enumext

ENUMERATE EXERCISE SHEETS

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©2024 by Pablo González†

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

Abstract

This package provides *"enumerated list"* environments for creating *"simple exercise sheets"* along with *"multiple choice questions"*, storing the ⟨*answers*⟩ to these in memory using the `multicol` package and the `l3seq` and `l3prop` modules.

Contents

1 Introduction 2
1.1 Description and usage 3
1.2 The concept of left margin 3
1.3 User interface 3
1.3.1 Internal counters 3
1.3.2 Support for multicol 4
1.3.3 Support for `minipage` 4
1.3.4 The `\label` and `\ref` system . 4
1.3.5 Support for `\footnote` 4
2 The environment `enumext` 4
2.1 The `\item*` in `enumext` 5
2.1.1 Keys for `\item*` in `enumext` . . 5
3 The command `\setenumext` 5
3.1 Keys for `label` and `ref` 6
3.2 Keys for spaces 6
3.2.1 Vertical spaces 7
3.2.2 Horizontal spaces 7
3.3 Keys for add `code` 8
3.4 Keys for `start` and `resume` 8
3.5 Keys for `multicols` 8
3.6 Keys for `minipage` 8
3.6.1 The command `\miniright` . . . 9
3.6.2 The key `miniright` 9
4 The storage system 9
4.1 Keys for storage 9
4.2 Keys for internal `label` and `ref` . . . 10
4.3 Keys for debugging and checking . . . 10
4.4 The command `\anskey` 10
4.5 The environment `keyans` 10
4.5.1 The `\item*` in `keyans` 11
4.6 The environment `keyanspic` 11
4.6.1 The command `\anspic` 12
4.7 Printing stored content 12
4.7.1 The command `\getkeyans` . . . 12
4.7.2 The command `\printkeyans` . 12
5 Full examples 13
6 The way of non-enumerated lists 16
7 References 18
8 Change history 18
9 Index of Documentation 19
10 Implementation 21
11 Index of Implementation 108

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

1 Introduction

In the LaTeX world 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:

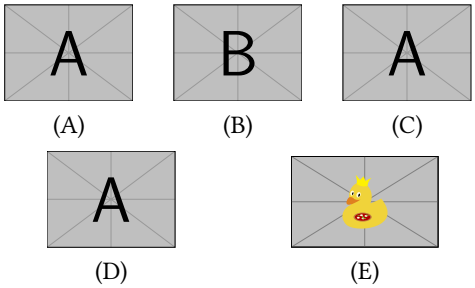
The answer to 3.(b) is "Very True!" and the answer to 4.(c).ii is "very good".

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 *

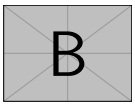
Another very common thing to use in my work is *"multiple choice questions"*, for example:

1. First type of questions
   (A) value
   (B) correct
   (C) value
   (D) value
2. Second type of questions
   I. $2\alpha+2\delta=90^\circ$
   II. $\alpha=\delta$
   III. $\angle EDF=45^\circ$
   (A) I only
   (B) II only
   (C) I and II only
   (D) I and III only
   (E) I, II, and III
⋆ 3. Third type of questions
   (1) $2\alpha+2\delta=90^\circ$
   (2) $\angle EDF=45^\circ$
   (A) value
   (B) value
   (C) value
   (D) value
   (E) value
4. Question with image and label below:



(A) (B) (C) (D) (E)

5. Question with image on left side:
   (A) value
   (B) value
   (C) value
   (D) correct
   (E) value



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

1. (B), $x=5$ *
2. (D) *
3. (C), some note *
4. (B) *
5. (D), "other note" *

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

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

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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[5], 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 `lualatex enumext.dtx` and move all files to appropriate locations, then run `mktexlsr`. To produce the documentation run `lualatex enumext.dtx` two times.

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

The package is loaded in the usual way:

```
\usepackage{enumext}
```

1.2 The concept of left margin

There is a direct relationship between the parameters `\leftmargin`, `\itemindent`, `\labelwidth` and `\labelsep` plus an *"extra space"* that makes it difficult to obtain the desired *horizontal spaces* in a `list` environment.
Usually we don't want the `list` to go beyond the left margin of the page, but since these four values are related, that causes a problem. The enumitem[5] package adds the `\labelindent` parameter to solve some of these problems. A simplified representation of this in the figure 1.

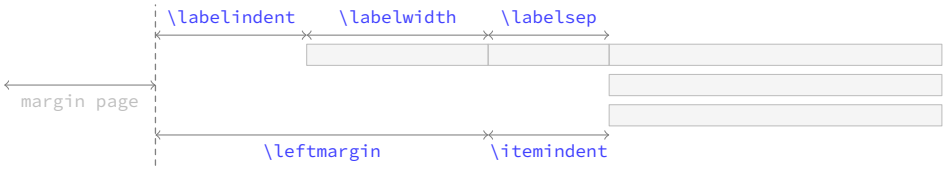

Figure 1: Representation of horizontal lengths in enumitem.

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.

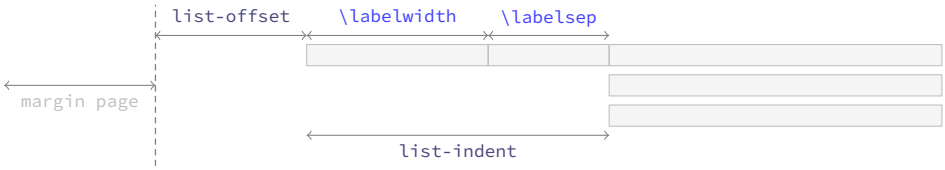

Figure 2: Representation of horizontal lengths concept in enumext.

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.

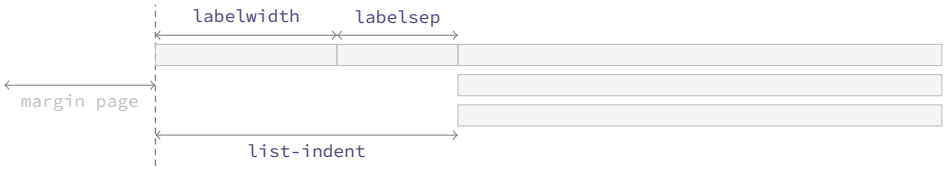

Figure 3: Default horizontal lengths `list-offset=0pt`, `list-indent=\labelwidth+\labelsep` in enumext.

1.3 User interface

The user interface consists in `enumext`, `enumext*`, `keyans`, `keyans*` and `keyanspic` environments, `\anskey`, `\item*` and `\anspic*` commands to ⟨*stored content*⟩, `\getkeyans` command to get the individual ⟨*stored content*⟩, `\printkeyans` to print all ⟨*stored content*⟩, `\miniright` for `minipage` and `\setenumext` to config all [⟨*key* = *val*⟩] options.

1.3.1 Internal counters

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

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

1.3.2 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.

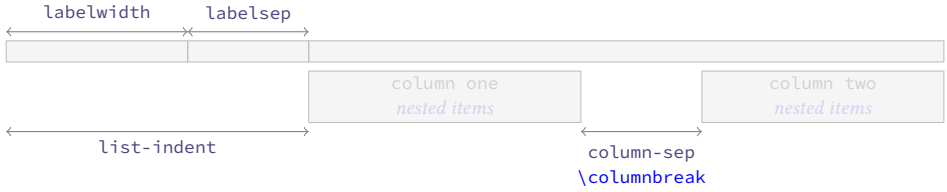

Figure 4: Representation of the two column output for a nested level in enumext environment.

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. The environment is available for all nesting levels, and can can together with the mini-env key. If you need to force a start a new column \columnbreak must be used (see §3.5).

- 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.

1.3.3 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 (left and right) is always used with *"aligned on top"* [t], the minipage environment on the *"right side"* always starts with \centering. It can be used at all nesting levels 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 §3.6).

1.3.4 The \label and \ref system

This package provides a user interface like the enumitem[5] package to customize the references which is activated by the ref key (§3.1), 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 (§4.2) when the key save-ans(§4.1) is active.

- The implementation of \label and \ref together with the save-ref key are compatible with the hyperref[7] package.

1.3.5 Support for \footnote

This package provides an internal implementation for the \footnote command which is compatible with the hyperref package, but, it will not produce the expected links, and when using the mini-env key or the starred environments enumext* and keyans* the output will look like the classic way they are displayed in the minipage environment.
The best way to solve this is to use Jean-François Burnol footnotehyper[8] package, it will support keeping the links if hyperref is loaded with the hyperfootnotes=true option (default) and will show the output numbered at the bottom of the page (as opposed to how it is displayed in the minipage environment). The way to load it is as follows:

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

2 The 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*}
```

The enumext is an *"enumerated list"* 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

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.

```
\begin{enumext}
  \item This text is in the first level.
    \begin{enumext}
      \item This text is in the second level.
        \begin{enumext}
          \item This text is in the third level.
            \begin{enumext}
              \item This text is in the fourth level.
            \end{enumext}
        \end{enumext}
    \end{enumext}
  \item[X] This text is in the first level.
  \item* This text is in the first level.
\end{enumext}
```

2.1 The \item* in enumext

\item* `\item*`
`\item*[⟨symbol⟩]`
`\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 value set by the labelsep key and can be ⟨*offset*⟩ using the second optional argument. The default values for ⟨*symbol*⟩ and ⟨*offset*⟩ are $\star$ '⋆' and the value set by labelsep key.

The *starred version* '*' 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 environment is NOT the same as in the keyans environment.

2.1.1 Keys for \item* in enumext

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

item-pos* = {⟨*rigid length* | *dim expression*⟩} 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.*

3 The command \setenumext

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

The command \setenumext sets the ⟨*keys*⟩ on a global basis for environment enumext, the \printkeyans command and the keyans environment. 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 arguments of environments and commands have the highest precedence, overriding both options passed by \setenumext. If the optional argument is not passed, the first level of the environment enumext will be taken by default.

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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` and `keyanspic` 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.

3.1 Keys for `label` and `ref`

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

Sets the ⟨*label*⟩ that will be printed at the *current level*. The default value for first level are `\arabic*.`, for second level are `(\alph*)`, for third level are `\roman*.` and for fourth level are `\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 reference"* 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` or `wrap-label` keys.

`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., `\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`.

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

`widest` = {⟨*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`}. The {⟨*code*⟩} must be passed between braces. This key does not modify the value set by the `labelwidth` key and is applied only on `\item` and `\item*`. When using it in the `\setenumext` command it is necessary to use the *double hash* '`{##1}`'. For example `wrap-label={\fbox{#1}}` or you can create a command:

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

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

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

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

3.2 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`.

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3.2.1 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 values for first level 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.

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 values for first level 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.

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 are 2.0pt plus 1.0pt minus 1.0pt, for third and fourth level are 1.0pt minus 1.0pt.

The value of this parameter also affects the *inner levels* and the keyans environment. 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 values for first level are 4.0pt plus 2.0pt minus 1.0pt, for the rest of the levels are 2.0pt plus 1.0pt minus 1.0pt.

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

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

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

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

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 on the *"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 on the *"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"*.

3.2.2 Horizontal spaces

itemindent = {⟨*rigid length*⟩} default: *0pt*

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

rightmargin = {⟨*rigid length*⟩} default: *0pt*

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

listparindent = {⟨*rigid length*⟩} default: *0pt*

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

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

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

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

Sets the *indentation* of the whole environment under the box defined by `labelwidth` and `labelsep` keys. Internally sets the value of `\leftmargin` and `\itemindent` for the current level.

If `list-indent=0pt` the ⟨*label*⟩ will be part of the text, separated by the value of the `labelsep` key and the *first word*, in simple terms it will look like a *"common paragraph"*. This setting is equivalent (more or less) to the `wide` key provided by the `enumitem` package.

3.3 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 `\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*⟩`}\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`: `\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.

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

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

3.4 Keys for `start` and `resume`

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

Sets the *start value* of the numbering on the current level. Internally ⟨*string*⟩ is 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`.

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

Sets the *start* to value from the previous of the counter defined by `label` key for the *"first level"*. This ⟨*key*⟩ does not receive an argument. The ⟨*key*⟩ can be overwritten using the `start` key. If the `save-ans` key is present and {⟨*store name*⟩} exist, the numbering will continue according to this key. This key is *"only"* available for the *"first level"* of `enumext`.

3.5 Keys for `multicols`

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

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

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

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

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

3.6 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`.

3.6.1 The command \miniright

\miniright
\miniright*

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

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

3.6.2 The key miniright

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

miniright = {⟨*code for drawing or tabular*⟩} default: *not used*

Set the *code* for the drawing or tabular to be placed in the minipage environment on the *"right side"* by starting it with the command \centering.

miniright* = {⟨*code for drawing or tabular*⟩} default: *not used*

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

4 The storage system

The entire mechanism for *"storing content"* it is activated according to save-ans key on the *"first level"* of enumext environment. Only when this ⟨*key*⟩ is *"active"* the \anskey command and the environments keyans and keyanspic are available.

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

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

4.1 Keys for storage

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 in enumext environment, \item* in keyans and keyans* environments and \anspic* in keyanspic environment. If the ⟨*sequence*⟩ or ⟨*prop list*⟩ does not exist, it will be created globally.

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

Wraps the *current argument* passed \anskey command to referenced by {#1}. The {⟨*code*⟩} must be passed between braces and only affects the ⟨*current argument*⟩ passed to \anskey and NOT the *"stored content"* in the ⟨*store name*⟩ set by save-ans key. If this key is passed using the \setenumext command it is necessary to use double '{##1}'.

wrap-opt = {⟨*code* {#1} *more code*⟩} default: *[{#1}]*

Wraps the *optional argument* passed to the \item* and \anspic* commands referenced by {#1} in the keyans, keyans* and keyanspic environments. The {⟨*code*⟩} must be passed between braces and only affects the current ⟨*optional argument*⟩ and NOT the *"stored content"* in ⟨*store name*⟩ set by save-ans key. If this key is passed using the \setenumext command, it is necessary to use the double '{##1}'.

save-sep = {⟨*text symbol*⟩} default: *{, }*

Sets the *text symbol* that will separate the current ⟨*label*⟩ defined by the label key from the ⟨*optional argument*⟩ (if present), when storing them in the ⟨*store name*⟩ defined by the save-ans key for the \item* command in the keyans and keyans* environment and for the \anspic command in the keyanspic environment. 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.

mark-ans = {⟨*symbol*⟩} default: *\textasteriskcentered*

Sets the *symbol* to be displayed in the left margin of the *"stored content"* in ⟨*store name*⟩ set by save-ans key when using show-ans key.

mark-pos = {⟨*left* | *right*⟩} default: *left*

Sets the aligned of the *symbol* defined by mark-ans key. The *"symbol"* is aligned in a box with the same dimensions of the label box defined by labelwidth key on the current level and separated by the value of the labelsep key.

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4.2 Keys for internal label and ref

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

Activates the internal *"label and ref"* mechanism for referencing *"stored content"* in ⟨*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 ⟨*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 within the environment in which the key save-ans=test was set.

mark-ref = {⟨*symbol*⟩} default: \textasteriskcentered

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

4.3 Keys for debugging and checking

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

Displays the *current* ⟨*argument*⟩ passed to \anskey in enumext environment, the current ⟨*label*⟩ for \item* in keyans environment and the current ⟨*label*⟩ for \anspic* in keyanspic environment at the place where it is executed. If the optional argument is present in \item* or \anspic* it will be shown in square brackets.

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

Displays the *position* occupied by the *"stored content"* by \anskey in enumext environment, \item* in keyans environment and \anspic* in keyanspic environment in ⟨*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. This key works under the logic that each question will contain *"only one answer"*, it is intended to be used in conjunction with no-store key.

no-store ⟨*value forbidden*⟩ default: *not used*

This is a *meta-key* that does not receive an argument. This key is used in conjunction with check-ans and is designed to be used with nested levels of enumext in which the \anskey command will not be used.

4.4 The command \anskey

\anskey \anskey{⟨*content*⟩}

The \anskey command takes a mandatory argument and is triggered by save-ans key. The *"content"* are *"stored"* in ⟨*store name*⟩ set by save-ans key. The command does *"not support"* verbatim content and must NOT be nested. By design it is assumed that each \item or \item* will have a *"single"* occurrence of the command unless a nested level is opened or the no-store key is used. If save-ref key are active and the hyperref[7] package is detected, \hyperlink and \hypertarget will be used, otherwise the usual *"label and ref"* system provided by LaTeX will be used.

Example

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

```
\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}
```

4.5 The environment 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 is an *"enumerated list"* environment designed for *"multiple choice"* questions activated by the save-ans key. This environment 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.

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```
\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` environment and have higher precedence than those set by `\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*)`.

4.5.1 The `\item*` in keyans

`\item*`

```
\item*
\item*[⟨content⟩]
```

The `\item*` and `\item*[⟨content⟩]` command store the current ⟨*label*⟩ set by `label` key next to the ⟨*content*⟩ (if it is present) in ⟨*store name*⟩ set by `save-ans` key in the *"first level"* of the `enumext` environment.

The *starred version* '`*`' 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 *starred version* '`*`' will only appear *"once"* within the environment.

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

Example

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

2. Text containing a question and image.
   (A) Choice
   (B) Choice
   (C) Choice
   (D) Choice
   * (E) [note] Correct choice

Some text

4.6 The environment `keyanspic`

`keyanspic`

```
\begin{keyanspic}[⟨number above, number below⟩]\anspic{⟨drawing⟩}\anspic*[⟨content⟩]{⟨drawing⟩}
```

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

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

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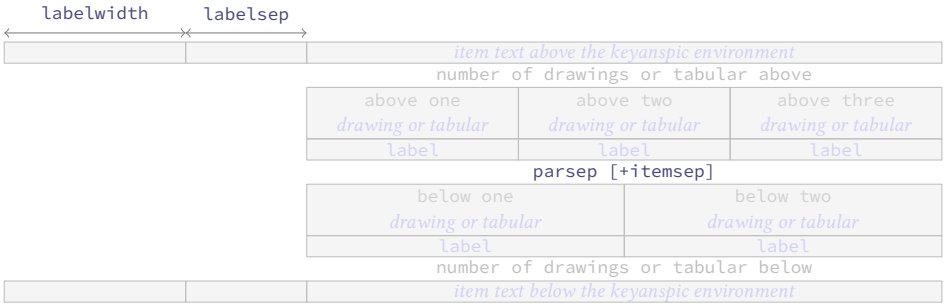

Figure 6: Representation of the keyanspic environment with optional argument [3,2] in enumext.

4.6.1 The command \anspic

\anspic

```
\anspic{⟨drawing or tabular⟩}
\anspic*[⟨content⟩]{⟨drawing or tabular⟩}
```

The \anspic command take three arguments, the *starred version* '*' store the current ⟨*label*⟩ next to the ⟨*content*⟩ (if it is present) in ⟨*store name*⟩ set by save-ans key.

The *starred version* '*' 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 version* '*' will only appear *"once"* within the environment.

Example

```
\begin{enumext}[save-ans=test,show-ans,nosep]
  \item Question with images.
    \begin{keyanspic}[3,2]
      \anspic{\includegraphics[scale=0.15]{example-image-a}}
      \anspic{\includegraphics[scale=0.15]{example-image-b}}
      \anspic{\includegraphics[scale=0.15]{example-image-a}}
      \anspic{\includegraphics[scale=0.15]{example-image-a}}
      \anspic*[note]{\includegraphics[scale=0.15]{example-image-a}}
    \end{keyanspic}
\end{enumext}
```

1. Question with images.

(A)

(B)

(C)

(D)

* (E)[note]

4.7 Printing stored content

4.7.1 The command \getkeyans

\getkeyans

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

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

The *"content"* can only be accessed *"after"* it is stored, if the ⟨*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.

4.7.2 The command \printkeyans

\printkeyans

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

The command \printkeyans prints *"all stored content"* in {⟨*store name*⟩} defined by save-ans key. The *"content"* can only be accessed *"after"* it is stored, if ⟨*store name*⟩ does not exist the command will return an error.

Internally it places the *"stored content"* inside the enumext environment with default values for label key are the same as those of the enumext environment along with the keys: nosep,first=\small,font=\small for all levels, except for the first one that adds the columns=2 key.

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The optional argument allows to handle the ⟨*keys*⟩ *"on the first level"* of the `enumext` environment encapsulated by the command. If need to pass options for nested levels use `\setenumext[`⟨*print , level*⟩`]{`⟨*store name*⟩`}`.

Example

```
\begin{enumext}[save-ans=sample,columns=2,show-pos=true,nosep,save-ref=true]
  \item Factor $3x+3y+3z$. \anskey{$3(x+y+z)$}
  \item True False

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

5 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.

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

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

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

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

Example 2

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

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

   A $36\,\text{km/h}$.
   ✓ B $360\,\text{km/h}$.
   C $27{,}8\,\text{km/h}$.
   D $3{,}60 \times 10^{8}\,\text{km/h}$.

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

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

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

   A $36\,\text{km/h}$.
   ✓ B $360\,\text{km/h}$.
   C $27{,}8\,\text{km/h}$.
   D $3{,}60 \times 10^{8}\,\text{km/h}$.

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

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

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

Example 3

A *"simple multiple choice"* test .

1. First type of questions
   - (A) value
   - (B) correct
   - (C) value
   - (D) value
2. Second type of questions

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

   II. $\alpha = \delta$

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

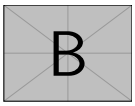
   - (A) I only
   - (B) II only
   - (C) I and II only
   - (D) I and III only
   - (E) I, II, and III
3. Third type of questions

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

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

   - (A) value
   - (B) value
   - (C) value
   - (D) value
   - (E) value
4. Question with image and label below:

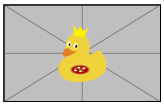
   (A)

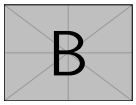
   (B)

   (C)

   (D)

   (E)
5. Question with image on left side:

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

Test keys

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

Example 4

A *"simple worksheet"* using ducks :) .

Factor $x^2 - 2x + 1$

Factor $3x + 3y + 3z$

The following questions need to be cuaqtified :)

True False

(a) $\alpha > \delta$

(b) 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)

6 The way of non-enumerated lists

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

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

Fake `itemize` environment

Here we set the `label` key using the default settings in 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.

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*` key comes into play. Unlike the `enumitem` package, the `align` key only supports three options, so what we will do is create a command in the style `\parleft` of `enumitem` that allows us to place *multiline labels* using `\parbox`.

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

Now we just need to set `wrap-label*={\itembx{#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.
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`[4] 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`[10] and `l3seq`[10] modules together with the `hyperref`[7] and `enumitem`[5] 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.

7 References

[1] Hirschhorn, Philip. "Using the exam document class". Available from CTAN, `https://www.ctan.org/pkg/exam`, 2023.

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[5] Bezos, Javier. "Customizing lists with the enumitem package". Available from CTAN, `https://www.ctan.org/pkg/enumitem`, 2019

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[8] Burnol, Jean-François. "The footnotehyper package". Available from CTAN, `https://www.ctan.org/pkg/footnotehyper`, 2021.

[9] The LaTeX Project. "The expl3 package". Available from CTAN, `https://www.ctan.org/pkg/l3kernel`, 2024.

[10] The LaTeX Project. "The LaTeX3 Interfaces". Available from CTAN, `https://www.ctan.org/pkg/l3kernel`, 2024.

[11] The LaTeX Project. "The xparse package". Available from CTAN, `https://www.ctan.org/pkg/xparse`, 2024.

[12] Gundlach, Patrick. "The lua-visual-debug package". Available from CTAN, `https://www.ctan.org/pkg/lua-visual-debug`, 2023.

[13] Lemvig, Mogens. "The shortlst package". Available from CTAN, `https://www.ctan.org/pkg/shortlst`, 1998.

[14] Niederberger, Clemens. "tasks – Horizontally columned lists". Available from CTAN, `https://www.ctan.org/pkg/tasks`, 2022.

8 Change history

v1.0 2024-05-17 – First public release.

9 Index of Documentation

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

C

Document class:
- article . . . 2
- book . . . 2
- exam . . . 3
- letter . . . 2
- report . . . 2

\columnbreak . . . 5
\columnsep . . . 9

Commands provide by enumext:
- \anskey . . . 4, 10, 11
- \anspic* . . . 4, 10–13
- \anspic . . . 10, 12, 13
- \getkeyans . . . 4, 11, 13
- \item* . . . 4–7, 10–12
- \item . . . 6, 7, 9–11
- \miniright . . . 4, 5, 10
- \printkeyans . . . 4, 6, 11, 13
- \setenumext . . . 4, 6, 7, 10, 12, 14

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:
- enumext* . . . 4, 5, 10
- enumext . . . 4–6, 9–14, 17
- keyans* . . . 4, 5, 10
- keyanspic . . . 4, 7, 10–13, 17
- keyans . . . 4–12, 17

Environments:
- enumerate . . . 1, 3, 4, 6, 19
- list . . . 4, 9, 19
- minipage . . . 3–5, 9, 10, 19
- multicols . . . 3, 5, 9

I

\item . . . 4, 5
\itemsep . . . 8

K

Keys for environments provide by enumext:
- above* . . . 8
- above . . . 8
- after . . . 9, 10
- align . . . 7, 18
- before* . . . 9
- before . . . 9
- below* . . . 8
- below . . . 8
- check-ans . . . 11
- columns-sep . . . 5, 9
- columns . . . 5, 8, 9
- first . . . 9
- font . . . 7
- item-pos* . . . 6
- item-sym* . . . 6
- itemindent . . . 8
- itemsep . . . 8, 12
- labelsep . . . 4, 6–10, 18
- labelwidth . . . 4, 6, 7, 9, 10, 18
- label . . . 7, 9, 10, 12, 13, 17, 18
- list-indent . . . 4, 8, 9
- list-offset . . . 4, 8, 18
- listparindent . . . 8
- mark-ans . . . 10
- mark-pos . . . 10
- mark-ref . . . 11
- mini-env . . . 5, 8, 9
- mini-sep . . . 5, 9
- miniright* . . . 10
- miniright . . . 10
- no-store . . . 11
- noitemsep . . . 8
- nosep . . . 8, 17
- parsep . . . 8, 12
- partopsep . . . 8
- ref . . . 5, 7
- resume . . . 9
- rightmargin . . . 8
- save-ans . . . 5, 9–13
- save-ref . . . 5, 7, 11, 13
- save-sep . . . 10
- show-ans . . . 10, 11
- show-length . . . 7
- show-pos . . . 10, 11, 13
- start . . . 9
- topsep . . . 8
- widest . . . 7
- wrap-ans . . . 10
- wrap-label* . . . 7, 18
- wrap-label . . . 7
- wrap-opt . . . 10

L

\label . . . 5

Labels provide by enumext:
- \Alph* . . . 7, 12
- \Roman* . . . 7
- \alph* . . . 7
- \arabic* . . . 7
- \roman* . . . 7

\labelsep . . . 4, 7
\labelwidth . . . 4, 7
\linewidth . . . 9
\listparindent . . . 8

P

Packages:
- enumerate . . . 18
- enumext . . . 1–4, 13, 18, 19
- enumitem . . . 4, 5, 9, 18, 19
- footnotehyper . . . 5
- hyperref . . . 5, 11, 19
- l3prop . . . 1, 19
- l3seq . . . 1, 19

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multicol 1, 2, 5, 19
xsim 3
\parsep 8
\partopsep 8

R

\raggedcolumns 5
\ref 5
\rightmargin 8

T

\topsep 8

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10 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.

10.1 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.

10.2 Initial set up

Start the DocStrip guards.

```
⟨*package⟩
```

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

```
⟨@@=enumext⟩
```

10.3 Declaration of the package

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

```
\NeedsTeXFormat{LaTeX2e}[2023-11-01]
```

Now declare the enumext package.

```
\ProvidesExplPackage
  {enumext}
  {2024-05-17}
  {1.0}
  {Enumerate exercise sheets}
```

Finally check if the `multicol` package is 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}[2023-03-30]
      }
  }
```

10.4 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_keyans_level_int`
`\l__enumext_keyans_level_h_int`
`\l__enumext_keyans_pic_level_int`
`\l__enumext_starred_bool`
`\g__enumext_starred_bool`
`\l__enumext_starred_level_one_bool`
`\l__enumext_standar_bool`
`\g__enumext_standar_bool`
`\l__enumext_standar_level_one_bool`
`\l__enumext_keyans_env_bool`

Integer variables will control the nesting levels of the environments and boolean variables will be used to determine if they are present (nested) in each other. The boolean variables `\g__enumext_starred_bool` and `\g__enumext_standar_bool` will be set to *"true"* when the `enumext` and `enumext*` environments are not nested with each other.

```
\int_new:N  \l__enumext_level_int
\int_new:N  \l__enumext_level_h_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
\bool_new:N \l__enumext_starred_bool
\bool_new:N \g__enumext_starred_bool
```

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```
\bool_new:N \l__enumext_starred_level_one_bool
\bool_new:N \l__enumext_standar_bool
\bool_new:N \g__enumext_standar_bool
\bool_new:N \l__enumext_standar_level_one_bool
\bool_new:N \l__enumext_keyans_env_bool
```

(*End of definition for* `\l__enumext_level_int` *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` and then modified by the function `\__enumext_label_style:Nnn` used by `label` key (§10.8).

```
\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.*)

`\g__enumext_resume_int`
`\g__enumext_resume_vii_int`
`\l__enumext_resume_name_tl`
`\l__enumext_resume_active_bool`
`\g__enumext_item_symbol_tl`
`\g__enumext_standar_series_tl`
`\g__enumext_starred_series_tl`

The boolean variable `\l__enumext_resume_bool` is used by `resume` key, the value from which the environment's will start is stored in the integer variable `\g__enumext_resume_int` (§??). The global token list `\g__enumext_item_symbol_tl` is used by `item-sym*` key (§10.27).

```
\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_item_symbol_tl
\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` (§10.12) and `label` (§10.10) 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 (§10.14).
The variables `\l__enumext_leftmargin_X_dim` and `\l__enumext_itemindent_X_dim` are used (and set) by the function `\__enumext_calc_hspace:NNNNNNNNNNNN` (§10.31) which determines the internal values for `\leftmargin` and `\itemindent`.

```
\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`

Internal variables used by `columns` key §10.18).

```
\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 }
  }
\clist_map_inline:nn { i, ii, iii, iv, v } { \__enumext_tmp:n {#1} }
```

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

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

Internal variables used by `\miniright` command (§10.19.4) and the keys `miniright`, `miniright*`, `mini-env` and `mini-sep` (§10.17, §10.19).

```
\int_new:N  \g__enumext_minipage_stat_int
\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 integer variable `\l__enumext_start_X_int` are used by the `start` key (§10.12), the token list `\l__enumext_fake_item_indent_X_tl` is used by `itemindent` key, the variables `\l__enumext_label_fill_left_X_tl` and `\l__enumext_label_fill_left_X_tl` are used by the `align` key (§10.10). 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

```
\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_columns_join_int
\l__enumext_store_keyans_label_tl
\l__enumext_store_keyans_item_opt_tl
\l__enumext_keyans_item_opt_tl
\l__enumext_keyans_tmpa_tl
\l__enumext_keyans_tmpb_tl
\l__enumext_keyans_tmpa_dim

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

The variable `\l__enumext_store_name_tl` sets the name for the storage in ⟨*sequence*⟩ and ⟨*prop list*⟩, the variable `\g__enumext_store_name_tl` is just a copy of the storage name used by the `check-ans` key (§??).

The variable `\l__enumext_store_anskey_arg_tl` stores the contents of `\anskey` (§10.25) and the variable `\l__enumext_store_keyans_label_tl` stores the contents of `\item*` (§10.29.2) for the `keyans` and `keyans*` environments and the contents of `\anspic*` (§10.35.1) for the `keyanspic` environment.

The variable `\l__enumext_keyans_tmpa_tl` is a temporary variable used by `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
\int_new:N  \l__enumext_store_columns_join_int
\tl_new:N   \l__enumext_store_keyans_label_tl
\tl_new:N   \l__enumext_store_keyans_item_opt_tl
\tl_new:N   \l__enumext_keyans_item_opt_tl
\tl_new:N   \l__enumext_keyans_tmpa_tl
\tl_new:N   \l__enumext_keyans_tmpb_tl
\dim_new:N  \l__enumext_keyans_tmpa_dim
```

(*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` (§10.40).

```
\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.*)

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\l__enumext_store_opt_X_tl
\l__enumext_print_keyans_X_tl
\l__enumext_store_columns_X_bool
\l__enumext_store_columns_X_int
\l__enumext_store_columns_sep_X_bool
\l__enumext_store_columns_sep_X_dim
\l__enumext_store_upper_level_X_bool

Internal variables used by [⟨*key* = *val*⟩] in `enumext` and `enumext*` environment, the command `\printkeyans` (§10.39) and the keys `columns*` and `columns-sep*`.

```
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \tl_new:c { l__enumext_store_opt_#1_tl             }
    \tl_new:c { l__enumext_print_keyans_#1_tl          }
    \bool_new:c { l__enumext_store_columns_#1_bool     }
    \int_new:c { l__enumext_store_columns_#1_int       }
    \bool_new:c { l__enumext_store_columns_sep_#1_bool }
    \dim_new:c { l__enumext_store_columns_sep_#1_dim   }
    \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_store_opt_X_tl` *and others.*)

\l__enumext_show_answer_bool
\l__enumext_show_position_bool
\l__enumext_mark_ref_sym_tl
\l__enumext_mark_answer_sym_tl
\l__enumext_mark_position_str

Internal variables for *"storage system"* mechanism used by `\anskey` (§10.25), `keyans` and `keyanspic` environments. These variables are used by `show-ans`, `show-pos`, `mark-ans`, `save-key` and `mark-ref` keys (§10.24).

```
\bool_new:N \l__enumext_show_answer_bool
\bool_new:N \l__enumext_show_position_bool
\tl_new:N   \l__enumext_mark_ref_sym_tl
\tl_new:N   \l__enumext_mark_answer_sym_tl
\str_new:N  \l__enumext_mark_position_str
```

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

\l__enumext_keyans_pic_body_seq
\l__enumext_keyans_pic_width_dim
\l__enumext_keyans_pic_above_int
\l__enumext_keyans_pic_below_int
\l__enumext_keyans_pic_above_skip

Internal variables used by `keyanspic` environment (§10.35.2).

```
\seq_new:N  \l__enumext_keyans_pic_body_seq
\dim_new:N  \l__enumext_keyans_pic_width_dim
\int_new:N  \l__enumext_keyans_pic_above_int
\int_new:N  \l__enumext_keyans_pic_below_int
\skip_new:N \l__enumext_keyans_pic_above_skip
```

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

\l__enumext_store_ans_bool
\l__enumext_check_ans_bool
\g__enumext_check_ans_show_bool
\g__enumext_check_ans_show_h_bool
\g__enumext_check_ans_item_tl
\g__enumext_count_item_anskey_int
\g__enumext_count_item_number_int

Internal variables used by *"check answer"* mechanism (§10.23) controlled by the `check-ans` and `no-store` keys.

```
\bool_new:N \l__enumext_store_ans_bool
\bool_new:N \l__enumext_check_ans_bool
\bool_new:N \g__enumext_check_ans_show_bool
\bool_new:N \g__enumext_check_ans_show_h_bool
\tl_new:N   \g__enumext_check_ans_item_tl
\int_new:N  \g__enumext_count_item_anskey_int
\int_new:N  \g__enumext_count_item_number_int
\int_new:N  \g__enumext_standar_star_env_int
\int_new:N  \g__enumext_starred_star_env_int
\int_new:N  \g__enumext_starred_keyans_star_env_int
\int_new:N  \g__enumext_standar_keyans_star_env_int
\int_new:N  \g__enumext_standar_keyans_pic_star_env_int
```

(*End of definition for* `\l__enumext_store_ans_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 (§10.7). 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_store_write_aux_file_tl
\l__enumext_label_copy_X_tl

Internal variables are used when executing the `save-ref` key. 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` and the variable `\l__enumext_store_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_store_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_int` `\g__enumext_footnote_arg_seq` `\g__enumext_footnote_int_seq`

Internal variables used for redefinition of `\footnote`.

```
\int_new:N \g__enumext_footnote_int
\seq_new:N \g__enumext_footnote_arg_seq
\seq_new:N \g__enumext_footnote_int_seq
```

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

`\c__enumext_counter_style_tl` `\l__enumext_ref_key_arg_tl` `\l__enumext_ref_aux_tl` `\l__enumext_the_counter_X_tl` `\l__enumext_counter_style_for_ref_X_tl`

Internal variables used by `ref` key (§10.17, §10.18).

```
\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_aux_tl
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \tl_new:c  { l__enumext_counter_style_for_ref_#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.*)

`\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_item_text_X_box` `\l__enumext_joined_width_X_dim` `\l__enumext_item_width_X_dim` `\g__enumext_item_symbol_aux_X_tl` `\l__enumext_align_label_X_str` `\g__enumext_minipage_active_X_bool` `\g__enumext_miniright_code_X_tl` `\g__enumext_minipage_center_X_bool` `\g__enumext_minipage_right_X_dim` `\g__enumext_minipage_right_X_skip`

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

```
\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             }
    \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 }
    \tl_new:c   { g__enumext_miniright_code_#1_tl    }
    \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`.)

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10.5 Some utility functions

__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

A internal *"hook"* function for execute code `minirigth` and `minirigth*` 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}
  }
```

(*End of definition for* `\__enumext_after_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_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_zero_count_level:

Internal function used by `check-ans` key.

```
\cs_set_protected:Nn \__enumext_zero_count_level:
  {
    \cs_set_protected:Npn \__enumext_tmp:n ##1
      {
        \int_gzero:c { g__enumext_count_level_##1_int }
      }
    \clist_map_inline:nn { i, ii, iii, iv, vii } { \__enumext_tmp:n {##1} }
  }
```

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

__enumext_current_env_set_bool:

The function `\__enumext_current_env_set_bool:` will set the global variables `\g__enumext_standar_bool` and `\g__enumext_starred_bool` with which we will distinguish whether the environments `enumext` and `enumext*` are nested in each other. This function is passed to the `\__enumext_safe_exec:` function in the definition of the `enumext` environment (pag 76) and to the `\__enumext_safe_exec_vii:` function in the definition of the `enumext*` environment (pag 89).

```
\cs_new_protected:Nn \__enumext_current_env_set_bool:
  {
```

```
    \str_case:en { \@currenvir }
      {
        {enumext}
          {
            \bool_lazy_and:nnT
              { \bool_not_p:n { \g__enumext_standar_bool } }
              { \int_compare_p:nNn { \l__enumext_level_h_int } = { \c_zero_int } }
              {
                \bool_gset_true:N \g__enumext_standar_bool
                \int_gset:Nn \g__enumext_standar_star_env_int { \inputlineno }
                \typeout{working-on-enumext}
              }
          }
        {enumext*}
          {
            \bool_lazy_and:nnT
              { \bool_not_p:n { \g__enumext_starred_bool } }
              { \int_compare_p:nNn { \l__enumext_level_int } = { \c_zero_int } }
              {
                \bool_gset_true:N \g__enumext_starred_bool
                \int_gset:Nn \g__enumext_starred_star_env_int { \inputlineno }
                \typeout{working-on-enumext*}
              }
          }
      }
  }
```

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

10.6 Copying `list` and `minipage` environments

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

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

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

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

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

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

(*End of definition for* `\__enumext_start_list:nn`, `\__enumext_stop_list:`, *and* `\__enumext_item_std:w`.)

The `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 `minipage` environment or a related command.

`\__enumext_minipage:w`
`\__enumext_endminipage:`

The functions `\__enumext_minipage:w`, `\__enumext_endminipage:` and correspond to copies of `\minipage`, `\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_minipage:w` *and* `\__enumext_endminipage:`.)

10.7 Compatibility with hyperref and footnotehyper

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 }
```

__enumext_after_hyperref:
__enumext_hypertarget:nn
__enumext_phantomsection:

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

```
\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}
          {
            \typeout{hyperfootnotes=true}
            \bool_set_true:N \l__enumext_footnotes_key_bool
          }
          { \typeout{hyperfootnotes=false} }
      }
      {  }
```

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 }
          }
          {
            \typeout{No ~ footnotehyper ~ load}
            \typeout{Load ~ and  ~ use  ~ \string\makesavenoteenv{enumext*}}
            \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`.)

10.8 Definition of counters

`\__enumext_define_counters:Nn`
`\__enumext_define_counters:cn`

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

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

```
\cs_new_protected:Npn \__enumext_define_counters:Nn #1 #2
  {
    \cs_if_exist:cTF { c@ #2 }
      { \msg_fatal:nnn { enumext } { counters }{ #2 } }
      {
        \tl_set:Nn #1 { #2 }
        \newcounter { #2 }
      }
  }
```

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

`enumXi` `enumXii` `enumXiii` `enumXiv` `enumXv` `enumXvi` `enumXvii` `enumXviii`

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.

```
\__enumext_define_counters:Nn \l__enumext_counter_i_tl    { enumXi    }
\__enumext_define_counters:Nn \l__enumext_counter_ii_tl   { enumXii   }
\__enumext_define_counters:Nn \l__enumext_counter_iii_tl  { enumXiii  }
\__enumext_define_counters:Nn \l__enumext_counter_iv_tl   { enumXiv   }
\__enumext_define_counters:Nn \l__enumext_counter_v_tl    { enumXv    }
\__enumext_define_counters:Nn \l__enumext_counter_vi_tl   { enumXvi   }
\__enumext_define_counters:Nn \l__enumext_counter_vii_tl  { enumXvii  }
\__enumext_define_counters:Nn \l__enumext_counter_viii_tl { enumXviii }
```

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

10.9 Definition of labels

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

`\__enumext_register_counter_style:Nn`

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

```
\cs_new_protected:Npn \__enumext_register_counter_style:Nn #1 #2
  {
    \tl_const:cn { c__enumext_widest_ \cs_to_str:N #1 _tl } {#2}
    \tl_gput_right:Nn \g__enumext_counter_styles_tl {#1}
  }
\__enumext_register_counter_style:Nn \arabic { 0 }
\__enumext_register_counter_style:Nn \Alph   { M }
\__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.)

10.10 Setting keys associated with label

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.*)

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

align

The align key is implemented differently for *"starred"* and *"non starred"* environments.

```
\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 }
                         },
        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 }
                         },
        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 }
                         },
        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 }
```

Definition of `align` key for `enumext*` and `keyans*` environments.

```
\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 .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`.)

10.11 Setting `label` and `ref` keys

`\__enumext_regex_label_ref_key:`

The internal function `\__enumext_regex_label_ref_key:` replace the * with the actual counter of the running level and is used by the `\__enumext_set_label_ref:n` function.
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_label_ref_key:
  {
    \tl_map_inline:Nn \c__enumext_counter_style_tl
      {
        \regex_replace_once:nnN { \c{##1}\* }
          { \c{##1}\cB{\u{l__enumext_ref_aux_tl}\cE} } \l__enumext_ref_key_arg_tl
      }
  }
```

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

`\__enumext_set_label_ref:n`

The `\__enumext_set_label_ref:n` function controlled by the `ref` key is in charge of handling the customization of the reference system.
First we will set the variable `\l__enumext_the_counter_X_tl` according to the command created for *each counter*, apply the *regex* function `\__enumext_regex_label_ref_key:` and then renew the command and save it in the variable `\l__enumext_counter_style_for_ref_X_tl`.

```
\cs_new_protected:Npn \__enumext_set_label_ref:n #1
  {
    \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
```

```
    \tl_set_eq:Nc \l__enumext_ref_aux_tl { l__enumext_counter_ \__enumext_level: _tl }
    \__enumext_regex_label_ref_key:
    \tl_set_eq:Nc \l__enumext_ref_aux_tl { l__enumext_the_counter_ \__enumext_level: _tl }
    \tl_put_right:ce { l__enumext_counter_style_for_ref_ \__enumext_level: _tl }
      {
        \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_aux_tl }
          { \exp_not:V \l__enumext_ref_key_arg_tl }
      }
  }
```

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

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

```
\cs_new_protected:Nn \__enumext_use_key_ref:
  {
    \tl_if_empty:cF { l__enumext_counter_style_for_ref_ \__enumext_level: _tl }
      {
        \tl_use:c { l__enumext_counter_style_for_ref_ \__enumext_level: _tl }
      }
  }
```

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

For `enumext*` and `keyans*` environments the situation is a bit different since `hyperref` interferes here (I am not clear why), so we will define a new function to execute the task.
To handle that we will look at the nesting level of the starred environments, later I will run the constraint functions to make everything OK.

`\__enumext_set_label_ref_h:n` The `\__enumext_set_label_ref_h:n` function controlled by the `ref` key is in charge of handling the customization of the reference system.
First we will set the variable `\l__enumext_the_counter_X_tl` according to the command created for *each counter*, apply the *regex* function `\__enumext_regex_label_ref_key:` and then renew the command and save it in the variable `\l__enumext_counter_style_for_ref_X_tl`.

```
\cs_new_protected:Npn \__enumext_set_label_ref_h:n #1
  {
    \tl_set:Nn \l__enumext_ref_key_arg_tl {#1}
    \int_compare:nNnTF { \l__enumext_level_h_int } = { 1 }
      {
        \tl_set_eq:NN \l__enumext_ref_aux_tl \l__enumext_counter_vii_tl
        \__enumext_regex_label_ref_key:
        \tl_set_eq:NN \l__enumext_ref_aux_tl \l__enumext_the_counter_vii_tl
        \tl_put_right:Ne \l__enumext_counter_style_for_ref_vii_tl
          {
            \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_aux_tl }
              { \exp_not:V \l__enumext_ref_key_arg_tl }
          }
      }
      {
        \tl_set_eq:NN \l__enumext_ref_aux_tl \l__enumext_counter_viii_tl
        \__enumext_regex_label_ref_key:
        \tl_set_eq:NN \l__enumext_ref_aux_tl \l__enumext_the_counter_viii_tl
        \tl_put_right:Ne \l__enumext_counter_style_for_ref_vii_tl
          {
            \exp_not:N \renewcommand { \exp_not:V \l__enumext_ref_aux_tl }
              { \exp_not:V \l__enumext_ref_key_arg_tl }
          }
      }
  }
```

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

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

```
\cs_new_protected:Nn \__enumext_use_key_ref_h:
  {
    \int_compare:nNnTF { \l__enumext_level_h_int } = { 1 }
      {
        \tl_if_empty:NF \l__enumext_counter_style_for_ref_vii_tl
          {
            \tl_use:N \l__enumext_counter_style_for_ref_vii_tl
```

```
      }
    }
    {
      \tl_if_empty:NF \l__enumext_counter_style_for_ref_viii_tl
        {
          \tl_use:N \l__enumext_counter_style_for_ref_viii_tl
        }
    }
}
```

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

10.11.1 Define and set `label` key 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.

```
\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_set_label_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.*)

10.11.2 Define and set `label` key 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.

```
\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_set_label_ref_h: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.*)

10.11.3 Define and set `label` key for `keyans` and `keyanspic` environment

`label` `\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`. The `keyanspic` environment use the same ⟨*label*⟩ as the `keyans` environment. Define and set `label` key for `keyans` environment.

```
\keys_define:nn { enumext / keyans }
  {
    label .code:n    = {
                         \__enumext_label_style:cvn { l__enumext_label_v_tl }
                           { l__enumext_counter_v_tl } {#1}
```

```
                        \dim_set_eq:cN  { l__enumext_labelwidth_v_dim }
                          \l__enumext_current_widest_dim
                        \__enumext_label_style:cvn { l__enumext_label_vi_tl }
                           { l__enumext_counter_vi_tl } {#1}
                        \dim_set_eq:cN  { l__enumext_labelwidth_v_dim }
                           \l__enumext_current_widest_dim
                      },
    label .initial:n = (\Alph*),
    label .value_required:n = true,
  }
```

(*End of definition for* `label`, `\l__enumext_label_v_tl`, *and* `\l__enumext_label_vi_tl`.)

10.12 Setting `start` and `widest` keys

`\__enumext_start_from:NNn`
`\__enumext_start_from:ccn`

The function `\__enumext_start_from:NNn` used by the `start` key 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 }
```

(*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`
`widest`
`\l__enumext_start_X_int`

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

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

10.13 Setting keys for vertical spaces

topsep
partopsep
parsep
noitemsep
nosep

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

10.14 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` 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 \c__enumext_all_envs_clist { \__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:n #1
  {
    \keys_define:nn { enumext / #1 } { list-indent .initial:n  = 0pt, }
  }
\clist_map_inline:nn { enumext*, keyans* } { \__enumext_tmp:n {#1} }
```

10.14.1 Functions for setting the fake `itemindent`

__enumext_fake_item:
__enumext_keyans_fake_item:
__enumext_fake_item_vii:
__enumext_fake_item_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:
  {
    \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 } }
            \ignorespaces
          }
      }
   }
\cs_set_protected:Nn \__enumext_keyans_fake_item:
  {
    \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
          }
      }
   }
\cs_set_protected:Nn \__enumext_fake_item_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 \mode_leave_vertical:
            \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_vii_dim
          }
      }
  }
\cs_set_protected:Nn \__enumext_fake_item_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 \mode_leave_vertical:
            \exp_not:N \skip_horizontal:N \l__enumext_fake_item_indent_viii_dim
          }
      }
  }
```

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

10.15 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`.)

10.16 Setting before, after and first keys

before
before*
after
first

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

10.16.1 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 *second argument* of the list.

```
\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⟩.

```
\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.

```
\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.

```
\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.*)

10.16.2 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:

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

```
\cs_new_protected:Nn \__enumext_before_args_exec_v:
  {
    \tl_use:N \l__enumext_before_starred_key_v_tl
  }
```

The function __enumext_before_keys_exec_v: executes the {⟨code⟩} set by the before key *"before"* the keyans environment is started in {⟨arg two⟩} of the list. The {⟨code⟩} is executed *"knowing"* all definition and values provides by ⟨keys⟩.

```
\cs_new_protected:Nn \__enumext_before_keys_exec_v:
  {
    \tl_use:N \l__enumext_before_no_starred_key_v_tl
  }
```

The function __enumext_after_stop_list_v: executes the {⟨code⟩} set by the after key *"after"* the keyans environment has finished.

```
\cs_new_protected:Nn \__enumext_after_stop_list_v:
  {
    \tl_use:N \l__enumext_after_stop_list_v_tl
  }
```

The function __enumext_after_args_exec_v: executes the {⟨code⟩} set by the first key after the end of {⟨arg two⟩} of the list defining the keyans environment, just before the first occurrence of \item.

```
\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.*)

10.16.3 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:

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

```
\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
  }
```

The functions `\__enumext_before_keys_exec_vii:` and `\__enumext_before_keys_exec_viii:` executes the {⟨*code*⟩} set by the `before` key *"before"* in `enumext*` and `keyans*` environments is started in {⟨*arg two*⟩} of the list. The {⟨*code*⟩} is executed *"knowing"* all definition and values provides by ⟨*keys*⟩.

```
\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
  }
```

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

```
\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
  }
```

The function `\__enumext_after_args_exec_v:` executes the {⟨*code*⟩} set by the `first` key after the end of {⟨*arg two*⟩} of the list defining the `keyans` environment, just before the first occurrence of `\item`.

```
\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.*)

10.17 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` 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 default value for `columns` key are `2` and the command `\miniright` is not available, so we will add the keys `miniright` and `miniright*` to implement support for `minipage`.

```
\cs_set_protected:Npn \__enumext_tmp:nn #1 #2
  {
    \keys_define:nn { enumext / #1 }
      {
        columns    .initial:n = 2,
        miniright  .tl_gset:c = { g__enumext_miniright_code_#2_tl },
        miniright  .value_required:n = true,
        miniright* .code:n    = {
```

```
                                \bool_gset_true:c { g__enumext_minipage_center_#2_bool }
                                \keys_set:nn { enumext / #1 } { miniright = {##1} }
                              },
        miniright* .value_required:n = true,
      }
  }
\clist_map_inline:nn { {enumext*}{vii}, {keyans*}{viii} } { \__enumext_tmp:nn #1 }
```

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

10.18 Adjustment of vertical spaces for `multicols`

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

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

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

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

10.18.1 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:`.)

10.18.2 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:`.)

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10.19 Adjustment of vertical spaces for minipage

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

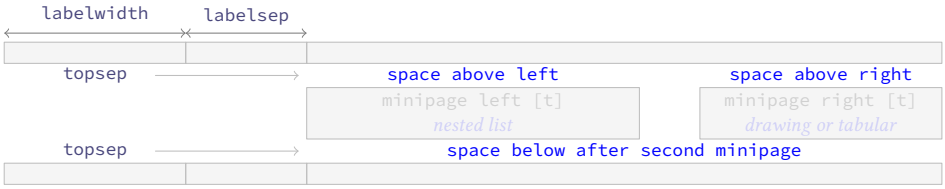

Figure 8: Representation of the minipage spacing adjustment for a nested level.

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

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

Again I must make clear that the implementation here is a *"bit questionable"*, but hunting the spaces (glue) produced by the minipage environment is quite complicated, even more if multicols it is nested. The setting of the values was more *"trial and error"* (aprox to \strutbox), using the help of the lua-visual-debug[12] package, again my attempts to find the correct values using \showoutput and \showboxdepth absolutely failed.

__enumext_mini_env*

Creates a __enumext_mini_env* environment (*custom version* of minipage) setting the \if@minipage switch to *"false"* to allow spaces at the *"above"* of the environment, plus we will add \vspace{0pt} to maintain alignment on *"top"*. 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.

```
\DeclareDocumentEnvironment{__enumext_mini_env*}{ m }
  {
     \__enumext_minipage:w [ t ] { #1 }
       \legacy_if_gset_false:n { @minipage }
       \vspace { 0pt }
  }
  { \__enumext_endminipage: }
```

(*End of definition for* __enumext_mini_env*.)

10.19.1 Adjustment of vertical spaces for minipage in enumext

__enumext_mini_set_vskip:

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

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

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

```
\cs_new_protected:Nn \__enumext_mini_set_vskip:
  {
    \int_compare:nNnTF
      { \int_use:c { l__enumext_columns_ \__enumext_level: _int } } > { 1 }
      {
```

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

```
        \skip_if_eq:nnTF
          { \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip } } { \c_zero_skip }
          {
            \skip_set:Nn \l__enumext_minipage_left_skip
              {
                -0.150\box_dp:N \strutbox
              }
            \skip_set:Nn \l__enumext_minipage_right_skip
              {
                0.695\box_dp:N \strutbox
              }
```

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```
            \skip_set:Nn \l__enumext_minipage_after_skip
              {
                \box_dp:N \strutbox
              }
            \__enumext_zero_parsep:
          }
          {
            \skip_set:Nn \l__enumext_minipage_left_skip
              {
                \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip }
              }
            \skip_set:Nn \l__enumext_minipage_right_skip
              {
                0.695\box_dp:N \strutbox
              }
            \skip_set:Nn \l__enumext_minipage_after_skip
              {
                1.85\box_dp:N \strutbox
                + \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip }
              }
          }
      }
      {
```

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

```
        \skip_if_eq:nnTF
          { \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip } } { \c_zero_skip }
          {
            \skip_set:Nn \l__enumext_minipage_left_skip
              {
                0.5\box_dp:N \strutbox
                - \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
              }
            \skip_set:Nn \l__enumext_minipage_right_skip
              {
                \skip_use:c { l__enumext_partopsep_ \__enumext_level: _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_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
              }
            \skip_set:Nn \l__enumext_minipage_right_skip
              {
                + \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip }
                + \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
              }
            \skip_set:Nn \l__enumext_minipage_after_skip
              {
                0.325\box_dp:N \strutbox
                + \skip_use:c { l__enumext_topsep_ \__enumext_level: _skip }
              }
          }
      }
  }
```

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

`\__enumext_zero_parsep:`

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

```
\cs_new_protected:Nn \__enumext_zero_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_minipage_after_skip { 2.15\box_dp:N \strutbox }
                 }
             }
        { 3 }{
               \skip_if_eq:nnF { \l__enumext_parsep_ii_skip } { \c_zero_skip }
                 {
                   \skip_add:Nn \l__enumext_minipage_after_skip { 2.15\box_dp:N \strutbox }
                 }
             }
        { 4 }{
               \skip_if_eq:nnF { \l__enumext_parsep_iii_skip } { \c_zero_skip }
                 {
                   \skip_add:Nn \l__enumext_minipage_after_skip { 2.15\box_dp:N \strutbox }
                 }
             }
      }
  }
```

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

`\__enumext_mini_addvspace:` The function `\__enumext_mini_addvspace:` will apply the spaces set using `\addvspace` *"above"* the `__enumext_mini_env*` environment in `enumext`, taking into account whether TEX is in ⟨*horizontal mode*⟩ or ⟨*vertical mode*⟩. For the latter we will make some adjustments since the `\partopsep` parameter comes into play and this affects the *vertical spacing*.

```
\cs_new_protected:Nn \__enumext_mini_addvspace:
  {
    \__enumext_mini_set_vskip:
    \mode_if_vertical:T
      {
        \skip_add:Nn \l__enumext_minipage_left_skip
          {
            \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
          }
        \skip_add:Nn \l__enumext_minipage_after_skip
          {
            \skip_use:c { l__enumext_partopsep_ \__enumext_level: _skip }
          }
      }
    \par\nopagebreak
    \addvspace { \l__enumext_minipage_left_skip }
  }
```

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

10.19.2 Adjustment of vertical spaces for `minipage` in keyans

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

```
\cs_new_protected:Nn \__enumext_keyans_mini_set_vskip:
  {
    \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
    \int_compare:nNnTF { \l__enumext_columns_v_int } > { 1 }
      {
        \skip_if_eq:nnTF { \l__enumext_topsep_v_skip } { \c_zero_skip }
          {
            \skip_set:Nn \l__enumext_minipage_left_skip { -0.25\box_dp:N \strutbox }
            \skip_set:Nn \l__enumext_minipage_right_skip { 0.705\box_dp:N \strutbox }
            \skip_set:Nn \l__enumext_minipage_after_skip { \box_dp:N \strutbox }
            \skip_if_eq:nnF { \l__enumext_parsep_i_skip } { \c_zero_skip }
              {
                \skip_add:Nn \l__enumext_minipage_after_skip { 2.15\box_dp:N \strutbox }
              }
          }
```

```
            {
              \skip_set:Nn \l__enumext_minipage_left_skip
                {
                  \skip_use:N \l__enumext_topsep_v_skip
                }
              \skip_set:Nn \l__enumext_minipage_right_skip
                {
                  0.705\box_dp:N \strutbox
                }
              \skip_set:Nn \l__enumext_minipage_after_skip
                {
                  1.85\box_dp:N \strutbox + \l__enumext_topsep_v_skip
                }
            }
        }
        {
          \skip_if_eq:nnTF { \l__enumext_topsep_v_skip } { \c_zero_skip }
            {
              \skip_set:Nn \l__enumext_minipage_left_skip
                {
                  0.5\box_dp:N \strutbox
                  + \l__enumext_partopsep_v_skip
                }
              \skip_set:Nn \l__enumext_minipage_right_skip
                {
                  \l__enumext_partopsep_v_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 - \l__enumext_partopsep_v_skip
                }
              \skip_set:Nn \l__enumext_minipage_right_skip
                {
                  \l__enumext_topsep_v_skip + \l__enumext_partopsep_v_skip
                }
              \skip_set:Nn \l__enumext_minipage_after_skip
                {
                  0.325\box_dp:N \strutbox + \l__enumext_topsep_v_skip
                }
            }
        }
    }
```

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

`\__enumext_keyans_mini_addvspace:`

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

```
\cs_new_protected:Nn \__enumext_keyans_mini_addvspace:
  {
    \__enumext_keyans_mini_set_vskip:
    \mode_if_vertical:T
      {
        \skip_add:Nn \l__enumext_minipage_left_skip
          {
            \l__enumext_partopsep_v_skip
          }
        \skip_add:Nn \l__enumext_minipage_after_skip
          {
            \l__enumext_partopsep_v_skip
          }
      }
    \par\nopagebreak
    \addvspace { \l__enumext_minipage_left_skip }
  }
```

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

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10.19.3 Adjustment of vertical spaces for minipage in enumext* and keyans*

__enumext_mini_set_vskip_vii:
__enumext_mini_set_vskip_viii:

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

```
\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_env* environment on the *left side* when the miniright 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:`.)

10.19.4 The command \miniright

The command `\miniright` will close the `__enumext_mini_env*` environment on the *"left side"*, open the `__enumext_mini_env*` environment on the *"right side"* adding the *adjusted vertical space*. By default we will add `\centering` when starting the *"right side"* environment. The *starred version* '`*`' inhibits the use of `\centering` command i.e. the usual LaTeX justification is maintained in the `__enumext_mini_env*` on the *"right side"*.

`\miniright` First we will perform some checks to prevent the command from being executed outside the `enumext` environment or from being executed inside the `keyanspic` environment, then we call the internal functions for 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 }
      }
    \int_compare:nNnT { \l__enumext_level_int } = { 0 }
      {
        \msg_error:nnn { enumext } { wrong-miniright-place }
      }
    \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* 9.)

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

```
\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:
        \end{__enumext_mini_env*}
        \hfill
        \begin{__enumext_mini_env*}
          { \dim_use:c { l__enumext_minipage_right_ \__enumext_level: _dim } }
          \par\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 } }
  }
```

(*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 version* '`*`' 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:
        \end{__enumext_mini_env*}
        \hfill
        \begin{__enumext_mini_env*}{ \l__enumext_minipage_right_v_dim }
          \par\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 } }
  }
```

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

10.20 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.*)

10.20.1 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:`.)

10.20.2 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:`.)

10.20.3 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:`.)

10.21 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*⟩.

`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*`.)

10.21.1 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 value 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 and resume* keys.

```
\cs_new:Npn \__enumext_filter_series_key:n #1
  {
    \str_case:nnF {#1}
      {
        { resume } {}
        { resume* } {}
      }
      { , { \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, save-ans and save-key keys.

```
\cs_new:Npn \__enumext_filter_series_pair:nn #1#2
  {
    \str_case:nnF {#1}
      {
        { series } {}
        { resume } {}
        { 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 (§10.33) and to the function __enumext_parse_keys_vii:n in the enumext* environment definition (§10.36).

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

```
\cs_new_protected:Npn \__enumext_resume_last:n #1
  {
    \bool_if:NT \l__enumext_standar_level_one_bool
      {
        %%\typeout{[[ON-LEVEL-ONE-ENUMEXT]]}
        \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_level_one_bool
      {
        %%\typeout{[[ON-LEVEL-ONE-ENUMEXT*]]}
        \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`.)

10.21.2 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 (§10.33) and the `enumext*` environment definition (§10.36).

```
\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:`.)

10.21.3 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_level_one_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_level_one_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.*)

10.21.4 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:.)

10.22 Setting save-ans key

The key save-ans is directly associated with the keys resume and resume*, this will activate the entire *"storage system"* in the enumext package.

save-ans

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

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

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

10.22.1 Internal functions for save-ans key

__enumext_storing_set:n
__enumext_storing_set_vii:n
__enumext_storing_standar:
__enumext_storing_starred:
__enumext_storing_exec:

The functions __enumext_storing_set:n and __enumext_storing_set_vii: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 we proceed to execute the functions __enumext_storing_standar: for the enumext environment and __enumext_storing_starred: for the enumext* environment.

```
\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
      {
        \msg_error:nnn { enumext } { save-ans-empty } { enumext }
      }
      {
        \__enumext_storing_standar:
      }
  }
\cs_new_protected:Npn \__enumext_storing_set_vii:n #1
  {
    \tl_set:Ne \l__enumext_store_name_tl {#1}
    \tl_if_empty:NTF \l__enumext_store_name_tl
      {
        \msg_error:nnn { enumext } { save-ans-empty } { enumext* }
      }
```

```
      {
        \__enumext_storing_starred:
      }
  }
```

The functions `\__enumext_storing_standar:` and `\__enumext_storing_starred:` will verify the state of the variables `\g__enumext_standar_level_one_bool` and `\g__enumext_starred_level_one_bool`, if this is true we execute the function `\__enumext_storing_exec:` otherwise we return an warning message.

```
\cs_new_protected:Nn \__enumext_storing_standar:
  {
    \bool_if:NTF \l__enumext_standar_level_one_bool
      {
        \__enumext_storing_exec:
      }
      {
        \msg_warning:nnn { enumext } { save-ans-nested } { enumext }
      }
  }
\cs_new_protected:Nn \__enumext_storing_starred:
  {
    \bool_if:NTF \l__enumext_starred_level_one_bool
      {
        \__enumext_storing_exec:
      }
      {
        \msg_warning:nnn { enumext } { save-ans-nested } { enumext* }
      }
  }
```

The function `\__enumext_storing_exec:` will set to true the variable `\l__enumext_store_active_bool` which activates the use of the `\anskey` command and the `keyans`, `keyans*` and `keyanspic` environments and will set to true the variable `\l__enumext_store_ans_bool` used for checking answers by the `check-ans` and `no-store` keys. 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 `resume` and `resume*` keys.

```
\cs_new_protected:Nn \__enumext_storing_exec:
  {
    \bool_set_true:N \l__enumext_store_active_bool
    \bool_set_true:N \l__enumext_store_ans_bool
    \prop_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _prop }
      {
        \prop_new:c { g__enumext_ \l__enumext_store_name_tl _prop }
      }
    \seq_if_exist:cF { g__enumext_ \l__enumext_store_name_tl _seq }
      {
        \seq_new:c { g__enumext_ \l__enumext_store_name_tl _seq }
      }
    \int_if_exist:cF { g__enumext_resume_ \l__enumext_store_name_tl _int }
      {
        \int_new:c { g__enumext_resume_ \l__enumext_store_name_tl _int }
      }
  }
```

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

10.23 The check answer mechanism

The mechanism for checking that all questions are answered follows this logic:

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

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

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

The integer variable associated to the sum of each \item and \item* in the environment \g__enumext_count_item_number_int must match the integer variable \g__enumext_count_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.

10.23.1 Setting check-ans key

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_bool,
        check-ans .initial:n  = false,
        no-store  .code:n = {
                              \bool_set_false:N \l__enumext_store_ans_bool
                              \bool_set_false:N \l__enumext_check_ans_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.)

10.23.2 Set-up check answer mechanism

__enumext_check_ans_set:

The function __enumext_check_ans_set: will adjust the value of the variable \g__enumext_count_item_number_int by decrementing its value by one each time you open a nested level enumext environment.

```
\cs_new_protected:Nn \__enumext_check_ans_set:
  {
    \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_count_item_number_int
                   \typeout{ENUMEXT ~ STANDAR ~ NEEEEEEEEEEEESTED}
                 }
             }
        { 2 }{
               \int_gdecr:N \g__enumext_count_item_number_int
             }
        { 3 }{
               \int_gdecr:N \g__enumext_count_item_number_int
             }
        { 4 }{
               \int_gdecr:N \g__enumext_count_item_number_int
             }
      }
    \int_case:nn { \l__enumext_level_h_int }
```

```
      {
        { 1 }{
               \bool_if:NT \g__enumext_standar_bool
                 {
                   \int_gdecr:N \g__enumext_count_item_number_int
                   \typeout{ENUMEXT ~ STARRED ~ NEEEEEEEEEEEESTED}
                 }
             }
      }
  }
```

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

`\__enumext_check_ans_exec:` The function `\__enumext_check_ans_exec:` will count the number of times the `\item` and `\item*` commands appears per level within the `enumext` environment. The boolean variable `\l__enumext_store_ans_bool` controlled by the `no-store` key will increment the integer variable of the level counter by `1` to preserve the equality that we will use in the final comparison of the process.

```
\cs_new_protected:Nn \__enumext_check_ans_exec:
  {
    \bool_if:NT \l__enumext_check_ans_bool
      {
        \__enumext_check_ans_set:
      }
  }
```

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

`\__enumext_check_ans_show:` The function `\__enumext_check_ans_show:` compares all executions of `\item` and `\item*` with the executions of `\anskey`. After the function is executed, we set the integer variables to zero.

```
\cs_new_protected:Nn \__enumext_check_ans_show:
  {
    \int_compare:nNnTF
      { \g__enumext_count_item_number_int } = { \g__enumext_count_item_anskey_int }
      {
        \msg_term:nnV { enumext } { items-same-answer } \g__enumext_store_name_tl
      }
      {
        \msg_warning:nnV { enumext } { item-different-answer } \g__enumext_store_name_tl
      }
    \int_gzero:N \g__enumext_count_item_number_int
    \int_gzero:N \g__enumext_count_item_anskey_int
  }
```

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

10.24 Keys and functions associated with storage

`wrap-ans` `wrap-opt` `save-sep` `mark-ans` `mark-pos` `show-ans` `mark-ref` `save-ref` We add the keys `wrap-ans`, `wrap-opt`, `save-sep`, `mark-ans`, `mark-pos`, `show-ans`, `show-pos`, `mark-ref` and `save-ref` related to the *"storage system"* and internal mechanism of *"label and ref"* only at the *first level* of `enumext` and `enumext*`.

```
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \keys_define:nn { enumext / #1 }
      {
        wrap-ans   .cs_set_protected:Np = \__enumext_anskey_wrapper:n ##1,
        wrap-ans   .initial:n = \fbox{##1},
        wrap-ans   .value_required:n = true,
        wrap-opt   .cs_set_protected:Np = \__enumext_keyans_wrapper_opt:n ##1,
        wrap-opt   .initial:n = [{##1}],
        wrap-opt   .value_required:n = true,
        save-sep   .tl_set:N  = \l__enumext_store_keyans_item_opt_sep_tl,
        save-sep   .initial:n = {, ~ },
        save-sep   .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-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   .initial:n = right,
        mark-pos   .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-ref   .tl_set:N   = \l__enumext_mark_ref_sym_tl,
      mark-ref   .initial:n  = \textasteriskcentered,
      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,
    }
  }
\clist_map_inline:nn { level-1, enumext* } { \__enumext_tmp:n {#1} }
```

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

`mark-pos` `show-ans`

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

```
\cs_set_protected:Npn \__enumext_tmp:n #1
  {
    \keys_define:nn { enumext / #1 }
      {
        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 .initial:n = right,
        mark-pos .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, keyans* } { \__enumext_tmp:n {#1} }
```

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

`columns*` `columns-sep*`

For the `enumext` and `enumext*` environments we will only add the keys `columns*` and `columns-sep*`. The values set by these keys will be passed as optional arguments to the *"inner levels"* of the `enumext` and `enumext*` environments via the `\__enumext_store_level_open:` function used by the *"storage system"* to preserve the structure and then used by the `\printkeyans` command.

```
\cs_set_protected:Npn \__enumext_tmp:nn #1 #2
  {
    \keys_define:nn { enumext / #1 }
      {
        columns*     .code:n = \bool_set_true:c { l__enumext_store_columns_#2_bool }
                               \int_set:cn { l__enumext_store_columns_#2_int } {##1}
                               \tl_put_right:ce { l__enumext_store_opt_#2_tl }
                                 {
                                   columns = \exp_not:v { l__enumext_store_columns_#2_int },
                                 },
        columns*     .value_required:n  = true,
        columns-sep* .code:n = \bool_set_true:c { l__enumext_store_columns_sep_#2_bool }
                               \dim_set:cn { l__enumext_store_columns_sep_#2_dim } {##1}
                               \tl_put_right:ce { l__enumext_store_opt_#2_tl }
                                 {
                                   columns-sep = \exp_not:v { l__enumext_store_columns_sep_#2_di
                                 },
        columns-sep* .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* `columns*` *and* `columns-sep*`.)

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10.24.1 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_generate_variant:Nn \prop_gput_if_not_in:Nnn { cen }
\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.)

10.24.2 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.)

10.24.3 Functions for storing the list structure in the sequence

__enumext_store_level_open:
__enumext_store_level_close:

The memorization structure of the list is handled by the functions __enumext_store_level_open: and __enumext_store_level_close: which are executed per level within the enumext environment. As this structure will be stored in the sequence set by the save-ans key, we will not be able to modify it locally, so it is better to take only two copies of the values set by the columns and columns-sep keys if they are present when changing levels within the enumext environment when executing \anskey. We will store these values in the variable \l__enumext_store_columns_X_tl if they are different from 0 and 0pt and pass them as an optional argument to the environment stored in the sequence enumext.

```
\cs_new_protected:Nn \__enumext_store_level_open:
  {
    \bool_if:NT \l__enumext_store_ans_bool
      {
        \tl_if_empty:cTF { l__enumext_store_opt_ \__enumext_level: _tl }
          {
            \__enumext_store_addto_seq:n
              {
                \item \begin{enumext}
              }
          }
          {
            \tl_put_left:cn { l__enumext_store_opt_ \__enumext_level: _tl }
              {
                \item \begin{enumext} [
              }
            \tl_put_right:cn { l__enumext_store_opt_ \__enumext_level: _tl }
              {
                ]
              }
            \__enumext_store_addto_seq:v { l__enumext_store_opt_ \__enumext_level: _tl }
          }
      }
  }
\cs_new_protected:Nn \__enumext_store_level_close:
  {
    \bool_if:NT \l__enumext_store_ans_bool
      {
```

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```
      \__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:`

When nesting the `enumext*` environment in `enumext` starting right after `\item` (without material between them) there is a problem with the alignment of the labels with the baseline between the two environments. One way to get around this problem is to place `\mode_leave_vertical:` and then apply `\vspace` taking into account `\baselineskip`, the value of `\parsep` of the current level of `enumext` and the value of `\topsep` of the `enumext*` environment.

```
\cs_new_protected:Nn \__enumext_store_level_open_vii:
  {
    \bool_if:NT \l__enumext_store_ans_bool
      {
        \tl_if_empty:NTF \l__enumext_store_opt_vii_tl
          {
            \__enumext_store_addto_seq:n
              {
                \item \mode_leave_vertical:
                  \vspace { -\skip_eval:n { \baselineskip + \parsep } }
                  \begin{enumext*}[before={\setlength{\topsep}{0pt}},]
              }
          }
          {
            \tl_put_left:Nn \l__enumext_store_opt_vii_tl
              {
                \item \mode_leave_vertical:
                  \vspace { -\skip_eval:n { \baselineskip + \parsep } }
                  \begin{enumext*}[before={\setlength{\topsep}{0pt}},
              }
            \tl_put_right:Nn \l__enumext_store_opt_vii_tl
              {
                ]
              }
            \__enumext_store_addto_seq:V \l__enumext_store_opt_vii_tl
          }
      }
  }
\cs_new_protected:Nn \__enumext_store_level_close_vii:
  {
    \bool_if:NT \l__enumext_store_ans_bool
      {
        \__enumext_store_addto_seq:n { \end{enumext*} }
      }
  }
```

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

10.24.4 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 }
    \makebox[0pt][ r ]
      {
        \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`.)

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10.25 The command \anskey and internal label and ref

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 very similar behaviour to that of \item in the enumext and enumext* environments.

\anskey We want the command to be executed as follows: \anskey(⟨*number*⟩)*[⟨*key = val*⟩]{⟨*content*⟩} so first we'll add the keys item-sym*, item-pos* and store-brk.

```
\keys_define:nn { enumext / anskey }
  {
    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,
    store-brk .bool_set:N = \l__enumext_store_columns_break_bool,
    store-brk .default:n  = true,
    store-brk .value_forbidden:n = true,
  }
```

This command \anskey will only be present when using the save-ans key in enumext and enumext* environments, otherwise it will return an error. If the check-ans key is active, increment \g__enumext_count_item_with_ans_int, then call internal function __enumext_store_anskey_code:nnnn will *"store content"* in the ⟨*sequence*⟩ and in the ⟨*prop list*⟩.

```
\NewDocumentCommand \anskey { d() s o +m }
  {
    \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_pic_level_int } = { 1 }
      {
        \msg_error:nnnn { enumext } { command-wrong-place }{ anskey }{ keyanspic }
      }
    \group_begin:
      \bool_if:NT \l__enumext_store_ans_bool
        {
          \bool_if:NT \l__enumext_check_ans_bool
            {
              \int_gincr:N \g__enumext_count_item_anskey_int
            }
          \__enumext_store_anskey_code:nnnn {#1} {#2} {#3} {#4}
        }
    \group_end:
  }
```

(*End of definition for* \anskey. *This function is documented on page* 10.)

__enumext_store_anskey_code:nnnn The internal function __enumext_store_anskey_code:nnnn first we pass the command ⟨*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*⟩ passed to the command.

```
\cs_new_protected:Npn \__enumext_store_anskey_code:nnnn #1 #2 #3 #4
  {
    \__enumext_store_addto_prop:n {#4}
    \bool_if:NT \l__enumext_store_ref_key_bool
      {
        \__enumext_store_internal_ref:
      }
    \__enumext_store_anskey_show_left:n { #4 }
```

Now we start processing the optional arguments 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 [⟨*key = val*⟩], if the store-brk key is present and the command is running under enumext (not in the starred version) we will add \columnbreak and then \item.

```
    \tl_clear:N \l__enumext_store_anskey_arg_tl
    \tl_if_novalue:nF {#3}
      {
        \keys_set:nn { enumext / anskey } {#3}
      }
    \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 }
```

Now we will check the (⟨*number*⟩) argument and add it to `\l__enumext_store_anskey_arg_tl` if the command is running under `enumext*` (starred version).

```
    \tl_if_novalue:nF {#1}
      {
        \int_set:Nn \l__enumext_store_columns_join_int {#1}
        \bool_if:NT \l__enumext_starred_bool
          {
            \tl_put_right:Ne \l__enumext_store_anskey_arg_tl
              {
                ( \exp_not:V \l__enumext_store_columns_join_int )
              }
          }
      }
```

And now we will review the starred argument `*` together with the keys `item-sym*` and `item-pos*` and pass them to `\l__enumext_store_anskey_arg_tl`.

```
    \bool_if:nTF {#2}
      {
        \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 {#4}
      }
      {
        \tl_put_right:Nn \l__enumext_store_anskey_arg_tl {#4}
      }
```

Finally we check 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 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:nnnn`.)

__enumext_store_internal_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`.
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` 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 } = { \c_zero_int } }
      }
      {
        \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
          { \tl_use:N \l__enumext_label_copy_vii_tl }
      }
    \bool_lazy_all:nT
      {
        { \bool_if_p:N \l__enumext_standar_bool }
        { \bool_if_p:N \g__enumext_starred_bool }
        { \int_compare_p:nNn { \l__enumext_level_int } > { \c_zero_int } }
      }
      {
        \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` 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 \l__enumext_standar_bool }
        { \int_compare_p:nNn { \l__enumext_level_int } > { \c_zero_int } }
        { \int_compare_p:nNn { \l__enumext_level_h_int } = { \c_zero_int } }
        { \bool_not_p:n { \l__enumext_starred_bool } }
      }
      {
        \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 \l__enumext_standar_bool }
        { \int_compare_p:nNn { \l__enumext_level_int } > { \c_zero_int } }
        { \bool_not_p:n { \g__enumext_starred_bool } }
        { \int_compare_p:nNn { \l__enumext_level_h_int } > { \c_zero_int } }
      }
      {
        \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
          {
```

```
2075              \int_step_function:nnN { 1 } { \l__enumext_level_int } \__enumext_tmp:n
2076              . \tl_use:N \l__enumext_label_copy_vii_tl
2077            }
2078        }
```

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

```
2079      \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
2080        {
2081          \l__enumext_store_name_tl \c_colon_str
2082          \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } }
2083        }
```

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

```
2084      \tl_put_right:Ne \l__enumext_store_write_aux_file_tl
2085        {
2086          \__enumext_newlabel:nn
2087            { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2088            { \l__enumext_newlabel_arg_two_tl }
2089        }
2090      \l__enumext_store_write_aux_file_tl
2091    }
```

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

`\__enumext_store_anskey_show_wrap:n`

The function `\__enumext_store_anskey_show_wrap:n` *"wraps"* the ⟨*argument*⟩ passed to `\anskey` when using the `wrap-ans` key.

```
2092 \cs_new_protected:Npn \__enumext_store_anskey_show_wrap:n #1
2093   {
2094     \par
2095     \bool_if:NT \l__enumext_starred_bool
2096       {
2097        \cs_set:Nn \__enumext_level: { vii }
2098       }
2099     \__enumext_print_keyans_box:cc
2100       { l__enumext_labelwidth_ \__enumext_level: _dim }
2101       { l__enumext_labelsep_ \__enumext_level: _dim }
2102     \__enumext_anskey_wrapper:n { #1 }
2103   }
```

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

`\__enumext_store_anskey_show_left:n`

The function `\__enumext_store_anskey_show_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` on the right side when using the `show-ans` key.

```
2104 \cs_new_protected:Npn \__enumext_store_anskey_show_left:n #1
2105   {
2106     \bool_if:NT \l__enumext_show_answer_bool
2107       {
2108         \__enumext_store_anskey_show_wrap:n { #1 }
2109       }
2110     \bool_if:NT \l__enumext_show_position_bool
2111       {
2112         \tl_set:Ne \l__enumext_mark_answer_sym_tl
2113           {
2114             \group_begin:
2115             \exp_not:N \normalfont
2116             \exp_not:N \footnotesize [ \int_eval:n
2117               {
2118                 \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop }
2119               }
2120               ]
2121             \group_end:
2122           }
2123         \__enumext_store_anskey_show_wrap:n { #1 }
2124       }
2125   }
```

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

10.26 Common functions for keyans, keyans* and keyanspic

10.26.1 Storing content in prop list

__enumext_keyans_addto_prop:n

The function __enumext_keyans_addto_prop:n will pass the contents of the current ⟨*label*⟩ \l__enumext_label_v_tl for the keyans environment and the current ⟨*label*⟩ \l__enumext_label_vi_tl for the keyanspic environment when using \item* and \anspic*, followed by the *contents* of the optional argument of both commands to the \l__enumext_store_keyans_label_tl variable, which will be passed to the ⟨*prop list*⟩ defined by the save-ans key using the __enumext_store_addto_prop:V.

```
\cs_new_protected:Npn \__enumext_keyans_addto_prop:n #1
  {
    \tl_clear:N \l__enumext_store_keyans_label_tl
    \int_compare:nNnTF { \l__enumext_keyans_pic_level_int } = { 1 }
      {
        \tl_put_right:Ne \l__enumext_store_keyans_label_tl { \l__enumext_label_vi_tl }
      }
      {
        \tl_put_right:Ne \l__enumext_store_keyans_label_tl { \l__enumext_label_v_tl }
      }
    \tl_if_novalue:nF { #1 }
      {
        % Set save-sep
        \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_tl
          {
            \tl_put_right:Ne \l__enumext_store_keyans_label_tl { \l__enumext_store_keyans_item_opt
          }
        \tl_put_right:Ne \l__enumext_store_keyans_label_tl { #1 }
      }
    \__enumext_store_addto_prop:V \l__enumext_store_keyans_label_tl
  }
```

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

10.26.2 The save-ref key for keyans, keyans* and keyanspic

The internal *"label and ref"* system for the keyans, keyans* and keyanspic environments has slight differences with the one implemented for the \anskey command, basically because in this environments we are interested in the current ⟨*label*⟩. The mechanism defined here will allow to execute \ref{⟨*store name : position*⟩} and will return 1.(A).

__enumext_keyans_store_ref:
__enumext_keyans_store_ref_aux_i:
__enumext_keyans_store_ref_aux_ii:

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

```
\cs_new_protected:Nn \__enumext_keyans_store_ref:
  {
    \bool_if:NT \l__enumext_store_ref_key_bool
      {
        \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, v, vi, vii, viii } { \__enumext_tmp:n {##1} }
        \__enumext_keyans_store_ref_aux_i:
      }
   }
```

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
```

```
2171            { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_vi_tl }
2172          }
2173        \int_compare:nNnT { \l__enumext_keyans_level_int } = { 1 }
2174          {
2175            \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2176              { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_v_tl }
2177          }
2178        \int_compare:nNnT { \l__enumext_keyans_level_h_int } = { 1 }
2179          {
2180            \tl_put_right:Ne \l__enumext_newlabel_arg_two_tl
2181              { \l__enumext_label_copy_i_tl . \l__enumext_label_copy_viii_tl }
2182          }
2183        \tl_put_right:Ne \l__enumext_newlabel_arg_one_tl
2184          {
2185            \l__enumext_store_name_tl \c_colon_str
2186            \int_eval:n { \prop_count:c { g__enumext_ \l__enumext_store_name_tl _prop } }
2187          }
2188         \__enumext_keyans_store_ref_aux_ii:
2189      }
```

Now auxiliary function `\__enumext_keyans_store_ref_aux_ii:` save the result in the variable `\l__enumext_store_write_aux_file_tl` and finally we write in the `.aux` file.

```
2190 \cs_new_protected:Nn \__enumext_keyans_store_ref_aux_ii:
2191   {
2192     \tl_put_right:Ne \l__enumext_store_write_aux_file_tl
2193       {
2194         \__enumext_newlabel:nn
2195           { \exp_not:V \l__enumext_newlabel_arg_one_tl }
2196           { \l__enumext_newlabel_arg_two_tl }
2197       }
2198     \l__enumext_store_write_aux_file_tl
2199   }
```

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

10.26.3 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_keyans_label_tl` variable to the sequence defined by the `save-ans` key.

```
2200 \cs_new_protected:Npn \__enumext_keyans_addto_seq:n #1
2201   {
2202     \tl_clear:N \l__enumext_store_keyans_label_tl
2203     \int_compare:nNnTF { \l__enumext_keyans_pic_level_int } = { 1 }
2204       {
2205         \tl_put_right:Ne \l__enumext_store_keyans_label_tl { \item \l__enumext_label_vi_tl }
2206       }
2207       {
2208         \tl_put_right:Ne \l__enumext_store_keyans_label_tl { \item \l__enumext_label_v_tl }
2209       }
2210     \tl_if_novalue:nF { #1 }
2211       {
2212         \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_tl
2213           {
2214             \tl_put_right:Ne \l__enumext_store_keyans_label_tl { \l__enumext_store_keyans_item_op
2215           }
2216         \tl_put_right:Ne \l__enumext_store_keyans_label_tl { #1 }
2217       }
2218     \__enumext_keyans_addto_seq_link:
2219   }
```

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_keyans_label_tl` into the global variable `\g__enumext_check_ans_item_tl` to be used by the function `\__enumext_keyans_check_ans:nn` and increment the value of the integer variable `\g__enumext_count_item_anskey_int` handled by the `check-ans` key.

```
2220 \cs_new_protected:Nn \__enumext_keyans_addto_seq_link:
2221   {
```

```
    \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_keyans_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_keyans_label_tl
    \tl_gset:NV \g__enumext_check_ans_item_tl \l__enumext_store_keyans_label_tl
    \bool_if:NT \l__enumext_check_ans_bool
      {
        \int_gincr:N \g__enumext_count_item_anskey_int
      }
  }
```

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

10.26.4 Check for starred commands

`\__enumext_keyans_check_ans:nn`

The function `\__enumext_keyans_check_ans:nn` performs an extra check for the `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_keyans_check_ans:nn #1 #2
  {
    \tl_if_empty:NTF \g__enumext_check_ans_item_tl
      {
        \msg_warning:nnnn { enumext } { missing-starred }{ #1 }{ #2 }
      }
      { \tl_gclear:N \g__enumext_check_ans_item_tl }
  }
```

(*End of definition for* `\__enumext_keyans_check_ans:nn`.)

10.26.5 The show-ans and show-pos keys for keyans and keyanspic

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

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

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

```
\cs_new_protected:Npn \__enumext_keyans_show_left:n #1
  {
    \tl_if_novalue:nF { #1 }
      {
        \tl_set:Ne \l__enumext_keyans_item_opt_tl { #1 }
      }
    \bool_if:NT \l__enumext_show_answer_bool
      {
        \__enumext_keyans_show_ans:
      }
    \bool_if:NT \l__enumext_show_position_bool
      {
        \__enumext_keyans_show_pos:
      }
  }
\cs_new_protected:Nn \__enumext_keyans_show_item_opt:
  {
    \tl_if_empty:NF \l__enumext_keyans_item_opt_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:n { \l__enumext_keyans_item_opt_tl } \c_space_tl
          }
      }
```

```
  }
\cs_new_protected:Nn \__enumext_keyans_show_ans:
  {
    \tl_put_left:Nn \l__enumext_label_v_tl
      {
        \__enumext_print_keyans_box:NN \l__enumext_labelwidth_i_dim \l__enumext_labelsep_i_dim
      }
  }
\cs_new_protected:Nn \__enumext_keyans_show_pos:
  {
    \int_compare:nNnTF { \l__enumext_keyans_pic_level_int } = { 1 }
      {
        \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:
          }
      }
      {
        \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 } + 1
              }
              ]
            \group_end:
          }
      }
    \tl_put_left:Nn \l__enumext_label_v_tl
      {
        \__enumext_print_keyans_box:NN
          \l__enumext_labelwidth_i_dim
          \l__enumext_labelsep_i_dim
      }
  }
```

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

10.27 Setting `item-sym*` and `item-pos*` keys

In order to have a cleaner implementation of `\item*` 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  = {$\star$},
        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*`.)

10.28 Redefining \footnote command

__enumext_footnotetext:nn
__enumext_renew_footnote:
__enumext_print_footnote:

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

```
\cs_new_protected:Nn \__enumext_footnotetext:nn
  {
    \footnotetext[#1]{#2}
  }
\cs_new_protected:Nn \__enumext_renew_footnote:
  {
    \seq_gclear:N \g__enumext_footnote_arg_seq
    \seq_gclear:N \g__enumext_footnote_int_seq
    \RenewDocumentCommand \footnote { o +m }
      {
        \tl_if_novalue:nTF {##1}
          {
            \stepcounter{footnote}
            \int_gset_eq:Nc \g__enumext_footnote_int { c@footnote }
          }
          {
            \int_gset:Nn \g__enumext_footnote_int { ##1 }
          }
        \footnotemark [ \g__enumext_footnote_int ]
        \seq_gput_right:Nn \g__enumext_footnote_arg_seq { ##2 }
        \seq_gput_right:NV \g__enumext_footnote_int_seq \g__enumext_footnote_int
      }
  }
\cs_new_protected:Nn \__enumext_print_footnote:
  {
    \seq_if_empty:NF \g__enumext_footnote_int_seq
      {
        \seq_map_pairwise_function:NNN
          \g__enumext_footnote_int_seq
          \g__enumext_footnote_arg_seq
          \__enumext_footnotetext:nn
      }
  }
```

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

10.29 Redefining \item command

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.

10.29.1 The \item command in enumext

__enumext_default_item:n

The \item and \item[⟨*custom*⟩] commands work in the usual way on enumext.

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_ans_bool set by the key check-ans, set the boolean variable \l__enumext_wrap_label_X_bool to "true" and execute __enumext_item_std:w.

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.

The boolean variable \l__enumext_wrap_label_X_bool is used by the function __enumext_make_label: (§10.30).

```
\cs_new_protected:Npn \__enumext_default_item:n #1
  {
    \tl_if_novalue:nTF {#1}
      {
        \bool_if:NT \l__enumext_check_ans_bool
          {
            \int_gincr:N \g__enumext_count_item_number_int
          }
        \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 }
```

```
2383            { l__enumext_wrap_label_opt_ \__enumext_level: _bool }
2384          \__enumext_item_std:w [#1] \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl
2385        }
2386    }
```

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

`\__enumext_starred_item:nn`

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 set by the `labelsep` key and can be *offset* using 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 optional argument in the global variable `\g__enumext_item_symbol_tl`, followed by setting the variable `\l__enumext_item_symbol_sep_X_dim` set by the key `item*-sep` or by the second optional argument.

Then we will see the state of the variable `\l__enumext_check_ans_bool` set by the key `check-ans`, set the boolean variable `\l__enumext_wrap_label_X_bool` to "true" and execute `\__enumext_item_-std:w`.

In this function the optional argument of `\__enumext_item_std:w` is omitted, we only want it to be numbered.

The boolean variable `\l__enumext_wrap_label_X_bool` and the vars `\l__enumext_item_symbol_-sep_X_dim`, `\g__enumext_item_symbol_tl` are used by the function `\__enumext_make_label:` (§10.30).

```
2387 \cs_new_protected:Npn \__enumext_starred_item:nn #1 #2
2388   {
2389     \tl_if_novalue:nF {#1}
2390       {
2391         \tl_set:cn { l__enumext_item_symbol_ \__enumext_level: _tl } {#1}
2392       }
2393     \tl_gset_eq:Nc \g__enumext_item_symbol_tl { l__enumext_item_symbol_ \__enumext_level: _tl }
2394     \tl_if_novalue:nTF {#2}
2395       {
2396         \dim_set_eq:cc
2397           { l__enumext_item_symbol_sep_ \__enumext_level: _dim }
2398           { l__enumext_labelsep_ \__enumext_level: _dim }
2399       }
2400       {
2401         \dim_set:cn { l__enumext_item_symbol_sep_ \__enumext_level: _dim } {#2}
2402       }
2403     \bool_if:NT \l__enumext_check_ans_bool
2404       {
2405         \int_gincr:N \g__enumext_count_item_number_int
2406       }
2407     \bool_set_true:c { l__enumext_wrap_label_ \__enumext_level: _bool }
2408     \__enumext_item_std:w \tl_use:c { l__enumext_fake_item_indent_ \__enumext_level: _tl }
2409   }
```

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

`\__enumext_redefine_item:`

The function `\__enumext_redefine_item:` will redefine the `\item` command in the `enumext` environment for the internal mechanism of check-answers for `check-ans` key and adding the starred `\item*` version.

This function is passed to `\__enumext_list_arg_two_X:` which is used in the definition of the `enumext` environment (§10.32).

```
2410 \cs_new_protected:Nn \__enumext_redefine_item:
2411   {
2412     \RenewDocumentCommand \item { s o o }
2413       {
2414        \bool_if:nTF {##1}
2415          {
2416            \__enumext_starred_item:nn {##2} {##3}
2417          }
2418          { \__enumext_default_item:n {##2} }
2419       }
2420   }
```

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

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10.29.2 The \item command in keyans

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.

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

```
\cs_new_protected:Npn \__enumext_keyans_starred_item:n #1
  {
    \tl_set_eq:NN \l__enumext_keyans_tmpa_tl \l__enumext_label_v_tl
    \__enumext_keyans_show_left: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
```

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

```
    \tl_set_eq:NN \l__enumext_label_v_tl \l__enumext_keyans_tmpa_tl
    \__enumext_keyans_addto_prop:n { #1 }
    \__enumext_keyans_store_ref:
    \__enumext_keyans_addto_seq:n { #1 }
  }
```

(*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* and *optional* argument by the __enumext_list_arg_two_v: function in the definition of the keyans environment. Here we need to use \peek_remove_spaces:n to prevent an unwanted space when using \item* in conjunction with the itemindent key.

This function is passed to __enumext_list_arg_two_v: which is used in the definition of the keyans environment (§10.32).

```
\cs_new_protected:Nn \__enumext_keyans_redefine_item:
  {
    \RenewDocumentCommand \item { s o }
      {
        \bool_if:nTF {##1}
          {
            \peek_remove_spaces:n
              {
                \__enumext_keyans_starred_item:n {##2}
              }
          }
          {
            \__enumext_keyans_default_item:n {##2}
          }
      }
  }
```

(*End of definition for* \item* *and* __enumext_keyans_redefine_item:. *This function is documented on page 11.*)

10.30 Redefining \makelabel command

Redefine \makelabel for the keys align, font, wrap-label, wrap-label* and \item* for enumext and keyans environments.

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10.30.1 Redefining \makelabel for enumext

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

```
\cs_new_protected:Nn \__enumext_item_starred:
  {
    \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 } }
        \makebox[ 0pt ][ r ]{ \g__enumext_item_symbol_tl }
        \skip_horizontal:n { \dim_use:c { l__enumext_item_symbol_sep_ \__enumext_level: _dim } }
      }
  }
```

(*End of definition for* __enumext_item_starred:.)

__enumext_make_label: The function __enumext_make_label: redefine \makelabel for the enumext environment.

This function is passed to __enumext_list_arg_two_X: which is used in the definition of the enumext environment (§10.32).

```
\cs_new_protected:Nn \__enumext_make_label:
  {
    \RenewDocumentCommand \makelabel { m }
      {
        \tl_use:c { l__enumext_label_fill_left_ \__enumext_level: _tl }
        \tl_use:c { l__enumext_label_font_style_ \__enumext_level: _tl }
        \bool_if:cTF { l__enumext_wrap_label_ \__enumext_level: _bool }
          {
            \__enumext_item_starred:
            \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_tl
      }
  }
```

(*End of definition for* __enumext_make_label:.)

10.30.2 Redefining \makelabel for keyans

__enumext_keyans_make_label: The function __enumext_keyans_make_label: redefine \makelabel for keyans environment.

This function is passed to __enumext_list_arg_two_v: which is used in the definition of the keyans environment (§10.32).

```
\cs_new_protected:Nn \__enumext_keyans_make_label:
  {
    \RenewDocumentCommand \makelabel { m }
      {
        \tl_use:N \l__enumext_label_fill_left_v_tl
        \tl_use:N \l__enumext_label_font_style_v_tl
        \bool_if:NTF \l__enumext_wrap_label_v_bool
          {
            \__enumext_wrapper_label_v:n { ##1 }
          }
          { ##1 }
        \tl_use:N \l__enumext_label_fill_right_v_tl
      }
  }
```

(*End of definition for* __enumext_keyans_make_label:.)

10.31 Calculation of \leftmargin and \itemindent

Consider the figure 9 where the default margins (on the left) of a list are represented.
The idea is to have control over these margins so that our list does not overlap the left margin of the page.
The *key* relationship is that the right edge of the \labelsep equals the right edge of the \itemindent, so that the left edge of the *label box* is at \leftmargin+\itemindent minus \labelwidth+\labelsep.
Thus, the handling of the margins by the package will be as shown in the figure 10.
Where the default values will look like in the figure 11.

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

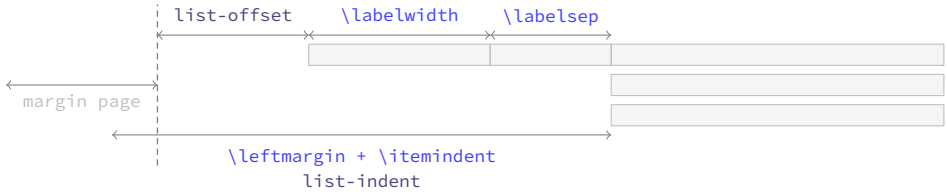

Figure 9: Representation of standard horizontal lengths in `list` environment.

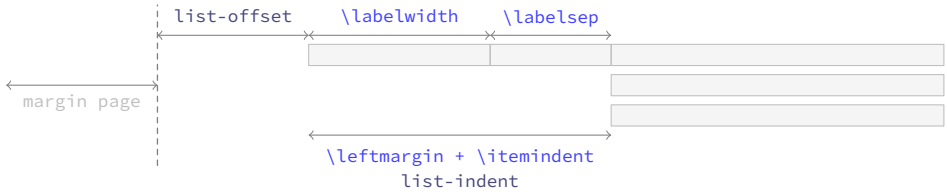

Figure 10: Representation of horizontal lengths concept in list in enumext.

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

And returns the *"adjusted"* values of `\leftmargin` and `\itemindent`.

This function is passed to `\__enumext_list_arg_two_X:` which is used in the definition of the `enumext` and `keyans` environments (§10.32).

```
\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}
          }
```

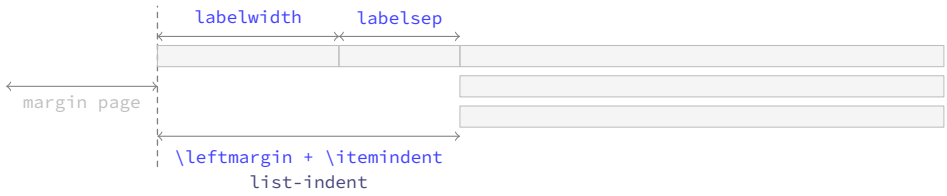

Figure 11: Default horizontal lengths in enumext.

```
          \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`.)

10.32 Setting second argument of the lists

At this point of the code we have already programmed 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`.

`\__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:`

In this function for the second list argument we will implement the keys `start`, `resume` and `show-length` together with the redefinition of `\item` for `enumext` and `keyans` environments.
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_fake_item:
            \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_use_key_ref:
            \__enumext_fake_item:
            \bool_if:cT { l__enumext_show_length_#1_bool }
              {
                \msg_term:nnne { enumext } { list-lengths } {#1} { \int_use:N \l__enumext_level_i
              }
          }
      }
  }
\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: }
      {
        \__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_use_key_ref_h:
        \str_if_eq:nnTF {#1} { vii }
          {
            \__enumext_fake_item_vii:
            \bool_if:cT { l__enumext_show_length_vii_bool }
              { \msg_term:nnnn { enumext } { list-lengths-not-nested } { vii } { enumext* } }
          }
          {
            \__enumext_fake_item_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:`.)

10.33 The environment enumext

enumext

We 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_after_args_exec:
  }
  {
    \__enumext_stop_list:
    \__enumext_stop_store_level:
    \__enumext_after_list:
  }
```

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

__enumext_safe_exec:

First we will execute the function `\__enumext_current_env_set_bool:` which will set the variable `\g__enumext_standard_bool` to *"true"* if the environment is not nested in `enumext*`, we increment the variable `\l__enumext_level_int` for the nesting levels and set the `\l__enumext_standard_bool` variable to *"true"*. Finally we set the variable `\l__enumext_standar_level_one_bool` to *"true"* only if the environment is not nested and we are at the first level of it.

```
\cs_new_protected:Nn \__enumext_safe_exec:
  {
    \__enumext_current_env_set_bool:
    \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_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 } }
```

```
      }
      {
        \typeout{[[ON-FIRST-LEVEL-ENUMEXT-NOT-NESTED]]}
        \bool_set_true:N \l__enumext_standar_level_one_bool
      }
  }
```

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

`\__enumext_parse_keys:n` Parse `[`⟨*key* = *val*⟩`]` by levels in `enumext`. If the variable `\l__enumext_store_active_bool` is true it will call the function `\__enumext_parse_store_keys:n` and reprocess the ⟨*keys*⟩ to pass them to the storage sequence.

```
\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}
          }
          {
            \exp_args:Ne \keys_set:nn
              { enumext / level-\int_use:N \l__enumext_level_int } {#1}
          }
        \bool_if:NT \l__enumext_store_active_bool
          {
            \__enumext_parse_store_keys:n {#1}
          }
      }
  }
```

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

`\__enumext_parse_store_keys:n` The function `\__enumext_parse_store_keys:n` searches for the values of the `columns` and `columns-sep` keys in the optional arguments per-level in `enumext` environment as long as the starred versions of the `columns*` and `columns-sep*` keys are not active. The captured values are stored in the variable `\l__enumext_store_opt_X_tl` which is used by the function `\__enumext_store_level_open:`.

```
\cs_new_protected:Npn \__enumext_parse_store_keys:n #1
  {
    \bool_if:cF { l__enumext_store_columns_ \__enumext_level: _bool }
      {
        \regex_match:nnT { \b columns\b } {#1}
          {
            \int_set_eq:cc
              { l__enumext_store_columns_ \__enumext_level: _int }
              { l__enumext_columns_  \__enumext_level: _int }
            \tl_put_right:ce { l__enumext_store_opt_ \__enumext_level: _tl }
              {
                columns = \exp_not:v { l__enumext_store_columns_ \__enumext_level: _int },
              }
          }
      }
    \bool_if:cF { l__enumext_store_columns_sep_ \__enumext_level: _bool }
      {
        \regex_match:nnT { \b columns-sep \b} {#1}
          {
            \dim_set_eq:cc
              { l__enumext_store_columns_sep_ \__enumext_level: _dim }
              { l__enumext_columns_sep_  \__enumext_level: _dim }
            \tl_put_right:ce { l__enumext_store_opt_ \__enumext_level: _tl }
              {
                columns-sep = \exp_not:v { l__enumext_store_columns_sep_ \__enumext_level: _dim }
              }
          }
      }
  }
```

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

__enumext_start_store_level:
__enumext_stop_store_level:

The __enumext_start_store_level: and __enumext_stop_store_level: functions activate the level saving mechanism for storage in ⟨*sequence*⟩ of the \anskey command.
If enumext are nested in enumext* add __enumext_store_level_open: to preserve the stored structure.

```
\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_not_p:n { \g__enumext_starred_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:
          }
      }
    \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_starred_bool }
      }
      {
        \int_compare:nNnT { \l__enumext_level_int } > { 0 }
          {
            \bool_set_true:c { l__enumext_store_upper_level_ \__enumext_level: _bool }
            \__enumext_store_level_open:
          }
      }
  }
\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_start_store_level: *and* __enumext_stop_store_level:.)

__enumext_before_list:

The function __enumext_before_list: 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.

```
\cs_new_protected:Nn \__enumext_before_list:
  {
    \__enumext_vspace_above:
    \__enumext_before_args_exec:
```

The function __enumext_check_ans_exec: will handle the check answer mechanism, which will be activated with the check-ans key.

```
    \__enumext_check_ans_exec:
```

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

```
    \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_mini_addvspace: is called and the __enumext_mini_env* environment on the *"left side"* will be initialized followed by the *"vertical spacing"* applied to preserve the *"baseline"* between the *left* and *right* side environments. After these actions, the function __enumext_multicols_start: is called to handle the multicols environment.

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

```
2740          \bool_set_true:c { l__enumext_minipage_active_ \__enumext_level: _bool }
2741          \int_gincr:N \g__enumext_minipage_stat_int
2742          \__enumext_mini_addvspace:
2743          \nointerlineskip\noindent
2744          \begin{__enumext_mini_env*}
2745            { \dim_use:c { l__enumext_minipage_left_ \__enumext_level: _dim } }
2746        }
2747      \__enumext_multicols_start:
2748    }
```

(*End of definition for* __enumext_before_list:.)

__enumext_multicols_start:

The function __enumext_multicols_start: will start the multicols environment according to the value passed by the columns key, then set the default value for \columnsep when columns-sep=0pt and set the value of \multicolsep equal to zero and leave \columnseprule equal to zero for inner levels.

```
2749 \cs_new_protected:Nn \__enumext_multicols_start:
2750   {
2751     \int_compare:nNnT
2752       { \int_use:c { l__enumext_columns_ \__enumext_level: _int } } > { 1 }
2753       {
2754         \dim_compare:nNnT
2755           { \dim_use:c { l__enumext_columns_sep_ \__enumext_level: _dim } } = { \c_zero_dim }
2756           {
2757             \dim_set:cn { l__enumext_columns_sep_ \__enumext_level: _dim }
2758               {
2759                 ( \dim_use:c { l__enumext_labelwidth_ \__enumext_level: _dim }
2760                   + \dim_use:c { l__enumext_labelsep_ \__enumext_level: _dim }
2761                 ) / \int_use:c { l__enumext_columns_ \__enumext_level: _int }
2762                 - \dim_use:c { l__enumext_listoffset_ \__enumext_level: _dim }
2763               }
2764           }
2765         \dim_set_eq:Nc \columnsep { l__enumext_columns_sep_ \__enumext_level: _dim  }
2766         \skip_zero:N \multicolsep
2767         \int_compare:nNnT { \l__enumext_level_int } > { 1 }
2768           {
2769             \dim_zero:N \columnseprule
2770           }
```

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.

```
2771         \bool_if:cF { l__enumext_minipage_active_ \__enumext_level: _bool }
2772           {
2773             \__enumext_multi_addvspace:
2774           }
2775         \raggedcolumns
2776         \begin{multicols}{ \int_use:c { l__enumext_columns_ \__enumext_level: _int } }
2777       }
2778   }
```

(*End of definition for* __enumext_multicols_start:.)

__enumext_multicols_stop:

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

```
2779 \cs_new_protected:Nn \__enumext_multicols_stop:
2780   {
2781     \int_compare:nNnT
2782       { \int_use:c { l__enumext_columns_ \__enumext_level: _int } } > { 1 }
2783       {
2784         \end{multicols}
```

```
      \bool_if:cF { l__enumext_minipage_active_ \__enumext_level: _bool }
        {
          \par\addvspace{ \skip_use:c { l__enumext_multicols_below_ \__enumext_level: _skip } }
        }
    }
}
```

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

`\__enumext_after_list:`

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

```
\cs_new_protected:Nn \__enumext_after_list:
  {
    \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
        \end{__enumext_mini_env*}
        \par\addvspace { \l__enumext_minipage_after_skip }
      }
      { \__enumext_multicols_stop: }
```

If the `check-ans` key is active, we set the boolean variable `\g__enumext_check_ans_show_bool` to true and copy the *"store name"* to the variable `\g__enumext_store_name_tl`.

```
    \bool_lazy_and:nnT
      { \bool_if_p:N \l__enumext_check_ans_bool }
      { \bool_not_p:n { \g__enumext_starred_bool } }
      {
        \bool_gset_true:N \g__enumext_check_ans_show_bool
        \tl_gset:NV \g__enumext_store_name_tl \l__enumext_store_name_tl
      }
```

Now apply the {⟨*code*⟩} handled by the `after` key together with the *vertical space* handled by the `below` key if they are present, set `\l__enumext_standar_bool` to false and save the *current value* of the counter for `series`, `resume` and `resume*` keys.

```
    \__enumext_after_stop_list:
    \__enumext_vspace_below:
    \bool_set_false:N \l__enumext_standar_bool
    \__enumext_resume_save_counter:
  }
```

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

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}
  {
    \int_compare:nNnT { \l__enumext_level_int } = { 0 }
      {
        \bool_if:NT \g__enumext_check_ans_show_bool
          {
            \__enumext_check_ans_show:
          }
        \bool_gset_false:N \g__enumext_standar_bool
        \bool_gset_false:N \g__enumext_check_ans_show_bool
        \tl_gclear:N \g__enumext_store_name_tl
      }
  }
```

10.34 The environment keyans

The environment `keyans` also based on lists. The main differences with the `enumext` environment are the *nesting* and the way the *answers* (choice) will be stored and checked, this environment is intended exclusively for *"multiple choice questions"*.

keyans

Now we define the environment keyans also based on lists.

```
\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_after_args_exec_v:
  }
  {
    \__enumext_keyans_check_ans:nn { item }{ keyans }
    \__enumext_stop_list:
    \__enumext_after_list_v:
  }
```

(*End of definition for* keyans. *This function is documented on page* 10.)

__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
    % 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:

The function __enumext_before_list_v: will add the *vertical spacing above* the environment if the above key is active next to the ⟨*code*⟩ defined by the before key if it is active.

```
\cs_new_protected:Nn \__enumext_before_list_v:
  {
    \__enumext_vspace_above_v:
    \__enumext_before_args_exec_v:
```

When the mini-env key is active it will set the value of the \l__enumext_minipage_right_v_dim to be the *width* of the __enumext_mini_env* environment on the *left side*, using this value together with the value of the \l__enumext_minipage_hsep_v_dim set by the mini-sep key, the value of \l__enumext_minipage_left_v_dim will be set, which will be the *width* of __enumextt_mini_env* environment on the *right side*, always having \linewidth as the maximum width between them.

```
    \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
          }
```

The boolean variable `\l__enumext_minipage_active_v_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_keyans_mini_addvspace:` is called and the `__enumext_mini_env*` environment on *left side* will be initialized followed by the *vertical spacing* `\l__enumext_minipage_left_skip`. Here we use the plain TEX macro `\nointerlineskip` to prevent baseline *"glue"* being added between the next pair of boxes in a *vertical list*.

```
        \bool_set_true:N \l__enumext_minipage_active_v_bool
        \int_gincr:N \g__enumext_minipage_stat_int
        \__enumext_keyans_mini_addvspace:
        \nointerlineskip\noindent
        \begin{__enumext_mini_env*}{ \l__enumext_minipage_left_v_dim }
      }
```

After these actions, the `\__enumext_keyans_multicols_start:` function is called to handle the `multicols` environment.

```
    \__enumext_keyans_multicols_start:
  }
```

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

`\__enumext_keyans_multicols_start:`

The function `\__enumext_keyans_multicols_start:` will start the `multicols` environment according to the value passed by the `columns` key.

```
\cs_new_protected:Nn \__enumext_keyans_multicols_start:
  {
    \int_compare:nNnT { \l__enumext_columns_v_int } > { 1 }
      {
```

Set the default value for `\columnsep` when `columns-sep` key is `0pt`.

```
        \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
```

Then we will set the value of `\multicolsep` and `\columnseprule` equal to zero (we do not want a vertical rule in this environment).

```
        \skip_zero:N \multicolsep
        \dim_zero:N \columnseprule
```

We will calculate the *vertical spacing* settings for the `multicols` environment using the function `\__enumext_keyans_multi_addvspace:` and apply our *"vertical adjust spacing"*, then start the `multicols` environment.

```
        \bool_if:NF \l__enumext_minipage_active_v_bool
          {
            \__enumext_keyans_multi_addvspace:
          }
        \raggedcolumns
        \begin{multicols}{ \l__enumext_columns_v_int }
      }
  }
```

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

`\__enumext_keyans_multicols_stop:`

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

```
\cs_new_protected:Nn \__enumext_keyans_multicols_stop:
  {
    \int_compare:nNnT { \l__enumext_columns_v_int } > { 1 }
      {
        \end{multicols}
        \bool_if:NF \l__enumext_minipage_active_v_bool
          {
```

```
2921              \par\addvspace{ \l__enumext_multicols_below_v_skip }
2922            }
2923        }
2924    }
```

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

`\__enumext_after_list_v:` The function `\__enumext_after_list_v:` will will check the state of the boolean variable `\l__enumext_minipage_active_v_bool`, if it is "true" a small test will be executed to check if we have omitted the use of `\miniright` (the `__enumext_mini_env*` environment has not been closed), then close `__enumext_mini_env*` and add the vertical adjustment space `\l__enumext_minipage_after_skip`, otherwise we will close the `multicols` environment.

```
2925 \cs_new_protected:Nn \__enumext_after_list_v:
2926   {
2927     \bool_if:NTF \l__enumext_minipage_active_v_bool
2928       {
2929         \int_compare:nNnT { \g__enumext_minipage_stat_int } = { 1 }
2930           {
2931             \msg_warning:nn { enumext } { missing-miniright }
2932             \miniright
2933           }
2934         \int_gzero:N \g__enumext_minipage_stat_int
2935         \end{__enumext_mini_env*}
2936         \par\addvspace{ \l__enumext_minipage_after_skip }
2937       }
2938       { \__enumext_keyans_multicols_stop: }
```

Finally we will apply the {⟨*code*⟩} handled by the `after` key together with the *vertical space* handled by the `below` key if they are present.

```
2939     \bool_set_false:N \l__enumext_keyans_env_bool
2940     \__enumext_after_stop_list_v:
2941     \__enumext_vspace_below_v:
2942   }
```

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

10.35 The environment keyanspic and \anspic

The `keyanspic` environment is a list-based environment that uses the same configuration for *"spacing"* and ⟨*label*⟩ as the `keyans` environment, but it does not use `\item`.
The contents are passed to the environment by means of the `\anspic` command and are placed inside `minipage` environments, with the ⟨*label*⟩ underneath, adjusting widths according to the options passed to the environment.
Again it is necessary to "adjust" the spacing, both vertical and horizontal, to obtain an output like the one shown in the figure 12.

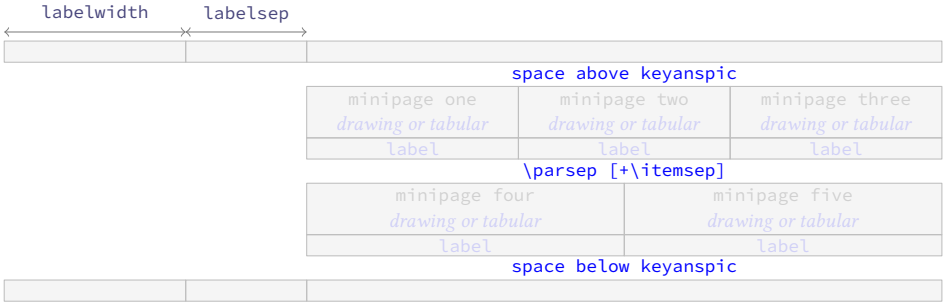

Figure 12: Representation of the `keyanspic` spacing in enumext.

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

10.35.1 The command \anspic

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

```
2943 \NewDocumentCommand \anspic { s o +m }
2944   {
```

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

```
    \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 }
      }
```

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

```
    \seq_put_right:Nn \l__enumext_keyans_pic_body_seq
      {
        \__enumext_keyans_anspic_code:nnn { #1 } { #2 } { #3 }
      }
  }
```

(*End of definition for* \anspic. *This function is documented on page* 12.)

__enumext_keyans_anspic_code:nnn

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

```
\cs_new_protected:Nn \__enumext_keyans_anspic_code:nnn
  {
    \stepcounter { enumXvi }
    #3 \\
    \bool_if:nT { #1 }
      {
        \__enumext_keyans_addto_prop:n { #2 }
        \__enumext_keyans_store_ref:
        \__enumext_keyans_addto_seq:n { #2 }
        \bool_lazy_or:nnT
          { \bool_if_p:N \l__enumext_show_answer_bool }
          { \bool_if_p:N \l__enumext_show_position_bool }
          {
            \tl_set_eq:NN \l__enumext_label_v_tl \l__enumext_label_vi_tl
            \__enumext_keyans_show_left:n { #2 }
            \tl_set_eq:NN \l__enumext_label_vi_tl \l__enumext_label_v_tl
          }
      }
    \tl_use:N \l__enumext_label_font_style_v_tl
    \__enumext_wrapper_label_v:n { \l__enumext_label_vi_tl } \__enumext_keyans_show_item_opt:
  }
```

(*End of definition for* __enumext_keyans_anspic_code:nnn.)

10.35.2 The environment keyanspic

keyanspic

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

```
\NewDocumentEnvironment{keyanspic}{ o }
  {
    \__enumext_keyans_pic_safe_exec:
    \__enumext_start_list:nn
      { }
      {
        \__enumext_keyans_pic_arg_two:
      }
```

We apply the "adjusted" vertical spacing above the environment

```
    \vspace { \l__enumext_keyans_pic_above_skip }
  }
```

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

```
{
  \tl_if_novalue:nTF { #1 }
    {
      \__enumext_keyans_pic_do:e { \seq_count:N \l__enumext_keyans_pic_body_seq }
    }
    { \__enumext_keyans_pic_do:n { #1 } }
  \__enumext_stop_list:
  \__enumext_keyans_check_ans:nn { anspic } { keyanspic }
  \setcounter { enumXvi } { 0 }
  \vspace { \l__enumext_topsep_v_skip }
  %\bool_set_false:N \l__enumext_store_active_bool
}
```

(*End of definition for* keyanspic. *This function is documented on page* 11.)

__enumext_keyans_pic_safe_exec: The function __enumext_keyans_pic_safe_exec: check nested and 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 }
      }
  }
```

(*End of definition for* __enumext_keyans_pic_safe_exec:.)

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

```
\cs_new_protected:Npn \__enumext_keyans_pic_skip_abs:N #1
  {
    \dim_compare:nNnT { #1 } < { 0pt }
      { \skip_set:Nn #1 { -#1 } }
  }
```

(*End of definition for* __enumext_keyans_pic_skip_abs:N.)

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

```
\cs_new_protected:Nn \__enumext_keyans_pic_arg_two:
  {
```

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

```
    \bool_set_false:N \l__enumext_leftmargin_tmp_v_bool
    \__enumext_list_arg_two_v:
```

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

```
    \skip_add:Nn \parsep { \itemsep }
    \dim_add:Nn  \leftmargin { -\labelwidth - \labelsep }
    \dim_zero:N  \labelwidth
    \dim_zero:N  \listparindent
    \dim_zero:N  \labelsep
    \skip_zero:N \partopsep
    \skip_zero:N \itemsep
```

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

```
    \__enumext_keyans_pic_skip_abs:N \parsep
    \skip_set:Nn \l__enumext_keyans_pic_above_skip
      {
        \box_dp:N \strutbox
```

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```
      + \l__enumext_topsep_v_skip
      - \parsep
    }
  \__enumext_item_std:w \scan_stop:
}
```

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

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

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

```
\cs_new_protected:Nn \__enumext_keyans_pic_do:n
  {
    \clist_map_function:nN { #1 } \__enumext_keyans_pic_row:n
  }
\cs_generate_variant:Nn \__enumext_keyans_pic_do:n { e }
```

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

`\__enumext_keyans_pic_row:n`

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

```
\cs_new_protected:Nn \__enumext_keyans_pic_row:n
  {
    \dim_set:Nn \l__enumext_keyans_pic_width_dim { \linewidth / #1 }
    \int_set:Nn \l__enumext_keyans_pic_above_int { \l__enumext_keyans_pic_below_int }
    \int_set:Nn \l__enumext_keyans_pic_below_int { \l__enumext_keyans_pic_above_int + #1 }
    \int_step_inline:nnn
      { \l__enumext_keyans_pic_above_int + 1 }
      { \l__enumext_keyans_pic_below_int }
      {
        \__enumext_minipage:w [ b ]{ \l__enumext_keyans_pic_width_dim }
          \centering
          \seq_item:Nn \l__enumext_keyans_pic_body_seq { ##1 }
        \__enumext_endminipage:
      }
    \par
  }
```

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

10.36 The environment enumext*

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` as in the non starred versions (at least I have not achieved it) and as we will make it behave differently, we have no other option than to define a cascade of functions.

To achieve the horizontal list environment we will capture the `\item` command and the content of this in an plain `lrbox` box using `\makebox` for the `label` and a `minipage` environment for the content passed to `\item`, we will also add the optional argument (⟨*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 optional first argument (⟨*number*⟩).

10.36.1 Functions for item box width

`\__enumext_starred_columns_set_vii:`

We set the default value for the width of the box containing the content of the items and create `\itemwidth` in a public form.

```
\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 - \c_one_int }
    \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
```

```
3074          - \l__enumext_labelsep_vii_dim
3075        }
3076      \dim_zero_new:N \itemwidth
3077    }
```

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

`\__enumext_starred_joined_item_vii:n`

The function `\__enumext_starred_joined_item_vii:n` will set the *width* of the box in which the content passed to `\item`(⟨*number*⟩) will be stored together with the value of `\itemwidth`.

```
3078 \cs_new_protected:Npn \__enumext_starred_joined_item_vii:n #1
3079   {
3080     \int_set:Nn \l__enumext_joined_item_vii_int {#1}
3081     \int_compare:nNnT { \l__enumext_joined_item_vii_int } > { \l__enumext_columns_vii_int }
3082       {
3083         \msg_warning:nnee { enumext } { item-joined }
3084           { \int_use:N \l__enumext_joined_item_vii_int }
3085           { \int_use:N \l__enumext_columns_vii_int }
3086         \int_set:Nn \l__enumext_joined_item_vii_int
3087           {
3088             \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + \c_one_int
3089           }
3090       }
3091     \int_compare:nNnT
3092       { \l__enumext_joined_item_vii_int }
3093         >
3094       { \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + \c_one_int }
3095       {
3096         \msg_warning:nnee { enumext } { item-joined-columns }
3097           { \int_use:N \l__enumext_joined_item_vii_int }
3098           {
3099             \int_eval:n
3100               { \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + \c_one_int }
3101           }
3102         \int_set:Nn \l__enumext_joined_item_vii_int
3103           {
3104             \l__enumext_columns_vii_int - \l__enumext_item_column_pos_vii_int + \c_one_int
3105           }
3106       }
```

Only need if `#1` » `1` (default are set before).

```
3107     \int_compare:nNnTF { \l__enumext_joined_item_vii_int } > { \c_one_int }
3108       {
3109         \int_set_eq:NN \l__enumext_joined_item_aux_vii_int \l__enumext_joined_item_vii_int
3110         \int_decr:N \l__enumext_joined_item_aux_vii_int
3111         \int_add:Nn \l__enumext_item_column_pos_vii_int { \l__enumext_joined_item_aux_vii_int }
3112         \int_gadd:Nn \g__enumext_item_count_all_vii_int { \l__enumext_joined_item_aux_vii_int }
3113         \dim_set:Nn \l__enumext_joined_width_vii_dim
3114           {
3115             \l__enumext_item_width_vii_dim * \l__enumext_joined_item_vii_int
3116             + (  \l__enumext_labelwidth_vii_dim + \l__enumext_labelsep_vii_dim
3117                + \l__enumext_columns_sep_vii_dim
3118               )*\l__enumext_joined_item_aux_vii_int
3119           }
3120         \dim_set_eq:NN \itemwidth \l__enumext_joined_width_vii_dim
3121       }
3122       {
3123         \dim_set_eq:NN \l__enumext_joined_width_vii_dim \l__enumext_item_width_vii_dim
3124         \dim_set_eq:NN \itemwidth \l__enumext_item_width_vii_dim
3125       }
3126   }
```

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

`\__enumext_start_mini_vii:`

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

```
3127 \cs_new_protected:Nn \__enumext_start_mini_vii:
3128   {
3129     \dim_compare:nNnT { \l__enumext_minipage_right_vii_dim } > { \c_zero_dim }
3130       {
```

```
      \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
      \begin{__enumext_mini_env*}{ \l__enumext_minipage_left_vii_dim }
    }
  }
```

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

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

```
\cs_new_protected:Nn \__enumext_stop_mini_vii:
  {
    \bool_if:NT \l__enumext_minipage_active_vii_bool
      {
        \end{__enumext_mini_env*}
        \hfill
        \bool_gset_true:N \g__enumext_minipage_active_vii_bool
      }
  }
```

Finally we execute code passed to the `miniright` key stored in the variable `\g__enumext_miniright_code_vii_tl` in the `__enumext_mini_env*` environment on the *"right side"*.

```
\__enumext_after_env:nn {enumext*}
  {
    \bool_if:NT \g__enumext_minipage_active_vii_bool
      {
        \begin{__enumext_mini_env*}{ \g__enumext_minipage_right_vii_dim }
          \par\addvspace { \g__enumext_minipage_right_skip }
          \bool_if:NF \g__enumext_minipage_center_vii_bool
            {
              \centering
            }
          \tl_use:N \g__enumext_miniright_code_vii_tl % the code
        \end{__enumext_mini_env*}
        \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
  }
```

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

`enumext*` First we will generate the environment and we will give a temporary definition to `\__enumext_stop_item_tmp_vii:` equal to `\noindent` and next to `\item` equal to `\__enumext_start_item_tmp_vii:` which we will redefine later.

```
\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:
      }
```

```
      \__enumext_starred_columns_set_vii:
      \item[] \scan_stop:
      \cs_set_eq:NN \__enumext_stop_item_tmp_vii: \noindent
      \cs_set_eq:NN \item \__enumext_start_item_tmp_vii:
  }
  {
    \__enumext_stop_item_tmp_vii:
    \__enumext_remove_extra_parsep_vii:
    \__enumext_stop_list:
    \__enumext_stop_store_level_vii:
    \__enumext_after_list_vii:
  }
```

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

`\__enumext_safe_exec_vii:` First check the maximum nesting level for the `enumext*` environment then set the vars `\l__enumext_starred_bool` and `\g__enumext_starred_bool`.

```
\cs_new_protected:Nn \__enumext_safe_exec_vii:
  {
    \__enumext_current_env_set_bool:
    \int_incr:N \l__enumext_level_h_int
    \int_compare:nNnT { \l__enumext_level_h_int } > { 1 }
      {
        \msg_error:nn { enumext } { nested }
      }
    \bool_set_true:N \l__enumext_starred_bool
    \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 } }
      }
      {
        \typeout{[[ON-FIRST-LEVEL-ENUMEXT*-NOT-NESTED]]}
        \bool_set_true:N \l__enumext_starred_level_one_bool
      }
  }
```

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

`\__enumext_parse_keys_vii:n` Parse [⟨*key* = *val*⟩] for `enumext*`. If the variable `\l__enumext_store_active_bool` is true it will call the function `\__enumext_parse_store_keys_vii:n` and reprocess the keys to pass them to the storage sequence.

```
\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}
        \bool_if:NT \l__enumext_store_active_bool
          {
            \__enumext_parse_store_keys_vii:n {#1}
          }
      }
  }
```

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

`\__enumext_parse_store_keys_vii:n` The function `\__enumext_parse_store_keys_vii:n` searches for the values of the `columns` and `columns-sep` keys in the optional argument in `enumext*` environment as long as the starred versions of the `columns*` and `columns-sep*` keys are not active. The captured values are stored in the variable `\l__enumext_store_opt_vii_tl` which is used by the function `\__enumext_store_level_open_vii:`.

```
\cs_new_protected:Npn \__enumext_parse_store_keys_vii:n #1
  {
    \bool_if:NF \l__enumext_store_columns_vii_bool
      {
        \regex_match:nnT { \b columns\b } {#1}
          {
```

```
            \int_set_eq:NN
              \l__enumext_store_columns_vii_int
              \l__enumext_columns_vii_int
            \tl_put_right:Ne \l__enumext_store_opt_vii_tl
              {
                columns = \exp_not:V \l__enumext_store_columns_vii_int ,
              }
          }
      }
    \bool_if:NF \l__enumext_store_columns_sep_vii_bool
      {
        \regex_match:nnT { \b columns-sep \b} {#1}
          {
            \dim_set_eq:NN
              \l__enumext_store_columns_sep_vii_dim
              \l__enumext_columns_sep_vii_dim
            \tl_put_right:Ne \l__enumext_store_opt_vii_tl
              {
                columns-sep = \exp_not:V \l__enumext_store_columns_sep_vii_dim,
              }
          }
      }
  }
```

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

`\__enumext_before_list_vii:`

The function `\__enumext_before_list_vii:` 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_vii:` handle by `mini-env`.

```
\cs_new_protected:Nn \__enumext_before_list_vii:
  {
    \__enumext_vspace_above_vii:
    \__enumext_check_ans_exec: % need by chek-ans
    \__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:` first call the function `\__enumext_stop_mini_vii:`, then apply the {⟨*code*⟩} handled by the `after` key together with the *vertical space* handled by the `below` key if they are present. Finally set false the vars `\g__enumext_starred_bool` and `\l__enumext_starred_bool`, save the *current value* of the counter in `\g__enumext_resume_vii_int` for the `resume` key. If the `save-ans` key is active, it will create the integer variable for the `resume` key, we only have to assign it the value of the current counter.

```
\cs_new_protected:Nn \__enumext_after_list_vii:
  {
    \__enumext_stop_mini_vii:
    \__enumext_after_stop_list_vii:
    \__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 level saving mechanism for storage in ⟨*sequence*⟩ of the `\anskey` command 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 } > { \c_zero_int }
          {
            \__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 } > { \c_zero_int }
          {
            \__enumext_store_level_close_vii:
          }
      }
  }
```

(*End of definition for* `\__enumext_start_store_level_vii:` *and* `\__enumext_stop_store_level_vii:`.)

10.36.2 The command `\item` in enumext*

`\__enumext_start_item_tmp_vii:`

First we will call the function `\__enumext_stop_item_tmp_vii:` that we will redefine later, we will increment the value of `\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`.

```
\cs_new_protected_nopar:Nn \__enumext_start_item_tmp_vii:
  {
    \__enumext_stop_item_tmp_vii:
    \int_incr:N \l__enumext_item_column_pos_vii_int
    \int_gincr:N \g__enumext_item_count_all_vii_int
    \__enumext_item_peek_args_vii:
  }
```

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

`\__enumext_item_peek_args_vii:`

The function `\__enumext_item_peek_args_vii:` will handle the `\item`(⟨*number*⟩). Look for the argument "`(`", if it is present we will call the function `\__enumext_joined_item_vii:w` (⟨*number*⟩), which is in charge of joining the item's in the same row, in case they are not present we will set the default value `(1)`.

```
\cs_new_protected:Nn \__enumext_item_peek_args_vii:
  {
    \peek_meaning:NTF (
      { \__enumext_joined_item_vii:w }
      { \__enumext_joined_item_vii:w (1) }
  }
```

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

`\__enumext_joined_item_vii:w`

The function `\__enumext_joined_item_vii:w` will first call the function `\__enumext_starred_joined_item_vii:n` in charge of setting the *width* of the box that will store the content passed to `\item`. Then we will look for the argument "`*`", if it is present we will call the function `\__enumext_starred_item_vii:w` otherwise we will call the function `\__enumext_standard_item_vii:w`.

```
\cs_new_protected:Npn \__enumext_joined_item_vii:w (#1)
  {
    \__enumext_starred_joined_item_vii:n {#1}
    \peek_meaning_remove:NTF *
      { \__enumext_starred_item_vii:w  }
      { \__enumext_standard_item_vii:w }
  }
```

(*End of definition for* `\__enumext_joined_item_vii:w`.)

`\__enumext_standard_item_vii:w`

The function `\__enumext_standard_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 ]`.

```
\cs_new_protected:Npn \__enumext_standard_item_vii:w
  {
    \bool_set_false:N \l__enumext_item_starred_vii_bool
      \peek_meaning:NTF [
        {
          \bool_set_eq:NN
            \l__enumext_wrap_label_vii_bool
```

```
      \l__enumext_wrap_label_opt_vii_bool
    \__enumext_start_item_vii:w
  }
  {
    \bool_set_true:N \l__enumext_wrap_label_vii_bool
    \legacy_if_set_true:n { @noitemarg }
    \__enumext_start_item_vii:w [ \l__enumext_label_vii_tl ]
  }
}
```

(*End of definition for* `\__enumext_standard_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`

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*⟩`]`.

```
\cs_new_protected:Npn \__enumext_starred_item_vii:w
  {
    \bool_set_true:N \l__enumext_item_starred_vii_bool
    \bool_set_true:N \l__enumext_wrap_label_vii_bool
    \peek_meaning:NTF [
      { \__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 ]
      }
  }
\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 ]
  }
```

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

10.36.3 Real definition of `\item` in enumext*

`\__enumext_start_item_vii:w`

The functions `\__enumext_start_item_vii:w` and `\__enumext_stop_item_vii:` executing the true definition of `\item` inside the `enumext*` environment.
The first thing we will do is set the value of `\__enumext_stop_item_tmp_vii:` equal to the value of `\__enumext_stop_item_vii:` which we will define later and add the `hyperref` compatible `enumXvii` counter, after that we will start capturing the item content in a box. Here need setting the `\if@hyper@item` switch to *"true"* for `hyperref` compatible. The explanation for this is given by the master Heiko Oberdiek on \refstepcounter{enumi} twice (or more) creates destination with the same identifier.

```
\cs_new_protected_nopar:Npn \__enumext_start_item_vii:w [#1]
  {
    \cs_set_eq:NN \__enumext_stop_item_tmp_vii: \__enumext_stop_item_vii:
    \legacy_if:nT { @noitemarg }
      {
        \legacy_if_set_false:n { @noitemarg }
        \legacy_if:nT { @nmbrlist }
          {
            \bool_if:NT \l__enumext_hyperref_bool
              {
                \legacy_if_set_true:n { @hyper@item }
              }
            \refstepcounter{enumXvii}
            \bool_if:NT \l__enumext_check_ans_bool
```

```
              {
                \int_gincr:N \g__enumext_count_item_number_int
              }
          }
      }
```

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

```
  \group_begin:
    \lrbox{ \l__enumext_item_text_vii_box }
      \bool_if:NF \l__enumext_footnotes_key_bool
        {
          \__enumext_renew_footnote:
        }
      \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 }
          \makebox[ 0pt ][ r ]{ \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
        }
      \group_begin:
        \tl_use:N \l__enumext_label_font_style_vii_tl
        \bool_if:NTF \l__enumext_wrap_label_vii_bool
          {
            \makebox[ \l__enumext_labelwidth_vii_dim ][ \l__enumext_align_label_vii_str ]
              { \__enumext_wrapper_label_vii:n {#1} }
          }
          {
            \makebox[ \l__enumext_labelwidth_vii_dim ][ \l__enumext_align_label_vii_str ]{ #1 }
          }
      \group_end:
      \skip_horizontal:N \l__enumext_labelsep_vii_dim
      \tl_use:N \l__enumext_after_list_args_vii_tl
      \__enumext_minipage:w [ t ]{ \l__enumext_joined_width_vii_dim  }
        \skip_set_eq:NN \parindent \l__enumext_listparindent_vii_dim
        \skip_set_eq:NN \parskip \l__enumext_parsep_vii_skip
        \tl_use:N \l__enumext_fake_item_indent_vii_tl
  }
```

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

`\__enumext_stop_item_vii:`

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

```
\cs_new_protected_nopar:Nn \__enumext_stop_item_vii:
  {
        \__enumext_endminipage:
      \endlrbox
    \group_end:
    \box_set_wd:Nn \l__enumext_item_text_vii_box
      {
        \l__enumext_joined_width_vii_dim
        + \l__enumext_labelwidth_vii_dim
        + \l__enumext_labelsep_vii_dim
      }
    \int_set:Nn \hbadness { 10000 }
    \box_use:N \l__enumext_item_text_vii_box
    \bool_if:NF \l__enumext_footnotes_key_bool
      {
```

```
      \__enumext_print_footnote:
    }
  \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
    }
    { \hspace{ \l__enumext_columns_sep_vii_dim } }
}
```

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

`\__enumext_remove_extra_parsep_vii:`

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

```
\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 }
      }
      =
      { \c_zero_int }
      {
        \par
        \vspace{ -\l__enumext_itemsep_vii_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*}
  {
    \int_compare:nNnT { \l__enumext_level_int } = { 0 }
      {
        \bool_if:NT \g__enumext_check_ans_show_h_bool
          {
            \__enumext_check_ans_show:
          }
        \bool_gset_false:N \g__enumext_starred_bool
        \bool_gset_false:N \g__enumext_check_ans_show_h_bool
        \tl_gclear:N \g__enumext_store_name_tl
      }
  }
```

10.37 The environment keyans*

10.37.1 Functions for item box width

`\__enumext_starred_columns_set_viii:`

We set the default value for the width of the box containing the content of the items and create `\itemwidth` in a public form.

```
\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 - \c_one_int }
    \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_zero_new:N \itemwidth
  }
```

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

`\__enumext_starred_joined_item_viii:n`

The function `\__enumext_starred_joined_item_viii:n` will set the *width* of the box in which the content passed to `\item(⟨number⟩)` will be stored together with the value of `\itemwidth`.

```
\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 + \c_one_int
          }
      }
    \int_compare:nNnT
      { \l__enumext_joined_item_viii_int }
        >
      { \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + \c_one_int }
      {
        \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 + \c_one_int }
          }
        \int_set:Nn \l__enumext_joined_item_viii_int
          {
            \l__enumext_columns_viii_int - \l__enumext_item_column_pos_viii_int + \c_one_int
          }
      }
    \int_compare:nNnTF { \l__enumext_joined_item_viii_int } > { \c_one_int }
      {
        \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_viii:n`.)

`\__enumext_start_mini_viii:`
`\__enumext_stop_mini_viii:`

The implementation of the `mini-env` key 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
      \begin{__enumext_mini_env*}{ \l__enumext_minipage_left_viii_dim }
    }
  }
\cs_new_protected:Nn \__enumext_stop_mini_viii:
  {
    \bool_if:NT \l__enumext_minipage_active_viii_bool
      {
        \end{__enumext_mini_env*}
        \hfill
        \bool_gset_true:N \g__enumext_minipage_active_viii_bool
      }
  }
\__enumext_after_env:nn {keyans*}
  {
    \bool_if:NT \g__enumext_minipage_active_viii_bool
      {
        \begin{__enumext_mini_env*}{ \g__enumext_minipage_right_viii_dim }
          \par\addvspace { \g__enumext_minipage_right_skip }
          \bool_if:NF \g__enumext_minipage_center_viii_bool
            {
              \centering
            }
          \tl_use:N \g__enumext_miniright_code_viii_tl % the code
        \end{__enumext_mini_env*}
        \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:`.)

keyans* First we will generate the environment and we will give a temporary definition to `\__enumext_stop_item_tmp_viii:` equal to `\noindent` and next to `\item` equal to `\__enumext_start_item_tmp_viii:` which we will redefine later.

```
\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:
      }
      \__enumext_starred_columns_set_viii:
      \item[] \scan_stop:
      \cs_set_eq:NN \__enumext_stop_item_tmp_viii: \noindent
      \cs_set_eq:NN \item \__enumext_start_item_tmp_viii:
  }
  {
    \__enumext_stop_item_tmp_viii:
    \__enumext_remove_extra_parsep_viii:
    \__enumext_keyans_check_ans:nn { item }{ keyans* }
    \__enumext_stop_list:
    \__enumext_after_list_viii:
  }
```

(*End of definition for* `keyans*`. *This function is documented on page* 10.)

__enumext_safe_exec_viii: First check the maximum nesting level for the `keyans*` environment.

```
\cs_new_protected:Nn \__enumext_safe_exec_viii:
  {
    \int_incr:N \l__enumext_keyans_level_h_int
    \int_compare:nNnT { \l__enumext_keyans_level_h_int } > { 1 }
      {
        \msg_error:nn { enumext } { nested }
```

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```
3612      }
3613    % Set false for interfering with enumext nested in keyans* (yes, its possible and crayze)
3614    \bool_set_false:N \l__enumext_store_active_bool
3615    \int_compare:nNnT { \l__enumext_level_int } > { 1 }
3616      {
3617        \msg_error:nn { enumext } { keyans-wrong-level }
3618      }
3619  }
```

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

`\__enumext_parse_keys_viii:n` Parse [⟨*key* = *val*⟩] for `keyans*`.

```
3620 \cs_new_protected:Npn \__enumext_parse_keys_viii:n #1
3621   {
3622     \tl_if_novalue:nF {#1}
3623       {
3624         \keys_set:nn { enumext / keyans* } {#1}
3625       }
3626   }
```

(*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`.

```
3627 \cs_new_protected:Nn \__enumext_before_list_viii:
3628   {
3629     \__enumext_vspace_above_viii:
3630     \__enumext_before_args_exec_viii:
3631     \__enumext_start_mini_viii:
3632   }
```

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

`\__enumext_after_list_viii:` The function `\__enumext_after_list:` first call the function `\__enumext_stop_mini_viii:`, then apply the {⟨*code*⟩} handled by the `after` key together with the *vertical space* handled by the `below` key if they are present.

```
3633 \cs_new_protected:Nn \__enumext_after_list_viii:
3634   {
3635     \__enumext_stop_mini_viii:
3636     \__enumext_after_stop_list_viii:
3637     \__enumext_vspace_below_viii:
3638   }
```

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

10.37.2 The command `\item` in keyans*

The idea here is to make the `\item` command behave in the same way as in the `keyans` environment with the difference of the optional argument (⟨*number*⟩) which works in the same way as in the `enumext*` environment. In simple terms we want to store the ⟨*label*⟩ next to the [⟨*content*⟩] if it is present in the ⟨*sequence*⟩ and ⟨*prop list*⟩ defined by `save-ans` key for `\item*`, `\item*`[⟨*content*⟩], `\item`(⟨*number*⟩)`*` and `\item`(⟨*number*⟩)`*`[⟨*content*⟩] commands.

`\__enumext_start_item_tmp_viii:` First we will call the function `\__enumext_stop_item_tmp_viii:` that we will redefine later, we will increment the value of `\l__enumext_item_column_pos_viii_int` that will count the item's by rows and the value of `\g__enumext_item_count_all_viii_int` that will count the total of item's in the environment. After that we will call the function `\__enumext_item_peek_args_viii:` that will handle the arguments passed to `\item`.

```
3639 \cs_new_protected_nopar:Nn \__enumext_start_item_tmp_viii:
3640   {
3641     \__enumext_stop_item_tmp_viii:
3642     \int_incr:N \l__enumext_item_column_pos_viii_int
3643     \int_gincr:N \g__enumext_item_count_all_viii_int
3644     \__enumext_item_peek_args_viii:
3645   }
```

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

__enumext_item_peek_args_viii:

The function __enumext_item_peek_args_viii: will handle the \item(⟨*number*⟩). Look for the argument "(", if it is present we will call the function __enumext_joined_item_viii:w (⟨*number*⟩), which is in charge of joining the item's in the same row, in case they are not present we will set the default value (1).

```
\cs_new_protected:Nn \__enumext_item_peek_args_viii:
  {
    \peek_meaning:NTF (
      { \__enumext_joined_item_viii:w }
      { \__enumext_joined_item_viii:w (1) }
  }
```

(*End of definition for* __enumext_item_peek_args_viii:.)

__enumext_joined_item_viii:w

The function __enumext_joined_item_viii:w will first call the function __enumext_starred_joined_item_viii:n in charge of setting the *width* of the box that will store the content passed to \item. Then we will look for the argument "*", if it is present we will call the function __enumext_starred_item_viii:w otherwise we will call the function __enumext_standard_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_standard_item_viii:w }
  }
```

(*End of definition for* __enumext_joined_item_viii:w.)

__enumext_standard_item_viii:w

The function __enumext_standard_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_standard_item_viii:w
  {
    \bool_set_false:N \l__enumext_item_starred_viii_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 ]
        }
  }
```

(*End of definition for* __enumext_standard_item_viii:w.)

__enumext_starred_item_viii:w
__enumext_starred_item_viii_aux_i:w
__enumext_starred_item_viii_aux_ii:w

The function __enumext_starred_item_viii:w together with the specified auxiliary functions aux_i:w and aux_ii:w execute \item* and \item*[⟨*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_wrap_label_viii_bool
    \peek_meaning:NTF [
      { \__enumext_starred_item_viii_aux_i:w }
      { \__enumext_starred_item_viii_aux_ii:w }
  }
```

The optional argument will be captured in the variables \l__enumext_keyans_tmpa_tl and \l__enumext_keyans_tmpb_tl which we will use later for the implementation of the show-ans and show-pos keys together with the stored in ⟨*sequence*⟩ and ⟨*prop list*⟩.

```
\cs_new_protected:Npn \__enumext_starred_item_viii_aux_i:w [#1]
  {
```

```
    \tl_clear:N \l__enumext_store_keyans_label_tl
    \tl_if_novalue:nF { #1 }
      {
        \tl_if_empty:NF \l__enumext_store_keyans_item_opt_sep_tl
          {
            \tl_put_right:Ne \l__enumext_store_keyans_label_tl { \l__enumext_store_keyans_item_opt
            \tl_put_right:Ne \l__enumext_store_keyans_label_tl { #1 }
          }
        \tl_set:Ne \l__enumext_keyans_item_opt_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 ]
  }
```

(*End of definition for* `\__enumext_starred_item_viii:w`, `\__enumext_starred_item_viii_aux_i:w`, *and* `\__enumext_starred_item_viii_aux_ii:w`.)

`\__enumext_starred_item_exec:`

The function `\__enumext_starred_item_exec:` will be in charge of storing the current ⟨*label*⟩ for `\item*` followed by the `[`⟨*content*⟩`]` for `\item*[`⟨*content*⟩`]` if present in the ⟨*sequence*⟩ and ⟨*prop list*⟩ set by the `save-ans` key. In this same function the keys `show-ans`, `show-pos` and `save-ref` are implemented.

```
\cs_new_protected:Nn \__enumext_starred_item_exec:
  {
    \tl_put_left:Ne \l__enumext_store_keyans_label_tl { \l__enumext_label_viii_tl }
    \__enumext_store_addto_prop:V \l__enumext_store_keyans_label_tl
    \__enumext_keyans_store_ref:
    \tl_put_left:Ne \l__enumext_store_keyans_label_tl { \item }
    \__enumext_keyans_addto_seq_link:
    \bool_if:NT \l__enumext_show_answer_bool
      {
        \__enumext_print_keyans_box:NN \l__enumext_labelwidth_i_dim \l__enumext_labelsep_i_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:
          }
        \__enumext_print_keyans_box:NN \l__enumext_labelwidth_i_dim \l__enumext_labelsep_i_dim
      }
  }
```

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

Real definition of `\item` in keyans*

`\__enumext_start_item_viii:w`

The implementation at this point 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:
    \legacy_if:nT { @noitemarg }
      {
        \legacy_if_set_false:n { @noitemarg }
        \legacy_if:nT { @nmbrlist }
          {
            \bool_if:NT \l__enumext_hyperref_bool
              {
                \legacy_if_set_true:n { @hyper@item }
              }
            \refstepcounter{enumXviii}
          }
```

```
    }
```

Here we start capturing `\item` and its contents into a group using the plain form of the `lrbox` environment.

```
  \group_begin:
    \lrbox{ \l__enumext_item_text_viii_box }
      \bool_if:NF \l__enumext_footnotes_key_bool
        {
          \__enumext_renew_footnote:
        }
      \bool_if:NT \l__enumext_item_starred_viii_bool
        {
          \__enumext_starred_item_exec:
        }
      \group_begin:
        \tl_use:N \l__enumext_label_font_style_viii_tl
        \bool_if:NTF \l__enumext_wrap_label_viii_bool
          {
            \makebox[ \l__enumext_labelwidth_viii_dim ][ \l__enumext_align_label_viii_str ]
              { \__enumext_wrapper_label_viii:n {#1} }
          }
          {
            \makebox[ \l__enumext_labelwidth_viii_dim ][ \l__enumext_align_label_viii_str ]{ #1
          }
      \group_end:
      \skip_horizontal:N \l__enumext_labelsep_viii_dim
      \tl_use:N \l__enumext_after_list_args_viii_tl
      \__enumext_minipage:w [ t ]{ \l__enumext_joined_width_viii_dim  }
        \skip_set_eq:NN \parindent \l__enumext_listparindent_viii_dim
        \skip_set_eq:NN \parskip \l__enumext_parsep_viii_skip
        \bool_if:NT \l__enumext_item_starred_viii_bool
          {
            \tl_use:N \l__enumext_fake_item_indent_viii_tl
            \__enumext_keyans_show_item_opt: \skip_horizontal:n { -\l__enumext_fake_item_indent_
          }
          {
            \tl_use:N \l__enumext_fake_item_indent_viii_tl
          }
  }
```

(*End of definition for* `\__enumext_start_item_viii:w`.)

`\__enumext_stop_item_viii:`

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

```
\cs_new_protected_nopar:Nn \__enumext_stop_item_viii:
  {
        \__enumext_endminipage:
      \endlrbox
    \group_end:
    \box_set_wd:Nn \l__enumext_item_text_viii_box
      {
        \l__enumext_joined_width_viii_dim
        + \l__enumext_labelwidth_viii_dim
        + \l__enumext_labelsep_viii_dim
      }
    \int_set:Nn \hbadness { 10000 }
    \box_use:N \l__enumext_item_text_viii_box
    \bool_if:NF \l__enumext_footnotes_key_bool
      {
        \__enumext_print_footnote:
      }
    \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
      }
      { \hspace{ \l__enumext_columns_sep_viii_dim } }
  }
```

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

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__enumext_remove_extra_parsep_viii:

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

```
\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 }
      }
      =
      { \c_zero_int }
      {
        \par
        \vspace{ -\l__enumext_itemsep_viii_skip }
        \int_gzero:N \g__enumext_item_count_all_viii_int
      }
  }
```

(*End of definition for* __enumext_remove_extra_parsep_viii:.)

10.38 The command \getkeyans

\getkeyans

The \getkeyans command takes a mandatory argument of the form {⟨*store name* : *position*⟩}. Retrieve a *"single"* content stored by \anskey, \anspic* and \item* 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} } }
  }
```

(*End of definition for* \getkeyans. *This function is documented on page* 12.)

__enumext_getkeyans_aux:n

The internal function __enumext_getkeyans_aux:n is in charge of *splitting* the ⟨*argument*⟩ using ":". If ":" is omitted it will return an error.

```
\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} }
  }
```

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

__enumext_getkeyans:nn

The internal function __enumext_getkeyans:nn will check for the existence of the ⟨*prop list*⟩, if it does not exist it will return an error message, then it will fetch the content specified by the second ⟨*argument*⟩ from ⟨*prop list*⟩.

```
\cs_new_protected:Npn \__enumext_getkeyans:nn #1 #2
  {
    \prop_if_exist:cF { g__enumext_#1_prop }
      { \msg_error:nnn { enumext } { undefined-storage-anskey } {#1} }
    \group_begin:
      \prop_item:cn { g__enumext_#1_prop }{#2}
    \group_end:
  }
```

(*End of definition for* __enumext_getkeyans:nn.)

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10.39 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 to define a set of ⟨*keys*⟩ with which we will control the options of the different nesting levels for the enumext and enumext* environment by storing the values of these in the token list variables \l__enumext_print_keyans_X_tl.

```
\keys_define:nn  { keyanskey / print }
  {
    level-1 .code:n     = \tl_put_right:Nn \l__enumext_print_keyans_i_tl
                            {
                              \setenumext[level,1] {#1} \setenumext[print,1] {#1}
                            },
    level-1 .initial:n  = { label=\arabic*., nosep, columns=2, first=\small, font=\small },
    level-2 .code:n     = \tl_put_right:Nn \l__enumext_print_keyans_ii_tl
                            {
                              \setenumext[level,2] {#1} \setenumext[print,2] {#1}
                            },
    level-2 .initial:n  = { nosep, label=(\alph*), first=\small, font=\small },
    level-3 .code:n     = \tl_put_right:Nn \l__enumext_print_keyans_iii_tl
                            {
                              \setenumext[level,3] {#1} \setenumext[print,3] {#1}
                            },
    level-3 .initial:n  = { nosep, label=\roman*., first=\small, font=\small },
    level-4 .code:n     = \tl_put_right:Nn \l__enumext_print_keyans_iv_tl
                            {
                              \setenumext[level,4] {#1} \setenumext[print,4] {#1}
                            },
    level-4 .initial:n  = { nosep, label=\Alph*., first=\small, font=\small },
    level-* .code:n     = \tl_put_right:Nn \l__enumext_print_keyans_vii_tl % starred
                            {
                              \setenumext[enumext*] {#1} %%\setenumext[print,*] {#1}
                            },
    level-* .initial:n  = { label=\arabic*., nosep, columns=2, first=\small, font=\small },
  }
```

\printkeyans Create a user command to print *"all stored content"* in ⟨*sequence*⟩ for \anskey, \item* and \anspic*.

```
\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:
  }
```

(*End of definition for* \printkeyans*. This function is documented on page* 12.)

__enumext_printkeyans:nnn The internal function __enumext_printkeyans:nnn will check for the existence of the ⟨*sequence*⟩, if it does not exist it will return an error message, then it will fetch the content specified by the first argument mapping the ⟨*sequence*⟩.

#1 : starred
#2 : key-val
#3 : seq-name

```
\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 }
          {
            %%\seq_show:c { g__enumext_#3_seq }
            \bool_if:nTF {#1}
              {
                \begin{enumext*}[#2]
                  \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
                \end{enumext*}
              }
              {
```

```
                \begin{enumext}[#2]
                  \seq_map_inline:cn { g__enumext_#3_seq } { ##1 }
                \end{enumext}
              }
          }
        }
        {
          \msg_error:nnn { enumext } { undefined-storage-anskey } {#3}
        }
    }
```

(*End of definition for* `\__enumext_printkeyans:nnn`.)

10.40 The command \setenumext

First we define a *"meta families"* of ⟨*keys*⟩ to access from `\setenumext`.

```
\keys_define:nn { enumext / meta-families }
  {
    level-1  .code:n = { \keys_set:nn { enumext / level-1  } {#1} } ,
    level-2  .code:n = { \keys_set:nn { enumext / level-2  } {#1} } ,
    level-3  .code:n = { \keys_set:nn { enumext / level-3  } {#1} } ,
    level-4  .code:n = { \keys_set:nn { enumext / level-4  } {#1} } ,
    keyans   .code:n = { \keys_set:nn { enumext / keyans   } {#1} } ,
    enumext* .code:n = { \keys_set:nn { enumext / enumext* } {#1} } ,
    keyans*  .code:n = { \keys_set:nn { enumext / keyans*  } {#1} } ,
    print-1  .code:n = { \keys_set:nn { keyanskey / print } { level-1 = {#1} } } ,
    print-2  .code:n = { \keys_set:nn { keyanskey / print } { level-2 = {#1} } } ,
    print-3  .code:n = { \keys_set:nn { keyanskey / print } { level-3 = {#1} } } ,
    print-4  .code:n = { \keys_set:nn { keyanskey / print } { level-4 = {#1} } } ,
    print-*  .code:n = { \keys_set:nn { keyanskey / print } { level-* = {#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
  {
    level-1 , level-2 , level-3 , level-4 , keyans, enumext*,
    keyans* , print-1 , print-2 , print-3 , print-4 , print-*,
  }
```

`\setenumext` Now we define the user command `\setenumext`.

```
\NewDocumentCommand \setenumext { o +m }
  {
    \tl_if_novalue:nTF {#1}
      {
        \seq_map_inline:Nn \c__enumext_all_families_seq
      }
      {
        \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} }
```

```
      }
  }
```

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

`\__enumext_set_parse:n`
`\__enumext_set_error:nn`

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} }
    \int_step_inline:nnn { 0 } { 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* `\__enumext_set_parse:n` *and* `\__enumext_set_error:nn`.)

10.41 Messages

Message used by package-load for `multicol` and `hyperref` packages.

```
\msg_new:nnn { enumext } { package-load }
  {
    The ~ '#1' ~ package ~ is ~ already ~ loaded.
  }

\msg_new:nnn { enumext } { package-not-load }
  {
    The ~ '#1' ~ package ~ will ~ be ~ loaded ~ as ~ a ~ dependency.
  }

\msg_new:nnn { enumext } { package-load-foot }
  {
    The ~ '#1' ~ package ~ is ~ loaded ~ with ~ the ~ option ~ '#2'.
  }
```

Message used in the creation of counters by enumext package.

```
\msg_new:nnn { enumext } { counters }
  {
    The ~ counter ~ '#1' ~ is ~ already ~ defined ~ by ~ some ~ \\
    package ~ or ~ macro, ~ it ~ cannot ~ be ~ continued.
  }
```

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 save-ans key.

```
\msg_new:nnn { enumext } { save-ans-empty }
  {
    The ~ 'save-ans' ~ key ~ cannot ~ be ~ empty~ in ~ '#1'. ~ \msg_line_context:.
  }
\msg_new:nnn { enumext } { save-ans-nested }
  {
    The ~ 'save-ans' ~ key ~ cannot ~ be ~ used ~ in ~ nested ~ '#1'. ~ \msg_line_context:.
  }
```

Messages used by the internal system to check answer used by check-ans key.

```
\msg_new:nnn { enumext } { items-same-answer }
  {
    **********~Checking~answers~on~'#1'~OK~**********\\
    **~ All ~ items ~ stored ~ in ~ sequence ~ '#1' ~ have ~ an ~ answer. \\
    ****************************************
    \prg_replicate:nn { 7 + \str_count:n {#1} } { * }
  }
\msg_new:nnn { enumext } { item-different-answer }
  {
    Number ~ of ~ items ~ different ~  of ~ number ~ of ~
    answer ~ in ~ sequence ~ '#1'~ closed ~ \msg_line_context:.
  }
```

Messages used by the internal system to check for *"starred"* \item* commands.

```
\msg_new:nnn { enumext } { missing-starred }
  {
    Missing ~ '\c_backslash_str #1*' ~ in ~ '#2' ~ \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.
  }
```

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Messages used by \anskey and \anspic commands.

```
\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 } { 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'.
  }
```

Messages used by 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.
  }
```

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'.
  }
```

Messages used by enumext* and keyans* environments.

```
\msg_new:nnn { enumext } { nested }
  {
    The ~ starred ~ environment ~ can't ~ be ~ nested ~ \msg_line_context:.
  }
\msg_new:nnn { enumext } { item-joined }
  {
    Items ~ joined ~ (#1) ~ > ~ #2  ~ columns ~\msg_line_context:.
```

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```
  }
\msg_new:nnn { enumext } { item-joined-columns }
  {
    Not ~ space ~ to ~ join ~ items ~ (#1) ~ > ~ #2 ~\msg_line_context:.
  }
```

10.42 Finish package

Finish package implementation.

```
\file_input_stop:
⟨/package⟩
```

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11 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

* 425
\+ 198
\- 198
\\ 206, 2965, 3988, 4001, 4006, 4011, 4026, 4049, 4050, 4065, 4070, 4075, 4080, 4089, 4094, 4103, 4112, 4117, 4122

A

above 1236
above* 1236
\addvspace . . 883, 911, 1034, 1113, 1176, 1182, 1210, 1227, 2787, 2802, 2921, 2936, 3160, 3167, 3570, 3577
after 721
align 379
\Alph *31*, *35*
\Alph 331, 508, 526, 539, 3864
\alph *31*, *35*
\alph 332, 506, 3854
\anskey *11*, *63*, 1912
\anspic *13*, *84*, 2943
\arabic *31*, *32*
\arabic 330, 505, 525, 3849, 3869

B

\b 2665, 2678, 3235, 3248
\baselineskip *43*
\baselineskip 1872, 1880
before 721
before* 721
below 1236
below* 1236
bool commands:
\bool_gset_false:N . . 2825, 2826, 3169, 3173, 3464, 3465, 3579
\bool_gset_true:N 226, 237, 825, 2809, 3152, 3170, 3562, 3580
\bool_if:NTF . 271, 283, 300, 1258, 1272, 1285, 1296, 1307, 1318, 1329, 1340, 1392, 1409, 1415, 1424, 1451, 1489, 1494, 1501, 1505, 1527, 1532, 1540, 1547, 1578, 1586, 1629, 1639, 1710, 1720, 1834, 1858, 1865, 1893, 1924, 1937, 1939, 1950, 1970, 2095, 2106, 2110, 2149, 2164, 2237, 2256, 2260, 2373, 2403, 2476, 2492, 2553, 2563, 2593, 2598, 2655, 2663, 2676, 2721, 2771, 2785, 2793, 2821, 2850, 2906, 2919, 2927, 2945, 3148, 3157, 3161, 3225, 3233, 3246, 3277, 3287, 3370, 3375, 3383, 3387, 3402, 3431, 3460, 3558, 3567, 3571, 3709, 3713, 3737, 3746, 3750, 3756, 3770, 3792
\bool_if:nTF 1211, 1228, 1978, 2414, 2448, 2512, 2966, 3889
\bool_if_p:N 1558, 1559, 1567, 1568, 1689, 1961, 2004, 2005, 2029, 2038, 2039, 2051, 2067, 2223, 2224, 2270, 2271, 2632, 2694, 2707, 2709, 2806, 2972, 2973, 3209
\bool_lazy_all:nTF . . 1687, 2027, 2036, 2049, 2065, 2630, 2692, 2705, 3207
\bool_lazy_and:nnTF . . 222, 233, 1557, 1566, 1960, 2003, 2222, 2805
\bool_lazy_or:nnTF 2269, 2971
\bool_new:N 25, 26, 27, 28, 29, 30, 31, 40, 50, 71, 76, 77, 82, 83, 86, 106, 108, 110, 113, 114, 123, 124, 125, 126, 135, 136, 161, 172, 174
\bool_not_p:n 223, 234, 1962, 2054, 2069, 2695, 2696, 2708, 2807
\bool_set_eq:NN 2381, 2429, 3320, 3664
\bool_set_false:N 280, 1671, 1672, 2814, 2857, 2939, 3003, 3020, 3272, 3317, 3614, 3661
\bool_set_true:N 262, 266, 372, 649, 1242, 1247, 1514, 1649, 1650, 1796, 1803, 2377, 2407, 2425, 2437, 2629, 2638, 2701, 2714, 2740, 2855, 2881, 3137, 3206, 3215, 3326, 3333, 3334, 3547, 3670, 3677, 3678
box commands:
\box_dp:N . 930, 934, 938, 949, 953, 964, 973, 979, 989, 1002, 1008, 1014, 1045, 1046, 1047, 1050, 1060, 1064, 1073, 1080, 1085, 1093, 1122, 1123, 1126, 1133, 1146, 1154, 1160, 1168, 3032
\box_new:N 47, 167
\box_set_wd:Nn 3423, 3784
\box_use:N 3430, 3791
\box_wd:N 338

C

\c 425, 426, 549, 551, 563, 565
\cB 426
\cE 426
\centering 1213, 1230, 3053, 3163, 3573
check-ans 1664
Document class:
article *36*
clist commands:
\clist_const:Nn 179
\clist_map_function:nN 3040
\clist_map_inline:Nn . 378, 591, 654, 720, 735, 816, 1252
\clist_map_inline:nn . 36, 55, 61, 73, 85, 112, 144, 158, 178, 214, 403, 420, 659, 831, 1358, 1677, 1773, 1791, 1812, 2024, 2158, 2331, 2541, 2544, 2570, 2580, 2583, 2603
\columnbreak *63*
\columnbreak 1964
columns 800
columns* 1792
columns-sep 800
columns-sep* 1792
\columnsep *80*, *83*
\columnsep 2765, 2903
\columnseprule *80*, *83*
\columnseprule 2769, 2905
Commands provide by enumext:
\anskey *24*, *25*, *57*, *58*, *61*, *63*, *65–67*, *69*, *79*, *91*, *102*, *103*, *107*
\anspic* *24*, *67–69*, *84*, *86*, *87*, *102*, *103*
\anspic *61*, *84*, *86*, *107*
\getkeyans *61*, *102*, *107*
\item* *24*, *61*, *67–69*, *72*, *73*, *93*, *99*, *100*, *102*, *103*
\itemwidth *87*, *88*, *95*, *96*
\item *71*, *73*, *88*, *92*, *93*, *96*, *98*, *99*
\miniright *24*, *40*, *48*, *49*, *80*, *81*, *83*, *84*, *107*
\printkeyans *25*, *61*, *103*
\setenumext *24*, *104*, *105*
Counters defined by enumext:
enumXiii *23*, *30*

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enumXii 23, 30
enumXiv 23, 30
enumXi 23, 30
enumXviii 23, 30
enumXvii 23, 30, 93
enumXvi 23, 30
enumXv 23, 30

cs commands:

\cs_generate_variant:Nn 340, 356, 555, 571, 1817, 1826, 1831, 1911, 2531, 3042
\cs_if_exist:NTF 310
\cs_new:Nn 192
\cs_new:Npn 202, 1359, 1368, 1377
\cs_new_eq:NN 246, 247, 248, 252, 253, 285, 286, 289, 290
\cs_new_protected:Nn . 216, 257, 421, 441, 473, 736, 740, 744, 748, 752, 756, 760, 764, 768, 772, 776, 780, 784, 788, 792, 796, 832, 844, 868, 885, 896, 920, 995, 1019, 1036, 1098, 1115, 1137, 1172, 1178, 1253, 1267, 1281, 1292, 1303, 1314, 1325, 1336, 1422, 1525, 1538, 1555, 1576, 1627, 1637, 1647, 1682, 1718, 1725, 1832, 1856, 1863, 1891, 1898, 2015, 2147, 2162, 2190, 2220, 2265, 2277, 2284, 2336, 2340, 2359, 2410, 2444, 2460, 2470, 2486, 2623, 2690, 2719, 2726, 2749, 2779, 2791, 2848, 2871, 2889, 2914, 2925, 2962, 3005, 3018, 3038, 3043, 3059, 3127, 3146, 3198, 3260, 3267, 3275, 3285, 3302, 3442, 3469, 3537, 3556, 3606, 3627, 3633, 3646, 3702, 3803
\cs_new_protected:Npn 184, 188, 293, 308, 325, 335, 341, 429, 448, 542, 556, 1200, 1219, 1388, 1407, 1479, 1512, 1605, 1616, 1818, 1827, 1947, 2092, 2104, 2126, 2200, 2242, 2250, 2369, 2387, 2421, 2433, 2500, 2534, 2573, 2641, 2661, 2867, 3013, 3078, 3218, 3231, 3308, 3315, 3331, 3339, 3344, 3356, 3488, 3620, 3652, 3659, 3675, 3683, 3697, 3822, 3835, 3882, 3960, 3972
\cs_new_protected_nopar:Nn . . . 3295, 3418, 3639, 3779
\cs_new_protected_nopar:Npn 3362, 3729
\cs_set:Nn 2097
\cs_set:Npn 2025, 2063, 3828
\cs_set_eq:NN . . 3188, 3189, 3364, 3596, 3597, 3731
\cs_set_protected:Nn 208, 660, 676, 688, 700
\cs_set_protected:Npn 32, 48, 56, 68, 74, 102, 140, 152, 159, 210, 357, 379, 408, 489, 509, 572, 592, 636, 655, 712, 721, 800, 817, 1236, 1347, 1664, 1738, 1774, 1792, 2017, 2151, 2320, 2532, 2571
\cs_to_str:N 327, 350

D

\d 198
\DeclareDocumentEnvironment 913

dim commands:

\dim_abs:n 2505, 2510
\dim_add:Nn 3023
\dim_compare:nNnTF . 662, 678, 690, 702, 1202, 1221, 2502, 2507, 2513, 2519, 2521, 2523, 2731, 2754, 2875, 2893, 3015, 3061, 3129, 3471, 3539
\dim_compare:nTF 1988
\dim_gset_eq:NN 3138, 3548
\dim_gzero:N 3172, 3582
\dim_new:N 44, 51, 52, 53, 70, 96, 109, 119, 168, 169, 175
\dim_set:Nn . . 338, 650, 1804, 2401, 2505, 2510, 2512, 2515, 2516, 2520, 2522, 2525, 2526, 2528, 2734, 2757, 2877, 2895, 3045, 3063, 3070, 3113, 3131, 3358, 3473, 3480, 3523, 3541
\dim_set_eq:NN 496, 516, 532, 536, 2396, 2543, 2582, 2680, 2765, 2903, 3120, 3123, 3124, 3250, 3349, 3530, 3533, 3534
\dim_use:N 663, 671, 1203, 1209, 1901, 1904, 1909, 2465, 2467, 2732, 2737, 2738, 2745, 2755, 2759, 2760, 2762
\dim_zero:N 2769, 2905, 3024, 3025, 3026
\dim_zero_new:N 3076, 3486
\c_zero_dim 665, 679, 691, 703, 1203, 1221, 1990, 2502, 2507, 2513, 2520, 2732, 2755, 2875, 2893, 3061, 3129, 3471, 3539

E

\end . . 1206, 1224, 1860, 1895, 2784, 2801, 2918, 2935, 3150, 3166, 3560, 3576, 3893, 3898
\endlist 28
\endlist 247
\endlrbox 3421, 3782
\endminipage 28
\endminipage 253
enumext 5, 2604

enumext internal commands:

\g__enumext_ ł__enumext_store_name_tl _prop 69
\l__enumext__resume_name_tl 53
__enumext_add_pre_parsep: . . . 41, 842, 844, 844
__enumext_after_args_exec: . 39, 736, 748, 2616
__enumext_after_args_exec_v: . 39, 40, 752, 764, 2841
__enumext_after_args_exec_vii: . . . 768, 792
__enumext_after_args_exec_viii: 796
__enumext_after_env:nn . . 81, 95, 188, 188, 2817, 3155, 3456, 3565
__enumext_after_hyperref: . . . 29, 255, 257, 257
__enumext_after_list: 81, 91, 98, 2621, 2791, 2791
\l__enumext_after_list_args_v_tl 766
\l__enumext_after_list_args_vii_tl 794, 3412
\l__enumext_after_list_args_viii_tl 798, 3766
__enumext_after_list_v: . . 84, 2846, 2925, 2925
__enumext_after_list_vii: . . . 3196, 3267, 3267
__enumext_after_list_viii: . . 3604, 3633, 3633
__enumext_after_star_env:nn 89
__enumext_after_stop_list: . . . 39, 40, 736, 744, 2812
__enumext_after_stop_list_v: 39, 752, 760, 2940
\l__enumext_after_stop_list_v_tl 762
__enumext_after_stop_list_vii: 768, 784, 3270
\l__enumext_after_stop_list_vii_tl . . . 786
__enumext_after_stop_list_viii: . 788, 3636
\l__enumext_after_stop_list_viii_tl . . . 790
\l__enumext_align_label_vii_str . . 3404, 3408
\l__enumext_align_label_viii_str . 3758, 3762
\l__enumext_align_label_X_str 159
\c__enumext_all_envs_clist . . 179, 378, 591, 654, 720, 735, 816, 1252
\c__enumext_all_families_seq . 104, 3922, 3931, 3953
__enumext_anskey_wrapper:n 1742, 2102
__enumext_at_begin_document:n . . 28, 184, 184, 244, 250
__enumext_before_args_exec: 38, 736, 736, 2729
__enumext_before_args_exec_v: . . 39, 752, 752, 2874
__enumext_before_args_exec_vii: . . 768, 768, 3264
__enumext_before_args_exec_viii: 772, 3630

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__enumext_before_keys_exec: 39, 736, 740, 2614
__enumext_before_keys_exec_v: .. 39, 752, 756, 2839
__enumext_before_keys_exec_vii 768
__enumext_before_keys_exec_vii: 40, 776, 3184
__enumext_before_keys_exec_viii: .. 40, 780, 3592
__enumext_before_list: ... 79, 2608, 2726, 2726
__enumext_before_list_v: . 82, 2834, 2871, 2871
__enumext_before_list_vii: 91, 3179, 3260, 3260
__enumext_before_list_viii: .. 98, 3588, 3627, 3627
\l__enumext_before_no_starred_key_v_tl 758
\l__enumext_before_no_starred_key_vii_tl 778
\l__enumext_before_no_starred_key_viii_tl 782
\l__enumext_before_starred_key_v_tl ... 754
\l__enumext_before_starred_key_vii_tl . 770
\l__enumext_before_starred_key_viii_tl 774
__enumext_calc_hspace:NNNNNNN 74, 2500, 2500, 2531, 2536, 2575
\l__enumext_check_ans_bool ... 71, 72, 123, 1668, 1672, 1720, 1939, 2237, 2373, 2403, 2806, 3375
__enumext_check_ans_exec: .. 59, 79, 1718, 1718, 2730, 3263
\g__enumext_check_ans_item_tl .. 68, 123, 2236, 2244, 2248
__enumext_check_ans_set: . 58, 1682, 1682, 1722
__enumext_check_ans_show: 59, 1725, 1725, 2823, 3462
\g__enumext_check_ans_show_bool 81, 123, 2809, 2821, 2826
\g__enumext_check_ans_show_h_bool 123, 3460, 3465
\l__enumext_columns_sep_v_dim 2893, 2895, 2903
\l__enumext_columns_sep_vii_dim .. 3061, 3063, 3072, 3117, 3252, 3440
\l__enumext_columns_sep_viii_dim . 3471, 3473, 3482, 3527, 3801
\l__enumext_columns_v_int 1041, 2891, 2899, 2911, 2916
\l__enumext_columns_vii_int .. 3066, 3069, 3073, 3081, 3085, 3088, 3094, 3100, 3104, 3239, 3435, 3446
\l__enumext_columns_viii_int . 3476, 3479, 3483, 3491, 3495, 3498, 3504, 3510, 3514, 3796, 3807
\g__enumext_count_item_anskey_int .. 68, 123, 1728, 1736, 1941, 2239
\g__enumext_count_item_number_int 123, 1693, 1698, 1701, 1704, 1712, 1728, 1735, 2375, 2405, 3377
\g__enumext_count_item_with_ans_int 63
\l__enumext_counter_i_tl 32, 317
\l__enumext_counter_ii_tl 32, 318
\l__enumext_counter_iii_tl 32, 319
\l__enumext_counter_iv_tl 32, 320
\l__enumext_counter_style_for_ref_vii_tl 456, 466, 477, 479
\l__enumext_counter_style_for_ref_viii_tl 483, 485
\l__enumext_counter_style_for_ref_X_tl 148
\c__enumext_counter_style_tl 32, 148, 423
\g__enumext_counter_styles_tl . 23, 31, 44, 328, 346
\l__enumext_counter_v_tl 32, 321
\l__enumext_counter_vi_tl 32, 322
\l__enumext_counter_vii_tl 32, 323, 453
\l__enumext_counter_viii_tl 32, 324, 463
__enumext_current_env_set_bool: . 27, 77, 216, 216, 2625, 3200
\l__enumext_current_widest_dim 23, 44, 352, 497, 517, 533, 537
__enumext_default_item:n ... 2369, 2369, 2418
__enumext_define_counters:Nn 23, 308, 308, 317, 318, 319, 320, 321, 322, 323, 324
__enumext_endminipage: . 28, 250, 253, 919, 3055, 3420, 3781
__enumext_fake_item: 660, 660, 2562
\l__enumext_fake_item_indent_v_dim 679, 684
\l__enumext_fake_item_indent_v_tl 681, 2426, 2430, 2438
\l__enumext_fake_item_indent_vii_dim 691, 696
\l__enumext_fake_item_indent_vii_tl 693, 3416
\l__enumext_fake_item_indent_viii_dim . 703, 708, 3773
\l__enumext_fake_item_indent_viii_tl .. 705, 3772, 3776
\l__enumext_fake_item_indent_X_tl 74
__enumext_fake_item_vii: 660, 688, 2592
__enumext_fake_item_viii: 660, 700, 2597
__enumext_filter_series:n 51, 1359, 1359, 1400, 1413, 1419
__enumext_filter_series_key:n 52, 1359, 1364, 1368
__enumext_filter_series_pair:nn .. 52, 1359, 1365, 1377
\g__enumext_footnote_arg_seq . 145, 2342, 2355, 2365
\g__enumext_footnote_int . 145, 2349, 2352, 2354, 2356
\g__enumext_footnote_int_seq . 145, 2343, 2356, 2361, 2364
__enumext_footnotes_key_bool 29
\l__enumext_footnotes_key_bool 25, 29, 94, 135, 266, 271, 280, 3383, 3431, 3746, 3792
__enumext_footnotetext:nn ... 2336, 2336, 2366
__enumext_getkeyans:nn .. 102, 3831, 3835, 3835
__enumext_getkeyans_aux:n 102, 3819, 3822, 3822
\l__enumext_hyperref_bool 25, 29, 135, 262, 283, 300, 2005, 2224, 3370, 3737
__enumext_hypertarget:nn 29, 257, 285, 289, 305
__enumext_if_is_int:n 196
__enumext_if_is_int:nTF 196, 544, 558
\l__enumext_item_column_pos_vii_int 92, 3088, 3094, 3100, 3104, 3111, 3298, 3435, 3438
\l__enumext_item_column_pos_viii_int ... 98, 3498, 3504, 3510, 3514, 3521, 3642, 3796, 3799
l__enumext_item_column_pos_X_int 159
\g__enumext_item_count_all_vii_int 92, 3112, 3299, 3446, 3453
\g__enumext_item_count_all_viii_int 98, 3522, 3643, 3807, 3814
\g__enumext_item_count_all_X_int 159
__enumext_item_peek_args_vii: 92, 3300, 3302, 3302
__enumext_item_peek_args_viii: . 98, 99, 3644, 3646, 3646
__enumext_item_starred: .. 74, 2460, 2460, 2478
\l__enumext_item_starred_vii_bool 3317, 3333,

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3387
\l__enumext_item_starred_viii_bool 3661, 3677, 3750, 3770
\l__enumext_item_starred_X_bool 159
__enumext_item_std:w *28*, *71–73*, *86*, 244, 248, 2378, 2384, 2408, 2426, 2430, 2438, 3036
\g__enumext_item_symbol_aux_vii_tl 3341, 3389, 3392, 3396, 3398
\g__enumext_item_symbol_aux_X_tl 159
\l__enumext_item_symbol_sep_vii_dim .. 3350, 3358, 3395, 3397
\g__enumext_item_symbol_tl *23*, *72*, 37, 2393, 2466, 2483
\l__enumext_item_symbol_vii_tl 3392
\l__enumext_item_text_vii_box 3382, 3423, 3430
\l__enumext_item_text_viii_box 3745, 3784, 3791
\l__enumext_item_text_X_box 159
\l__enumext_item_width_vii_dim ... 3070, 3115, 3123, 3124
\l__enumext_item_width_viii_dim .. 3480, 3525, 3533, 3534
\l__enumext_item_width_X_dim 159
\l__enumext_itemindent_X_dim 48
\l__enumext_itemsep_vii_skip 3452
\l__enumext_itemsep_viii_skip 3813
\l__enumext_joined_item_aux_vii_int .. 3109, 3110, 3111, 3112, 3118
\l__enumext_joined_item_aux_viii_int . 3519, 3520, 3521, 3522, 3528
\l__enumext_joined_item_aux_X_int 159
__enumext_joined_item_vii:w .. *92*, 3305, 3306, 3308, 3308
\l__enumext_joined_item_vii_int .. 3080, 3081, 3084, 3086, 3092, 3097, 3102, 3107, 3109, 3115
__enumext_joined_item_viii:w . *99*, 3649, 3650, 3652, 3652
\l__enumext_joined_item_viii_int . 3490, 3491, 3494, 3496, 3502, 3507, 3512, 3517, 3519, 3525
\l__enumext_joined_item_X_int 159
\l__enumext_joined_width_vii_dim . 3113, 3120, 3123, 3413, 3425
\l__enumext_joined_width_viii_dim 3523, 3530, 3533, 3767, 3786
\l__enumext_joined_width_X_dim 159
__enumext_keyans_addto_prop:n *67*, 2126, 2126, 2440, 2968
__enumext_keyans_addto_seq:n . *68*, 2200, 2200, 2442, 2970
__enumext_keyans_addto_seq_link: 2200, 2218, 2220, 3708
__enumext_keyans_anspic_code:nnn . *85*, 2959, 2962, 2962
__enumext_keyans_check_ans:nn .. *68*, *69*, 2242, 2242, 2844, 3000, 3602
__enumext_keyans_default_item:n .. *73*, 2421, 2421, 2456
\l__enumext_keyans_env_bool 20, 2695, 2708, 2855, 2939
__enumext_keyans_fake_item: .. 660, 676, 2552
\l__enumext_keyans_item_opt_tl 86, 2254, 2267, 2273, 3693
\l__enumext_keyans_level_h_int 20, 2178, 3608, 3609
\l__enumext_keyans_level_int .. 20, 1194, 1928, 2173, 2854, 2858, 2953
__enumext_keyans_make_label: *31*, *74*, 2486, 2486, 2551
__enumext_keyans_mini_addvspace: *46*, *83*, 1098, 1098, 2883
__enumext_keyans_mini_right_cmd:n *49*, 1196, 1219, 1219
__enumext_keyans_mini_set_vskip: . *45*, 1036, 1036, 1100
__enumext_keyans_multi_addvspace: . *83*, 885, 896, 2908
__enumext_keyans_multi_set_vskip: . *42*, 885, 885, 898
__enumext_keyans_multicols_start: *83*, 2887, 2889, 2889
__enumext_keyans_multicols_stop: . *83*, 1223, 2914, 2914, 2938
__enumext_keyans_parse_keys:n 2833, 2867, 2867
\l__enumext_keyans_pic_above_int . 118, 3046, 3047, 3049
\l__enumext_keyans_pic_above_skip .. *86*, 118, 2991, 3030
__enumext_keyans_pic_arg_two: *86*, 2989, 3018, 3018
\l__enumext_keyans_pic_below_int . 118, 3046, 3047, 3050
\l__enumext_keyans_pic_body_seq .. *85–87*, 118, 2957, 2996, 3054
__enumext_keyans_pic_do:n *87*, 2996, 2998, 3038, 3038, 3042
\l__enumext_keyans_pic_level_int .. 20, 1186, 1932, 2129, 2168, 2203, 2286, 3007, 3008
__enumext_keyans_pic_row:n *87*, 3040, 3043, 3043
__enumext_keyans_pic_safe_exec: .. *86*, 2985, 3005, 3005
__enumext_keyans_pic_skip_abs:N .. *86*, 3013, 3013, 3029
\l__enumext_keyans_pic_width_dim . 118, 3045, 3052
__enumext_keyans_redefine_item: .. *73*, 2444, 2444, 2550
__enumext_keyans_safe_exec: . 2832, 2848, 2848
__enumext_keyans_show_ans: .. 2250, 2258, 2277
__enumext_keyans_show_item_opt: . 2250, 2265, 2438, 2981, 3773
__enumext_keyans_show_left:n . *73*, 2250, 2250, 2436, 2976
__enumext_keyans_show_pos: .. 2250, 2262, 2284
__enumext_keyans_starred_item:n .. *73*, 2433, 2433, 2452
__enumext_keyans_store_ref: .. *67*, 2147, 2147, 2441, 2969, 3706
__enumext_keyans_store_ref_aux_i: *67*, 2147, 2159, 2162
__enumext_keyans_store_ref_aux_ii: *68*, 2147, 2188, 2190
\l__enumext_keyans_tmpa_dim 86
\l__enumext_keyans_tmpa_tl *24*, *99*, 86, 2435, 2439
\l__enumext_keyans_tmpb_tl *99*, 86
__enumext_keyans_wrapper_opt:n .. 1745, 2273
\l__enumext_label_copy_i_tl .. 2059, 2166, 2171, 2176, 2181
\l__enumext_label_copy_v_tl 2176
\l__enumext_label_copy_vi_tl 2171

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\l__enumext_label_copy_vii_tl 2034, 2045, 2076, 2166
\l__enumext_label_copy_viii_tl 2181
\l__enumext_label_copy_X_tl 137
\l__enumext_label_fill_left_v_tl 2490
\l__enumext_label_fill_left_X_tl 74
\l__enumext_label_fill_right_v_tl 2497
\l__enumext_label_fill_right_X_tl 74
\l__enumext_label_font_style_v_tl 2491, 2980
\l__enumext_label_font_style_vii_tl . . . 3401
\l__enumext_label_font_style_viii_tl . . 3755
\l__enumext_label_i_tl 489
\l__enumext_label_ii_tl 489
\l__enumext_label_iii_tl 489
\l__enumext_label_iv_tl 489
__enumext_label_style:Nnn *23*, *31*, 341, 341, 356, 494, 514, 530, 534
\l__enumext_label_v_tl . . *67*, *68*, 527, 2134, 2208, 2279, 2313, 2435, 2439, 2836, 2975, 2977
\l__enumext_label_vi_tl . *67*, *68*, 527, 2131, 2205, 2975, 2977, 2981
\l__enumext_label_vii_tl . 509, 3328, 3353, 3360
\l__enumext_label_viii_tl 509, 3672, 3700, 3704
\l__enumext_label_width_by_box . . 44, 337, 338
__enumext_label_width_by_box:Nn *31*, 335, 335, 340, 352, 568
\l__enumext_labelsep_i_dim . . . 2281, 2317, 3711, 3726
\l__enumext_labelsep_v_dim 2898
\l__enumext_labelsep_vii_dim . 3065, 3074, 3116, 3351, 3411, 3427
\l__enumext_labelsep_viii_dim 3475, 3484, 3526, 3765, 3788
\l__enumext_labelwidth_i_dim . 2281, 2316, 3711, 3726
\l__enumext_labelwidth_v_dim 2898
\l__enumext_labelwidth_vii_dim . . . 3065, 3073, 3116, 3404, 3408, 3426
\l__enumext_labelwidth_viii_dim . . 3475, 3483, 3526, 3758, 3762, 3787
\l__enumext_leftmargin_tmp_v_bool . *86*, 3020
\l__enumext_leftmargin_tmp_X_bool 48
\l__enumext_leftmargin_tmp_X_dim 48
\l__enumext_leftmargin_X_dim 48
__enumext_level: 192, 192, 432, 434, 435, 443, 445, 663, 667, 671, 738, 742, 746, 750, 834, 836, 838, 840, 873, 875, 877, 879, 883, 923, 926, 945, 954, 960, 965, 969, 980, 984, 985, 990, 1026, 1030, 1203, 1209, 1256, 1258, 1260, 1263, 1270, 1272, 1274, 1277, 1836, 1844, 1848, 1852, 2097, 2100, 2101, 2377, 2378, 2382, 2383, 2384, 2391, 2393, 2397, 2398, 2401, 2407, 2408, 2462, 2465, 2467, 2474, 2475, 2476, 2479, 2482, 2611, 2613, 2663, 2668, 2669, 2670, 2672, 2676, 2681, 2682, 2683, 2685, 2701, 2714, 2721, 2732, 2734, 2737, 2738, 2740, 2745, 2752, 2755, 2757, 2759, 2760, 2761, 2762, 2765, 2771, 2776, 2782, 2785, 2787, 2793
\l__enumext_level_h_int . 20, 224, 451, 475, 1690, 1707, 2053, 2070, 2634, 3201, 3202, 3210
\l__enumext_level_int . *77*, 20, 194, 235, 846, 997, 1190, 1684, 2030, 2040, 2046, 2052, 2060, 2068, 2075, 2565, 2626, 2627, 2633, 2646, 2653, 2699, 2712, 2767, 2819, 2862, 2949, 3211, 3279, 3289, 3458, 3615
__enumext_list_arg_two_i: 2532
__enumext_list_arg_two_ii: 2532
__enumext_list_arg_two_iii: 2532
__enumext_list_arg_two_iv: 2532
__enumext_list_arg_two_v: . *73*, 2532, 2838, 3021
__enumext_list_arg_two_vii: 2571, 3183
__enumext_list_arg_two_viii: 2571, 3591
\l__enumext_listoffset_v_dim 2900
\l__enumext_listparindent_vii_dim 3414
\l__enumext_listparindent_viii_dim . . . 3768
__enumext_make_label: *31*, *71*, *72*, *74*, 2470, 2470, 2560
\l__enumext_mark_answer_sym_tl . *62*, 113, 1751, 1906, 2112, 2288, 2301, 3715
\l__enumext_mark_position_str 113, 1755, 1756, 1779, 1780, 1904
\l__enumext_mark_ref_sym_tl . . 113, 1765, 2010, 2232
__enumext_mini_addvspace: . . *45*, *80*, 1019, 1019, 2742
__enumext_mini_addvspace_vii: *47*, 1172, 1172, 3141
__enumext_mini_addvspace_viii: *47*, 1172, 1178, 3551
__enumext_mini_env* 913
__enumext_mini_right_cmd:n . *48*, *49*, 1198, 1200, 1200
__enumext_mini_set_vskip: . . *43*, 920, 920, 1021
__enumext_mini_set_vskip_vii: *47*, 1115, 1115, 1174
__enumext_mini_set_vskip_viii: *47*, 1115, 1137, 1180
__enumext_minipage:w *28*, 250, 252, 915, 3052, 3413, 3767
\l__enumext_minipage_active_v_bool . . *83*, *84*, 2881, 2906, 2919, 2927
\g__enumext_minipage_active_vii_bool . . . *89*, 3152, 3157, 3169
\l__enumext_minipage_active_vii_bool . 3137, 3148
\g__enumext_minipage_active_viii_bool 3562, 3567, 3579
\l__enumext_minipage_active_viii_bool 3547, 3558
\g__enumext_minipage_active_X_bool . . . 159
\l__enumext_minipage_active_X_bool 62
\g__enumext_minipage_after_skip 62, 1119, 1131, 3167, 3577
\l__enumext_minipage_after_skip *43*, *44*, *81*, *84*, 62, 936, 951, 971, 987, 1002, 1008, 1014, 1028, 1038, 1047, 1050, 1062, 1080, 1091, 1107, 1139, 1152, 1166, 2802, 2936
\g__enumext_minipage_center_vii_bool . 3161, 3170
\g__enumext_minipage_center_viii_bool 3571, 3580
\g__enumext_minipage_center_X_bool . . . 159
\l__enumext_minipage_hsep_v_dim . . . *82*, 2879
\l__enumext_minipage_hsep_vii_dim 3135
\l__enumext_minipage_hsep_viii_dim . . . 3545
\l__enumext_minipage_left_skip *43*, *83*, 62, 928, 943, 962, 977, 1024, 1034, 1039, 1045, 1054, 1071, 1083, 1103, 1113, 1117, 1122, 1126, 1140, 1144, 1158, 1176, 1182
\l__enumext_minipage_left_v_dim *82*, 2877, 2885
\l__enumext_minipage_left_vii_dim 3131, 3143

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\l__enumext_minipage_left_viii_dim 3541, 3553
\l__enumext_minipage_left_X_dim 62
\g__enumext_minipage_right_skip 62, 1118, 1123, 1127, 3160, 3570
\l__enumext_minipage_right_skip . . 43, 62, 932, 947, 967, 982, 1040, 1046, 1058, 1076, 1087, 1141, 1148, 1162, 1210, 1227
\l__enumext_minipage_right_v_dim . . 82, 1221, 1226, 2875, 2879
\g__enumext_minipage_right_vii_dim 88, 3139, 3159, 3172
\l__enumext_minipage_right_vii_dim 88, 3129, 3134, 3140
\g__enumext_minipage_right_viii_dim . . 3549, 3569, 3582
\l__enumext_minipage_right_viii_dim . . 3539, 3544, 3550
\g__enumext_minipage_right_X_dim 159
\g__enumext_minipage_right_X_skip 159
\g__enumext_minipage_stat_int . 80, 83, 62, 1215, 1232, 2741, 2795, 2800, 2882, 2929, 2934
\g__enumext_miniright_code_vii_tl . 89, 3165, 3171
\g__enumext_miniright_code_viii_tl 3575, 3581
\g__enumext_miniright_code_X_tl 159
__enumext_multi_addvspace: . . . 42, 80, 868, 868, 2773
__enumext_multi_set_vskip: . . 41, 832, 832, 870
\l__enumext_multicols_above_ii_skip . . . 851
\l__enumext_multicols_above_iii_skip . . 857
\l__enumext_multicols_above_iv_skip . . . 863
\l__enumext_multicols_above_v_skip 887, 901, 911
\l__enumext_multicols_above_X_skip 56
\l__enumext_multicols_below_v_skip 891, 905, 2921
\l__enumext_multicols_below_X_skip 56
__enumext_multicols_start: 80, 2747, 2749, 2749
__enumext_multicols_stop: 80, 1205, 2779, 2779, 2804
__enumext_newlabel:nn 25, 29, 66, 293, 293, 2086, 2194
\l__enumext_newlabel_arg_one_tl 25, 29, 66, 67, 137, 2009, 2079, 2087, 2183, 2195, 2230
\l__enumext_newlabel_arg_two_tl 25, 29, 65, 137, 2033, 2043, 2057, 2073, 2088, 2170, 2175, 2180, 2196
__enumext_parse_keys:n . . . 52, 2607, 2641, 2641
__enumext_parse_keys_vii:n 52, 3178, 3218, 3218
__enumext_parse_keys_viii:n . 3587, 3620, 3620
__enumext_parse_series:n 52, 1388, 1388, 2649, 3224
__enumext_parse_store_keys:n . 78, 2657, 2661, 2661
__enumext_parse_store_keys_vii:n . 90, 3227, 3231, 3231
\l__enumext_parsep_i_skip 849, 851, 1000, 1048
\l__enumext_parsep_ii_skip 855, 857, 1006
\l__enumext_parsep_iii_skip . . . 861, 863, 1012
\l__enumext_parsep_vii_skip 3415
\l__enumext_parsep_viii_skip 3769
\l__enumext_partopsep_v_skip . . 903, 907, 1074, 1078, 1085, 1089, 1105, 1109
\l__enumext_partopsep_viii_skip 1150
__enumext_phantomsection: 29, 257, 286, 290, 306
__enumext_print_footnote: . . . 2336, 2359, 3433, 3794
__enumext_print_keyans_box:NN 62, 1898, 1898, 1911, 2099, 2281, 2315, 3711, 3726
\l__enumext_print_keyans_i_tl 3845, 3874
\l__enumext_print_keyans_ii_tl . . . 3850, 3875
\l__enumext_print_keyans_iii_tl . . 3855, 3876
\l__enumext_print_keyans_iv_tl . . . 3860, 3877
\l__enumext_print_keyans_vii_tl . . 3865, 3878
\l__enumext_print_keyans_X_tl 102
__enumext_printkeyans:nnn 103, 3879, 3882, 3882
__enumext_redefine_item: . 72, 2410, 2410, 2559
\l__enumext_ref_aux_tl 148, 432, 434, 437, 453, 455, 458, 463, 465, 468
\l__enumext_ref_key_arg_tl . . 148, 426, 431, 438, 450, 459, 469
__enumext_regex_label_ref_key: . . 32, 33, 421, 421, 433, 454, 464
__enumext_register_counter_style:Nn . . 325, 325, 330, 331, 332, 333, 334
__enumext_remove_extra_parsep_vii: . . 3193, 3442, 3442
__enumext_remove_extra_parsep_viii: . 3601, 3803, 3803
__enumext_renew_footnote: . . . 2336, 2340, 3385, 3748
\l__enumext_resume_active_bool 52, 54, 37, 1392, 1514
\l__enumext_resume_bool 23
__enumext_resume_counter: . . 54, 55, 1512, 1518, 1525
__enumext_resume_counter:n . 52, 54, 1483, 1488, 1512, 1512, 1582, 1590
__enumext_resume_counter_save_ans: . . 54, 55, 1512, 1523, 1555
__enumext_resume_counter_series: 54, 55, 1512, 1521, 1538
\g__enumext_resume_int . 23, 37, 1435, 1529, 1530
__enumext_resume_last:n . . 52, 1388, 1394, 1407
\l__enumext_resume_name_tl 37, 1431, 1439, 1442, 1458, 1466, 1469, 1515, 1516, 1544, 1551
__enumext_resume_save_counter: 53, 1422, 1422, 2815, 3273
__enumext_resume_series:n . 54, 1353, 1479, 1479
__enumext_resume_starred: . 56, 1354, 1576, 1576
\g__enumext_resume_vii_int . . 91, 37, 1462, 1534, 1535
__enumext_safe_exec: 27, 2606, 2623, 2623
__enumext_safe_exec_vii: . 27, 3177, 3198, 3198
__enumext_safe_exec_viii: . . . 3586, 3606, 3606
\l__enumext_series_name_tl 54
\l__enumext_series_str 53, 1351, 1390, 1398, 1399, 1401, 1403, 1426, 1429, 1433, 1453, 1456, 1460, 2645, 3222
__enumext_set_error:nn 3960, 3970, 3972
__enumext_set_label_ref:n . . . 32, 429, 429, 501
__enumext_set_label_ref_h:n . 33, 448, 448, 521
__enumext_set_parse:n 3943, 3960, 3960
\l__enumext_setkey_tmpa_int . . . 97, 3936, 3940
\l__enumext_setkey_tmpa_seq 97, 3934, 3944, 3950, 3952, 3954, 3967
\l__enumext_setkey_tmpa_tl 97, 3942, 3946
\l__enumext_setkey_tmpb_seq 97, 3935, 3938, 3942, 3943

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\l__enumext_setkey_tmpb_tl 97, 3962, 3964, 3965
\l__enumext_show_answer_bool . 113, 1759, 1783, 2106, 2256, 2270, 2972, 3709
__enumext_show_length:nnn . . 38, 202, 202, 4012, 4013, 4014, 4015, 4016, 4017, 4018, 4019, 4020, 4021, 4027, 4028, 4029, 4030, 4031, 4032, 4033, 4034, 4035, 4036
\l__enumext_show_position_bool 113, 1762, 1786, 2110, 2260, 2271, 2973, 3713
\g__enumext_standar_bool . 27, 20, 223, 226, 1424, 1489, 1501, 1527, 1540, 1578, 1710, 2632, 2825
\l__enumext_standar_bool 81, 20, 2038, 2051, 2067, 2629, 2814
\g__enumext_standar_keyans_pic_star_env_-int 134
\g__enumext_standar_keyans_star_env_int 133
\g__enumext_standar_level_one_bool 57
\l__enumext_standar_level_one_bool . . 77, 20, 1409, 1558, 1629, 2638
\g__enumext_standar_series_tl . 37, 1412, 1413, 1580, 1583
\g__enumext_standar_star_env_int . . 130, 227
\g__enumext_standard_bool 77
\l__enumext_standard_bool 77
__enumext_standard_item_vii:w 92, 3313, 3315, 3315
__enumext_standard_item_viii:w 99, 3657, 3659, 3659
\g__enumext_starred_bool 27, 90, 91, 20, 234, 237, 1451, 1494, 1505, 1532, 1547, 1586, 1689, 2029, 2039, 2069, 2164, 2696, 2709, 2807, 3173, 3209, 3464
\l__enumext_starred_bool . 90, 91, 20, 1962, 1970, 2054, 2095, 3206, 3272
__enumext_starred_columns_set_vii: . . 3059, 3059, 3186
__enumext_starred_columns_set_viii: . 3469, 3469, 3594
__enumext_starred_item:nn . . . 2387, 2387, 2416
__enumext_starred_item_exec: . 100, 3702, 3702, 3752
__enumext_starred_item_vii:w 92, 93, 3312, 3331, 3331
__enumext_starred_item_vii_aux_i:w . . 3331, 3336, 3339
__enumext_starred_item_vii_aux_ii:w . 3331, 3337, 3342, 3344
__enumext_starred_item_vii_aux_iii:w 3331, 3347, 3356
__enumext_starred_item_viii:w 99, 3656, 3675, 3675
__enumext_starred_item_viii_aux_i:w . 3675, 3680, 3683
__enumext_starred_item_viii_aux_ii:w 3675, 3681, 3695, 3697
__enumext_starred_joined_item_vii:n . 88, 92, 3078, 3078, 3310
__enumext_starred_joined_item_viii:n 96, 99, 3488, 3488, 3654
\g__enumext_starred_keyans_star_env_int 132
\g__enumext_starred_level_one_bool 57
\l__enumext_starred_level_one_bool 20, 1415, 1567, 1639, 3215
\g__enumext_starred_series_tl . 37, 1418, 1419, 1588, 1591
\g__enumext_starred_star_env_int . . 131, 238
__enumext_start_from:NNn 35, 542, 542, 555, 577
\l__enumext_start_i_int 1530, 1542, 1561
__enumext_start_item_tmp_vii: 89, 3189, 3295, 3295
__enumext_start_item_tmp_viii: 97, 3597, 3639, 3639
__enumext_start_item_vii:w . 92, 93, 3323, 3328, 3353, 3360, 3362, 3362
__enumext_start_item_viii:w . . 99, 3667, 3672, 3700, 3729, 3729
__enumext_start_list:nn 28, 76, 86, 244, 246, 2610, 2835, 2986, 3181, 3589
__enumext_start_mini_vii: . 91, 3127, 3127, 3265
__enumext_start_mini_viii: 98, 3537, 3537, 3631
__enumext_start_store_level: . 79, 2609, 2690, 2690
__enumext_start_store_level_vii: . 91, 3180, 3275, 3275
\l__enumext_start_vii_int . . . 1535, 1549, 1570
\l__enumext_start_X_int 74, 572
__enumext_stop_item_tmp_vii: . 89, 92, 93, 3188, 3192, 3297, 3364
__enumext_stop_item_tmp_viii: . . 97, 98, 3596, 3600, 3641, 3731
__enumext_stop_item_vii: 93, 94, 3364, 3418, 3418
__enumext_stop_item_viii: 101, 3731, 3779, 3779
__enumext_stop_list: . . 28, 244, 247, 2619, 2845, 2999, 3194, 3603
__enumext_stop_mini_vii: 89, 91, 3146, 3146, 3269
__enumext_stop_mini_viii: . 98, 3537, 3556, 3635
__enumext_stop_store_level: . . 79, 2620, 2690, 2719
__enumext_stop_store_level_vii: . . 91, 3195, 3275, 3285
\l__enumext_store_active_bool 24, 57, 78, 90, 86, 1559, 1568, 1649, 1924, 2655, 2694, 2707, 2850, 2857, 2945, 3003, 3225, 3277, 3287, 3614
__enumext_store_addto_prop:n 61, 67, 1817, 1818, 1826, 1949, 2145, 3705
__enumext_store_addto_seq:n 61, 68, 1827, 1827, 1831, 1838, 1852, 1860, 1869, 1887, 1895, 2013, 2235
\l__enumext_store_ans_bool . 57, 123, 1650, 1671, 1834, 1858, 1865, 1893, 1937
\l__enumext_store_anskey_arg_tl 24, 63, 64, 86, 1955, 1964, 1966, 1972, 1980, 1983, 1993, 1998, 2001, 2007, 2013
__enumext_store_anskey_code:nnnn . 63, 1943, 1947, 1947
__enumext_store_anskey_show_left:n 66, 1954, 2104, 2104
__enumext_store_anskey_show_wrap:n 66, 2092, 2092, 2108, 2123
\l__enumext_store_columns_break_bool . 1918, 1961
\l__enumext_store_columns_join_int 86, 1969, 1974
\l__enumext_store_columns_sep_vii_bool 3246
\l__enumext_store_columns_sep_vii_dim 3251, 3255
\l__enumext_store_columns_sep_X_bool . . 102
l__enumext_store_columns_sep_X_dim . . . 102
\l__enumext_store_columns_vii_bool . . . 3233
\l__enumext_store_columns_vii_int 3238, 3242
\l__enumext_store_columns_X_bool 102

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\l__enumext_store_columns_X_int 102
__enumext_store_internal_ref: . . 63, 65, 1952, 2015, 2015
\l__enumext_store_item_symbol_sep_dim 1916, 1990, 1995
\l__enumext_store_item_symbol_tl . 1914, 1981, 1985
\l__enumext_store_keyans_item_opt_sep_-tl 1748, 2139, 2141, 2212, 2214, 3688, 3690
\l__enumext_store_keyans_item_opt_tl . . . 86
\l__enumext_store_keyans_label_tl 24, 67, 68, 86, 2128, 2131, 2134, 2141, 2143, 2145, 2202, 2205, 2208, 2214, 2216, 2226, 2235, 2236, 3685, 3690, 3691, 3704, 3705, 3707
__enumext_store_level_close: . 61, 1832, 1856, 2723
__enumext_store_level_close_vii: 1863, 1891, 3291
__enumext_store_level_open: . . 60, 61, 78, 1832, 1832, 2702, 2715
__enumext_store_level_open_vii: . . 90, 1863, 1863, 3281
\g__enumext_store_name_tl 24, 81, 86, 1730, 1733, 2810, 2827, 3466
\l__enumext_store_name_tl 24, 56, 86, 1445, 1448, 1472, 1475, 1563, 1572, 1607, 1608, 1618, 1619, 1651, 1653, 1655, 1657, 1659, 1661, 1820, 1822, 1829, 2081, 2082, 2118, 2185, 2186, 2294, 2307, 2810, 3721
\l__enumext_store_opt_vii_tl . 1867, 1877, 1883, 1887, 3240, 3253
\l__enumext_store_opt_X_tl 102
\l__enumext_store_ref_key_bool 63, 1768, 1950, 2004, 2149, 2223
\l__enumext_store_upper_level_X_bool . . 102
\l__enumext_store_write_aux_file_tl 25, 66, 68, 137, 2084, 2090, 2192, 2198
__enumext_storing_exec: . 57, 1605, 1631, 1641, 1647
__enumext_storing_set:n . . 56, 1597, 1605, 1605
__enumext_storing_set_vii:n . . 56, 1602, 1605, 1616
__enumext_storing_standar: . 56, 57, 1605, 1613, 1627
__enumext_storing_starred: . 56, 57, 1605, 1624, 1637
\l__enumext_the_counter_vii_tl 455
\l__enumext_the_counter_viii_tl 465
\l__enumext_the_counter_X_tl 148
__enumext_tmp:n 32, 36, 48, 55, 56, 61, 68, 73, 74, 85, 102, 112, 140, 144, 152, 158, 159, 178, 210, 214, 655, 659, 1347, 1358, 1664, 1681, 1738, 1773, 1774, 1791, 2017, 2024, 2025, 2046, 2060, 2063, 2075, 2151, 2158, 2532, 2570, 2571, 2603
__enumext_tmp:nn 357, 378, 379, 407, 408, 420, 572, 591, 636, 654, 712, 720, 721, 735, 800, 816, 817, 831, 1236, 1252, 1792, 1816, 2320, 2335
__enumext_tmp:nnn 489, 505, 506, 507, 508, 509, 525, 526
__enumext_tmp:nnnnnn 592, 617, 620, 623, 625, 627, 630, 633
__enumext_tmp:w 3828, 3831
\l__enumext_tmpa_vii_int 3069, 3072
\l__enumext_tmpa_viii_int 3479, 3482
\l__enumext_tmpa_X_int 159
\l__enumext_topsep_v_skip 889, 893, 1043, 1056, 1064, 1069, 1089, 1093, 3002, 3033
\l__enumext_topsep_vii_skip . . 1120, 1129, 1133
\l__enumext_topsep_viii_skip . 1142, 1164, 1168
__enumext_use_key_ref: 33, 441, 441, 2561
__enumext_use_key_ref_h: . . 33, 473, 473, 2589
\l__enumext_vspace_a_star_v_bool 1285
\l__enumext_vspace_a_star_vii_bool . . . 1307
\l__enumext_vspace_a_star_viii_bool . . . 1318
\l__enumext_vspace_a_star_X_bool 74
__enumext_vspace_above: . . 49, 1253, 1253, 2728
__enumext_vspace_above_v: . 50, 1281, 1281, 2873
\l__enumext_vspace_above_v_skip . . 1283, 1287, 1289
__enumext_vspace_above_vii: . . 50, 1303, 1303, 3262
\l__enumext_vspace_above_vii_skip 1305, 1309, 1311
__enumext_vspace_above_viii: . 50, 1303, 1314, 3629
\l__enumext_vspace_above_viii_skip 1316, 1320, 1322
\l__enumext_vspace_b_star_v_bool 1296
\l__enumext_vspace_b_star_vii_bool . . . 1329
\l__enumext_vspace_b_star_viii_bool . . . 1340
\l__enumext_vspace_b_star_X_bool 74
__enumext_vspace_below: . . 50, 1267, 1267, 2813
__enumext_vspace_below_v: . 50, 1292, 1292, 2941
\l__enumext_vspace_below_v_skip . . 1294, 1298, 1300
__enumext_vspace_below_vii: . . 51, 1325, 1325, 3271
\l__enumext_vspace_below_vii_skip 1327, 1331, 1333
__enumext_vspace_below_viii: . 51, 1325, 1336, 3637
\l__enumext_vspace_below_viii_skip 1338, 1342, 1344
__enumext_widest_from:nNNn . . 35, 556, 556, 571, 583
\g__enumext_widest_label_tl 23, 31, 44, 345, 349, 353
\l__enumext_wrap_label_opt_v_bool 2429
\l__enumext_wrap_label_opt_vii_bool 92, 3322
\l__enumext_wrap_label_opt_viii_bool 99, 3666
\l__enumext_wrap_label_opt_X_bool 74
\l__enumext_wrap_label_v_bool 2425, 2429, 2437, 2492
\l__enumext_wrap_label_vii_bool 92, 3321, 3326, 3334, 3402
\l__enumext_wrap_label_viii_bool . . 99, 3665, 3670, 3678, 3756
\l__enumext_wrap_label_X_bool 74
__enumext_wrapper_label_v:n 2494, 2981
__enumext_wrapper_label_vii:n 3405
__enumext_wrapper_label_viii:n 3759
__enumext_zero_count_level: 208, 208
__enumext_zero_parsep: 44, 940, 995, 995
enumext* 5, 3175
enumXi 317
enumXii 317
enumXiii 317
enumXiv 317
enumXv 317
enumXvi 317

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enumXvii 317
enumXviii 317
Environments provide by enumext:
enumext* 22, 23, 25–27, 30, 32–34, 37, 38, 40, 47, 50–54, 56, 58–65, 67, 70, 71, 76, 77, 79, 90, 91, 93, 95, 96, 98, 100, 103, 106, 107
enumext 22, 23, 25, 27, 30, 31, 33–46, 48–54, 56, 58–63, 65, 67, 70–79, 81, 82, 86–88, 91, 103, 106
keyans* 22–24, 26, 27, 30, 32–34, 37, 38, 40, 47, 50, 51, 57, 58, 60, 61, 67, 71, 76, 97, 98, 106, 107
keyanspic 22–25, 30, 31, 34, 48, 57, 58, 61, 67–69, 84–86, 107
keyans 22–25, 27, 30, 31, 34–40, 42, 45, 46, 48–50, 57, 58, 60, 61, 67–69, 73–76, 81, 82, 84–86, 88, 98, 106, 107
Environments:
list 27, 28, 75–77
lrbox 87, 94, 101
minipage 27, 28, 40, 43, 84–87, 94, 101
multicols 41–43, 48, 80, 81, 83, 84
exp commands:
\exp_after:wN 3831
\exp_args:Ne 2652, 3819
\exp_not:N 156, 348, 437, 458, 468, 669, 683, 684, 695, 696, 707, 708, 2009, 2115, 2116, 2228, 2291, 2292, 2304, 2305, 3718, 3719, 3828
\exp_not:n 437, 438, 458, 459, 468, 469, 670, 1375, 1386, 1800, 1807, 1974, 1985, 1995, 2009, 2010, 2087, 2195, 2230, 2232, 2672, 2685, 3242, 3255

F

\fbox 1743
file commands:
\file_input_stop: 4137
first 721
font 357
\footnote 71
\footnote 71, 2344
\footnotemark 2354
\footnotesize 2116, 2292, 2305, 3719
\footnotetext 2338

G

\getkeyans 13, 102, 3817
group commands:
\group_begin: . . 1936, 2114, 2290, 2303, 3381, 3400, 3717, 3744, 3754, 3839, 3873
\group_end: 1945, 2121, 2297, 2310, 3410, 3422, 3724, 3764, 3783, 3841, 3880

H

\hbadness 3429, 3790
hbox commands:
\hbox_set:Nn 337
\hfill 387, 391, 396, 397, 1207, 1225, 2009, 2228, 3151, 3561
hook commands:
\hook_gput_code:nnn 9, 186, 190, 255
\hook_gset_rule:nnnn 256
\hspace 3440, 3801
\hyperlink 64, 68
\hyperlink 2009, 2228
\hypertarget 29
\hypertarget 285

I

\IfHyperBoolean 263
\IfPackageLoadedTF 11, 259, 273
\ignorespaces 672
\inputlineno 227, 238
int commands:
\int_add:Nn 3111, 3521
\int_case:nn 846, 997, 1684, 1707
\int_compare:nNnTF 451, 475, 922, 1041, 1186, 1190, 1194, 1727, 1928, 1932, 2129, 2168, 2173, 2178, 2203, 2286, 2627, 2646, 2699, 2712, 2751, 2767, 2781, 2795, 2819, 2858, 2862, 2891, 2916, 2929, 2949, 2953, 3008, 3081, 3091, 3107, 3202, 3279, 3289, 3435, 3444, 3458, 3491, 3501, 3517, 3609, 3615, 3796, 3805, 3940
\int_compare_p:nNn 224, 235, 1690, 2030, 2040, 2052, 2053, 2068, 2070, 2633, 2634, 3210, 3211
\int_decr:N 3110, 3520
\int_eval:n 1822, 2082, 2116, 2186, 2292, 2305, 2547, 2588, 3099, 3509, 3719
\int_from_alph:n 550, 564
\int_from_roman:n 552, 566
\int_gadd:Nn 3112, 3522
\int_gdecr:N 1693, 1698, 1701, 1704, 1712
\int_gincr:N 1529, 1534, 1941, 2239, 2375, 2405, 2741, 2882, 3299, 3377, 3643
\int_gset:Nn 227, 238, 2352
\int_gset_eq:NN 1428, 1435, 1441, 1447, 1455, 1462, 1468, 1474, 2349
\int_gzero:N 212, 1215, 1232, 1735, 1736, 2800, 2934, 3453, 3814
\int_if_exist:NTF 1401, 1439, 1445, 1466, 1472, 1659
\int_incr:N 2626, 2854, 3007, 3201, 3298, 3608, 3642
\int_mod:nn 3446, 3807
\int_new:N 20, 21, 22, 23, 24, 37, 38, 62, 78, 90, 99, 107, 120, 121, 128, 129, 130, 131, 132, 133, 134, 145, 162, 163, 164, 165, 166, 1403, 1661
\int_set:Nn 546, 550, 552, 1542, 1549, 1561, 1570, 1797, 1969, 3046, 3047, 3069, 3080, 3086, 3102, 3429, 3479, 3490, 3496, 3512, 3790, 3936
\int_set_eq:NN . 1530, 1535, 2667, 3109, 3237, 3519
\int_step_function:nnN 2046, 2060, 2075
\int_step_inline:nnn 3048, 3963
\int_to_roman:n 194, 2026, 2064
\int_use:N . . 923, 1544, 1551, 1563, 1572, 2547, 2565, 2588, 2653, 2752, 2761, 2776, 2782, 3084, 3085, 3097, 3494, 3495, 3507
\int_zero:N 3438, 3799
\c_one_int . 3069, 3088, 3094, 3100, 3104, 3107, 3479, 3498, 3504, 3510, 3514, 3517
\c_zero_int . . 224, 235, 2030, 2040, 2052, 2053, 2068, 2070, 3279, 3289, 3449, 3810
\item 28, 39, 40, 62, 71, 84, 86, 87, 89, 97
\item 71, 73, 92, 93, 98, 100, 248, 1840, 1846, 1871, 1879, 1966, 2205, 2208, 2412, 2446, 3187, 3189, 3595, 3597, 3707
\item* 6, 12, 2444
item-pos* 2320
item-sym* 2320
\itemindent 23, 75
\itemindent 74
itemindent 636
\itemsep 85, 86
\itemsep 3022, 3028
\itemwidth 3076, 3120, 3124, 3486, 3530, 3534

K

keyans 11, 2830
keyans* 11, 3584
keyanspic 12, 2983

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Keys for environments provide by enumext:
above* 24, 49, 50
above 24, 49, 50, 79, 82, 91, 98
after 38–40, 81, 84, 91, 98
align 24, 31, 32, 73, 94
before* 38, 39, 79, 91, 98
before 38–40, 82
below* 24, 49–51
below 24, 49–51, 81, 84, 91, 98
check-ans 24, 25, 27, 57, 58, 63, 68, 69, 71, 72, 79, 81, 95, 106
columns-sep* 25, 60, 78, 90
columns-sep 40, 61, 78, 80, 83, 90
columns* 25, 60, 78, 90
columns 23, 40, 43, 49, 61, 78, 80, 83, 90
first 38–40, 94
font 31, 73, 94
item-pos* 63, 64, 70
item-sym* 23, 63, 64, 70, 72
item*-sep 72
itemindent 24, 37, 73, 94
itemsep 36, 76
labelsep 31, 72, 75, 94
labelwidth 30, 31, 34, 35, 75
label 23, 30, 31, 34, 35, 87
lisparindent 76
list-indent 23, 37, 86
list-offset 37
listparindent 37, 94
mark-ans 25, 59, 66
mark-pos 59, 60
mark-ref 25, 59, 65
mini-env . . 24, 40, 43, 48, 49, 71, 79, 82, 88, 91, 96, 98
mini-sep 24, 40, 79, 82
miniright* 24, 40
miniright 24, 40, 47, 89
minirigth* 27
minirigth 27
no-store 25, 57–59
noitemsep 36, 44
nosep 36, 44
parindent 76
parsep 36, 76, 94
partopsep 36
ref 26, 32, 33
resume* 51, 52, 56, 57, 81
resume 23, 51–57, 76, 81, 91
rightmargin 37
save-ans 24, 52–56, 61, 63, 67, 68, 73, 82, 84, 85, 91, 98, 100, 102, 103, 106
save-key 25, 52
save-ref 25, 29, 59, 63–65, 67, 68, 73, 100
save-sep 59
series 51–56, 81
show-ans 25, 59, 60, 62, 63, 66, 73, 99, 100
show-length 27, 38, 76, 106
show-pos 25, 59, 60, 62, 63, 66, 69, 73, 99, 100
start 24, 27, 35, 76
store-brk 63
topsep 36
widest 23, 27, 35
wrap-ans 59, 62, 66
wrap-label* 31, 71, 73, 92, 94, 99
wrap-label 31, 73, 92, 94, 99
wrap-opt 59
keys commands:
\keys_define:nn 359, 381, 410, 491, 511, 527, 574, 594, 638, 657, 714, 723, 802, 819, 1238, 1349, 1595, 1600, 1666, 1740, 1776, 1794, 1912, 2322, 3843, 3906
\l_keys_key_str 3997
\keys_set:nn . 373, 826, 1243, 1248, 1491, 1496, 1583, 1591, 1958, 2648, 2652, 2869, 3223, 3624, 3908, 3909, 3910, 3911, 3912, 3913, 3914, 3915, 3916, 3917, 3918, 3919, 3957
keyval commands:
\keyval_parse:NNn 1363

L

label 489, 509, 527
Labels provide by enumext:
\Alph* 30, 31
\Roman* 30, 31
\alph* 30, 31
\arabic* 30–32
\roman* 30, 31
\labelsep 86
\labelsep 3023, 3026
labelsep 357
\labelwidth 31, 86
\labelwidth 3023, 3024
labelwidth 357
\leftmargin 23, 75
\leftmargin 74, 3023
legacy commands:
\legacy_if:nTF 3365, 3368, 3732, 3735
\legacy_if_gset_false:n 916
\legacy_if_set_false:n 3367, 3734
\legacy_if_set_true:n 3327, 3352, 3359, 3372, 3671, 3699, 3739
\linewidth 79, 82
\linewidth 2736, 2879, 3045, 3072, 3133, 3482, 3543
\list 28
\list 246
list-indent 636
list-offset 636
\listparindent 3025
listparindent 636
\lrbox 3382, 3745

M

\makebox 87
\makebox . . 1902, 1904, 2466, 3396, 3404, 3408, 3758, 3762
\makelabel 71, 73, 74, 87
\makelabel 73, 74, 2472, 2488
\makesavenoteenv 279
mark-ans 1738
mark-pos 1738, 1774
mark-ref 1738
mini-env 800
mini-sep 800
\minipage 28
\minipage 252
\miniright 10, 48, 1184, 2798, 2932
\miniright* 10
mode commands:
\mode_if_vertical:TF 871, 899, 1022, 1101
\mode_leave_vertical: . . 669, 683, 695, 707, 1871, 1879, 1900, 2464, 3394

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msg commands:
\msg_error:nn .. 2860, 2864, 2951, 3010, 3204, 3611, 3617, 3920
\msg_error:nnn . 1188, 1192, 1217, 1234, 1503, 1507, 1610, 1621, 3833, 3838, 3903, 3973
\msg_error:nnnn 1926, 1930, 1934, 2852, 2947, 2955
\msg_fatal:nn 2628
\msg_fatal:nnn 311
\msg_info:nnn 13, 16, 261, 275
\msg_line_context: .. 4001, 4006, 4011, 4026, 4041, 4045, 4057, 4061, 4065, 4070, 4075, 4080, 4085, 4089, 4094, 4099, 4103, 4108, 4112, 4117, 4122, 4127, 4131, 4135
\msg_new:nnn 3974, 3978, 3982, 3986, 3991, 3995, 3999, 4004, 4009, 4024, 4039, 4043, 4047, 4054, 4059, 4063, 4068, 4073, 4078, 4083, 4087, 4092, 4097, 4101, 4106, 4110, 4115, 4120, 4125, 4129, 4133
\msg_term:nnn 1730
\msg_term:nnnn 2555, 2565, 2594, 2599
\msg_warning:nn 2797, 2931
\msg_warning:nnn 1634, 1644, 1733
\msg_warning:nnnn 2246, 2504, 2509, 3083, 3096, 3493, 3506
\multicolsep *80*, *83*
\multicolsep 2766, 2904

N

\NeedsTeXFormat 3
\newcounter 314
\NewDocumentCommand 1184, 1922, 2943, 3817, 3871, 3927
\NewDocumentEnvironment . 2604, 2830, 2983, 3175, 3584
\newlabel *29*
\newlabel 297
no-store 1664
\noindent *89*, *97*
\noindent . 2743, 2884, 3142, 3188, 3437, 3552, 3596, 3798
\nointerlineskip 2743, 2884, 3142, 3552
noitemsep 592
\nopagebreak 882, 910, 1033, 1112, 1175, 1181
\normalfont 2115, 2291, 2304, 3718
nosep 592

P

Packages:
enumext *22*, *56*, *75*, *84*, *105*
enumitem *30*
expl3 . . . . . *87*
footnotehyper *29*
hyperref *25*, *27*, *29*, *33*, *64*, *68*, *93*, *105*
lua-visual-debug *43*
multicol *22*, *105*
shortlst *87*
\par 882, 910, 1033, 1112, 1175, 1181, 1210, 1227, 2094, 2787, 2802, 2921, 2936, 3057, 3160, 3167, 3437, 3451, 3570, 3577, 3798, 3812
\parindent 3414, 3768
\parsep *41*, *44*, *85*, *86*
\parsep 1872, 1880, 2585, 3022, 3029, 3034
parsep 592
\parskip 3415, 3769
\partopsep *86*
\partopsep 2586, 3027
partopsep 592
peek commands:
\peek_meaning:NTF 3304, 3318, 3335, 3346, 3648, 3662, 3679
\peek_meaning_remove:NTF 3311, 3655
\peek_remove_spaces:n 2450
\phantomsection *29*
\phantomsection 286
prg commands:
\prg_do_nothing: 290
\prg_new_protected_conditional:Npnn . . . 196
\prg_replicate:nn 205, 4052
\prg_return_false: 200
\prg_return_true: 199
\printkeyans *13*, *103*, 3871
prop commands:
\prop_count:N 1822, 2082, 2118, 2186, 2294, 2307, 3721
\prop_gput_if_not_in:Nnn 1817, 1820
\prop_if_exist:NTF 1651, 3837
\prop_item:Nn 3840
\prop_new:N 1653
\ProvidesExplPackage 4

R

\raggedcolumns 2775, 2910
\ref *65*, *67*
ref 489, 509
\refstepcounter 3374, 3741
regex commands:
\regex_match:nnTF 198, 549, 551, 563, 565, 2665, 2678, 3235, 3248
\regex_replace_once:nnN 425
\renewcommand 437, 458, 468
\RenewDocumentCommand . . . 2344, 2412, 2446, 2472, 2488
\RequirePackage 17
resume 1347
resume* 1347
rightmargin 636
\Roman *31*, *35*
\Roman 333
\roman *31*, *35*
\roman 334, 507, 3859

S

save-ans 1595
save-ref 1738
save-sep 1738
scan commands:
\scan_stop: *86*, 3036, 3187, 3595, 3828, 3831
seq commands:
\seq_clear:N 3934
\seq_const_from_clist:Nn 3922
\seq_count:N 2996, 3938
\seq_gclear:N 2342, 2343
\seq_gput_right:Nn 1829, 2355, 2356
\seq_if_empty:NTF 2361, 3886, 3952
\seq_if_exist:NTF 1655, 3884
\seq_item:Nn 3054
\seq_map_function:NN 3943
\seq_map_inline:Nn .. 3892, 3897, 3931, 3953, 3954
\seq_map_pairwise_function:NNN 2363
\seq_new:N 100, 101, 118, 146, 147, 1657
\seq_pop_left:NN 3942
\seq_put_right:Nn 2957, 3950, 3967
\seq_set_from_clist:Nn 3935
\seq_set_map_e:NNn 3944
\seq_show:N 3888
series 1347
\setcounter 560, 564, 566, 2547, 2588, 3001

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\setenumext . 6–9, 104, 3847, 3852, 3857, 3862, 3867, 3927
\setlength 1873, 1881
show-ans 1738, 1774
show-length 712
skip commands:
\skip_add:Nn . 851, 857, 863, 873, 877, 901, 905, 1002, 1008, 1014, 1024, 1028, 1050, 1103, 1107, 3022
\skip_eval:n 1872, 1880
\skip_gset:Nn 1123, 1127, 1131
\skip_gzero_new:N 1118, 1119
\skip_horizontal:N 684, 696, 708, 3397, 3411, 3765
\skip_horizontal:n . . . 670, 1901, 1909, 2465, 2467, 3395, 3773
\skip_if_eq:nnTF 849, 855, 861, 925, 959, 1000, 1006, 1012, 1043, 1048, 1069, 1120, 1142, 1255, 1269, 1283, 1294, 1305, 1316, 1327, 1338
\skip_new:N 58, 59, 63, 64, 65, 66, 67, 122, 176
\skip_set:Nn . 834, 838, 887, 891, 928, 932, 936, 943, 947, 951, 962, 967, 971, 977, 982, 987, 1045, 1046, 1047, 1054, 1058, 1062, 1071, 1076, 1080, 1083, 1087, 1091, 1122, 1126, 1144, 1148, 1152, 1158, 1162, 1166, 3016, 3030
\skip_set_eq:NN 2545, 2584, 2585, 3414, 3415, 3768, 3769
\skip_use:N 836, 840, 875, 879, 883, 903, 907, 926, 945, 954, 960, 965, 969, 980, 984, 985, 990, 1026, 1030, 1056, 1256, 1260, 1263, 1270, 1274, 1277, 2787
\skip_zero:N 2586, 2766, 2904, 3027, 3028
\skip_zero_new:N 1038, 1039, 1040, 1117, 1139, 1140, 1141
\c_zero_skip 849, 855, 861, 926, 960, 1000, 1006, 1012, 1043, 1048, 1069, 1120, 1142, 1256, 1270, 1283, 1294, 1305, 1316, 1327, 1338
\small 3849, 3854, 3859, 3864, 3869
\star 2326
start 572
\stepcounter 2348, 2964
str commands:
\c_backslash_str 4061, 4070, 4071, 4075, 4076, 4080, 4081, 4112, 4113, 4117, 4122, 4123
\c_colon_str 2081, 2185, 3828
\str_case:nn 218
\str_case:nnTF 1370, 1379
\str_clear:N 2645, 3222
\str_count:n 205, 4052
\str_if_empty:NTF 1390, 1433, 1460
\str_if_eq:nnTF 2548, 2590
\str_if_in:nnTF 3824
\str_new:N 117, 171
\str_set:Nn . . . 413, 414, 415, 1755, 1756, 1779, 1780
\string 279
\strutbox 930, 934, 938, 949, 953, 964, 973, 979, 989, 1002, 1008, 1014, 1045, 1046, 1047, 1050, 1060, 1064, 1073, 1080, 1085, 1093, 1122, 1123, 1126, 1133, 1146, 1154, 1160, 1168, 3032

T

TEX and LATEX 2ε commands:
\@auxout 295
\@currenvir 218
\protected@write 295
text commands:
\text_expand:n 3820
\textasteriskcentered 1752, 1766
\thepage 301
tl commands:
\c_space_tl 2273, 4011, 4026
\tl_clear:N 386, 392, 1955, 2128, 2202, 3685
\tl_clear_new:N 343
\tl_const:Nn 148, 327
\tl_gclear:N 1412, 1418, 2248, 2483, 2827, 3171, 3398, 3466, 3581
\tl_gclear_new:N 1398
\tl_gput_right:Nn 328
\tl_greplace_all:Nnn 349
\tl_gset:Nn 1399, 1413, 1419, 2236, 2810, 3341
\tl_gset_eq:NN 345, 2393, 3391
\tl_if_blank:nTF 3389
\tl_if_empty:NTF . 443, 477, 483, 1426, 1431, 1453, 1458, 1516, 1580, 1588, 1608, 1619, 1836, 1867, 1981, 2139, 2212, 2244, 2267, 2462, 3688, 3965
\tl_if_empty:nTF 1481
\tl_if_exist:NTF 1486
\tl_if_novalue:nTF . . 1956, 1967, 2136, 2210, 2252, 2346, 2371, 2389, 2394, 2423, 2643, 2994, 3220, 3622, 3686, 3929
\tl_map_inline:Nn 346, 423
\tl_new:N 34, 39, 41, 42, 43, 45, 46, 79, 80, 81, 87, 88, 89, 91, 92, 93, 94, 95, 97, 98, 104, 105, 115, 116, 127, 137, 138, 139, 142, 150, 151, 154, 155, 170, 173
\tl_put_left:Nn 1844, 1877, 1964, 2279, 2313, 3704, 3707
\tl_put_right:Nn 344, 435, 456, 466, 1798, 1805, 1848, 1883, 1966, 1972, 1980, 1983, 1993, 1998, 2001, 2007, 2033, 2043, 2057, 2073, 2079, 2084, 2131, 2134, 2141, 2143, 2170, 2175, 2180, 2183, 2192, 2205, 2208, 2214, 2216, 2226, 2670, 2683, 3240, 3253, 3690, 3691, 3845, 3850, 3855, 3860, 3865
\tl_remove_all:Nn 3964
\tl_remove_once:Nn 2021, 2155
\tl_replace_all:Nnn 348
\tl_reverse:N 2020, 2022, 2154, 2156
\tl_set:Nn 156, 313, 387, 391, 396, 397, 431, 450, 667, 681, 693, 705, 1515, 1607, 1618, 2112, 2254, 2288, 2301, 2391, 3693, 3715, 3962
\tl_set_eq:NN 354, 432, 434, 453, 455, 463, 465, 2019, 2153, 2166, 2435, 2439, 2975, 2977
\tl_to_str:n 1486, 1492, 1497, 3820
\tl_trim_spaces:n 344, 3950, 3962, 3968
\tl_use:N . 350, 353, 445, 479, 485, 738, 742, 746, 750, 754, 758, 762, 766, 770, 774, 778, 782, 786, 790, 794, 798, 1906, 2026, 2034, 2045, 2059, 2064, 2076, 2378, 2384, 2408, 2426, 2430, 2438, 2474, 2475, 2482, 2490, 2491, 2497, 2611, 2836, 2980, 3165, 3401, 3412, 3416, 3575, 3755, 3766, 3772, 3776, 3874, 3875, 3876, 3877, 3878, 3946
token commands:
\token_to_str:N 297
\topsep 1873, 1881
topsep 592
\typeout 228, 239, 265, 268, 278, 279, 1411, 1417, 1694, 1713, 2637, 3214

U

\u 426
use commands:
\use:N 206, 2479, 2613
\use:n 1361, 3826
\use_none:nn 289
\usecounter 2546, 2587

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V

\value 1429, 1435, 1442, 1448, 1456, 1462, 1469, 1475

\vspace 917, 1260, 1263, 1274, 1277, 1287, 1289, 1298, 1300, 1309, 1311, 1320, 1322, 1331, 1333, 1342, 1344, 1872, 1880, 2991, 3002, 3452, 3813

W

widest 572
wrap-ans 1738
wrap-label 357
wrap-label* 357
wrap-opt 1738

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