 3537, 4353, 5142
\l__enumext_check_start_line_env_tl . *36*, 153, 316, 324, 332, 2284, 2290, 2293
\l__enumext_columns_sep_v_dim 3964, 3966, 3974
\l__enumext_columns_sep_vii_dim . . 4452, 4454, 4463, 4475, 4551, 4974
\l__enumext_columns_sep_viii_dim . 4483, 4485, 4494, 4506, 4600, 5252
\l__enumext_columns_v_int 1510, 1528, 1699, 3962, 3970, 3982, 3987
\l__enumext_columns_vii_int . . 4457, 4460, 4464, 4473, 4515, 4519, 4522, 4528, 4534, 4538, 4968, 4982
\l__enumext_columns_viii_int . 4488, 4491, 4495, 4504, 4564, 4568, 4571, 4577, 4583, 4587, 5246, 5261
\l__enumext_counter_i_tl 41, 597
\l__enumext_counter_ii_tl 41, 598
\l__enumext_counter_iii_tl 41, 599
\l__enumext_counter_iv_tl 41, 600
\c__enumext_counter_style_tl *35*, 46, 230
\g__enumext_counter_styles_tl . *30*, *43*, 63, 608, 626
\l__enumext_counter_v_tl 41, 601, 860
\l__enumext_counter_vi_tl 41, 602
\l__enumext_counter_vii_tl 41, 603, 794
\l__enumext_counter_viii_tl 41, 604, 810
\l__enumext_current_widest_dim *30*, 63, 632, 728, 774, 845
__enumext_def_meta_key:nnn . . . *138*, 5487, 5515, 5521, 5535
__enumext_default_item:n . . . 3314, 3314, 3378
__enumext_define_counters:Nn *30*, 588, 588, 597, 598, 599, 600, 601, 602, 603, 604
__enumext_endminipage: . *38*, 378, 387, 582, 4666, 4962, 5240
\g__enumext_envir_name_tl *36*, 30, 287, 302, 361, 2087, 2092, 2102, 2242, 2247, 2252, 2266, 2271, 2276
\l__enumext_envir_name_tl *35*, *36*, *98*, 30, 256, 266, 315, 323, 331, 3456, 4190, 5883, 5886, 5893, 5896, 5903, 5906, 5913, 5916, 5922, 5926, 5932, 5936, 5993, 5997
__enumext_execute_after_env: *37*, *71*, *74*, *75*, *86*, *90*, 3073, 3073, 3917, 4995
__enumext_fake_item_indent: . 1056, 1056, 3682
\l__enumext_fake_item_indent_v_dim 1075, 1080
\l__enumext_fake_item_indent_v_tl 1077, 3521, 3525, 3532
__enumext_fake_item_indent_vii: . 1056, 1085, 3715
\l__enumext_fake_item_indent_vii_dim . 1088, 1092
\l__enumext_fake_item_indent_vii_tl . . 1090, 4957
__enumext_fake_item_indent_viii: 1056, 1097, 3720
\l__enumext_fake_item_indent_viii_dim 1100, 1104
\l__enumext_fake_item_indent_viii_tl . 1102, 5231
\l__enumext_fake_item_indent_X_tl 96
__enumext_fake_make_label_vii:n . *126*, 4892, 4892, 4949
__enumext_fake_make_label_viii:n 5172, 5191, 5223
__enumext_filter_first_level:n . . *136*, 5384, 5384, 5418, 5429
__enumext_filter_first_level_key:n *136*, 5384, 5389, 5393
__enumext_filter_first_level_pair:nn . *136*, 5384, 5390, 5402
__enumext_filter_save_key:n . . *78*, 2407, 2415, 2438, 2444, 2446, 2446, 5303, 5309, 5315, 5321, 5327, 5333
__enumext_filter_save_key_key:n . . *78*, 2446, 2451, 2455
__enumext_filter_save_key_pair:nn *79*, 2446, 2452, 2463
__enumext_filter_series:n *66*, 1844, 1844, 1882, 1894, 1899
__enumext_filter_series_key:n *66*, 1844, 1849, 1853
__enumext_filter_series_pair:nn . . *66*, 1844, 1850, 1861
__enumext_first_item_tmp_vii: *122*, *124*, 4748, 4821, 4821
__enumext_first_item_tmp_viii: . . *130*, 5010, 5064, 5064
\g__enumext_footnote_standar_arg_seq . . 172, 456, 467, 470

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\g__enumext_footnote_standar_int 172, 450, 453, 455, 458
\g__enumext_footnote_standar_int_seq .. 172, 458, 463, 466, 471
\g__enumext_footnote_starred_arg_seq .. 172, 486, 497, 500
\g__enumext_footnote_starred_int 172, 480, 483, 485, 488
\g__enumext_footnote_starred_int_seq .. 172, 488, 493, 496, 501
__enumext_footnotes_key_bool 38
\l__enumext_footnotes_key_bool 33, 38, 162, 399, 404, 411, 512, 528, 542, 555
__enumext_footnotetext:nn .. 439, 439, 468, 498
__enumext_foreach_add_body:n . 139, 5536, 5596, 5599
\l__enumext_foreach_after_tl 5540, 5608
\l__enumext_foreach_before_tl 5538, 5603
\g__enumext_foreach_default_keys_tl ... 138
\l__enumext_foreach_default_keys_tl ... 122, 5558, 5579
__enumext_foreach_keyans:nn .. 139, 5536, 5575, 5577
\l__enumext_foreach_name_prop_tl . 122, 5581, 5606
\l__enumext_foreach_print_seq 122, 5591, 5597, 5601
\l__enumext_foreach_sep_tl 5550, 5597
\l__enumext_foreach_start_int 5542, 5593
\l__enumext_foreach_step_int 5546, 5594
\l__enumext_foreach_stop_int . 5544, 5586, 5588, 5595
__enumext_foreach_wrapper:n 5548, 5604
__enumext_getkeyans:nn .. 134, 5272, 5286, 5290
__enumext_getkeyans_aux:n 134, 5272, 5274, 5277
\l__enumext_hyperref_bool . 33, 38, 39, 162, 396, 414, 431, 2694, 3190, 4901
__enumext_hypertarget:nn 39, 389, 416, 420, 436
__enumext_if_is_int:n 222
__enumext_if_is_int:nTF 222, 878, 892
__enumext_internal_mini_page: 41, 104, 123, 569, 569, 3730, 4761
__enumext_is_not_nested: . 30, 35, 104, 123, 250, 250, 3729, 4760
__enumext_is_on_first_level: . 30, 36, 104, 123, 250, 276, 3736, 4773
\g__enumext_item_anskey_int 85, 93, 153, 348, 375, 376, 2227, 2643, 3204
__enumext_item_answer_diff: .. 74, 75, 90, 2223, 2223, 3080
\g__enumext_item_answer_diff_int . 74, 75, 153, 349, 2225, 2232, 2256
\l__enumext_item_column_pos_vii_int 125, 4522, 4528, 4534, 4538, 4545, 4832, 4968, 4971
\l__enumext_item_column_pos_viii_int .. 130, 4571, 4577, 4583, 4587, 4594, 5075, 5246, 5249
l__enumext_item_column_pos_X_int 178
\g__enumext_item_count_all_vii_int 125, 4546, 4833, 4982, 4990
\g__enumext_item_count_all_viii_int 130, 4595, 5076, 5260, 5269
\g__enumext_item_count_all_X_int 178
\g__enumext_item_number_bool 153
\l__enumext_item_number_bool 73, 160, 2177, 2182, 2186, 2190, 2203, 2828, 2882, 3321, 3355, 4910
\g__enumext_item_number_int .. 73, 153, 347, 374, 376, 2176, 2181, 2185, 2189, 2202, 2227, 3320, 3354, 4909
__enumext_item_peek_args_vii: 125, 4829, 4834, 4836
__enumext_item_peek_args_viii: .. 130, 5072, 5077, 5079
__enumext_item_starred_exec: . 96, 3333, 3360, 3402, 3423
__enumext_item_starred_exec:nn .. 3333, 3333, 3376
\l__enumext_item_starred_vii_bool 4851, 4865, 4914
\l__enumext_item_starred_viii_bool 5094, 5109, 5201, 5232
\l__enumext_item_starred_X_bool 178
__enumext_item_std:w 38, 95, 96, 99, 378, 382, 3324, 3330, 3358, 3521, 3525, 3532
\g__enumext_item_symbol_aux_tl . 96, 126, 3338, 3341, 3366, 3410, 3430
\g__enumext_item_symbol_aux_vii_tl 4873, 4916, 4919, 4923, 4925
\g__enumext_item_symbol_aux_X_tl 178
\l__enumext_item_symbol_sep_vii_dim .. 4881, 4888, 4922, 4924
\l__enumext_item_symbol_vii_tl 4919
\l__enumext_item_text_vii_box 4941, 4966
\l__enumext_item_text_viii_box ... 5215, 5244
\l__enumext_item_text_X_box 178
\l__enumext_item_width_vii_dim ... 4461, 4470, 4549, 4557, 4558
\l__enumext_item_width_viii_dim .. 4492, 4501, 4598, 4606, 4607
\l__enumext_item_width_X_dim 178
\l__enumext_item_wrap_key_bool 100, 153, 3274, 3294, 3545, 3552, 3579, 4347, 4365, 5095, 5110, 5178
\l__enumext_itemindent_X_dim 67
\l__enumext_itemsep_i_skip ... 1371, 1378, 1381, 1383, 1390, 1394, 1397, 1399, 1539, 1546, 1548, 1549, 1554, 1558, 1560, 1561
\l__enumext_itemsep_ii_skip .. 1411, 1418, 1421, 1423, 1430, 1434, 1437, 1439
\l__enumext_itemsep_iii_skip . 1450, 1457, 1460, 1462, 1469, 1473, 1476, 1478
\l__enumext_itemsep_vii_skip 4988
\l__enumext_itemsep_viii_skip 5267
\l__enumext_joined_item_aux_vii_int .. 4543, 4544, 4545, 4546, 4552
\l__enumext_joined_item_aux_viii_int . 4592, 4593, 4594, 4595, 4601
\l__enumext_joined_item_aux_X_int 178
__enumext_joined_item_vii:w .. 125, 4829, 4839, 4840, 4842
\l__enumext_joined_item_vii_int .. 4514, 4515, 4518, 4520, 4526, 4531, 4536, 4541, 4543, 4549
__enumext_joined_item_viii:w . 130, 5072, 5082, 5083, 5085
\l__enumext_joined_item_viii_int . 4563, 4564, 4567, 4569, 4575, 4580, 4585, 4590, 4592, 4598
\l__enumext_joined_item_X_int 178
\l__enumext_joined_width_vii_dim . 4547, 4554, 4557, 4943, 4951
\l__enumext_joined_width_viii_dim 4596, 4603, 4606, 5217, 5225
\l__enumext_joined_width_X_dim 178

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__enumext_keyans_addto_prop:n 91, 3093, 3093, 3534, 4350
__enumext_keyans_addto_seq:n . 92, 3166, 3166, 3536, 4352
__enumext_keyans_addto_seq_link: 3166, 3184, 3186, 5141
__enumext_keyans_default_item:n .. 99, 3516, 3516, 3553
\l__enumext_keyans_env_bool 30, 3761, 3774, 3926, 4016
__enumext_keyans_fake_item_indent: .. 1056, 1072, 3672
\l__enumext_keyans_level_h_int .. 129, 24, 803, 829, 2812, 2874, 3144, 4767, 5027, 5028
\l__enumext_keyans_level_int .. 24, 1659, 2808, 2870, 3139, 3284, 3925, 3930, 4313
__enumext_keyans_make_label: . 100, 3557, 3557, 3670
__enumext_keyans_make_label_box: 3557, 3561, 3566, 3603
__enumext_keyans_make_label_std: 3557, 3569, 3591
__enumext_keyans_mini_right_cmd:n 63, 1661, 1694, 1694
__enumext_keyans_mini_set_vskip: 60
__enumext_keyans_minipage_add_space: 1490, 1516, 3955
__enumext_keyans_minipage_set_skip: . 1490, 1490, 1518
__enumext_keyans_multi_addvspace: 1290, 1301, 3979
__enumext_keyans_multi_set_vskip: 56, 1290, 1290, 1303
__enumext_keyans_multicols_start: 3943, 3958, 3960
__enumext_keyans_multicols_stop: 1698, 3943, 3985, 4014
__enumext_keyans_name_and_start: 30, 36, 129, 309, 309, 3927, 4201, 5032
__enumext_keyans_parse_keys:n 3939, 3939, 4034
__enumext_keyans_pic_arg_two: 113, 4194, 4217, 4248
\l__enumext_keyans_pic_level_int .. 24, 1640, 2816, 2878, 3096, 3134, 3169, 4196, 4197
__enumext_keyans_pic_parse_keys:n 4194, 4203, 4247
__enumext_keyans_pic_safe_exec: . 113, 4194, 4194, 4246
__enumext_keyans_pic_skip_abs:N . 113, 4194, 4210, 4221
__enumext_keyans_pos_mark_set: 94, 3240, 3240, 3277, 3309
__enumext_keyans_pre_itemsep_skip: .. 1490, 1509, 1536
__enumext_keyans_redefine_item: . 100, 3539, 3539, 3669
__enumext_keyans_ref: 47, 852, 869, 3671
__enumext_keyans_ref:n 47, 849, 852, 852
__enumext_keyans_safe_exec: . 3919, 3919, 4033
__enumext_keyans_save_item_opt:n 93, 99, 3207, 3207, 3530, 4349
__enumext_keyans_set_item_width: 109, 4020, 4020, 4042
__enumext_keyans_show_ans: 94, 3240, 3269, 3596, 3611, 4354
__enumext_keyans_show_item_opt: 93, 99, 3207, 3214, 3533, 4362
__enumext_keyans_show_item_opt_viii: .. 93, 3207, 3227, 5234
__enumext_keyans_show_pos: 94, 3240, 3282, 3597, 3612, 4355
__enumext_keyans_starred_item:n .. 99, 3528, 3528, 3548
__enumext_keyans_starred_item_star: .. 131, 5107, 5135, 5203
__enumext_keyans_store_ref: .. 91, 3113, 3113, 3535, 4351, 5139
__enumext_keyans_store_ref_aux_i: 92, 3113, 3125, 3128
__enumext_keyans_store_ref_aux_ii: 92, 3113, 3154, 3156
__enumext_keyans_unknown_keys:n . 3451, 3457, 3462, 4191
__enumext_keyans_unknown_keys:nn 3451, 3464, 3466
__enumext_keyans_wraper_label:n 100
__enumext_keyans_wraper_label_viii:n 5172, 5172, 5208
__enumext_keyans_wrapper_item_v:n 3580, 3583
__enumext_keyans_wrapper_item_viii:n 5179, 5183
__enumext_keyans_wrapper_label:n 3557, 3573, 3599, 3614, 4359
__enumext_keyans_wrapper_opt_v:n 3222
__enumext_keyans_wrapper_opt_viii:n .. 3235
\l__enumext_label_copy_i_tl .. 2609, 3132, 3137, 3142, 3147
\l__enumext_label_copy_v_tl 3142
\l__enumext_label_copy_vi_tl 3137
\l__enumext_label_copy_vii_tl 2585, 2596, 2625, 3132
\l__enumext_label_copy_viii_tl 3147
\l__enumext_label_copy_X_tl 164
\l__enumext_label_fill_left_v_tl 3595
\l__enumext_label_fill_left_X_tl 96
\l__enumext_label_fill_right_v_tl 3600
\l__enumext_label_fill_right_X_tl 96
\l__enumext_label_font_style_v_tl 3598, 3613, 4358, 4366
\l__enumext_label_font_style_vii_tl ... 4929
\l__enumext_label_font_style_viii_tl .. 5207
\l__enumext_label_i_tl 720
\l__enumext_label_ii_tl 720
\l__enumext_label_iii_tl 720
\l__enumext_label_iv_tl 720
__enumext_label_style:Nnn 30, 43, 621, 621, 636, 725, 771, 840, 842
\l__enumext_label_v_tl 92, 837, 3101, 3174, 3243, 4037, 4225
\l__enumext_label_vi_tl 92, 837, 3098, 3171, 4359, 4367
\l__enumext_label_vii_tl . 766, 4860, 4883, 4890
\l__enumext_label_viii_tl 766, 5104, 5133, 5137
\l__enumext_label_width_by_box .. 63, 617, 618
__enumext_label_width_by_box:Nn 43, 615, 615, 620, 632, 902, 3242
\l__enumext_labelsep_v_dim ... 3263, 3969, 4237, 4361
\l__enumext_labelsep_vii_dim . 2711, 4456, 4466,

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4550, 4825, 4881, 4936, 4945
\l__enumext_labelsep_viii_dim 4487, 4497, 4599, 5068, 5145, 5210, 5219
\l__enumext_labelwidth_v_dim . 845, 3253, 3258, 3279, 3311, 3609, 3969, 4237, 4356
\l__enumext_labelwidth_vii_dim ... 2714, 4456, 4465, 4550, 4825, 4927, 4944
\l__enumext_labelwidth_viii_dim .. 4487, 4496, 4599, 5068, 5152, 5169, 5205, 5218
\l__enumext_leftmargin_tmp_v_bool . *113*, 4219
\l__enumext_leftmargin_tmp_X_bool 67
\l__enumext_leftmargin_tmp_X_dim 67
\l__enumext_leftmargin_X_dim 67
__enumext_level: 218, 218, 749, 752, 753, 761, 763, 1059, 1063, 1067, 1135, 1139, 1143, 1147, 1230, 1232, 1234, 1236, 1278, 1280, 1282, 1284, 1288, 1322, 1328, 1333, 1335, 1338, 1341, 1354, 1357, 1668, 1672, 1678, 1741, 1743, 1745, 1748, 1755, 1757, 1759, 1762, 2402, 2404, 2406, 2434, 2435, 2437, 2494, 2502, 2506, 2510, 2721, 2725, 3323, 3324, 3328, 3329, 3330, 3338, 3346, 3347, 3350, 3357, 3358, 3362, 3365, 3367, 3401, 3403, 3404, 3406, 3409, 3420, 3421, 3424, 3425, 3427, 3767, 3780, 3787, 3795, 3798, 3800, 3802, 3803, 3804, 3805, 3808, 3813, 3819, 3825, 3832, 3845, 3847, 3850, 3851, 3853, 3857, 3863, 3888, 3893, 3904, 3906
\l__enumext_level_h_int *123*, 24, 259, 282, 296, 787, 822, 1647, 2173, 2193, 2604, 2848, 2860, 3775, 4762, 4763
\l__enumext_level_int *104*, 24, 220, 269, 281, 297, 571, 1242, 1367, 1646, 2167, 2199, 2581, 2591, 2597, 2603, 2610, 2619, 2624, 2847, 2859, 3075, 3686, 3731, 3732, 3743, 3751, 3765, 3778, 3809, 3934, 4309, 4805, 4815, 5040, 5923, 5927, 5933, 5937
__enumext_list_arg_two_i: 3651
__enumext_list_arg_two_ii: 3651
__enumext_list_arg_two_iii: 3651
__enumext_list_arg_two_iv: 3651
__enumext_list_arg_two_v: *100*, 3651, 4039, 4220
__enumext_list_arg_two_vii: 3692, 4742
__enumext_list_arg_two_viii: 3692, 5004
\l__enumext_listoffset_v_dim . 3971, 4025, 4028
\l__enumext_listparindent_vii_dim 4952, 4956
\l__enumext_listparindent_viii_dim 5226, 5230
__enumext_log_answer_vars: . *37*, 363, 371, 3082
__enumext_log_global_vars: . *37*, 363, 363, 3081
__enumext_make_label: *96*, 3381, 3381, 3680
__enumext_make_label_box: ... 3381, 3385, 3390, 3413
__enumext_make_label_std: ... 3381, 3393, 3397
\l__enumext_mark_answer_sym_tl *80*, 2346, 2560, 2737, 3265, 5149, 5156
\l__enumext_mark_answer_sym_v_tl . 3265, 3297
\l__enumext_mark_answer_sym_viii_tl ... 5149
\l__enumext_mark_position_str 126, 2352, 2353, 2354, 2558, 3267, 5150, 5167
\l__enumext_mark_position_v_str .. 126, 3267
\l__enumext_mark_position_viii_str 126, 5150, 5167
\l__enumext_mark_ref_sym_tl .. 2334, 2699, 3198
\l__enumext_mark_sep_tmpa_dim 126, 3243, 3253, 3258
\l__enumext_mark_sep_tmpb_dim 126, 3248, 3252, 3257, 3266
\l__enumext_mark_sym_sep_dim . 2349, 2709, 2711, 2714, 2717, 2719
\l__enumext_mark_sym_sep_v_dim ... 3261, 3263, 3266, 3279, 3311
\l__enumext_mark_sym_sep_viii_dim 5143, 5145, 5152, 5169
\l__enumext_meta_path_tl . 122, 5511, 5512, 5514, 5515
\c__enumext_meta_paths_prop *138*, 5487
__enumext_mini_addvspace_vii: *62*, 1626, 1626, 4624
__enumext_mini_addvspace_viii: *62*, 1626, 1632, 4689
__enumext_mini_env* 569
__enumext_mini_page 1678, 1705, 3857, 3956, 4626, 4691, 4712
__enumext_mini_right_cmd:n *63*, 1663, 1665, 1665
__enumext_mini_set_vskip_vii: *61*, 1569, 1569, 1628
__enumext_mini_set_vskip_viii: *61*, 1569, 1591, 1634
__enumext_minipage:w *38*, 378, 386, 576, 4649, 4951, 5225
\l__enumext_minipage_active_v_bool 3953, 3976, 4001
\g__enumext_minipage_active_vii_bool .. *121*, 4638, 4647, 4669
\l__enumext_minipage_active_vii_bool . 4620, 4631
\g__enumext_minipage_active_viii_bool 4702, 4710, 4729
\l__enumext_minipage_active_viii_bool 4685, 4696
\g__enumext_minipage_active_X_bool ... 178
\l__enumext_minipage_active_X_bool 83
__enumext_minipage_add_space: . *57*, *106*, 1318, 1344, 3855
\g__enumext_minipage_after_skip 83, 1573, 1585, 4667, 4727
\l__enumext_minipage_after_skip .. *57*, *107*, 83, 1331, 1371, 1373, 1378, 1381, 1385, 1390, 1394, 1397, 1401, 1413, 1418, 1421, 1425, 1430, 1434, 1437, 1441, 1452, 1457, 1460, 1464, 1469, 1473, 1476, 1480, 1492, 1506, 1539, 1541, 1546, 1548, 1550, 1554, 1558, 1560, 1562, 1593, 1606, 1620, 1674, 1701, 4011
\g__enumext_minipage_center_vii_bool . 4653, 4670
\g__enumext_minipage_center_viii_bool 4714, 4730
\g__enumext_minipage_center_X_bool ... 178
\l__enumext_minipage_hsep_v_dim 3951
\l__enumext_minipage_hsep_vii_dim 4618
\l__enumext_minipage_hsep_viii_dim ... 4683
\l__enumext_minipage_left_skip 83, 1493, 1571, 1576, 1580, 1594, 1598, 1612, 1630, 1636
\l__enumext_minipage_left_v_dim .. 3949, 3956
\l__enumext_minipage_left_vii_dim 4614, 4626
\l__enumext_minipage_left_viii_dim 4679, 4691
\l__enumext_minipage_left_X_dim 83
\g__enumext_minipage_right_skip 83, 1572, 1577, 1581, 4652, 4713
\l__enumext_minipage_right_skip . *57*, 83, 1320, 1326, 1331, 1333, 1335, 1494, 1495, 1501, 1506, 1507, 1508, 1513, 1595, 1602, 1616, 1680, 1707
\l__enumext_minipage_right_v_dim . 1696, 1705, 3947, 3951

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\g__enumext_minipage_right_vii_dim *120*, 4622, 4649, 4672
\l__enumext_minipage_right_vii_dim *120*, 4612, 4617, 4623
\g__enumext_minipage_right_viii_dim .. 4687, 4712, 4732
\l__enumext_minipage_right_viii_dim .. 4677, 4682, 4688
\g__enumext_minipage_right_X_dim 178
\g__enumext_minipage_right_X_skip 178
__enumext_minipage_set_skip: . *57*, 1318, 1318, 1346
\g__enumext_minipage_stat_int .. *106*, 83, 1685, 1712, 3854, 3865, 3870, 3954, 4003, 4008
\l__enumext_minipage_temp_skip 83, 1392, 1402, 1405, 1432, 1442, 1445, 1471, 1481, 1484, 1556, 1563, 1565
\l__enumext_miniright_code_vii_box 4660, 4664
\g__enumext_miniright_code_vii_tl *121*, 4655, 4662, 4671
\l__enumext_miniright_code_viii_box .. 4721, 4725
\g__enumext_miniright_code_viii_tl 4716, 4723, 4731
\l__enumext_miniright_code_X_box 178
\l__enumext_mode_box_bool 641, 3388, 3564
__enumext_multi_addvspace: *56*, *105*, 1273, 1273, 3816
__enumext_multi_set_vskip: *55*, 1228, 1228, 1275
\l__enumext_multicols_above_ii_skip ... 1247
\l__enumext_multicols_above_iii_skip .. 1256
\l__enumext_multicols_above_iv_skip ... 1265
\l__enumext_multicols_above_v_skip 1292, 1306, 1316, 1507
\l__enumext_multicols_above_X_skip 75
\l__enumext_multicols_below_ii_skip .. 1374, 1383, 1387, 1399, 1404
\l__enumext_multicols_below_iii_skip . 1414, 1423, 1427, 1439, 1444
\l__enumext_multicols_below_iv_skip .. 1453, 1462, 1466, 1478, 1483
\l__enumext_multicols_below_v_skip 1296, 1310, 1508, 1542, 1549, 1551, 1561, 1564, 3993
\l__enumext_multicols_below_X_skip 75
\g__enumext_multicols_right_X_skip 75
__enumext_multicols_start: *105*, *106*, 3792, 3792, 3859
__enumext_multicols_stop: *106*, 1670, 3822, 3822, 3875
__enumext_nested_base_line_fix: *50*, *104*, 976, 982, 3747
__enumext_newlabel:nn *33*, *39*, *82*, 424, 424, 2635, 3160
\l__enumext_newlabel_arg_one_tl *33*, *39*, *82*, *92*, 164, 2628, 2636, 2698, 3149, 3161, 3196
\l__enumext_newlabel_arg_two_tl *33*, *39*, *81*, 164, 2584, 2594, 2607, 2622, 2637, 3136, 3141, 3146, 3162
__enumext_parse_foreach_keys:n .. 5536, 5552, 5569
__enumext_parse_foreach_keys:nn . 5536, 5559, 5571
__enumext_parse_keys:n *50*, *67*, 3738, 3738, 3900
__enumext_parse_keys_vii:n *67*, 4737, 4775, 4775
__enumext_parse_keys_viii:n . 5000, 5045, 5045
__enumext_parse_save_key:n *78*, 2427, 2432, 2432
__enumext_parse_save_key_vii:n *78*, 2422, 2432, 2440
__enumext_parse_series:n .. *67*, *104*, *123*, 1870, 1870, 3746, 4781
__enumext_parse_store_keys:n *104*
\l__enumext_parsep_i_skip 1245, 1249
\l__enumext_parsep_ii_skip 1254, 1258
\l__enumext_parsep_iii_skip 1263, 1267
\l__enumext_parsep_vii_skip 4953
\l__enumext_parsep_viii_skip 5227
\l__enumext_partopsep_v_skip . 1308, 1312, 1503, 1526
\l__enumext_partopsep_viii_skip 1604
__enumext_phantomsection: *39*, 389, 417, 421, 437
__enumext_pre_itemsep_skip: *57*, *58*, 1336, 1365, 1365
__enumext_print_footnote: .. 439, 461, 525, 530
__enumext_print_footnote_mini: 439, 491, 552, 557
__enumext_print_footnote_standar: 503, 519, 583
__enumext_print_footnote_starred: 503, 548, 563, 567
__enumext_print_keyans_box:NN *80*, 2552, 2552, 2565, 2713, 2724, 3278, 3310, 5151, 5168
\l__enumext_print_keyans_i_tl 5310, 5342
\l__enumext_print_keyans_ii_tl ... 5316, 5343
\l__enumext_print_keyans_iii_tl .. 5322, 5344
\l__enumext_print_keyans_iv_tl ... 5328, 5345
\l__enumext_print_keyans_star_bool . *50*, *135*, 126, 988, 1000, 5365, 5370
\l__enumext_print_keyans_starred_tl *134*, *135*, 126, 5304, 5363
\l__enumext_print_keyans_vii_tl *134*, 5334, 5346
\l__enumext_print_keyans_X_tl 126
__enumext_printkeyans:nnn *135*, 5339, 5347, 5350
__enumext_redefine_item: . *96*, 3370, 3370, 3679
\l__enumext_ref_key_arg_tl *45*, 46, 233, 742, 743, 755, 786, 789, 799, 805, 815, 854, 855, 865
\l__enumext_ref_the_count_tl . *45*, 46, 749, 752, 755, 794, 796, 799, 810, 812, 815, 860, 862, 865
__enumext_regex_counter_style: .. *35*, *45*, 228, 228, 750, 795, 811, 861
__enumext_register_counter_style:Nn .. 605, 605, 610, 611, 612, 613, 614
__enumext_remove_extra_parsep_vii: .. 4755, 4977, 4977
__enumext_remove_extra_parsep_viii: . 5017, 5255, 5255
__enumext_renew_footnote: .. 439, 443, 509, 514
__enumext_renew_footnote_mini: 439, 473, 539, 544
__enumext_renew_footnote_standar: 503, 503, 575
__enumext_renew_footnote_starred: 503, 535, 4947, 5221
\l__enumext_renew_the_count_v_tl 863, 871, 873
\l__enumext_renew_the_count_vii_tl 797, 824, 826
\l__enumext_renew_the_count_viii_tl 813, 831, 833
\l__enumext_renew_the_count_X_tl 46
__enumext_rescan_anskey_env:n .. *88*, *90*, 2891, 2957, 3052, 3060

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__enumext_reset_global_bool: . . 339, 342, 351
__enumext_reset_global_int: . . . 339, 341, 345
__enumext_reset_global_tl: 339, 343, 357
__enumext_reset_global_vars: . 37, 90, 339, 339, 3090
\l__enumext_resume_active_bool 67, 69, 57, 1874, 1994
__enumext_resume_counter: . . 68, 69, 1992, 1998, 2005
__enumext_resume_counter:n . 67, 69, 1963, 1968, 1992, 1992, 2062, 2070
__enumext_resume_counter_save_ans: . . 69, 70, 1992, 2003, 2035
__enumext_resume_counter_series: . 69, 1992, 2001, 2018
\g__enumext_resume_int . . . 57, 1915, 2009, 2010
__enumext_resume_last:n . . 67, 1870, 1876, 1889
\l__enumext_resume_name_tl 57, 1911, 1919, 1922, 1938, 1946, 1949, 1995, 1996, 2024, 2031
__enumext_resume_save_counter: . 67, 107, 124, 1902, 1902, 3881, 4799
__enumext_resume_series:n . 68, 1838, 1959, 1959
__enumext_resume_starred: . 70, 1839, 2056, 2056
\g__enumext_resume_vii_int 57, 1942, 2014, 2015
\l__enumext_rightmargin_vii_dim . . 4468, 4472, 4477
\l__enumext_rightmargin_viii_dim . 4499, 4503, 4508
__enumext_safe_exec: . . 41, 104, 3727, 3727, 3899
__enumext_safe_exec_vii: . 41, 4736, 4758, 4758
__enumext_safe_exec_viii: 129, 4999, 5021, 5021
__enumext_second_part: . . 107, 3861, 3861, 3913
__enumext_second_part_v: . . . 3943, 3999, 4047
\l__enumext_series_name_tl 69
\l__enumext_series_str . 67, 104, 123, 1836, 1872, 1880, 1881, 1883, 1885, 1906, 1909, 1913, 1933, 1936, 1940, 3742, 4779
__enumext_set_error:nn 5446, 5483, 5485
__enumext_set_item_width: 107, 3883, 3883, 3909
__enumext_set_parse:n 5446, 5457, 5473
\l__enumext_setkey_tmpa_int . . . 117, 5450, 5454
\l__enumext_setkey_tmpa_seq . . 117, 5448, 5458, 5464, 5466, 5468, 5480
\l__enumext_setkey_tmpa_tl 117, 5456, 5460
\l__enumext_setkey_tmpb_seq . . 117, 5449, 5452, 5456, 5457
\l__enumext_setkey_tmpb_tl 117, 5475, 5477, 5478
\l__enumext_show_answer_bool . 2321, 2340, 2731, 3219, 3232, 3273, 3578, 5147, 5177
__enumext_show_length:nnn . . 52, 236, 236, 5694, 5695, 5696, 5697, 5698, 5699, 5700, 5701, 5702, 5703, 5709, 5710, 5711, 5712, 5713, 5714, 5715, 5716, 5717, 5718
\l__enumext_show_pos_tmp_int . 126, 3286, 3289, 3304
\l__enumext_show_position_bool . . . 2324, 2343, 2735, 3220, 3233, 3293, 5154
\g__enumext_standar_bool 35, 104, 30, 258, 261, 280, 354, 505, 521, 1904, 1969, 1981, 2007, 2020, 2058, 2198, 2212, 2589, 2602, 2617, 3762
\l__enumext_standar_bool 104, 107, 30, 1654, 2590, 3734, 3880, 4772
\l__enumext_standar_first_bool 36, 104, 30, 285, 1891, 2038, 2100, 2107
__enumext_standar_item_vii:w . 125, 4829, 4847, 4849
__enumext_standar_item_viii:w 130, 5072, 5090, 5092
__enumext_standar_ref: 45, 740, 759, 3681
__enumext_standar_ref:n 45, 732, 740, 740
\g__enumext_standar_series_tl . 57, 1893, 1894, 2060, 2063
__enumext_standar_unknown_keys:n 3494, 3498, 3502
__enumext_standar_unknown_keys:nn 3494, 3504, 3506
\g__enumext_starred_bool 35, 123, 30, 268, 271, 295, 355, 1653, 1931, 1974, 1985, 2012, 2027, 2066, 2172, 2218, 2580, 3130, 4673
\l__enumext_starred_bool 123, 124, 129, 30, 2618, 2653, 2659, 2707, 3006, 3011, 3735, 4771, 4798, 5033, 5037
__enumext_starred_columns_set_vii: . . 4450, 4450, 4746
__enumext_starred_columns_set_viii: . 4450, 4481, 5008
\l__enumext_starred_first_bool 36, 123, 30, 300, 986, 999, 1896, 2047, 2100, 2107
__enumext_starred_item_vii:w . 125, 4829, 4846, 4863
__enumext_starred_item_vii_aux_i:w . . 4829, 4868, 4871
__enumext_starred_item_vii_aux_ii:w . 4829, 4869, 4874, 4876
__enumext_starred_item_vii_aux_iii:w 4829, 4879, 4886
__enumext_starred_item_viii:w 130, 131, 5089, 5107, 5107
__enumext_starred_item_viii_aux_i:w . . 131, 5107, 5113, 5116
__enumext_starred_item_viii_aux_ii:w . 131, 5107, 5114, 5128, 5130
__enumext_starred_joined_item_vii:n 119, 125, 4512, 4512, 4844
__enumext_starred_joined_item_viii:n . 119, 130, 4512, 4561, 5087
__enumext_starred_ref: 46, 784, 820, 3712
__enumext_starred_ref:n 46, 778, 784, 784
\g__enumext_starred_series_tl . 57, 1898, 1899, 2068, 2071
__enumext_starred_unknown_keys:n 3476, 3478, 3480
__enumext_starred_unknown_keys:nn 3476, 3482, 3484
__enumext_start_from:NNn 48, 876, 876, 889, 911, 917
\l__enumext_start_i_int 2010, 2022, 2041
__enumext_start_item_tmp_vii: 122, 4749, 4829, 4829
__enumext_start_item_tmp_viii: . . 5011, 5072, 5072
__enumext_start_item_vii:w 125, 127, 4855, 4860, 4883, 4890, 4938, 4938
__enumext_start_item_viii:w . . 130, 5099, 5104, 5133, 5212, 5212
\g__enumext_start_line_tl 36, 30, 288, 303, 360, 2242, 2247, 2252, 2266, 2271, 2276

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__enumext_start_list:nn *38*, *101*, 378, 380, 3903, 4036, 4740, 5002
__enumext_start_list_tag:n . . 4049, 4075, 4948, 5222
__enumext_start_mini_vii: *124*, 4610, 4610, 4790
__enumext_start_mini_viii: . . . *129*, 4675, 4675, 5056
__enumext_start_save_ans_msg: *71*, 2084, 2084, 2109
__enumext_start_store_level: *104*, 3756, 3756, 3902
__enumext_start_store_level_vii: *124*, 4739, 4801, 4801
\l__enumext_start_vii_int . . . 2015, 2029, 2050
\l__enumext_start_X_int 96
__enumext_stop_item_tmp_vii: *122*, *124*, *125*, *127*, 4748, 4754, 4831, 4940
__enumext_stop_item_tmp_viii: *130*, 5010, 5016, 5074, 5214
__enumext_stop_item_vii: *127*, 4938, 4940, 4960
__enumext_stop_item_viii: . . . 5212, 5214, 5238
__enumext_stop_list: *38*, *121*, *124*, 378, 381, 3827, 3835, 3989, 3996, 4633, 4641, 4698, 4705
__enumext_stop_list_tag:n . . . 4049, 4091, 4963, 5241
__enumext_stop_mini_vii: *121*, *124*, 4610, 4629, 4794
__enumext_stop_mini_viii: *129*, 4675, 4694, 5060
__enumext_stop_save_ans_msg: . *71*, 2084, 2089, 3079
__enumext_stop_start_list_tag: . . 4049, 4083, 4950, 5224
__enumext_stop_store_level: . . *105*, *106*, 3785, 3785, 3828, 3836
__enumext_stop_store_level_vii: . . *121*, *124*, 4634, 4642, 4801, 4811
\l__enumext_store_active_bool *32*, *71*, 108, 2039, 2048, 2116, 2804, 3760, 3773, 3921, 3929, 4305, 4803, 4813, 5023, 5039
__enumext_store_active_keys:n *77*, *78*, *104*, 2400, 2400, 3753
__enumext_store_active_keys_vii:n *77*, *78*, *123*, 2400, 2410, 4782
__enumext_store_addto_prop:n *79*, *91*, 2476, 2476, 2484, 2644, 3111, 5138
__enumext_store_addto_seq:n *79*, *93*, 2485, 2485, 2489, 2496, 2510, 2518, 2527, 2541, 2549, 2702, 3201
\l__enumext_store_anskey_arg_tl *32*, *82*, *83*, 108, 2650, 2655, 2657, 2662, 2669, 2672, 2682, 2687, 2690, 2696, 2702
__enumext_store_anskey_code:n *82*, *85*, *90*, 2641, 2641, 2797, 3050, 3058
\l__enumext_store_anskey_env_tl . . *32*, *88*, 108, 2980, 2984, 2990, 3052, 3060
\l__enumext_store_anskey_opt_tl . . *32*, *89*, 108, 2981, 3008, 3014, 3021, 3027, 3037, 3047, 3056
__enumext_store_anskey_safe_outer: *85*
\g__enumext_store_columns_break_bool . 2904, 3005, 3067
\l__enumext_store_columns_break_bool . 2652, 2753
\l__enumext_store_current_label_tl *32*, *91–93*, *131*, 108, 3095, 3098, 3101, 3107, 3109, 3111, 3168, 3171, 3174, 3180, 3182, 3192, 3201, 5118, 5123, 5124, 5137, 5138, 5140
\l__enumext_store_current_label_tmp_tl . *32*, 108
\l__enumext_store_current_opt_arg_tl . *32*, *93*, *131*, 108, 3211, 3216, 3223, 3229, 3236, 5126
__enumext_store_internal_ref: . . *81*, *82*, 2566, 2566, 2647
\g__enumext_store_item_join_int . . 2907, 3012, 3016, 3068
\l__enumext_store_item_join_int . . 2660, 2664, 2756
\g__enumext_store_item_star_bool . 2909, 3019, 3069
\l__enumext_store_item_star_bool . 2667, 2758
\g__enumext_store_item_symbol_sep_dim 2914, 3034, 3039, 3071
\l__enumext_store_item_symbol_sep_dim 2679, 2684, 2763
\g__enumext_store_item_symbol_tl . 2912, 3025, 3029, 3070
\l__enumext_store_item_symbol_tl . 2670, 2674, 2761
\l__enumext_store_keyans_item_opt_sep_v_-tl 3105, 3107, 3178, 3180
\l__enumext_store_keyans_item_opt_sep_-viii_tl 5121, 5123
__enumext_store_level_close: . *79*, 2490, 2514, 3789
__enumext_store_level_close_vii: . *80*, 2521, 2545, 4817
__enumext_store_level_open: *79*, *105*, 2490, 2490, 3768, 3781
__enumext_store_level_open_vii: . . *80*, 2521, 2521, 4807
\g__enumext_store_name_tl *32*, *71*, 108, 359, 366, 367, 368, 369, 2092, 2118, 2241, 2246, 2251, 2265, 2270, 2275, 3077
\l__enumext_store_name_tl *32*, *71*, *73*, 108, 1925, 1928, 1952, 1955, 2043, 2052, 2087, 2096, 2097, 2118, 2119, 2120, 2122, 2123, 2125, 2127, 2128, 2130, 2132, 2133, 2157, 2478, 2480, 2487, 2630, 2631, 2743, 2986, 3151, 3152, 3303, 5162
\l__enumext_store_ref_key_bool *82*, 2337, 2645, 2693, 3115, 3189
\l__enumext_store_save_key_vii_bool . . 2412, 2442
\l__enumext_store_save_key_vii_tl 2414, 2415, 2443, 2444, 2525, 2533, 2537, 2541
\l__enumext_store_save_key_X_bool . . *77*, 126
\l__enumext_store_save_key_X_tl . . *77*, *78*, 126
\l__enumext_store_upper_level_X_bool . . 126
__enumext_storing_exec: *71*, *87*, 2094, 2110, 2114
__enumext_storing_set:n . . *71*, 2079, 2094, 2094
\l__enumext_the_counter_v_tl 862
\l__enumext_the_counter_vii_tl 796
\l__enumext_the_counter_viii_tl 812
\l__enumext_the_counter_X_tl 46
__enumext_tmp:n 41, 45, 50, 56, 67, 74, 75, 82, 90, 95, 96, 107, 135, 142, 167, 171, 178, 198, 637, 646, 1832, 1843, 2075, 2083, 2136, 2154, 2330, 2399, 2418, 2431, 2568, 2575, 2576, 2597, 2610, 2613, 2624, 3117, 3124, 3451, 3461, 3494, 3501, 3651, 3691, 3692, 3726
__enumext_tmp:nn 647, 668, 669, 703, 704, 719, 906, 931, 1012, 1034, 1035, 1055, 1109, 1117, 1118, 1132, 1197, 1213, 1214, 1227, 1721, 1737, 2295, 2329, 3435, 3450

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__enumext_tmp:nnn 720, 736, 737, 738, 739, 766, 782, 783
__enumext_tmp:nnnnnn 932, 957, 960, 963, 965, 967, 970, 973
__enumext_tmp:w 5283, 5286
\l__enumext_tmpa_vii_int 4460, 4463, 4472, 4503
\l__enumext_tmpa_viii_int 4491, 4494
\l__enumext_tmpa_X_dim 178
\l__enumext_tmpa_X_int 178
\l__enumext_topsep_v_skip 1294, 1298, 1497, 4298
\l__enumext_topsep_vii_skip . . 1574, 1583, 1587
\l__enumext_topsep_viii_skip . 1596, 1618, 1622
__enumext_undefine_anskey_env: . *86*, *90*, 2837, 2837, 3088
__enumext_unskip_unkern: . . *35*, 242, 242, 1347, 1519, 3830, 3831, 3871, 3991, 3992, 4009, 4954, 4955, 5228, 5229
\l__enumext_vspace_a_star_v_bool 1770
\l__enumext_vspace_a_star_vii_bool . . . 1792
\l__enumext_vspace_a_star_viii_bool . . . 1803
\l__enumext_vspace_a_star_X_bool 96
__enumext_vspace_above: *64*, *106*, 1738, 1738, 3841
__enumext_vspace_above_v: . *65*, 1766, 1766, 3945
\l__enumext_vspace_above_v_skip . . 1768, 1772, 1774
__enumext_vspace_above_vii: *65*, *124*, 1788, 1788, 4787
\l__enumext_vspace_above_vii_skip 1790, 1794, 1796
__enumext_vspace_above_viii: . *65*, 1788, 1799, 5054
\l__enumext_vspace_above_viii_skip 1801, 1805, 1807
\l__enumext_vspace_b_star_v_bool 1781
\l__enumext_vspace_b_star_vii_bool . . . 1814
\l__enumext_vspace_b_star_viii_bool . . . 1825
\l__enumext_vspace_b_star_X_bool 96
__enumext_vspace_below: *64*, *107*, 1752, 1752, 3879
__enumext_vspace_below_v: . *65*, 1777, 1777, 4018
\l__enumext_vspace_below_v_skip . . 1779, 1783, 1785
__enumext_vspace_below_vii: *65*, *124*, 1810, 1810, 4797
\l__enumext_vspace_below_vii_skip 1812, 1816, 1818
__enumext_vspace_below_viii: . *65*, 1810, 1821, 5062
\l__enumext_vspace_below_viii_skip 1823, 1827, 1829
__enumext_widest_from:nNNn . . *48*, 890, 890, 905, 924
\g__enumext_widest_label_tl *30*, *43*, 63, 625, 629, 633
\l__enumext_wrap_label_opt_v_bool 3524
\l__enumext_wrap_label_opt_vii_bool *125*, 4854
\l__enumext_wrap_label_opt_viii_bool . . *130*, 5098
\l__enumext_wrap_label_opt_X_bool 96
\l__enumext_wrap_label_v_bool 3520, 3524, 3531, 3577, 3585, 4348
\l__enumext_wrap_label_vii_bool . . *125*, 4854, 4858, 4866, 4930
\l__enumext_wrap_label_viii_bool . *130*, 5098, 5102, 5111, 5176, 5185
\l__enumext_wrap_label_X_bool 96
__enumext_wrapper_label_v:n . 3583, 3587, 4367
__enumext_wrapper_label_vii:n 4932
__enumext_wrapper_label_viii:n . . 5183, 5187
\l__enumext_write_aux_file_tl . *33*, *82*, *92*, 164, 2633, 2639, 3158, 3164
enumext* *5*, 4734
enumXi 588
enumXii 588
enumXiii 588
enumXiv 588
enumXv 588
enumXvi 588
enumXvii 588
enumXviii 588
Environments provide by enumext:
anskey* *32*, *71*, *76*, *78*, *81*, *83*, *84*, *86–88*, *90*, *104*, *105*, *124*, *133*, *135*, *140*, *142*
enumext* . . *29*, *30*, *33–35*, *39–43*, *46*, *48–52*, *54*, *61*, *62*, *65–68*, *70–73*, *76–82*, *84–86*, *89*, *91*, *92*, *97*, *98*, *103–105*, *110*, *118*, *119*, *121*, *122*, *124*, *126–130*, *132–137*, *141*, *144*, *145*
enumext *29*, *30*, *34*, *35*, *39–43*, *45–50*, *52–57*, *60*, *62–64*, *66–68*, *70–73*, *76–79*, *81*, *82*, *84–86*, *89*, *91*, *92*, *95–97*, *99*, *101*, *102*, *105*, *107*, *108*, *113*, *118*, *120*, *123*, *124*, *126*, *129*, *134–137*, *141*, *142*, *144*
keyans* *29*, *30*, *32–36*, *39–42*, *46–52*, *54*, *61*, *62*, *65*, *71*, *72*, *75*, *76*, *79*, *86*, *91*, *93*, *98*, *103*, *110*, *118*, *120*, *128*, *129*, *141*, *143*, *145*
keyanspic . . *29*, *30*, *32*, *33*, *36*, *42*, *47*, *71*, *72*, *75*, *79*, *86*, *91–93*, *98*, *110–115*, *117*, *143*
keyans *29*, *30*, *32*, *33*, *35*, *36*, *39*, *40*, *42*, *43*, *47–50*, *52*, *54*, *56*, *60*, *62–65*, *71*, *72*, *75*, *76*, *79*, *86*, *91–94*, *98–102*, *108*, *110*, *112*, *113*, *116*, *120*, *130*, *141*, *143*
Environments:
center *118*
description *97*, *118*
enumerate *118*
flushleft *118*
flushright *118*
itemize *118*
list *34*, *38*, *84*, *97*, *101*, *106*, *107*, *110*, *112–114*, *118*, *121*
lrbox *127*
minipage *34*, *38*, *40*, *41*, *54*, *56–58*, *112*, *115*, *117*, *118*, *121*, *127*
multicols *54–58*, *63*, *105–107*
quotation *118*
quote *118*
scontents *87*, *89*
tabbing *118*
trivlist *118*
verbatim *118*
verse *118*
exp commands:
\exp_after:wN 5286
\exp_args:Ne 3049, 3057, 3750, 5274
\exp_args:NV . . . 2769, 2924, 3464, 3482, 3504, 5571
\exp_not:N 54, 628, 755, 799, 815, 865, 1065, 1068, 1079, 1080, 1081, 1092, 1093, 1104, 1105, 2698, 2740, 2741, 3194, 3300, 3301, 5159, 5160, 5283
\exp_not:n 290, 305, 318, 326, 334, 694, 714, 755, 799, 815, 865, 1066, 1859, 1868, 2308, 2357, 2461, 2474, 2636, 2664, 2674, 2684, 2698, 2699, 3016, 3029, 3039, 3161, 3196, 3198, 4162, 5400, 5410, 5603, 5608

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F

\fbox 2364
\fboxrule 2364
\fboxsep 2364
file commands:
\file_input_stop: 6007
first 1118
font 647
\footnote *39*
\footnote *39*, 445, 475
\footnotemark 455, 485
\footnotesize 2741, 3301, 5160
\footnotetext 441
\foreachkeyans *18*, *138*, 5536

G

\getkeyans *18*, *133*, 5272
group commands:
\group_begin: 2739, 2784, 2959, 3046, 3299, 5158, 5341
\group_end: 2746, 2800, 3063, 3307, 5165, 5348

H

\hbadness 4965, 5243
hbox commands:
\hbox_overlap_left:n 2556, 3366, 4923
\hbox_set:Nn 617, 4225
\hbox_set_end: 4964, 5242
\hbox_set_to_wd:Nnw 4941, 5215
\hfill 677, 682, 688, 689, 1677, 1704, 2698, 3194, 4637, 4701
hook commands:
\hook_gput_code:nnn 5, 208, 212, 216, 389
\hook_gremove_code:nn *89*, 2975
\hook_gset_rule:nnnn 390
\hook_if_empty:nTF 2973
\hyperlink *83*, *93*
\hyperlink 2698, 3194
\hypertarget *39*
\hypertarget 416

I

\IfDocumentMetadataTF . . 507, 523, 537, 550, 3383, 3559, 4077, 4085, 4093, 4129, 4137, 4145, 4249, 4258, 4266, 4273, 4278, 4326, 4335, 4425, 4433, 4635, 4699, 4745, 4753, 4899, 5007, 5015
\IfHyperBoolean 397
\IfPackageLoadedTF 7, 15, 393, 406
\ignorespaces . . 1068, 1081, 1093, 1105, 4238, 4750, 4827, 4860, 4883, 4890, 4936, 4956, 5012, 5070, 5104, 5133, 5210, 5230
\inputlineno 290, 305, 318, 326, 334
int commands:
\int_add:Nn 4545, 4594
\int_case:nn . . . 1242, 1367, 2167, 2193, 2232, 2256
\int_case:nnTF 244
\int_compare:nNnTF . . 571, 787, 803, 822, 829, 1337, 1356, 1510, 1528, 1640, 1659, 1671, 1699, 2280, 2286, 2808, 2812, 2816, 2824, 2870, 2874, 2878, 3075, 3096, 3134, 3139, 3144, 3169, 3284, 3732, 3743, 3765, 3778, 3794, 3809, 3824, 3865, 3930, 3934, 3962, 3987, 4003, 4197, 4309, 4313, 4515, 4525, 4541, 4564, 4574, 4590, 4763, 4767, 4805, 4815, 4967, 4979, 5028, 5040, 5245, 5257, 5454, 5586
\int_compare_p:nNn . . . 259, 269, 281, 282, 296, 297, 1646, 1647, 2173, 2199, 2581, 2591, 2603, 2604, 2619, 2660, 2847, 2848, 2859, 2860, 3012, 3775
\int_decr:N 4544, 4593
\int_eval:n . . 376, 919, 2480, 2631, 2741, 3152, 3301, 3666, 3711, 4533, 4582, 5160
\int_from_alph:n 884, 898
\int_from_roman:n 886, 900
\int_gadd:Nn 4546, 4595
\int_gdecr:N 2176, 2181, 2185, 2189, 2202
\int_gincr:N 2009, 2014, 2643, 3204, 3320, 3354, 3537, 3854, 3954, 4353, 4833, 4909, 5076, 5142
\int_gset:Nn 453, 483, 2225
\int_gset_eq:NN . . 450, 480, 1908, 1915, 1921, 1927, 1935, 1942, 1948, 1954
\int_gzero:N . 347, 348, 349, 1685, 1712, 2292, 3068, 3870, 4008, 4990, 5269
\int_if_exist:NTF 1883, 1919, 1925, 1946, 1952, 2130
\int_incr:N 2823, 3286, 3731, 3925, 4196, 4762, 4832, 5027, 5075
\int_mod:nn 4981, 5259
\int_new:N . 24, 25, 26, 27, 28, 29, 57, 58, 83, 100, 119, 133, 145, 146, 157, 158, 159, 161, 172, 173, 181, 182, 183, 184, 185, 1885, 2133
\int_set:Nn 880, 884, 886, 2022, 2029, 2041, 2050, 2960, 4419, 4420, 4460, 4491, 4514, 4520, 4536, 4563, 4569, 4585, 4965, 5243, 5450, 5588
\int_set_eq:NN 2010, 2015, 4543, 4592
\int_sign:n 2227
\int_step_function:nnN 2597, 2610, 2624
\int_step_function:nnnN 5592
\int_step_inline:nn 5502
\int_step_inline:nnn 4421
\int_to_roman:n 220, 2577, 2614
\int_use:N 369, 374, 375, 1338, 1357, 1672, 2024, 2031, 2043, 2052, 3666, 3686, 3711, 3751, 3795, 3804, 3819, 3825, 4518, 4519, 4531, 4567, 4568, 4580, 5923, 5927, 5933, 5937
\int_zero:N 3289, 4971, 5249
\item . *95*, *99*, *124*, *127*, *130*, *132*, 382, 2498, 2504, 2529, 2535, 2657, 3171, 3174, 3372, 3541, 4253, 4254, 4747, 4749, 5009, 5011, 5140
\item* *5*, *16*, *75*, 3539
item-join 2751
item-pos* 2751, 3435
item-star 2751
item-sym* 2751, 3435
\itemindent *102*
\itemindent *101*
itemindent 1012
\itemsep 4242
\itemwidth . 587, 2364, 3885, 3891, 4022, 4028, 4554, 4558, 4603, 4607

K

keyans *15*, 4031
keyans* *15*, 4997
keyanspic *16*, 4244
Keys for \anskey provide by enumext:
break-col *82*, *84*, *87–89*
item-join *82*, *84*, *87–89*
item-pos* *83*, *84*, *87–89*
item-star *83*, *84*, *87–89*
item-sym* *83*, *84*, *87–89*
Keys for anskey* provide by enumext:
break-col *82*, *84*, *87–89*
item-join *82*, *84*, *87–89*
item-pos* *83*, *84*, *87–89*
item-star *83*, *84*, *87–89*

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item-sym* 83, 84, 87–89
Keys for environments provide by enumext:
above* 31, 50, 64, 65, 106, 124
above 31, 50, 64, 65, 106, 124, 129
after 52, 53, 107, 124, 129
align 31, 44, 94–96, 100, 126, 140
base-fix 50, 66, 78, 104
before* 52, 53, 106, 124, 129
before 52, 53
below* 31, 64, 65, 107, 124
below 31, 64, 65, 107, 124, 129
check-ans . 33, 34, 36, 71, 72, 74, 75, 79, 90, 93, 107, 108, 124, 128, 142
columns-sep 54, 105, 128
columns 31, 54, 64, 105
first 52, 53, 127
font 43, 96, 100, 116, 126
item-pos* 96, 97
item-sym* 32, 96, 97
itemindent 31, 50, 51, 95, 96, 99, 100, 127
itemsep 49, 103, 128
label-pos 112, 113, 115, 116
label-sep 112
labelsep 43, 102, 126
labelwidth 42, 43, 45–48, 102, 126
label 30, 42, 43, 45, 48, 113, 118
layout-sep 112
layout-sty 112, 117
layout-top 112
lisparindent 103
list-indent 31, 50, 51, 113
list-offset 50, 51, 107, 109
listparindent 50, 127
mark-ans* 76, 79, 94
mark-ans 76, 79, 84
mark-pos* 76, 79, 94
mark-pos 32, 76, 79, 140
mark-ref 76, 79, 81, 83
mark-sep* 76, 79, 94
mark-sep 32, 76, 79, 131
mini-env 31, 39–41, 54, 63, 64, 79, 106, 118, 120, 122, 124, 129
mini-right* 31, 34, 54, 79, 121, 122, 124
mini-right 31, 34, 54, 62, 79, 121, 122, 124
mini-sep 31, 54, 79, 106
mode-box 43, 95–97, 100, 101
no-store 33, 71–73, 78, 85, 95, 96
noitemsep 49
nosep 49
parindent 103
parsep 49, 103, 113, 127
partopsep 49
ref 30, 35, 45–47, 141
resume* 30, 66, 67, 70–72, 78, 107, 124, 136
resume 30, 37, 66–72, 78, 79, 107, 124, 136
rightmargin 50, 118
save-ans 32, 37, 66–71, 73, 74, 77–79, 85–87, 90–92, 99, 108, 115, 126, 129–131, 133, 134, 136, 141
save-key 32, 66, 78, 79, 104, 123
save-pos 79
save-ref 33, 39, 76, 79, 81–83, 91, 93, 100, 131
save-sep 76, 79, 91, 131
series 30, 66–70, 79, 104, 107, 123, 124, 136
show-ans 32, 76, 79, 80, 82, 84, 93, 94, 116, 131
show-length 35, 52, 141
show-pos 32, 76, 80, 82, 84, 93, 116, 131
start* 31, 48, 66
start 31, 35, 48, 66
store-key 77
topsep 49, 50, 113
widest 30, 35, 48
wrap-ans* 33, 76, 79, 100, 116
wrap-ans 42, 76, 79, 80, 83
wrap-label* 31, 43, 95, 96, 99, 100, 125, 126, 130
wrap-label 31, 43, 95, 96, 99, 100, 113, 116, 125, 126, 130
wrap-opt 76, 79, 93, 99, 116
wrap-sep 83
keys commands:
\keys_define:nn 639, 649, 671, 706, 722, 768, 837, 908, 934, 976, 1014, 1037, 1111, 1120, 1199, 1216, 1723, 1834, 2077, 2138, 2297, 2332, 2420, 2425, 2751, 2902, 2938, 3437, 3453, 3476, 3496, 4151, 5300, 5412, 5528, 5536
\keys_if_exist_p:nn 5524, 5525
\l_keys_key_str 84, 87, 2769, 2924, 3464, 3482, 3504, 5571, 5679
\keys_precompile:nnN . . 135, 204, 204, 5302, 5308, 5314, 5320, 5326, 5332, 5554
\keys_set:nn . 663, 993, 1005, 1222, 1728, 1733, 1971, 1976, 2063, 2071, 2368, 2369, 2373, 2374, 2378, 2379, 2383, 2384, 2388, 2389, 2393, 2394, 2789, 3745, 3750, 3941, 4169, 4171, 4173, 4175, 4177, 4179, 4181, 4183, 4185, 4187, 4207, 4780, 5049, 5416, 5421, 5422, 5423, 5424, 5427, 5432, 5433, 5434, 5435, 5436, 5437, 5438, 5470, 5580
\keys_set_known:nn 3056
keyval commands:
\keyval_parse:NNn 1848, 2450, 5388

L

label 720, 766, 837
label-pos 4151
label-sep 4151
Labels provide by enumext:
\Alph* 42, 43
\Roman* 42, 43
\alph* 42, 43
\arabic* 35, 42, 43
\roman* 42, 43
labelsep 647
\labelwidth 43
labelwidth 647
\lastnodetype 244
layout-sep 4151
layout-sty 4151
layout-top 4151
\leftmargin 102
\leftmargin 101, 4237
legacy commands:
\legacy_if:nTF 4894, 4897, 5193, 5196
\legacy_if_gset_false:n 577, 4650
\legacy_if_set_false:n 4896, 5195
\legacy_if_set_true:n 4859, 4882, 4889, 4903, 5103, 5132
\linewidth 106
\linewidth 3849, 3885, 3951, 4022, 4418, 4463, 4494, 4616, 4681
\list 380
list-indent 1012
list-offset 1012

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\listparindent 4240
listparindent 1012

M

\makebox *118*
\makebox 2558, 3419, 3609, 4343, 4356, 4927, 5205
\makelabel *95*, *96*, *100*, *118*
\makelabel *95*, *99*, 3399, 3415, 3593, 3605
mark-ans 2330, 4151
mark-ans* 2295, 2330
mark-pos 2330, 4151
mark-pos* 2295, 2330
mark-ref 2330
mark-sep 2330, 4151
mark-sep* 2295, 2330
mini-env 1197
mini-sep 1197
\minipage 386
\miniright *11*, *62*, 1638, 1689, 1716, 3868, 4006
mode commands:
\mode_if_math:TF 2832, 2886
\mode_if_vertical:TF 1276, 1304, 1324, 1348, 1499, 1520
\mode_leave_vertical: 991, 1002, 1065, 1079, 2554, 3364, 4921
mode-box 637
msg commands:
\msg_error:nn . . 1691, 1718, 2793, 2826, 2830, 2884, 2992, 3932, 3936, 4199, 4256, 4311, 4765, 5030, 5042, 5439, 5498
\msg_error:nnn 745, 791, 807, 857, 1642, 1649, 1656, 1687, 1714, 1983, 1987, 2102, 2775, 2834, 2852, 2864, 2872, 2876, 2880, 2888, 2930, 3470, 3488, 3510, 4769, 5035, 5288, 5297, 5381, 5486, 5517, 5526, 5563, 5584
\msg_error:nnnn 2778, 2806, 2810, 2814, 2818, 2933, 3473, 3491, 3513, 3923, 4307, 4315, 5025, 5360, 5566
\msg_error:nnnnn 693, 713, 2307, 2356, 4161
\msg_fatal:nn 3733
\msg_fatal:nnn 591
\msg_info:nnn 9, 12, 17, 20, 395, 408
\msg_line_context: . . 5644, 5649, 5654, 5683, 5688, 5693, 5708, 5723, 5727, 5731, 5735, 5739, 5743, 5750, 5757, 5763, 5777, 5781, 5786, 5790, 5794, 5798, 5803, 5807, 5811, 5815, 5820, 5855, 5859, 5864, 5869, 5873, 5878, 5954, 5958, 5963, 5968, 5973, 5977, 5981, 5985, 5989, 5993, 5997, 6001, 6005
\msg_log:nnn 2122, 2127, 2132
\msg_log:nnnnn 373, 2265, 2270, 2275
\msg_log:nnnnnn 365
\msg_new:nnn 5611, 5615, 5619, 5623, 5628, 5641, 5646, 5651, 5656, 5665, 5673, 5677, 5681, 5686, 5691, 5706, 5721, 5725, 5729, 5733, 5737, 5741, 5745, 5754, 5760, 5766, 5770, 5774, 5779, 5784, 5788, 5792, 5796, 5801, 5805, 5809, 5813, 5818, 5853, 5857, 5862, 5867, 5871, 5876, 5952, 5956, 5961, 5966, 5971, 5975, 5979, 5983, 5987, 5991, 5995, 5999, 6003
\msg_new:nnnn . . 5632, 5823, 5832, 5841, 5847, 5880, 5890, 5900, 5910, 5920, 5930, 5940, 5946
\msg_term:nnnn . 2086, 2091, 3675, 3685, 3717, 3722
\msg_term:nnnnn 2246
\msg_warning:nn 3867, 4005
\msg_warning:nnnn 2283, 2289, 3623, 3628, 4517, 4530, 4566, 4579
\msg_warning:nnnnn 2241, 2251
\multicolsep *105*
\multicolsep 1341, 1513, 3815, 3978

N

\NeedsTeXFormat 3
\NewCommandCopy 382
\newcounter 594
\NewDocumentCommand 1638, 2781, 4303, 5272, 5339, 5446, 5495, 5573
\NewDocumentEnvironment . 3897, 4031, 4244, 4734, 4997
\newenvsc 2895
\newlabel *39*
\newlabel 428
no-store 2136
\noindent 3856, 4625, 4690, 4970, 5248
\nointerlineskip 1350, 1353, 1522, 1525, 1679, 1706, 4625, 4690
noitemsep 932
\nopagebreak 1287, 1315, 1350, 1353, 1522, 1525, 1629, 1635
\normalfont 2740, 3300, 5159
nosep 932

P

Packages:
caption *121*
enumext *29*, *42*, *45*, *71*, *75*, *97*, *102*, *112*, *140*
enumitem *42*
expl3 . . . . . *118*
footnotehyper *38*, *40*, *41*
hyperref *33*, *34*, *38*, *39*, *83*, *93*, *126*, *140*
latex-lab-block *38*
ltcmd *38*
ltsockets *110*
lua-visual-debug *57*
multicol *29*, *140*
scontents *29*, *86*, *87*
shortlst *118*, *122*, *127*
tagpdf *110*
\par . . 1287, 1315, 1353, 1525, 1629, 1635, 1674, 1679, 1701, 1706, 2706, 3832, 3993, 4011, 4289, 4292, 4438, 4652, 4667, 4713, 4727, 4970, 5248
para commands:
\para_end: 4987, 5266
\parbox 2364
\parindent 4952, 5226
\parsep *55*, *113*
\parsep 992, 3708, 4221, 4230
parsep 932
\parskip 4953, 5227
\partopsep 3709, 4009, 4241
partopsep 932
peek commands:
\peek_meaning:NTF 4838, 4852, 4867, 4878, 5081, 5096, 5112
\peek_meaning_remove:NTF 4845, 5088
\peek_remove_spaces:n 3546
\phantomsection *39*
\phantomsection 417
prg commands:
\prg_do_nothing: 421
\prg_new_protected_conditional:Npnn . . . 222
\prg_replicate:nn 239
\prg_return_false: 226
\prg_return_true: 225
\printkeyans *19*, *134*, 5339
prop commands:
\prop_const_from_keyval:Nn 5487

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\prop_count:N 367, 2480, 2631, 2743, 3152, 3303, 5162, 5589
\prop_get:NnNTF 5513
\prop_gput_if_not_in:Nnn 2478
\prop_if_exist:NTF 2120, 5292, 5582
\prop_item:Nn 5294, 5606
\prop_new:N 2123
\ProvidesExplPackage 4

R

\raggedcolumns 3818, 3981
\raisebox 4380
\ref *81*, *91*
ref 720, 766, 837
\refstepcounter 4906, 5198
regex commands:
\regex_match:nnTF . . 224, 883, 885, 897, 899, 2988
\regex_replace_once:nnN 232
\renewcommand 755, 799, 815, 865
\RenewDocumentCommand . 445, 475, 1689, 1716, 3372, 3399, 3415, 3541, 3593, 3605, 4254
\RequirePackage 13, 21
resume 1832
resume* 1832
rightmargin 1012
\Roman *43*, *48*
\Roman 613
\roman *43*, *48*
\roman 614, 738, 5324

S

\s 2989
save-ans 2075
save-key 2418
save-ref 2330
save-sep 2295, 2330, 4151
scan commands:
\scan_stop: 4253, 4747, 5009, 5283, 5286
scontents internal commands:
\l__scontents_fname_out_tl 2948
__scontents_parse_environment_keys:n . 2954
__scontents_rescan_tokens:n 2961
\l__scontents_storing_bool 2946
\l__scontents_writing_bool 2947
seq commands:
\seq_clear:N 5448, 5591
\seq_const_from_clist:Nn 5441
\seq_count:N 368, 4444, 5452
\seq_gclear:N 470, 471, 500, 501
\seq_gput_right:Nn 456, 457, 486, 487, 2487
\seq_if_empty:NTF 463, 493, 5354, 5466
\seq_if_exist:NTF 2125, 5352
\seq_if_in:NnTF 5358
\seq_item:Nn 2986, 4431
\seq_map_function:NN 5457
\seq_map_inline:Nn 5367, 5375, 5467, 5468
\seq_map_pairwise_function:NNN 465, 495
\seq_new:N 120, 121, 123, 143, 174, 175, 176, 177, 2128
\seq_pop_left:NN 5456
\seq_put_right:Nn 4317, 5464, 5480, 5601
\seq_set_from_clist:Nn 5449
\seq_set_map_e:NNn 5458
\seq_use:Nn 204, 205, 5597
series 1832
\setcounter 894, 898, 900, 3666, 3711, 4286
\setenumext *6*, *136*, 5446
\setenumextmeta *6*, *137*, 5487
show-ans 2295, 2330, 4151
show-length 1109
show-pos 2295, 2330, 4151
skip commands:
\skip_add:Nn 1247, 1256, 1265, 1278, 1282, 1306, 1310, 1326, 1384, 1386, 1400, 1403, 1424, 1426, 1440, 1443, 1463, 1465, 1479, 1482, 1501, 1550, 1551, 1562, 1564, 4230, 4239
\skip_gset:Nn 1577, 1581, 1585
\skip_gzero_new:N 1572, 1573
\skip_horizontal:N . . 1080, 1092, 1104, 4924, 4936, 4974, 5210, 5252
\skip_horizontal:n . . 1066, 2555, 2563, 3365, 3367, 4361, 4823, 4922, 4956, 5066, 5230
\skip_if_eq:nnTF 1245, 1254, 1263, 1370, 1410, 1450, 1538, 1574, 1596, 1740, 1754, 1768, 1779, 1790, 1801, 1812, 1823
\skip_new:N . . . 77, 78, 79, 84, 85, 86, 87, 88, 89, 196
\skip_set:Nn 1230, 1234, 1292, 1296, 1320, 1373, 1374, 1392, 1413, 1414, 1432, 1452, 1453, 1471, 1495, 1541, 1542, 1556, 1576, 1580, 1598, 1602, 1606, 1612, 1616, 1620, 4214
\skip_set_eq:NN 1331, 1332, 1334, 1341, 1506, 1507, 1508, 1513, 3664, 3707, 3708, 4953, 5227
\skip_sub:Nn 1380, 1382, 1396, 1398, 1420, 1422, 1436, 1438, 1459, 1461, 1475, 1477, 1548, 1549, 1560, 1561
\skip_use:N 1232, 1236, 1280, 1284, 1288, 1308, 1312, 1322, 1328, 1741, 1745, 1748, 1755, 1759, 1762, 3832
\skip_vertical:N . 578, 581, 1004, 4651, 4665, 4989, 5268
\skip_vertical:n 1003, 4988, 5267
\skip_zero:N 1340, 1354, 1492, 1493, 1494, 1512, 1526, 3709, 3815, 3978, 4241, 4242
\skip_zero_new:N 1571, 1593, 1594, 1595
\c_zero_skip . 578, 581, 1004, 1245, 1254, 1263, 1411, 1450, 1574, 1596, 1741, 1755, 1768, 1779, 1790, 1801, 1812, 1823, 4651, 4665, 4989, 5268
\small 5307, 5313, 5319, 5325, 5331, 5337
\smash 3417, 3607
socket commands:
\socket_assign_plug:nn . . 4079, 4087, 4095, 4131, 4139, 4147
\socket_new:nn 4049, 4099
\socket_new_plug:nnn 4050, 4058, 4066, 4100, 4108, 4117
\socket_use:n 4132, 4140, 4148
\socket_use:nn 4080, 4088, 4096
start 906
start* 906
start-list-tags 4049, 4099
\stepcounter 449, 479, 4224, 4373
stop-list-tags 4049, 4099
stop-start-tags 4049, 4099
str commands:
\c_backslash_str 2834, 5644, 5649, 5654, 5659, 5661, 5663, 5668, 5670, 5768, 5772, 5776, 5786, 5790, 5798, 5799, 5803, 5815, 5816, 5820, 5821, 5842, 5844, 5848, 5850, 5878, 5941, 5943, 5947, 5949, 5958, 5959, 5963, 5968, 5969, 5973, 5977, 5981
\c_colon_str 2630, 3151, 5283
\c_left_brace_str 5749, 5756, 5762
\c_right_brace_str 5749, 5756, 5762
\str_case:nn 252, 311, 3244

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\str_case:nnTF . 1855, 1863, 2457, 2465, 5395, 5404
\str_clear:N 3742, 4779
\str_count:n 239
\str_if_empty:NTF 1872, 1913, 1940
\str_if_eq:nnTF 3667, 3713, 5497
\str_if_in:nnTF 5279
\str_new:N 80, 128, 129, 130, 148, 191
\str_set:Nn . 678, 684, 690, 709, 710, 711, 2303, 2304, 2305, 2352, 2353, 2354, 4156, 4159
\str_set_eq:NN 3267, 5150, 5167
\str_use:N 3421
\strut 3417, 3607
\strutbox . 1359, 1362, 1373, 1374, 1385, 1387, 1402, 1405, 1413, 1414, 1425, 1427, 1442, 1445, 1452, 1453, 1464, 1466, 1481, 1484, 1530, 1533, 1541, 1542, 1550, 1551, 1563, 1565, 1576, 1577, 1580, 1587, 1600, 1608, 1614, 1622, 4233, 4239, 4289, 4297, 4386

T

tag commands:
\tag_mc_begin:n 4056, 4106, 4115
\tag_mc_begin_pop:n 4072, 4124, 4281, 4283
\tag_mc_end: 4060, 4110, 4119
\tag_mc_end_push: 4053, 4103, 4269
\tag_resume:n . . 4052, 4102, 4260, 4268, 4337, 4435, 4635, 4699
\tag_struct_begin:n . 4054, 4055, 4062, 4063, 4064, 4104, 4105, 4112, 4113, 4114, 4270
\tag_struct_end:n 4061, 4068, 4069, 4070, 4071, 4111, 4120, 4121, 4122, 4123, 4280, 4282, 4753, 5015
\tag_suspend:n . 4073, 4125, 4251, 4262, 4275, 4328, 4427, 4745, 5007
\tag_tool:n 4261
TEX and LATEX 2ε commands:
\@auxout 426
\@currenvir 252, 311
\protected@write 426
tex commands:
\tex_newlinechar:D 2960
text commands:
\text_expand:n 5275
\textasteriskcentered 2300, 2347
\textborn 3441
\textreferencemark 2335
\thepage 432
tl commands:
\c_space_tl 3223, 3236, 5693, 5708, 5731, 5735, 5922, 5923, 5932, 5933, 5993, 5997
\tl_clear:N . . 676, 683, 2293, 2404, 2414, 2435, 2443, 2650, 2980, 2981, 3095, 3168, 5118
\tl_clear_new:N 623
\tl_const:Nn 46, 607
\tl_gclear:N . 359, 360, 361, 1893, 1898, 3070, 3410, 3430, 4671, 4731, 4925
\tl_gclear_new:N 1880
\tl_gput_right:Nn 608
\tl_greplace_all:Nnn 629
\tl_gset:Nn 287, 288, 302, 303, 1881, 1894, 1899, 2118, 3341, 4873
\tl_gset_eq:NN 625, 3337, 4918
\tl_if_blank:nTF 2773, 2791, 2928, 3468, 3486, 3508, 4916, 5561
\tl_if_empty:NTF . 743, 761, 789, 805, 824, 831, 855, 871, 1906, 1911, 1933, 1938, 1996, 2060, 2068, 2097, 2157, 2494, 2525, 2670, 3025, 3047, 3077, 3105, 3178, 3216, 3229, 3362, 4442, 5121, 5478
\tl_if_empty:nTF 1961
\tl_if_exist:NTF 1966
\tl_if_novalue:nTF 447, 477, 2787, 3103, 3176, 3209, 3316, 3335, 3343, 3518, 3740, 4205, 4777, 5047, 5119
\tl_map_inline:Nn 230, 626
\tl_new:N 38, 39, 40, 43, 48, 49, 52, 53, 59, 61, 62, 64, 65, 101, 102, 103, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 122, 124, 125, 126, 134, 137, 138, 155, 164, 165, 166, 169, 190
\tl_put_left::Ne 3014
\tl_put_left:Nn 2502, 2533, 2655, 3008, 3021, 3027, 3037, 4655, 4716, 5137, 5140
\tl_put_right:Nn 624, 753, 797, 813, 863, 2506, 2537, 2584, 2594, 2607, 2622, 2628, 2633, 2657, 2662, 2669, 2672, 2682, 2687, 2690, 2696, 3098, 3101, 3107, 3109, 3136, 3141, 3146, 3149, 3158, 3171, 3174, 3180, 3182, 3192, 5123, 5124
\tl_remove_all:Nn 5477
\tl_remove_once:Nn 2572, 3121
\tl_replace_all:Nnn 628, 5512
\tl_reverse:N 2571, 2573, 3120, 3122
\tl_set:Nn . 54, 256, 266, 315, 316, 323, 324, 331, 332, 593, 677, 682, 688, 689, 742, 786, 854, 1063, 1077, 1090, 1102, 1995, 2096, 2405, 2415, 2436, 2444, 2737, 2948, 2984, 3211, 3297, 3456, 4190, 5126, 5156, 5475, 5511, 5581
\tl_set_eq:NN 634, 748, 751, 794, 796, 810, 812, 860, 862, 2570, 3119, 3132, 3265, 5149
\tl_to_str:n 1966, 1972, 1977, 5275
\tl_trim_spaces:n . . . 624, 5464, 5475, 5481, 5497
\tl_use:N 630, 633, 763, 826, 833, 873, 1135, 1139, 1143, 1147, 1151, 1155, 1159, 1163, 1167, 1171, 1175, 1179, 1183, 1187, 1191, 1195, 2560, 2577, 2585, 2596, 2609, 2614, 2625, 3324, 3330, 3358, 3401, 3403, 3409, 3424, 3521, 3525, 3532, 3595, 3598, 3600, 3613, 3904, 4037, 4358, 4366, 4662, 4723, 4929, 4957, 4958, 5207, 5231, 5236, 5342, 5343, 5344, 5345, 5346, 5363, 5460, 5579
token commands:
\token_to_str:N 428
\topsep 4009, 4239
topsep 932
\topskip 1340, 1512

U

\u 233, 2989
\unkern 247
unknown 2751, 3451, 3476, 3494
\unskip 246
use commands:
\use:N 240, 3406, 3427, 3906
\use:n 1846, 2448, 5281, 5386
\use_none:nn 420, 5518
\usecounter 3665, 3710

V

\value 1909, 1915, 1922, 1928, 1936, 1942, 1949, 1955
vbox commands:
\vbox_set:Nn 4330
\vbox_set_top:Nn 4660, 4721
\vspace 992, 1745, 1748, 1759, 1762, 1772, 1774, 1783, 1785, 1794, 1796, 1805, 1807, 1816, 1818, 1827, 1829

W

widest 906
wrap-ans 2330
wrap-ans* 2295, 2330, 4151

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wrap-label 647
wrap-label* 647
wrap-opt 2295, 2330, 4151

Z

\z 2989

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