An Extension of the \LaTeX-Theorem Environment

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Abstract

ntoerem.sty is a package for handling theorem-like environments. Additionally to several features for defining the layout of theorem-like environments which can be regarded to be standard requirements for a theorem-package, it provides solutions for two related problems: placement of endmarks and generation of lists of theorem-like environments.

In contrast to former approaches, it solves the problem of setting endmarks of theorem-like environments (theorems, definitions, examples, and proofs) automatically at the right positions, even if the environment ends with a displaymath or (even nested) list environments, it also copes with the amsmath package. This is done in the same manner as the handling of labels by using the .aux file.

It also introduces the generation of lists of theorem-like environments in the same manner as listoffigures. Additionally, more comfortable referencing is supported.

After running \LaTeX several times (depending on the complexity of references, in general, three runs are sufficient), the endmarks are set correctly, and theoremlists are generated.

Since ntoerem.sty uses the standard \LaTeX \newtheorem command, existing documents can be switched to ntoerem.sty without having to change the .tex file. Also, it is compatible with \LaTeX files using theorem.sty written by Frank Mittelbach.

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1 Introduction

For our purposes here, “theorems” are labelled enunciations, often set off from the main text by extra space and a font change. Theorems, corollaries, conjectures, definitions, examples, remarks, and proofs are all instances of “theorems”. The “header” of these structures is composed of the type of the structure (such as Theorem or Remark), a number which serializes the instances of the same type throughout the document, and an optional name (such as “Correctness Theorem”). The layout of theorems can be changed by parameters as the fonts of the header and the body, the way how to arrange the headers, the indentation, and the way of numbering it. Confronted with these requirements, theorem.sty, a style for dealing with theorem layout was developed by Frank Mittelbach which was the standard theorem-environment for long time.

But then the desire for additional features like “endmarks” and “theorem-lists” arose. Two extensions of theorem.sty were developed: One for handling endmarks, thmmarks.sty and one for generating lists, newthm.sty. Thus, Frank Mittelbach suggested to combine the new features into one “standard-to-be” package. And now, here it is.

2 The User-Interface

2.1 How to include the package

The package ntheorem.sty is included by

\usepackage[⟨options⟩]{ntheorem.sty},

where the optional parameter ⟨options⟩ selects predefined configurations and special requirements.

The following ⟨options⟩ are available by now, concerning three independent issues:
Predefining environments: (see Section 2.3.6) With [standard] and [noconfig], it can be chosen, if and what file is used for activating a (user-defined) standard set of theorem environments.

Compatibility with amsthm: option [amsthm] provides compatibility with the theorem-layout commands of the amsthm-package (see Section 3.2).

Activation of endmarks: [thmmarks] enables the automatical placement of endmarks (see 2.3); when using the amsmath-package, [thmmarks] must be complemented by [amsmath] (see Section 3.2).

Activation of extended reference features: [thref] enables the extended reference features (see Section 4.1).

Compatibility with hyperref: option [hyperref] provides compatibility with the hyperref-package (see section 3.4).

2.2 Defining New Theorem Sets

The syntax and semantics is exactly the same as in standard LaTeX: the command \newtheorem defines a new “theorem set” or “theorem-like structure”. Two required arguments name the new environment set and give the text to be typeset with each instance of the new “set”, while an optional argument determines how the “set” is enumerated:

\newtheorem{foo}{bar} The theorem set foo (whose name is bar) uses its own counter.

\newtheorem{foo2}[foo]{bar2} The theorem set foo2 (printed name bar2) uses the same counter as the theorem set foo.

\newtheorem{foo3}[section]{bar} The theorem set foo3 (printed name bar) is enumerated within the counter section, i.e. with every new \section the enumeration begins again with 1, and the enumeration is composed from the section-number and the theorem counter itself.

For every environment ⟨name⟩ defined by \newtheorem, two environments ⟨name⟩ and ⟨name∗⟩ are defined. In the main document, they have exactly the same effect, but the latter causes no entry in the respective list of theorems (cf. \section and \section∗), see also Section 2.4.

Theorem sets can be redefined by \renewtheorem, with the same arguments as explained for \newtheorem. When redefining a theorem set, the counter is not re-initialized.

2.3 Defining the Layout of Theorem Sets

For theorem-like environments, the user can set parameters by setting several switches and then calling \newtheorem. The layout of a theorem set is defined with the values of the switches at the time \newtheorem is called.
2.3.1 Common Parameters for all Theorem Sets

These additional parameters affect the vertical space around theorem environments: \
theorempreskipamount and \theorempostskipamount define, respectively, the \nspacing before and after such an environment. These parameters apply for all \ntheorem sets and can be manipulated with the ordinary length macros. They are \nrubber lengths, ('skips'), and therefore can contain plus and minus parts.

2.3.2 Parameters for Individual Sets

The layout of individual theorem sets can be further determined by switches con-\ntrolling the appearance of the headers and the header-body-layout:

- \theoremstyle{⟨style⟩}: The general structure of the theorem layout is de-\nfined via its \theoremstyle. \ntheorem provides several predefined styles including those of Frank Mittelbach’s \ntheorem.sty (cf. Section 2.3.4. Additional styles can be defined by \newtheoremstyle (cf. Section2.5.1).

- \theoremheaderfont{⟨fontcmds⟩}: The theorem header is set in the font specified by ⟨fontcmds⟩.
  In contrast to \theorem.sty, \theoremheaderfont can be set individually for each environment type.

- \theorembodyfont{⟨fontcmds⟩}: The theorem body is set in the font specified by ⟨fontcmds⟩.

- \theoremseparator{⟨thing⟩}: ⟨thing⟩ separates the header from the body of the theorem-environment. E.g., ⟨thing⟩ can be “:” or “.”.

- \theoreminindent{⟨dimen⟩} can be used to indent the theorem wrt. the surrounding text.
  ! It’s a ‘(dimen)’, so the user shouldn’t try to specify a plus or minus part, cause this leads to an error.

- \theoremnumbering{⟨style⟩} specifies the appearance of the numbering of the theorem set. Possible ⟨styles⟩ are arabic (default), alph, Alph, roman, Roman, greek, Greek, and fnsymbol.
  Clearly, if a theorem-environment uses the counter of another environment type, also the numbering style of that environment is used.

- \theoremsymbol{⟨thing⟩}: This is only active if \ntheorem.sty is loaded with option [thmmarks]. ⟨thing⟩ is set as an endmark at the end of every instance of the environment. If no symbol should appear, say \theoremsymbol{}.

The flexibility provided by these command should relieve the users from the ugly hacking in \newtheorem to fit most of the requirements stated by publishers or supervisors.

With the command \theoremclass{⟨theorem-type⟩} (where ⟨theorem-type⟩ must be an already defined theorem type), these parameters can be set to the values which were used when \newtheorem was called for ⟨theorem-type⟩.
With \theoremclass{LaTeX}, the standard \LaTeX layout can be chosen.
2.3.3 Font Selection

From the document structuring point of view, theorem environments are regarded as special parts inside a document. Furthermore, the theorem header is only a distinguished part of a theorem environment. Thus, \texttt{\theoremheaderfont} inherits characteristics of \texttt{\theorembodyfont} which also inherits in characteristics of the font of the surrounding environment. Thus, if for example \texttt{\theorembodyfont} is \texttt{\itshape} and \texttt{\theoremheaderfont} is \texttt{\bfseries} the font selected for the header will have the characteristics ‘bold extended italic’. If this is not desired, the corresponding property has to be explicitly overwritten in \texttt{\theoremheaderfont}, e.g. by \texttt{\theoremheaderfont{\normalfont\bfseries}}

2.3.4 Predefined theorem styles

The following theorem styles are predefined, covering those from \texttt{theorem.sty}:

- **plain**: This theorem style emulates the original \LaTeX\ definition, except that additionally the parameters \texttt{\theoremm...skipamount} are used.
- **break**: In this style, the theorem header is followed by a line break.
- **change**: Header number and text are interchanged, without a line break.
- **changebreak**: Like \texttt{change}, but with a line break after the header.
- **margin**: The number is set in the left margin, without a line break.
- **marginbreak**: Like \texttt{margin}, but with a line break after the header.
- **nonumberplain**: Like \texttt{plain}, without number (e.g. for proofs).
- **nonumberbreak**: Like \texttt{break}, without number.
- **empty**: No number, no name. Only the optional argument is typeset.

2.3.5 Default Setting

If no option is given, i.e. \texttt{ntheorem.sty} is loaded by \texttt{\usepackage{ntheorem.sty}}, the following default is set up:

\begin{verbatim}
\theoremstyle{plain},
\theoremheaderfont{\normalfont\bfseries} and
\theorembodyfont{\itshape},
\theoremmseperator{},
\theoremmindent0cm,
\theoremmnumbering{arabic},
\theoremsymbol{}. \end{verbatim}

Thus, by only saying \texttt{\newtheorem{...}{...}}, the user gets the same layout as in standard \LaTeX.
2.3.6 A Standard Set of Theorems

A standard configuration of theorem sets is provided within the file ntheorem.std, which will be included by the option [standard]. It uses the amssymb and latexsym (automatically loaded) packages and defines the following sets:

Theorems: Theorem, Lemma, Proposition, Corollary, Satz, Korollar,
Definitions: Definition,
Examples: Example, Beispiel,
Remarks: Anmerkung, Bemerkung, Remark,
Proofs: Proof and Beweis.

These theorem sets seem to be the most frequently used environments in english and german documents.

The layout is defined to be theoremstyle plain, bodyfont \itshape, Headerfont \bfseries, and endmark (theoremsymbol) \ensuremath{\Box} for all theorem-like environments. For the definition-, remark- and example-like sets, the above setting is used, except bodyfont \upshape. The proof-like sets are handled a bit differently. There, the layout is defined as theoremstyle nonumberplain, bodyfont \upshape, headerfont \scshape and endmark \ensuremath{\blacksquare}. For a more detailed information look at ntheorem.std or at the code-section.

2.3.7 Customization and Local Settings

Since the user should not change ntheorem.std, we've added the possibility to use an own configuration-file. If one places the file ntheorem.cfg in the path searched by \TeX, this file is read automatically (if [standard] is not given). The usage of ntheorem.cfg can be prevented by the [noconfig] option. Thus, just a copy of ntheorem.std to ntheorem.cfg must be made which then can freely be modified by the user. Note, that if a configuration-file exists, this will always be used (i.e. with option standard and an existing configuration-file, the .cfg file will be used and the .std file won't.

2.4 Generating Theoremlists

Similar to the \LaTeX command \listoffigures, any theorem set defined with a \newtheorem statement may be listed at any place in your document by

\listtheorems{⟨list⟩}

The argument ⟨list⟩ is a comma-separated list of the theorem sets to be listed. For a theorem set ⟨name⟩, only the instances are listed which are instantiated by \begin⟨name⟩. Those instantiated by \begin⟨name⟩* are omitted (cf. \section and \section*).

For example, \listtheorems{Corollary,Lemma} leads to a list of all instances of one of the theorem sets “Corollary” or “Lemma”. Note, that the set name given to the command is the first argument which is specified by \newtheorem which is also the one to be used in \begin{theorem} ... \end{theorem}.

1Note, that mathmode is ensured for the symbol.
If \texttt{listtheorems} is called for a set name which is not defined via \texttt{newtheorem}, the user is informed that a list is generated, but there will be no typeset output at all.

### 2.4.1 Defining the List Layout

\texttt{\theoremlisttype{⟨type⟩}}

Theoremlists can be formatted in different ways. Analogous to theorem layout, there are several predefined types which can be selected by

The following four \texttt{⟨type⟩}s are available (for examples, the user is referred to section 4).

\texttt{all} List any theorem of the specified set by number, (optional) name and pagename. This one is also the default value.

\texttt{allname} Like \texttt{all}, additionally with leading theoremname.

\texttt{opt} Analogous to \texttt{all}, but only the theorems which have an optional name are listed.

\texttt{optname} Like \texttt{opt}, with leading theoremname.

### 2.4.2 Writing Extra Stuff to Theorem File

Similar to \texttt{\addcontentsline} and \texttt{\addtocontents}, additional entries to theoremlists are supported. Since entries to theoremlists are a bit more intricate than entries to the lists maintained by standard \LaTeX \texttt{\addcontentsline} and \texttt{\addtocontents} cannot be used in a straightforward way\footnote{For a theorem, its number has to be stored explicitly since different theorem sets can use the same counter. Also, it is optional to reset the counter for each section.}.

\texttt{\addtheoremline{⟨name⟩}{⟨text⟩}}

where \texttt{⟨name⟩} is the name of a valid theorem set and \texttt{⟨text⟩} is the text, which should appear in the list. For example,

\texttt{\addtheoremline{Example}{Extra Entry with number}}

generates an entry with the following characteristics:

- The Label of the theorem “Example” is used.
- The current value of the counter for “Example” is used
- The current pagename is used.
- The specified text is the optional text for the theorem.

Thus, the above command has the same effect as it would be for

\texttt{\begin{Example}{Extra Entry with number} \end{Example}}

except, that there would be no output of the theorem, and the counter isn’t advanced.

\texttt{\addtheoremline*}

Alternatively you can use
which is the same as above, except that the entry appears without number.

Sometimes, e.g. for long lists, special control sequences (e.g. a pagebreak) or additional text should be inserted into a list. This is done by

\addtothemreamble{⟨name⟩}{⟨text⟩}

where ⟨name⟩ is the name of a theorem set and ⟨text⟩ is the text to be written into the theorem file. If the optional argument ⟨name⟩ is omitted, the given text is inserted in every list, otherwise it is only inserted for the given theorem set.

2.5 For Experts: Defining Layout Styles

2.5.1 Defining New Theorem Layouts

Additional layout styles for theorems can be defined by

\newtheoremstyle{⟨name⟩}{⟨head⟩}{⟨opt-head⟩}.

After this, \theoremstyle{⟨name⟩} is a valid \theoremstyle. Here, ⟨head⟩ has to be a statement using two arguments, ##1, containing the keyword, and ##2, containing the number. ⟨opt-head⟩ has to be a statement using three arguments where the additional argument ##3 contains the optional parameter.

Since \LaTeX implements theorem-like environments by \trivlist, both header declarations must be of the form \item[... \text{\theoremlabelfont} ...], where the dotted parts can be formulated by the user. If there are some statements producing output after the \item[...], you have to care about implicit spaces.

Because of the @, if \newtheoremstyle is used in a .tex file, it has to be put between \makeatletter and \makeatother.

For details, look at the code documentation or the definitions of the predefined theoremstyles.

Theorem styles can be redefined by \renewtheoremstyle, with the same arguments as explained for \newtheoremstyle.

2.5.2 Defining New Theorem List Layouts

Analogous, additional layouts for theorem lists can be defined by

\newtheoremlisttype{⟨name⟩}{⟨start⟩}{⟨line⟩}{⟨end⟩}.

The first argument, ⟨name⟩, is the name of the listtype, which can be used as a valid \theoremlisttype. ⟨start⟩ is the sequence of commands to be executed at the very beginning of the list. Corresponding, ⟨end⟩ will be executed at the end of the list. These two are set to do nothing in the standard-types. ⟨line⟩ is the part to be called for every entry of the list. It has to be a statement using four arguments: ##1 will be replaced with the name of the theorem, ##2 with the number, ##3 with the theorem’s optional text and ##4 with the pagernumber.

WARNING: Self-defined Layouts will break with the hyperref-package.

Theorem list types can be redefined by \renewtheoremlisttype, with the same arguments as explained for \newtheoremlisttype.
2.6 Setting End Marks

The automatic placement of endmarks is activated by calling `ntheorem.sty` with the option `[thmmarks]`. Since then, the endmarks are set automatically, there are only a few commands for dealing with very special situations.

If in a single environment, the user wants to replace the standard endmark by some other, this can be done by saying `\qed`, if `\qedsymbol` has been defined by `\qedsymbol{⟨something⟩}` (in option standard, `\qedsymbol` is defined to be the symbol used for proofs, since a potential use of this features is to close trivial corollaries without explicitly proving them).

Additionally, if in a single environment of a theorem set, that is defined without an endmark, the user wants to set an endmark, this is done with `\qedsymbol` and `\qed` as described above. `\qedsymbol` can be redefined everywhere in the document.

On the other hand, if in some situation, the user decides to set the endmark manually (e.g. inside a figure or a minipage), the automatic handling can be turned off by `\NoEndMark` for the current environment. Then – assumed that he current environment is of type ⟨name⟩, the endmark can manually be set by just saying \(\langle name\rangle Symbol\).

Note that there must be no empty line in the input before the `\end{theorem}`, since then, the end mark is ignored (cf. Theorem 3 in Section 4).

2.7 Extended Referencing Features

The extended referencing features are activated by calling `ntheorem.sty` with the option `[thref]`.

Note that the option has to be explicitely given since version 1.13.

Often, when writing a paper, one changes propositions into theorems, theorems into corollaries, lemmata into remarks an so on. Then, it is necessary to adjust also the references, i.e., from “see Proposition \ref{completeness}” to “see Theorem \ref{completeness}”. For relieving the user from this burden, the type of the respective labeled entities can be associated with the label itself:

\begin{verbatim}
\label{⟨label⟩} [⟨type⟩]
\end{verbatim}

associates the type ⟨type⟩ with ⟨label⟩.

This task is automated for theorem-like environments:

\begin{verbatim}
\begin{Theorem}⟨name⟩\label{⟨label⟩}
\end{verbatim}

is equivalent to

\begin{verbatim}
\begin{Theorem}⟨name⟩\label{⟨label⟩} [Theorem]
\end{verbatim}

\thref{⟨label⟩}

The additional information is used by

\begin{verbatim}
\thref{⟨label⟩}
\end{verbatim}

which outputs the respective environment-type and the number, e.g., “Theorem 42”. Note that \LaTeX\ has to be run twice after changing labels (similar to getting references OK; in the intermediate run, warnings about undefined reference types can occur).

The [thref] option interferes with the babel package, thus in this case, ntheorem has to be loaded after babel.
2.8 Miscellaneous

Inside a theorem-like environment \(\langle\text{env}\rangle\), the name given as optional argument is accessible by \(\langle\text{env}\rangle\text{name}\).

3 Possible Interferences

Since \texttt{ntheorem} reimplements the handling of theorem-environments completely, it is incompatible with every package also concerning those macros. Additionally, the \texttt{thmmarks} algorithm for placing endmarks requires modifications of several environments (cf. Section 7). Thus, environments which are reimplemented or additionally defined by document options or styles are not covered by the endmark algorithm of \texttt{ntheorem.sty}.

The [thref] option changes the \texttt{\textbackslash label} command and the treatment of labels when reading the .aux file. Thus it is potentially incompatible with all packages also changing \texttt{\textbackslash label} (or \texttt{\newlabel}). Compatibility with babel’s \texttt{\newlabel} is achieved if babel is loaded before ntheorem.

3.1 Interfering Document Options.

\texttt{ntheorem.sty} also copes with the usual document options \texttt{leqno} and \texttt{fleqn}\(^3\). If one of those options is used in the \texttt{\documentclass} declaration, it is automatically recognized by the \texttt{thmmarks} part of \texttt{ntheorem.sty}.

If one of those options is not used in \texttt{\documentclass}, but with \texttt{amsmath} (see next section), it must not be specified for \texttt{ntheorem}, since all \texttt{amsmath} environments detect this option by themselves.

3.2 Combination with amslatex.

\texttt{ntheorem.sty} interferes with \texttt{amsmath.sty} and \texttt{amsthm.sty}.

Note, that the LaTeX amstex package \texttt{amstex.sty} (\LaTeX 2.09) is obsolete and you should use \texttt{amsmath} and \texttt{amstext} for \LaTeX 2ε instead.

We would be happy if someone knowing and using \texttt{amsmath} would join the development and maintenance of this style.

3.2.1 amsmath

The math environments of \texttt{amsmath} are adapted in the option [amsmath], (i.e., if \texttt{\usepackage{amsmath}} is used then \texttt{\usepackage[thmmarks]{ntheorem.sty}} must be completed to \texttt{\usepackage[amsmath,thmmarks]{ntheorem})}. Note, that \texttt{amsmath} has to be loaded \textit{before} \texttt{ntheorem} since the definitions have to be overwritten.

3.2.2 amsthm

\texttt{amsthm.sty} conflicts with the definition of theorem layouts in \texttt{theorem.sty}, some features of \texttt{amsthm.sty} have been incorporated into option [amsthm] which has to be used \textit{instead of} \texttt{\usepackage{amsthm}}.

\(^3\) Although for \texttt{fleqn} and long formulas reaching to the right margin, equation numbers and endmarks can be smashed over the formula since \texttt{fleqn} does not use \texttt{\textbackslash eqno} for controlling the setting of the equation number.
The Option provides theoremstyles \texttt{plain}, \texttt{definition}, and \texttt{remark}, and a \texttt{proof} environment as in \texttt{amsthm.sty}.

The \texttt{newtheorem*} command is defined even without this option. Note that \texttt{newtheorem*} always switches to the nonumbered version of the current theorem-style which thus must be defined.

The command \texttt{newtheoremstyle} is not taken over from \texttt{amsthm.sty}. Also, \texttt{swapnumbers} is not implemented. Here, the user has to express his definitions by the \texttt{newtheoremstyle} command provided by \texttt{ntheorem.sty}, including the use of \texttt{theoremheaderfont} and \texttt{theorembodyfont}. The options \texttt{[amsthm]} and \texttt{[standard]} are in conflict since they both define an environment \texttt{proof}.

Thus, we recommend not to use \texttt{amsthm}, since the features for defining theorem-like environments in \texttt{ntheorem.sty}—following \texttt{theorem.sty}—seem to be more intuitive and user-friendly.

### 3.3 Babel

The \texttt{[thref]} option interferes with the babel package, thus in case that babel is used, ntheorem has to be loaded \texttt{after} babel.

### 3.4 Hyperref

Since \texttt{hyperref} redefines the \LaTeX\ \texttt{contentsline}-command, it breaks with \texttt{ntheorem} below version 1.17. Since version 1.17, the option \texttt{[hyperref]} makes \texttt{ntheorem} work with \texttt{hyperref}. Theoremlists will then get linked list.

WARNING: The definition and redefinition of Theorem List Layouts (see Section 2.5.2) isn’t yet working with the \texttt{hyperref}-package.

### 4 Examples

The setting is as follows.

- For Theorems:

```latex
\theoremstyle{marginbreak}
\theoremheaderfont{\normalfont\bfseries}\theorembodyfont{\slshape}
\theoremsymbol{\ensuremath{\diamondsuit}}
\theoremseparator{:}
\newtheorem{Theorem}{Theorem}
```

- For Lemmas:

```latex
\theoremstyle{changebreak}
\theoremsymbol{\ensuremath{\heartsuit}}
\theoremindent0.5cm
\theoremnumbering{greek}
\newtheorem{Lemma}{Lemma}
```

- For Corollaries:

```latex
\theoremindent0cm
\theoremsymbol{\ensuremath{\spadesuit}}
\theoremnumbering{arabic}
\newtheorem{Corollary}[Theorem]{Corollary}
```
• For Examples:
  \begin{quote}
  \theoremstyle{change}
  \theorembodyfont{\upshape}
  \theoremsymbol{\ensuremath{\ast}}
  \theoremseparator{}
  \newtheorem{Example}{Example}
  \end{quote}

• For Definitions:
  \begin{quote}
  \theoremstyle{plain}
  \theoremsymbol{\ensuremath{\clubsuit}}
  \theoremseparator{.}
  \newtheorem{Definition}{Definition}
  \end{quote}

• For Proofs:
  \begin{quote}
  \theoremheaderfont{\sc}\theorembodyfont{\upshape}
  \theoremstyle{nonumberplain}
  \theoremsymbol{\rule{1ex}{1ex}}
  \newtheorem{Proof}{Proof}
  \end{quote}

Note, that parts of the setting are inherited. For instance, the fonts are not reset before defining “Lemma”, so the font setting of “Theorem” is used.

1 Example (Simple one) The first example is just a text.
In the next examples, it is shown how an endmark is put at a displaymath, a single equation and both types of eqnarrays.

1 Theorem (Long Theorem):
The examples are put into this theorem environment.
The next example will not appear in the list of examples since it is written as
\begin{quote}
  \begin{Example*} ... \end{Example*}
\end{quote}

2 Example (Ending with a displayed formula) Look, the endmark is really at the bottom of the line:
\[ f^{(n)}(z) = \frac{n!}{2\pi i} \oint_{\partial D} \frac{f(\zeta)}{(\zeta - z)^{n+1}} d\zeta \]

At this point, we add an additional entry without number in the Example list:
\begin{quote}
  \addtheoremline*{Example}{Extra Entry}
\end{quote}

α Lemma (Display with array):
Lemmata are indented and numbered with greek symbols. Also for displayed arrays of this form, it looks good:
\begin{quote}
  \begin{array}{l}
    a = \begin{array}{r}
      \text{first line} \\
      \text{second line}
    \end{array} \\
  \end{array}
  \text{try to put this text in the lowest line}
\end{quote}
Just try to get this with the presented array structure ... without using dirty tricks, you can position the outer array either \[t\], \[c\], or \[b\], and you will not get the desired effect.

\[
a = \begin{array}[t]{cc}
  & \text{try to put this text in the lowest line} \\
\end{array}
\]

\[
\begin{array}[t]{c}
  \text{second line}
\end{array}
\]

\[\diamondsuit\]

\[\beta\] Lemma (Equation):

For equations, we decided to put the endmark after the equation number, which is vertically centered. Currently, we do not know, how to get the equation number centered and the endmark at the bottom (one has to know the internal height of the math material) ... If anyone knows, please inform us.

\[
\int_{\gamma} f(z) \, dz := \int_{a}^{b} f(\gamma(t))\gamma'(t) \, dt
\]

With the break-theoremstyles, if the environment is labeled and written as

\[
\begin{Lemma}[Breakstyle] \label{breakstyle}
\end{Lemma}
\]

\[\gamma\] Lemma (Breakstyle):

you see, there is a leading space ... If a percent (comment) (or an explicit \ignorespaces) is put directly after the label, e.g.

\[
\begin{Lemma}[Breakstyle] \label{breakstyle} %
\end{Lemma}
\]

the space disappears.

From the predefined styles, this is exactly the case for the break-styles. That’s no bug, it’s \LaTeX-immanent.

The example goes on with an eqnarray:

\[
f(z) = \frac{1}{2\pi i} \int_{\partial D} \frac{f(\zeta)}{\zeta - z} \, d\zeta \\
= \frac{1}{2\pi} \int_{0}^{2\pi} f(z_0 + re^{it}) \, dt
\]

PROOF (of nothing)

\[
f(z) = \frac{1}{2\pi i} \int_{\partial D} \frac{f(\zeta)}{\zeta - z} \, d\zeta \\
= \frac{1}{2\pi} \int_{0}^{2\pi} f(z_0 + re^{it}) \, dt
\]

\[\blacklozenge\]

That’s it (the end of the Theorem).

\[\lozenge\]

If there are some environments in the same thm-environment, the last gets the endmark:
Definition 1 (With a list).

\[
\int_{\gamma} f(z) \, dz := \int_{a}^{b} f(\gamma(t)) \gamma'(t) \, dt
\]  (4)

- you’ve seen, how it works for text and
- math environments,
- and it works for lists.

2 Corollary (Q.E.D.):  
And here is a trivial corollary, which is ended by `\texttt{\textbackslash qedsymbol\{\texttt{q.e.d}\}}` and `\texttt{\textbackslash qed}`.  

3 Example

\[ f^{(n)}(z) = \frac{n!}{2\pi i} \oint_{\partial D} \frac{f(\zeta)}{(\zeta - z)^{n+1}} \, d\zeta \]

If there is some text after an environment, the endmark is put after the text.  

The next one is done by the following sequence. Note, that `\texttt{\textbackslash hfill}` is inserted to prevent \LaTeX{} from using its nested list management (a verbatim is also a trivlist), i.e. this causes \LaTeX{} to start the verbatim-Part in a new line.

\begin{Example}
\texttt{\textbackslash hfill}
\begin{verbatim}
And, it also works for verbatim
... when the \texttt{\end{verbatim}} is in the
same line as the text ends. \texttt{\end{verbatim}}
^ this space is important !!
\end{verbatim}
\end{Example}

4 Example (Using `verbatim`)

And, it also works for verbatim
... when the \texttt{\end{verbatim}} is in the
same line as the text ends.  

There must be no empty line in the input before the \texttt{\end{theorem}} (since then, the end mark is ignored)

\begin{Theorem}
\begin{verbatim}
some text ... but no end mark
\end{verbatim}
\end{Theorem}

3 Theorem:  
\texttt{some text ... but no end mark}

Now, there is a corollary which should appear with a different name in the list of corollaries:
4 Corollary (title in text):

\begin{Corollary*}[title in text]\label{otherlabel} ...
\end{Corollary*} \addtheoremline{Corollary}{title in list}

It also works in the center environment.

5 Theorem (Quote):

\begin{Theorem}[Manual End Mark]\label{somelabel}
a line of text with a manually set endmark \hfill\TheoremSymbol \hfill
some more text, but no automatic endmark set. \NoEndMark
\end{Theorem}

In quote environments, the text is normally indented from left and right by the same space. The endmark is not indented from the right margin, i.e., it is typeset to the right margin of the surrounding text.

Here is an example for turning off the endmark automatically and manual handling:

\begin{Theorem}[Manual End Mark]
a line of text with a manually set endmark \hfill\TheoremSymbol \hfill
some more text, but no automatic endmark set. \NoEndMark
\end{Theorem}

Also, one should note, that \hfill is inserted to set the endmark at the right margin.

5 Example (Quickie) It also works for short one's.

If you are tired of the greek numbers and the indentation for lemmata ... you can redefine it:

\theoremstyle{changebreak}
\theoremheaderfont{\normalfont\bfseries}\theorembodyfont{\slshape}
\theoremsymbol{\ensuremath{\heartsuit}}
\theoremsymbol{\ensuremath{\diamondsuit}}
\theoremseparator{:}
\threemindent0.5cm
\theoremnumbering{arabic}
\renewtheorem{Lemma}{Lemma}

4 Lemma:

\begin{Theorem}[somename]
Obviously, we are in Theorem~\Theoremname.
\end{Theorem}

another lemma, with arabic numbering ... note that the numbering continues.

the optional argument (i.e. the 'theorem'-name) can be accessed by \(\langle env\rangle\)name.

\begin{Theorem}[somename]
Obviously, we are in Theorem~\Theoremname.
\end{Theorem}

7 Theorem (somename):

\begin{Theorem}[somename]
Obviously, we are in Theorem somename.
\end{Theorem}
This feature can e.g. be used for automatically generating executable code and a commented solution sheet:

\begin{exercise}[quicksort]
\begin{verbatimwrite}{solutions/quicksort.c}
\end{verbatimwrite}
\verbatiminput{solutions/quicksort.c}
\end{exercise}

This will write the C-code to a file solutions/quicksort.c and type it also on the solution sheet.

Now, we define an environment KappaTheorem which uses the same style parameters as Theorems and is numbered together with Corollaries (Theorems are also numbered with Corollaries). Note that we define a complex header text and a complex end mark.
\begin{quote}
\verb|\theoremclass{Theorem}|
\verb|\theoremsymbol{\ensuremath{a\atop b}}|
\verb|\newtheorem{KappaTheorem}[Corollary]{\(\kappa\)-Theorem}|
\end{quote}

8 \(\kappa\)-Theorem (1st \(\kappa\)-Theorem):

\begin{quote}
That's the first Kappa-Theorem.
\end{quote}

4.1 Extended Referencing Features

The standard \verb|\label| command is extended by an optional argument which is intended to contain the “name” of the structure which is labeled, allowing more comfortable referencing; e.g., this section has been started with

\begin{quote}
\verb|\subsection*{Extended Referencing Features}|\%
\verb|\label{sec-ExtRef}|[Section]
\end{quote}

As already stated, for theorem-like environments the optional argument is filled in automatically, i.e.,

\begin{quote}
\verb|\begin{Theorem}[Manual End Mark]\label{somelabel}|\verb|\end{Theorem}|
\end{quote}
(cf. page 16) is equivalent to

\begin{quote}
\verb|\begin{Theorem}[Manual End Mark]\label{somelabel}|[Theorem]
\thref{⟨label⟩} additionally outputs the contents of the optional argument which has been associated with ⟨label⟩:
\end{quote}

This is \verb|\thref{sec-ExtRef}|
A theorem end mark has been set manually in \verb|\thref{somelabel}|.
A center environment has been shown in \verb|\thref{otherlabel}|.
The first Kappa-Theorem has been given in \verb|\thref{kappatheorem1}|.

generates
This is Section 4.1.
A theorem end mark has been set manually in Theorem 6. A center environment has been shown in Corollary 4. The first Kappa-Theorem has been given in $\kappa$-Theorem 8.

Here one must be careful that the handling of the optional argument is automated only for environments defined by \texttt{newtheorem}, i.e., \textit{not} for sectioning, equations, or enumerations. Calling \texttt{\thref{⟨label⟩}} for a label which has been set without an optional argument can result in different unintended results: If \texttt{(label)} is not inside a theorem-like environment, an error message is obtained, otherwise the type of the surrounding theorem-like environment is output, e.g., calling \texttt{\thref{label}} then results in “Theorem \texttt{(number)}”! Additionally, currently there is no support for multiple references such as “see Theorems 5 and 7” (this would require plural-forms for different languages and handling of \texttt{ref}-lists, probably splitting into different sublists for different environments)\textsuperscript{4}.

### 4.2 List of Theorems and Friends

Note, that we put the following lists into the \texttt{quote}-environment to emphasize them from the surrounding text. So the lists are indented slightly at the margin.

With
\begin{verbatim}
\addtotheoremfile{Added into all theorem lists},
\end{verbatim}
in every list, an additional line of text would be inserted. But it isn’t actually done in this documentation since we want to use different list formats.

Only for the list of Examples, this one is added:
\begin{verbatim}
\addtotheoremfile{Example}{Only concerning Example lists}
\end{verbatim}

With
\begin{verbatim}
\theoremlisttype{all}
\listtheorems{Lemma},
\end{verbatim}
all lemmas are listed:
\begin{verbatim}
α Display with array ...................................... 13
β Equation ................................................. 14
γ Breakstyle ............................................... 14
4 .......................................................... 16
5 .......................................................... 22
6 .......................................................... 22
\end{verbatim}

From the examples, only those are listed which have an optional name:
\begin{verbatim}
\theoremlisttype{opt}
\listtheorems{Example}
\end{verbatim}

\textsuperscript{4}If someone is interested in programming this, please contact us; it seems to be algorithmically easy, but tedious.
leads to

0 Extra Entry with number ......................... 8
Extra Entry ........................................ 9
1 Simple one ....................................... 13
Extra Entry ....................................... 13
4 Using \texttt{verbatim} ............................... 15
5 Quickie ........................................ 16

Only concerning Example lists

One should note the line \textit{Only concerning example lists}, which was added by the \addto\theoremfile\-statement above.

For the next list, another layout, using the \texttt{tabular}-environment, is defined:

\begin{verbatim}
\newtheoremlisttype{tab}\
{\begin{tabular}{lrlr}\end{tabular}}
\end{verbatim}

Thus, by saying

\begin{verbatim}
\theorylisttype{tab}\
\listtheorems{Theorem,Lemma},
\end{verbatim}

theorems and lemmata are listed:

\begin{verbatim}
Theorem 1 Long Theorem 13
Lemma $\alpha$ Display with array 13
Lemma $\beta$ Equation 14
Lemma $\gamma$ Breakstyle 14
Theorem 3 15
Theorem 5 Quote 16
Theorem 6 Manual End Mark 16
Lemma 4 16
Theorem 7 somename 16
Theorem 9 Correctness 21
Theorem 10 Completeness 21
Lemma 5 22
Lemma 6 22
Theorem 11 23
\end{verbatim}

\LaTeX\-lists can also be used to format the theoremlist. The input

\begin{verbatim}
\newtheoremlisttype{list}\
{\begin{trivlist}\item\end{trivlist}}
\end{verbatim}

\begin{verbatim}
\theorylisttype{list}\
\listtheorems{Corollary}
\end{verbatim}

leads to

\begin{verbatim}
2 Corollary: Q.E.D. ........................................ 15
4 Corollary: title in list ................................ 16
\end{verbatim}

In this example, after the item, $\textbackslash$\textbackslash{} is used instead of $\textbackslash$\textbackslash{}, because in the latter case, \texttt{\dotfill} will produce an error if the optional argument (\texttt{##3}) is missing.
5 The End Mark Algorithm

5.1 The Idea

The handling of endmarks with thmmarks.sty is based on the same two-pass principle as the handling of labels: the necessary information about endmarks is contained in the .aux file.

With thmmarks.sty, \TeX{} is always aware whether it is in some theorem-like environment. There, potential positions for endmarks can be

1. at the end of simple text lines in open text,
2. at the end of displaymaths,
3. at the end of equations or equationarrays, or
4. at the end of text lines at the end of lists (or, more general, trivlists, such as verbatim or center).

The problem is, that in the cases (2)–(4), the endmarks has to be placed in a box which is already shipped out, when }\textbackslash\text{end}(...} is processed. Thus, in those situations, \TeX{} needs to know from the .aux file, whether is has to put an endmark.

When \TeX{} is in a theorem-like environment and comes to one of the points mentioned in (2)–(4), and the .aux file says that there is an endmark, then it is put there. Anyway, it maintains a counter of the potential positions of an end mark in the current theorem-like environment. When it comes to an }\textbackslash\text{end}{}{\text{the} \text{orem}, it looks if it is in situation (1) (then the endmark is simply put at the end of the current line). Otherwise, the last horizontal box is already shipped out (thus it contains a situation (2)–(4)) and the endmark must be set in it. In this case, a note is written in the .aux file, where the endmark actually has to be set (ie, at the latest potential point for setting an endmark inside the theorem).

5.2 The Realization

Let }\textbackslash\text{env} be a theorem-like environment. Then, additional to the counter }\textbackslash\text{env}, \TeX{} maintains two counters }\textbackslash\text{curr}{}\text{env} and }\textbackslash\text{end}{}\text{env}. In the ith environment of type }\textbackslash\text{env}, }\textbackslash\text{curr}{}\text{env}= i (the }\textbackslash\text{env} counter }\textbackslash\text{env} cannot be used since a) environments can use the counter of other environments, and b) often counters are reinitialized inside a document). }\textbackslash\text{end}{}\text{env} counts the potential situations for putting an endmark inside an environment. It is set to 1 when starting an environment. Each time, when a situation (2)–(4) is reached, the command

\begin{verbatim}
\textbackslash\text{mark}<\roman{curr}{}\text{env} \text{ctr} >{}\text{env}\text{<\roman{end}{}\text{env} ctr}>
\end{verbatim}

is called }\textbackslash\text{<\text{curr}{}\text{env} ctr} >{}\text{env}\text{<\text{end}{}\text{env} ctr}> uniquely identifies all situations (2)–(4) in a document.

If at this position an endmark has to be set,

\begin{verbatim}
\textbackslash\text{mark}<\roman{curr}{}\text{env} \text{ctr} >{}\text{env}\text{<\roman{end}{}\text{env} ctr}>
\end{verbatim}

is defined in the .aux file to be }\textbackslash\text{end}{}\text{env}Symbol, otherwise it is undefined and simply ignored.

When \TeX{} comes to an }\textbackslash\text{end}{}({}\text{env}), it looks if it is in situation (1). If so, the endmark is simply put at the end of the current line. Otherwise,
\[
\text{\def\mark\langle\text{\roman{current}}\rangle\langle\text{env}\rangle}\% \\
\langle\text{\roman{end}}\langle\text{env}\rangle\rangle\langle\langle\text{\text{Symbol}}\rangle\rangle
\]

is written to the .aux file for setting the endmark at the latest potential position inside the theorem in the next run.

9 **Theorem (Correctness):**

1. For a .tex file, which does not contain nested theorem-like environments of the same type, in the above situation, the following holds: When compiling, at the ith situation in the jth environment of type \langle env \rangle, \text{mark} j \langle env \rangle i is handled.

For .tex files which contain nested theorem-like environments of the same type, \text{mark} k \langle env \rangle l is handled, where k is the number of the latest environment of type \langle env \rangle which has been called at this moment, and l is the number of situations (2)–(4) which have occurred in environments of type \langle env \rangle since the the kth \begin{langle env \rangle}.

2. When finishing an environment, either an endmark is set directly (when in a text line) or an order to put the end symbol at the latest potential position is written to the .aux file.

\[\diamondsuit\]

10 **Theorem (Completeness):**

The handling of endmarks is complete wrt. plain text, displaymath, equation, eqnarray, eqnarray*, and all environments ended by endtrivlist, including center and verbatim.

\[\diamondsuit\]

So, where can be bugs?

• in the plain \TeX handling of endmarks,

• in some special situations which have not been tested yet,

• in some special environments which have not been tested yet.

• in the amsmath environments. We seldom use them, so we do not know their pitfalls, and we ran only general test cases.

6 **Problems and Questions**

6.1 **Known Limitations**

• Since ntheorem.sty uses the .aux file for storing information about the positions of endmarks, \LaTeX must be run twice for correctly setting the endmarks.

• Since ntheorem.sty uses the .aux file for storing information about lists in the .thm file, a minimum of two runs is needed. If theorems move in any of these runs up to five runs can be needed to generate correct lists.

• Since we need to expand the optional argument of theorems in various ways for the lists, we decided to copy the text verbatim into the .thm file. Thus, if you use things like \thesection etc., the list won’t show the correct text. Therefore you shouldn’t use any command that needs to be expanded.
• In nested environments ending at the same time, only the endmark for the inner environment is set, as the following example shows:

\begin{Lemma}
Some text.
\begin{Proof} The Proof \end{Proof}
\end{Lemma}

yields to

\begin{Lemma}
Some text.
\begin{Proof} The Proof \end{Proof}
\end{Lemma}

5 Lemma:

Some text.

\begin{Proof} The Proof \end{Proof}

You can handle this by specifying something invisible after the end of the inner theorem. Then the endmark for the outer theorem is set in the next line:

\begin{Lemma}
Some text.
\begin{Proof} The Proof \end{Proof}~
\end{Lemma}

yields to

6 Lemma:

Some text.

\begin{Proof} The Proof \end{Proof}

• Document option fleqn is problematic: fleqn handles equations not by $$ but by lists (check what happens for

\begin{theorem} \[ \text{displaymath} \] \end{theorem}

in standard \LaTeX: The displaymath is not set in an own line). Also, for long formulas, the equation number and the endmark are smashed into the formula at the right text margin.

• Naturally, ntheorem.sty will not work correctly in combination with other styles which change the handling of

1. theorem-like environments, or
2. environments concerned with the handling of endmarks, e.g. \[ \ldots \], eqnarray, etc.

• ntheorem.sty is compatible with Frank Mittelbach’s theorem.sty, which is the most widespread style for setting theorems.

It cannot be used with theorem.sty, but it can be used instead of it.
6.2 Known “Bugs” and Problems

- Ending a theorem *directly* after the text, e.g.

\begin{Theorem} text \end{Theorem}

suppresses the endmark:

11 Theorem:

\text

Therefore a space or a newline should be inserted before \end{...}.

- With theoremstyle break, if the linebreak would cause ugly linebreaking in the following text, it is suppressed.

6.3 Open Questions

- For *equations*, we decided to put the endmark after the equation number, which is vertically centered. Currently, we do not know, how to get the equation number centered and the endmark at the bottom (one has to know the internal height of the math material).

- The placement of endmarks is mainly based on a check whether \LaTeX{} is in an ordinary text line when encountering an end-of-environment. This question is *partially* answered by \ifhmode: In a text line, \LaTeX{} is always in \hmode. But, after an displaymath, \LaTeX{} is also in \hmode. Thus, additionally \lastskip is checked: after a displaymath, \lastskip=0 holds. In most situations, when text has been written into a line, \lastskip ≠ 0. But, this does not hold, if the source code is of the following form: ...	ext\label{bla}: then, \lastskip=0. In those situations, the endmark is suppressed.

?? How can it be detected whether \LaTeX{} has just ended a displaymath?

- The above problem with the label: The break style enforces a linebreak by \hfill\penalty-8000 after the \trivlist-item. Thus, \TeX{} gets back into the horizontal mode. The label places a “whatsit” somewhere ... and, it seems that the “whatsit” makes \TeX{} think that there is a line of text.

If someone has a solution to one of those questions, please inform us. (You can be sure to be mentioned in the Acknowledgements.)

7 Code Documentation

7.1 Documentation of the Macros

1 \typeout{Style ‘\basename’, Version \fileversion\space <\filedate>}
2 \ProvidesPackage{ntheorem}[iledate \space\fileversion]
3 \newif\if@thmmarks\@thmmarksfalse
4 \newif\ifthm@tempif

general setup.

7.1.1 Thmmarks-Related Stuff
\DeclareOption{thmmarks}{%*********************************
PackageInfo{basename}{Option 'thmmarks' loaded}%
% 
\@thmmarkstrue
\newcounter{endNonectr}
\newcounter{currNonectr}
\newif\ifsetendmark\setendmarktrue

activate placement of endmarks and define counters for upper level.
\ifsetendmark: true if an endmark has to be set in a complex situation which
must be handled by the .aux file. For further comments see \@endtheorem.
In the following, all relevant environments are changed for handling potential end
mark positions:

Changes to List Environment
Original: ltrlists.dtx
\endtrivlist Replaces \LaTeX's \endtrivlist. An augmented functionality of \LaTeX's \endtrivlist
is contained in \@endtrivlist.

8 \gdef\endtrivlist{%
9 \@endtrivlist{\PotEndMark{\hbox{}\nobreak\hfill\nobreak}}

At an \endtrivlist (which is called at the end of \list environments and several
other environments), \@endtrivlist is called to end the \trivlist and set a
potential position for an endmark at the end of the line if \TeX is in a text line.

\@endtrivlist A new command\] which augments \LaTeX's functionality of \endtrivlist by check-
ing if an end mark has to be set:

10 \gdef@endtrivlist#1{% % from \endtrivlist
11 \if@inlabel \indent\fi
12 \if@newlist \@noitemerr\fi
13 \ifhmode
14 \ifdim\lastskip >\z@ #1\unskip \par %<<<<<<<<<<<<<<<<<<<<<<
15 \else \unskip \par \fi
16 \fi
17 \if@noparlist \else
18 \ifdim\lastskip >\z@\@tempskipa\lastskip \vskip -\lastskip
19 \advance@tempskipa\parskip \advance@tempskipa -\@outerparskip
20 \vskip@tempskipa
21 \fi
22 \fi
23 \@endparenv
24 \fi}

New: parameter \#1.
\#1 is executed when the \trivlist ends with a text line (ie the endmark can be
put simply at the end of the line):
Line 14: case split: if in hmode and \lastskip > 0, then \TeX is in a text line, the
endmark is set here.

Changes to Math Environments
Original: ltmath.dtx
For equations, end marks are placed behind the equation number:

Line 25: As default, work for equation numbers at the right: Then, a \quad is placed between equation number and endmark.

Line 26: In addition to the equation number (set by \@eqnnum at the right of the line) \SetMark@endeqn is carried out.

If an end mark is set, a displaymath is put into box such that the end marks appears at its bottom level at the right. Thus, also the definition of \[ has to be changed:

Lines 29–35, 43, 44: the old definition.

Lines 36–39: The end position of a displaymath inside a theorem-environment corresponds to end\InTheoType ctr+1. An endmark has to be set there, if \mark<\roman{curr#1ctr}>#1 \roman{end#1ctr}+1 > is defined and not the empty symbol.

Lines 40–41: If so, the whole displayed stuff is put in an array with maximal depth 0.5ex and vertically adjusted with its bottom line (then, the endmarks will appear adjusted to its bottom line).

Line 42: The counter has to be re-decremented.

At the end of a displaymath, the end marks is set at its bottom level:

Lines 45–56: the old definition.

\[ \]

25 \gdef\SetMark@endeqn{\quad}% as default, cf. option leqno
26 \gdef\endequation{\eqno \hbox{\@eqnnum \PotEndMark{\SetMark@endeqn}}%
27 $$\global\@ignoretrue}$
28 \[ \gdef[{
29 \relax\ifmmode
30 \@badmath
31 \else
32 \ifvmode
33 \nointerlineskip
34 \makebox[.6\linewidth]{}
35 \fi
36 $$\stepcounter{end\InTheoType ctr}$$%$$BRACE MATCH HACK
37 \relax\ifmmode
38 \@badmath
39 \else
40 \PotEndMark{\@eqnnum}\global\@ignoretrue$$%%$$BRACE MATCH HACK
45 \[ \]
Lines 46–51: Look, if an endmark has to be set in this displaymath (analogous to lines 36–42 of \def\[). If so, there is an inner array which has to be closed (line 50).

Lines 52–61: the old definition.
Line 56: changed to set an endmark at the right of the line if necessary (this is done by \eqno).

\endeqnarray

For \eqnarrays, the end marks is set below the number of the last equation:
\begin{verbatim}
\gdef\SetMark@endeqnarray#1{\llap{\raisebox{-1.3em}{#1}}}
\gdef\endeqnarray{%
  \global\let\Oldeqnnum=\@eqnnum
  \gdef\@eqnnum{\Oldeqnnum\PotEndMark{\SetMark@endeqnarray}}%
  \@@eqncr
  \egroup
  \global\advance\c@equation\m@ne
  $$\global\@ignoretrue
\end{verbatim}

Line 62: As default work for equation numbers at the right: Then, the endmark is placed below the last equation number at the right margin.

New: Lines 64, 65, 70:
Line 64: save \@eqnnum.
Line 65: define \@eqnnum to carry out \Oldeqnnum, then a potential endmark position is handled: if an endmark is set, between the equation number and the endmark, the command sequence \SetMark@endeqnarray is carried out – there, since \SetMark@endeqnarray is a function of one argument, the endmark will be this argument.

Lines 66–69: from latex.ltx. Line 66 sets the equation number.
Line 70: restore \@eqnnum.

\endeqnarray*

In an \eqnarray*, the end mark is set at the right of the last equation:
\begin{verbatim}
\@namedef{endeqnarray*}{%    % from \@eqncr:
  \let\reserved@a\relax
  \ifcase\@eqcnt \def\reserved@a{& & &}\or \def\reserved@a{& &}\%
  \or \def\reserved@a{&}\else
    \let\reserved@a\@empty
    \latexerror{Too many columns in eqnarray environment}\@ehc\fi
  \reserved@a {\normalfont \normalcolor \PotEndMark{}}%
  \global\eqnstrue\global\@eqcnt{z0}\cr
  %
  \egroup
  \global\advance\c@equation\m@ne
  $$\global\@ignoretrue
\end{verbatim}

This is just \LaTeX's \endeqnarray where lines 73–79 are inserted from \@eqncr and augmented (line 78) to set a potential endmark (with no additional commands)
at the end of the current line.

Changes to Tabbing Environment
Original: lttab.dtx

\endtabbing  Here, the \endtrivlist modification is not sufficient: \LaTeX{} is not in lmode when it calls \endtrivlist from \endtabbing; additionally, \@stopline already outputs a linebreak. Thus, the end mark is inserted before \@stopline at the right margin (using \).

84 \gdef\endtabbing{%
85 \PotEndMark{'}\@stopline\ifnum\@tabpush >\z@ \obadpoptabs
86 \fi\endtrivlist}

Changes to Center Environment
Original: ltmiscen.dtx

\endcenter  In \LaTeX{}, \endcenter just calls \endtrivlist. Here, the situation is more complex since the endmark has to be put in the last line without affecting its centering: if in a text line (only then, here is a potential endmark position):  

87 \gdef\endcenter{%
88 \endtrivlist
89 \PotEndMark{\rightskip0pt%
90 \settowidth{\leftskip}%
91 { \csname mark\roman{curr\InTheoType ctr}\InTheoType
92 \roman{end\InTheoType ctr}\endcsname}%
93 \advance\leftskip@flushglue\hskip\@flushglue}}

The \rightskip of the line is set to 0, \leftskip is set to the width of one space (since on the right, one space is added after the text) plus the endmark and infinitely stretchable glue (\@flushglue), and also the line is continued with \@flushglue (the actual position is one space after the text), and then the endmark is placed (by \PotEndMark).

Handling of Endmarks

\@endtheorem  \@endtheorem is called for every \end{⟨env⟩}, where ⟨env⟩ is a theorem-like environment. \@endtheorem is extended to organize the placement of the corresponding end mark \InTheoType gives the innermost theorem-like environment, i.e. the one to be ended):

94 \gdef\empty{}
95 \gdef\endtheorem{%
96 \expandafter
97 \ifx\csname InTheoType Symbol\endcsname\@empty\setendmarkfalse\fi
98 \endtrivlist
99 \{\ifsetendmark
100 \hbox{\nobreak\hfill\nobreak\csname InTheoType Symbol\endcsname
101 \setendmarkfalse {\fi}}
102 \ifsetendmark\OrganizeTheoremSymbol\else\global\setendmarktrue{\fi}

Lines 96, 97: if the end symbol of the environment ⟨env⟩ to be closed is empty, simply no end symbol has to be set (it makes a difference, if no end symbol is set, or if an empty end symbol is set).
(originally, it calls \endtrivlist):

\endtrivlist is called to put \langle \text{env} \rangle Symbol at the end of the line and set setendmark to false if \TeX{} is in a text line and setendmark is true. At this point, setendmark is false iff the user has disabled it locally or the end symbol is empty.

Line 99: the endmark is not set, if setendmark is false.

Line 102: if setendmark is true, the correct placement of the end symbol is organized, else (ie either setendmarkfalse is set by the user, or the endmark is already set by \endtrivlist) reset setendmark to true.

For further comments see \endtrivlist and \OrganizeTheoremSymbol.

The construction in line 100 guarantees that the endmark is put at the end of the line, even if it is the only letter in this line.

By \NoEndMark, the automatical setting of an end mark is blocked for the current environment.

\[\text{\gdef\NoEndMark}{\global\setendmarkfalse}\]

set setendmark to false. It is automatically reset to true after the end of the current environment.

With \qed, the user can locally change the end symbol to appear:

\[\text{\gdef\qed}{\expandafter\def\csname \InTheoType Symbol\endcsname}{\the\qedsymbol}\]

When calling \qed, the end symbol of the innermost theorem-like environment at that time is set to the value stored in \qedsymbol at that time.

Handling a potential endmark position:

\[\text{\gdef\PotEndMark#1}{\SetEndMark{\InTheoType}{#1}}\]

Argument: \langle cmd_seq \rangle := \text{#1} is a command sequence to be executed when setting the endmark.

It adds the current theorem type \langle env \rangle to the parameters, and calls \PotEndMark\langle env \rangle\langle cmd_seq \rangle.

\SetEndMark sets an endmark for an environment. It is called by \PotEndMark.

\[\text{\gdef\SetEndMark#1\#2}{\%\stepcounter{end#1ctr}\%}\]

\%\ifundefined{mark\roman{curr#1ctr}#1\roman{end#1ctr}}\relax\%

\%\hskip-\rightmargin\hbox to 0cm{\~\}%

Arguments:

\langle env \rangle := \#1: current theorem-environment.

\langle cmd_seq \rangle := \#2: is a command sequence to be executed when setting the endmark. Both arguments are transmitted from by \PotEndMark.

Line 108: increments end\langle env \ranglectr for preparing the next situation for setting a potential endmark.

Line 109, 110: if
\mark<\roman{curr\langle env\rangle ctr}>\langle env\rangle<\roman{end\langle env\rangle ctr}>

is undefined – which is the case iff at this position no endmark has to be set –, nothing is done.

Line 111: otherwise, \langle cmd_seq \rangle and then  
\mark<\roman{curr\langle env\rangle ctr}>\langle cmd_seq \rangle<\roman{end\langle env\rangle ctr}>,  
which is defined in the .aux file to be the end symbol are called. The construction \langle cmd_seq \rangle{\ldots} in line 111 allows the handling of the end symbol as an argument of \langle cmd_seq \rangle as needed for \endeqnarray.

Line 112: By \hskip\text{	extendash}rightmargin\hbox to \text{0cm}~, a negative hspace of amount \text{rightmargin} is added after the end symbol – thus, the symbol is set as there were no right margin (this concerns, e.g., \quote environments).

Writing to .aux file. (copied from \def\label (ltxref.dtx))


ewskip\mysavskip
\gdef\@bbsphack{\mysavskip\lastskip\unskip}
\gdef\@eesphack{\ifdim\mysavskip>\z@\vskip\mysavskip\else\fi}

Lines 114–116 and 117–119 are similar to \@bsphack and \@bsphack of latex.ltx. They undo resp. redo the last skip.

\OrganizeTheoremSymbol

The information for setting the end marks is written to the .aux file:

\def\OrganizeTheoremSymbol{%  
\@bbsphack  
\edef\thm@tmp{\expandafter\expandafter\expandafter\thm@meaning\expandafter\meaning\csname\InTheoType Symbol\endcsname\relax}  
\protected@write\@auxout{}{\string\global\string\def\string\mark<\roman{curr\InTheoType ctr}\InTheoType \roman{end\InTheoType ctr}\{\thm@tmp}}  
\@eesphack}

Lines 125–127: Write  
\global\def\mark<\roman{curr\langle env\rangle ctr}>\langle env\rangle<\roman{end\langle env\rangle ctr}>\langle\langle env\rangle Symbol\rangle} to the .aux file. \langle env\rangle,:=\InTheoType gives the innermost theorem-like environment, i.e. the one the end symbol has to be set for.

7.1.2 Option leqno to Thmmarks

\DeclareOption{leqno}{%  
\if@thmmarks  
\PackageInfo{\basename}{Option ‘leqno’ loaded}  
\gdef\SetMark@endeqn#1{\hss\llap{#1}}  
\gdef\SetMark@endeqnarray#1{\hss\llap{#1}}}

\PackageInfo{\basename}{Option ‘leqno’ loaded}  
\gdef\SetMark@endeqnarray#1{\hss\llap{#1}}
leqno is only active if thmmarks is also active.

Line 134, 135: Since with leqno, the equation number is placed on the left, after infinitely stretchable glue, the endmark can be set straight at the right margin.

7.1.3 Option fleqn to Thmmarks

\DeclareOption{fleqn}{%
  if@thmmarks
  PackageInfo{\basename}{Option `fleqn' loaded}%
  fleqn is only active if thmmarks is also active.\}

Since fleqn treats displayed math as trivlists, it’s quite another thing:

\renewcommand\[{
  \ifmmode\@badmath
  \else
    \begin{trivlist}
    \@beginparpenalty\predisplaypenalty
    \@endparpenalty\postdisplaypenalty
    \item \[
    \hb@xt@\linewidth\bgroup \m@th\displaystyle
    \hskip\mathindent\bgroup
    \stepcounter{end\InTheoType ctr}
    \@ifundefined{mark\roman{curr\InTheoType ctr}\InTheoType\roman{end\InTheoType ctr}}{elax}
    {\ifx\csname\InTheoType Symbol\endcsname\@empty\else
      \boxmaxdepth=.5ex\begin{array}\[b\]{l}
      \boxmaxdepth=\maxdimen\displaystyle\fi}
    \addtocounter{end\InTheoType ctr}{-1}
    \relax\ifmmode
    \egroup \PotEndMark{}%
    \egroup
    \end{trivlist}
  \else \@badmath \fi}
\]

Lines 140–148, 156: the old definition.

Line 149–155: if an endmark has to be set in this displaymath, it is put into an array with depth $\leq 0.5\text{ex}$, and vertically adjusted to the bottom line.

Here, the end mark is placed after a \hfil ate the end of the line containing the displaymath:

\renewcommand\[{
  \stepcounter{end\InTheoType ctr}
  \@ifundefined{mark\roman{curr\InTheoType ctr}\InTheoType\roman{end\InTheoType ctr}}{elax}
  {\ifx\csname\InTheoType Symbol\endcsname\@empty\else
    \boxmaxdepth=.5ex\begin{array}\[b\]{l}
    \boxmaxdepth=\maxdimen\displaystyle\fi}
  \addtocounter{end\InTheoType ctr}{-1}
  \relax\ifmmode
  \egroup \PotEndMark{}%
  \egroup
  \end{trivlist}
  \else \@badmath \fi}

Lines 158–162: Look, if an endmark has to be set in this displaymath. If so, close the inner array.
Lines 164–169: the old definition.
Line 165: Added \PotEndMark.

\endequation for equations, the end mark is also set with the equation number:

\begin{verbatim}
170 \gdef\endequation{\
171 \$\hfil % $\$
172 \displaywidth\linewidth\hbox{\@eqnnum \PotEndMark{\SetMark@endeqn}}%\n173 \egroup
174 \endtrivlist}
\end{verbatim}

Line 172: When the equation number is set, also the endmark is set with the same
trick as for \endequation without fleqn.

\endeqnarray When the equation number is set, also the endmark is set with the same trick as
for \endeqnarray without fleqn (see Lines 176, 177, 182):

\begin{verbatim}
175 \gdef\endeqnarray{\
176 \global\let\Oldeqnnum=\@eqnnum
177 \gdef\@eqnnum{\Oldeqnnum\PotEndMark{\SetMark@endeqnarray}}%\n178 \@@eqncr
179 \egroup
180 \global\advance\c@equation\m@ne$$% $$
181 \global\@ignoretrue
182 \global\let\@eqnnum\Oldeqnnum}
183 \fi}
\end{verbatim}

7.1.4 Option amsmath to Thmmarks

Taken from amsmath.sty.

\begin{verbatim}
184 \DeclareOption{amsmath}{\%
185 \if@thmmarks
186 \PackageInfo{\basename}{Option 'amsmath' loaded}%
187 amsmath is only active it thmmarks is also active.
188 \newdimen\thm@amstmpdepth
189
TtagsPlusEndmarks Since amsmath uses “tags” for setting end marks, some macros are defined which
\begin{verbatim}
190 \gdef\TagsPlusEndmarks{\%
191 \global\let\Old@maketag@@@=\maketag@@@
192 \global\let\Old@df@tag=\df@tag
193 \if@eqnsw\SetTagPlusEndMark\else
194 \iftag@\SetTagPlusEndMark
195 \else\SetOnlyEndMark
196 \fi\fi}
\end{verbatim}

Lines 189, 190: store the original macros.

Line 191: if equation numbers are set as default, call \SetTagPlusEndMark to set
tag and end mark.

Line 192: if a tag is set manually, call \SetTagPlusEndMark to set tag and end mark.

Line 193: otherwise, call \SetOnlyEndMark to set only an end mark.
Set only an end mark:
Line 196: force setting the end mark as a tag:
Lines 198, 199: if tags are set to the left, the tag consists of a \hbox over the whole displaywidth, with the (potential) endmark at its right.
Line 201: if tags are set to the right, the tag consists only of the (potential) endmark.

Set a tag and an end mark:
Lines 204–211: redefine the \maketag@@@ macro:
Lines 205–207: if tags are set to the left, build a box of the whole displaywidth and put the original tag on the left, and the (potential) endmark at the right.
Lines 209, 210: if the tags are set to the right, the (potential) end mark is put below it.

Lines 213, 214: restore the original macros.

In the gather environment, just the augmented tag is used:

New:
Line 216: the last tag contains the potential endmark.
Line 221: restore the original macros.
Line 224: Since let always takes the expansion of a macro when the let is executed, all let's have to be adjusted (this is the same for all subsequent let-statements).
\endalign also uses the augmented tags:

\begin{verbatim}
def\endalign{\ifingather@else % \TagsPlusEndmarks\fi % \math@cr \\
\ifnum0='{\fi}% \else $$% \RestoreTags % \fi \\
\global\@ignoretrue}
\end{verbatim}

New:

Lines 226, 227: if the \align is not inside another environment, its tags have to contain the endmarks.

Line 238: this case, the original macros have to be restored.

\begin{verbatim}
\expandafter\let\csname endalign*\endcsname\endalign
\let\endxalignat\endalign
\expandafter\let\csname endxalignat*\endcsname\endalign
\let\endalignat\endalign
\expandafter\let\csname endalignat*\endcsname\endalign
\let\endflalign\endalign
\expandafter\let\csname endflalign*\endcsname\endalign
\end{verbatim}

Adjust let-statements.

The \multiline environment has two different \end commands, depending if the equation numbers are set on the left or on the right:

\begin{verbatim}
def\lendmultline@{\@eqnswfalse\tag@true\tagsleft@false \\
\endmultline@}
\end{verbatim}

End of \multiline environment if tags are set to the left: in this case, the last line of a \multiline does not contain a tag. Thus the situation of setting an endmark tag at the right is faked:

Lines 250, 251: display no equation number, set a tag, set it at the right, and call \lendmultline.

\begin{verbatim}
def\rendmultline@{\TagsPlusEndmarks % \iftag@ \\
\begingroup \ifshifttag@ \\
\hskip\multlinegap
\endgroup \hskip\multlinegap}
\end{verbatim}

\lendmultline also uses the augmented tags:
In `amsmath`, displaymaths are handled by \halign. \[ has to be changed such that the \halign header contains one more column:

\[
def\{%
\relax\ifmmode\RIfM@ \else
\DN@ \ GLOBAL\totwidth\wdz@ \ global\thm@amstmpdepth\dp0% \ halign to \displaywidth
\if@fleqn\else\hfil\fi
\setboxz@h{$\m@th\displaystyle{####}$} \boxz@
\tabskip\@mathmargin
\tabskip 0pt plus 1000pt
\tabskip Opt plus 1000pt
\cr
\%\]}

Note, that in `amsmath`, \def\RIfM@{\relax\ifmmode}. For here, this has to be extended since otherwise the surrounding \if@thmmarks...\fi is misinterpreted!!

New:
Line 292: store depth of current displaymath material (needed if end mark has to be set).

Line 294, 295: \halign gets one more column, after \boxz@ which contains the displaymath material, after a \hfil, an additional column is inserted.

The (potential) end mark is set in the additional column (which is started by the &) (line 304):

\[ \begin{align*}
\def\{ %
\relax\ifmmode \RIfM@ \DN@ \PotEndMark{&\raisebox{-\thm@amstmpdepth}} \crr
\black@ \totwidth@ 
\egroup
\%$
\end{align*}\]

Added Line 304: set potential end mark at bottom niveau of displaymath.

\def\equation{\gather\def\{\@amsmath@err{\Invalid@@\}\@eha}}
\def\endequation{\endgather}
\renewenvironment{equation*}{\equation}{\nonumber\endequation}
unchanged from amsmath.sty.

\else\PackageError{\basename}{Option amsmath cannot be used without option thmmarks.}\@eha
\fi
% end of option amsmath

If option amsmath is requested without option thmmarks, an error occurs.

7.1.5 Theorem-Layout Stuff

\let\thm@usestd\undefined
\DeclareOption{standard}{\let\thm@usestd\relax}
\let\thm@noconfig\undefined
\DeclareOption{noconfig}{\let\thm@noconfig\relax}

Options for selection of a configuration: if no such option is given ntheorem.cfg will be loaded (which has to be provided by the user), [standard] will load ntheorem.std, a predefined setting, and [noconfig] does not preload any configuration.

\gdef\InTheoType{None}
\gdef\NoneKeyword{None}
\gdef\NoneSymbol{None}
\gdef\None{None}

Set \InTheoType to none on the upper document level.

With \newtheoremstyle, new theorem-layout styles are defined.
\newtheoremstyle
Arguments:
⟨style⟩:=#1: the name of the theoremstyle to be defined,
⟨cmd_seq1⟩:=#2: command sequence for setting the header for environment instances with no optional text,
⟨cmd_seq2⟩:=#3: command sequence for setting the header for environment instances with optional text.

Line 330: if this style is not yet defined, define it.
Line 331: define \th@⟨style⟩ to be a macro which defines
Line 332: a) the two-argument macro \@begintheorem#1#2 to be ⟨cmd_seq1⟩,
Line 333: b) \@opargbegintheorem#1#2#3 to be ⟨cmd_seq2⟩.

The predefined theorem styles use this command.

\renewtheoremstyle
335 \gdef\renewtheoremstyle#1#2#3{%
336 \expandafter\ifdefundefined{th@#1}%
337 {\PackageError{\basename}{Theorem style #1 undefined}@ehc}%
338 {}%
339 \expandafter\let\csname th@#1\endcsname\relax
340 \newtheoremstyle{#1}{#2}{#3}

Arguments:
⟨style⟩:=#1: the name of the theoremstyle to be defined,
#2, #3 as for \newtheoremstyle.

Checks, if theoremstyle ⟨style⟩ is already defined. If so, \th@⟨style⟩ is made undefined and \renewtheoremstyle is called with the same arguments.

Predefined Theorem Styles

\begin{Verbatim}
\renewcommand{\th@plain}{\item\[
\hskip\labelsep \itemsep \theorem@headerfont ##1##2\theorem@separator\]
\renewcommand{\th@change}{\item\[
\hskip\labelsep \itemsep \theorem@headerfont ##2##1\theorem@separator\]
\renewcommand{\th@margin}{\item\[
\hskip\labelsep \itemsep \theorem@headerfont ##2##1\ (##3)\theorem@separator\]
\renewcommand{\th@break}{\item\hbox to \textwidth{\itemsep
\itemsep \hfill
\itemsep \itemsep \hfill
\itemsep ##1##2\theorem@separator##3\theorem@separator}
\renewcommand{\th@changebreak}{\item\hbox to \textwidth{\itemsep
\itemsep \itemsep \hfill
\itemsep \itemsep \hfill
\itemsep ##1##2\theorem@separator##3\theorem@separator}}
\end{Verbatim}
For instance, `break` is commented:
\newtheoremstyle{break}
results in
\gdef\th@break{
\def\@begintheorem##1##2{\item\[\hskip\labelsep \theorem@headerfont
##1\ ##2\theorem@separator\]\hfill\penalty-8000}
\def\@opargbegintheorem##1##2##3{\item\[\hskip\labelsep
##1\ ##2\ (##3)\theorem@separator\]\hfill\penalty-8000}
Then, calling \texttt{\textbackslash th@break} sets \texttt{\textbackslash begin@theorem} as follows:

Since each theorem environment is basically a trivlist, the header is set as the item contents: \texttt{\textbackslash theorem@headerfont} holds the font commands for the header font, \#1 is the keyword to be displayed, and \#2 its environment number. The linebreak after the header is achieved by offering to fill the line with space and the distinct wish to put a linebreak after it. Thus, if plain text follows, the line break is executed, but if a list or a display follows, it is not executed.

Note: The \texttt{\textbackslash hfill\penalty-8000} causes TeX to leave vertical mode, setting the item contents (i.e., the header) and entering horizontal mode to perform the \texttt{\textbackslash hfill}.

\texttt{\textbackslash theoremstyle} The handling of \texttt{\textbackslash theoremstyle}, \texttt{\textbackslash theorembodyfont}, and \texttt{\textbackslash theoremskipamounts} is taken from theorem.sty by Frank Mittelbach:

\begin{verbatim}
396 \gdef\theoremstyle#1{%
397 \@ifundefined{th@#1}{\@warning{Unknown theoremstyle `#1'. Using `plain'}%}
398 \theorem@style{plain}}%
399 \{\theorem@style{#1}}
401 \newtoks\theoremstyle
402 \newtoks\theorem@style
403 \global\theorem@style{plain}
\end{verbatim}

If \texttt{\textbackslash theoremstyle} is called, it is checked if the argument is a valid \texttt{theoremstyle}, and if so, it is stored in the token \texttt{\theorem@style}. It is initialized to \texttt{plain}.

\texttt{\textbackslash theorembodyfont}

\begin{verbatim}
404 \newtoks\theorembodyfont
405 \global\theorembodyfont{\itshape}
\end{verbatim}

\texttt{\textbackslash theoremnumbering}

\begin{verbatim}
406 \newtoks\theoremnumbering
407 \global\theoremnumbering{arabic}
\end{verbatim}

\texttt{\textbackslash theorempreskipamount}
\texttt{\textbackslash theorempostskipamount}

\begin{verbatim}
408 \newskip\theorempreskipamount
409 \newskip\theorempostskipamount
410 \global\theorempreskipamount\topsep
411 \global\theorempostskipamount\topsep
\end{verbatim}

\texttt{\textbackslash theoremindent}

\begin{verbatim}
412 \newdimen\theoremindent
413 \global\theoremindent0cm
414 \newdimen\theorem@indent
\end{verbatim}

\texttt{\textbackslash theoremheaderfont}

\begin{verbatim}
415 \newtoks\theoremheaderfont
416 \global\theoremheaderfont{\normalfont\bfseries}
417 \def\theorem@headerfont{\normalfont\bfseries}
\end{verbatim}

\texttt{\textbackslash theoremseparator}

\begin{verbatim}
418 \newtoks\theoremseparator
419 \global\theoremseparator{}
420 \def\theorem@separator{}
\end{verbatim}
\begin{quote}
\texttt{\theoremsymbol}\n\begin{verbatim}
421 \newtoks\theoremsymbol
422 \global\theoremsymbol{ }
\end{verbatim}
\end{quote}

\begin{quote}
\texttt{\qedsymbol}\n\begin{verbatim}
423 \newtoks\qedsymbol
424 \global\qedsymbol{ }
\end{verbatim}
\end{quote}

\begin{quote}
\texttt{\theoremkeyword}\n\begin{verbatim}
425 \newtoks\theoremkeyword
426 \global\theoremkeyword{None}
\end{verbatim}
\end{quote}

\begin{quote}
\texttt{\theoremclass}\n\begin{verbatim}
427 \gdef\theoremclass#1{\csname th@class@#1\endcsname}
428 \gdef\th@class@LaTeX{\theoremstyle{plain}
429 \theoremheaderfont{\normalfont\bfseries} \itshape
430 \theorembodyfont{\normalfont\itshape}
431 \theoremseparator{}
432 \theoremindent0cm
433 \theoremnumbering{arabic}
434 \theoremsymbol{ }}
\end{verbatim}
\end{quote}

Calling \texttt{\theoremclass\{\textit{env}\}} calls \texttt{\th@class@\textit{env}} (which is defined in \texttt{\newtheorem} in Lines -45535). \texttt{\th@class@\textit{env}} restores all style parameters to their values given for \textit{env}. Especially, \texttt{\th@class@LaTeX} restores the standard LaTeX parameters.

\begin{quote}
\texttt{\qedsymbol}\n\begin{verbatim}
437 \newtoks\qedsymbol
438 \global\qedsymbol{ }
\end{verbatim}
\end{quote}

\textbf{Compatibility with amsthm.}

\begin{quote}
\texttt{amsthm}\n\begin{verbatim}
439 \DeclareOption{amsthm}{% 
440 \PackageInfo{basename}{Option ‘amsthm’ loaded}\
441 \def\swapnumbers{\PackageError{basename}{swapnumbers not implemented.\n442 Use theoremstyle change instead.}@\eha}
443 \end{verbatim}
\end{quote}

Calling \texttt{\theoremclass\{\textit{env}\}} calls \texttt{\th@class@\textit{env}} (which is defined in \texttt{\newtheorem} in Lines -45535). \texttt{\th@class@\textit{env}} restores all style parameters to their values given for \textit{env}. Especially, \texttt{\th@class@LaTeX} restores the standard LaTeX parameters.
The syntax of \newtheorem is retained. The macro is extended to deal with the additional requirements:

\newtheorem{proof}{Proof}
\newenvironment{proof}[1][\proofname]{\@thm{proof}{proof}{#1}}% end of option amsthm

An auxiliary variable.

Defining New Theorem-Environments.

The syntax of \newtheorem is retained. The macro is extended to deal with the additional requirements:

\gdef\newtheorem{%
  \expandafter\ifundefined{th@nonumber\the\theorem@style}
    {\PackageError{ltthm}{Theorem style \the\theorem@style (nonumber) undefined (you need it here for newtheorem*) }{\@ehc}}%
  {%
    \expandafter\theorem@@style
  }
}

\newskip\thm@topsepadd
\newcommand\openbox{\leavevmode
  \hbox to.77778em{%}
  \hfil\vrule
  \vbox to.675em{\hrule width.6em\vfil\hrule}%
  \vrule\hfil}
\gdef\proofSymbol{\openbox}
\newcommand\proofname{Proof}
\newenvironment{proof}[1][\proofname]{\@thm{proof}{proof}{#1}}% end of option amsthm

An auxiliary variable.

 reproduces the TeX code for theorem styles and environments, documenting the functionality and syntax. It includes examples and references to original documentation and auxiliary variables.
Defines \texttt{\theoreminstyle} to be the current \texttt{\theoreminstyle} or – in case of \texttt{\newtheoreminstyle} – to be its non-numbered equivalent (which has to be defined!), and then calls \texttt{\@newtheoreminstyle}.

\texttt{\renewtheoreminstyle}

\texttt{\@newtheoreminstyle} does the main job for initializing a new theorem environment type. It is called by \texttt{\newtheoreminstyle}.

\texttt{\newtheoreminstyle}

Analogous to \texttt{\newtheoreminstyle}.
\texttt{\noexpand\theoremseparator{\the\theoremseparator}}

\texttt{\noexpand\theoreindent{\the\theoreindent}}

\texttt{\noexpand\theoremnumbering{\the\theoremnumbering}}

\texttt{\noexpand\theoremsymbol{\the\theoremsymbol}}

\texttt{}}

\texttt{\ifnextchar[{{\@othm{#1}}}{{\@nthm{#1}}}}% MUST NOT BE IN ANY IF !!!

Argument: \texttt{\langle env\rangle:=#1} is the (internal) environment name to be defined, which is read from the \LaTeX{} source.

Line 507: check if \texttt{\langle env\rangle} is not yet defined (or is redefined).

Lines 509–534 are executed exactly if \texttt{\langle env\rangle} and \texttt{\langle env\rangle*} are not yet defined.

Line 509: \texttt{\thm@tempif=true} iff \texttt{\langle env\rangle} and \texttt{\langle env\rangle*} are not yet defined.

Line 510: Initialize theorem list handling for \texttt{\langle env\rangle}.

Lines 512–515: if \texttt{thmmarks} is active and the counters are not yet defined, for every theorem-like, define

\begin{verbatim}
curr\langle env\rangle ctr: in the ith environment of type \langle env\rangle, curr\langle env\rangle ctr = i, and
end\langle env\rangle ctr: when the innermost environment is of type \langle env\rangle, in the jth potential position for an end mark in this environment, end\langle env\rangle ctr = j. (if the counters are already defined, \langle env\rangle is redefined, and these internal counters have to be continued).
\end{verbatim}

Lines 517–534: define several commands: (\texttt{\xdef} expands the definition at the time it is called and makes it global):

Line 517: store the current value of \texttt{\theoremsymbol} (\texttt{\edef}: expand \texttt{\the\theoremsymbol} now) as \texttt{\langle env\rangle Symbol}.

Lines 518–520, 521–523: Define the commands \texttt{\env} and \texttt{\env*} to set the header of \texttt{\langle env\rangle}. (using a switch \texttt{\thm@starredenv}: \relax iff starred).

Lines 524, 525: Set \texttt{end\langle env\rangle*} to \texttt{end\langle env\rangle}.

Lines 526–534: define \texttt{\setparms@\langle env\rangle} to set the style parameters of the header for every \texttt{\langle env\rangle} environment (in the sequel, \texttt{current} means, at the moment \texttt{\@newtheorem} is called):

Lines 527, 528: setting \texttt{\theorem@headerfont} to the \texttt{current} value of \texttt{\theoremheaderfont}, followed by a check if it is a bold style,

Lines 529, 530: setting \texttt{\theorem@separator} to the \texttt{current} value of \texttt{\theoremseparator},

Lines 531, 532: setting \texttt{\theorem@indent} to the \texttt{current} value of \texttt{\theoreindent},

Line 533: executing the command sequence currently stored in \texttt{\theorembodyfont}, and

Line 534: calling \texttt{th@\the\theorem@style} (which initializes \texttt{\@begintheorem} and \texttt{\@opargbegin theorem} according to the \texttt{current} value of \texttt{\theoremstyle} by calling \texttt{th@\the\theorem@style}).

Line 535–549: define \texttt{\th@class@\langle env\rangle} to initialize all style parameters as they are set for the \texttt{\langle env\rangle} environment.

Note, that the \texttt{\@ifundefined} from line 507 ends after line 549.

Line 550: According to the next character, call \texttt{\@othm\langle env\rangle} (if another counter is used) or \texttt{\@nthm\langle env\rangle}.

Thus, when calling \texttt{\@newthm} with \texttt{#1=\langle env\rangle}, for current values \texttt{\theoremstyle=plain, \theorembodyfont=\upshape, \theoremheaderfont=\bf, \theoremseparator=:, \theoreindent=1cm, \theoremnumbering=arabic, and \theoremsymbol=\Box},

42
the macro $\setparms@\langle env \rangle$ is defined as

$$\setparms@\langle env \rangle == \def\theorem@headerfont{\bf\theorem@checkbold}$$

$$\def\theorem@separator{:}$$

$$\def\theorem@indent{0cm}$$

$$\upshape \th@plain$$

and the macro $\th@class@\langle env \rangle$ is defined as

$$\th@class@\langle env \rangle == \def\theoremstyle{plain}$$

$$\def\theoremheaderfont{\bf}$$

$$\def\theorembodyfont{\upshape}$$

$$\def\theoremseparator{:}$$

$$\def\theoremindent{0cm}$$

$$\def\theoremmnumbering{arabic}$$

$$\def\thesymbol{\Box}$$

Note, that line 533 must not be inside any $\texttt{if} \ldots \texttt{fi}$ construct.

\@renewtheorem

545 $\def\@renewtheorem#1{%$
546 \expandafter\@ifundefined{#1}{%$
547 \PackageError{\basename}{Theorem style #1 undefined}@ehc}{%$
548 {}%$
549 \expandafter\let\csname #1\endcsname\relax$
550 \expandafter\let\csname #1\endcsname\relax
551 \@renewtheorem{#1}$

Argument: $\langle env \rangle$:=#1 is the (internal) environment name to be redefined, which is read from the LATEX source. If $\langle env \rangle$ is already defined, make it (and $\langle env \rangle*$, too) undefined and call $\@renewtheorem{\langle env \rangle}$.

\@nthm

\@nthm is called by $\@renewtheorem$ if the environment to be defined has a counter of its own.

552 $\def\@nthm#1#2{%$
553 \expandafter\protected@xdef\csname num@addtheoremline#1\endcsname{%$
554 \noexpand\@num@addtheoremline{#1}{#2}%$
555 \expandafter\protected@xdef\csname nonum@addtheoremline#1\endcsname{%$
556 \noexpand\@nonum@addtheoremline{#1}{#2}%$
557 \theoremkeyword{#2}%$
558 \expandafter\protected@xdef\csname #1Keyword\endcsname{%$
559 \noexpand\@nthm#1#2

Arguments:
$\langle env \rangle$:=#1 is the (internal) environment name to be defined (transmitted from $\@renewtheorem$).
$\langle output\_name \rangle$:=#2 is its keyword to be used in the output (read from the LATEX source).

Lines 553–556: Define $\@num@addtheoremline\langle env \rangle$ to call

$\@num@addtheoremline\langle env\rangle\langle output\_name\rangle$.

For comments on $\@num@addtheoremline$ and $\@nonum@addtheoremline$ see Section 7.1.8.
Lines 557–559: Define \(\langle\text{env}\rangle\text{Keyword}\langle\text{env}\rangle\) to typeset/output \(\langle\text{output\_name}\rangle\). (note the similarity with the handling of \texttt{\textbackslash theoremsymbol} for handling complex keywords)

Line 560: According to the next character, call \texttt{\@xnthm\{(\text{env})\}\{(\text{output\_name})\}} (if \langle\text{env}\rangle\text{-environments should be numbered relative to some structuring level) or \texttt{\@ynthm\{(\text{env})\}\{(\text{output\_name})\}}.

\texttt{\@othm} \texttt{\@othm} is called by \texttt{\@newtheorem} if the environment to be defined uses another counter.

\texttt{\@othm} \texttt{\@othm} is called by \texttt{\@newtheorem} if the environment to be defined uses another counter.

Arguments:
\langle\text{env}\rangle:=\#1 is the (internal) environment name to be defined (transmitted from \texttt{\@newtheorem}).
\langle\text{use\_ctr}\rangle:=\#2 is the internal name of the theorem which counter is used, and
\langle\text{output\_name}\rangle:=\#3 is its “name” to be used in the output (both read from the \LaTeX source).

Line 562: if the counter to be used is undefined, goto error, else set \texttt{\the\langle\text{env}\rangle} to use \texttt{\the\langle\text{use\_ctr}\rangle} and do the following:

Lines 564–572 happen only if \langle\text{env}\rangle is not yet defined or gets redefined:

Line 564: (from latex.ltx) make \langle\text{env}\rangle use the counter \langle\text{use\_ctr}\rangle.

Line 565–571 similar to lines 553–559 of \texttt{\@nthm}.

Lines 572–574 define \texttt{\mkheader@\langle\text{env}\rangle} to set the style parameters of the header and set the header (by \texttt{\@othm}):

\texttt{\mkheader@\langle\text{env}\rangle} == \texttt{\setparms@\langle\text{env}\rangle\@thm\{(\text{env})\}\{(\text{use\_ctr})\}\{(\text{output\_name})\}}.

\texttt{\setparms@\langle\text{env}\rangle} is defined when \texttt{\@newtheorem\{(\text{env})\}} is carried out).

Line 575: (from latex.ltx): \texttt{\end\langle\text{env}\rangle} calls \texttt{\@endtheorem}.

\texttt{\@xnthm} \texttt{\@xnthm} is called by \texttt{\@nthm} if the numbering is relative to some structuring level.
Arguments:
\langle env\rangle := #1 is the (internal) environment name to be defined (transmitted from \@newtheorem).
\langle output\_name\rangle := #2 is its keyword to be used in the output,
\langle level\rangle := #3 is the structuring level relative to which \langle env\rangle has to be numbered (both read from the \LaTeX{} source).

Lines 578–587 happen only if \langle env\rangle is not yet defined or gets redefined:
Lines 578, 579: in not yet defined, define \langle env\rangle-counter (otherwise, \langle env\rangle is redefined).
Line 581: (from latex.ltx): define the counter for \langle env\rangle and add \langle level\rangle to its reset-triggers.
Lines 582, 583: define \the\langle env\rangle to be the command sequence
\the\langle level\rangle \@thmcountersep\langle numbering\rangle\{(\langle env\rangle)\},
where \langle numbering\rangle is the value of \texttt{theoremmnumbering} when \@xnthm (and thus, \texttt{newtheorem}\{(\langle env\rangle)\}) is called.

Lines 584–586: define \texttt{mkheader@}\langle env\rangle to set the style parameters of the header and set the header (by \@thm):
\texttt{mkheader@}\langle env\rangle == \setparms@\langle env\rangle \@thm\{(\langle env\rangle)\}\{(\langle output\_name\rangle)\}.
(\texttt{setparms@}\langle env\rangle is defined when \texttt{newtheorem}\{(\langle env\rangle)\} is carried out).
Line 587: (from latex.ltx): \texttt{end(\langle env\rangle) calls \@endtheorem}.

\@ynthm \@ynthm is called by \@nthm if the counter is not relative to any structuring level.

\@ynthm is called by \@nthm if the counter is not relative to any structuring level.
\begin{itemize}
\item Lines 599–601: if \texttt{thmmarks} is active, the counter for the current environment \langle env'\rangle is incremented, since the last endmark in environment \langle env'\rangle is definitely not the position for its endmark (necessary for nested environments ending at the same time).
\item Line 602: set \texttt{InTheoType} to \langle env\rangle.
\item Lines 603–606: if \texttt{thmmarks} is active, increment \texttt{curr\langle env\rangle ctr} and set \texttt{end\langle env\rangle ctr} to 0.
\item Line 607: adapted from \texttt{latex.ltx}: increment the corresponding counter.
\item Lines 608–612: handle \texttt{\theorempreskipamount} and \texttt{\theorempostskipamount} (if in \texttt{vmode}, there is additional space, cf. \texttt{\trivlist} and \texttt{\@trivlist} in \texttt{latex.ltx}).
\item Lines 613–615: handle \texttt{\theoremindent}.
\item Line 616: if there is an optional argument, call \texttt{\@ythm{\langle env\rangle}}{{\langle use_ctr\rangle}}{{\langle output_name\rangle}}}, otherwise call \texttt{\@xthm{\langle env\rangle}}{{\langle use_ctr\rangle}}{{\langle output_name\rangle}}).
\end{itemize}

\texttt{\@xthm} \texttt{\@xthm} is called by \texttt{\@thm} if there is no optional text in the theorem header.

\begin{itemize}
\item Lines 617–621: \texttt{\@begintheorem{\langle env\rangle}{\csname the\langle use_ctr\rangle\endcsname}}{\csname the\langle use_ctr\rangle\endcsname}{{\langle output_name\rangle}}, \texttt{\@othmcaption{\langle env\rangle}}{{\langle use_ctr\rangle}}{{\langle output_name\rangle}}{}}{\@undefined}\@ignorespaces.
\item Changed to three instead of two parameters (the first one is new):\langle env\rangle:=\#1: (added) internal name of the theorem environment,\langle use_ctr\rangle:=\#2: internal name of the theorem which counter is used,\langle output_name\rangle:=\#3: keyword to be displayed in the output; all arguments are transmitted from \texttt{\@othm/\@nthm/\@ynthm}.
\end{itemize}

For comments, see \texttt{\@ythm}.
\@ythm \@ythm is called by \@thm if there is an optional text in the theorem header.

Line 623: define \langle env \rangle name to be the optional argument.

Line 624: call
\begin{enumerate}
\item \@opargbegintheorem{\langle output\_name \rangle}{\the{\langle use\_ctr\rangle}}{\langle opt\_text \rangle}
\end{enumerate}

which outputs the header.

Line 625, 626: if \langle env \rangle is not the starred version, call
\begin{enumerate}
\item \@thm@thmcaption{\langle env \rangle}{\langle output\_name \rangle}{\the{\langle use\_ctr\rangle}}{\langle opt\_text \rangle}
\end{enumerate}

which makes an entry into the theorem list.

\@endtheorem \@endtheorem it is only changed by option [thmmarks]. Otherwise refer to the definition in latex.ltx

7.1.7 Extended Referencing Facilities

\label The original \label macro is extended (cf. ltxref.dtx) with an optional argument, containing the type of the labeled construct:

\begin{enumerate}
\item \DeclareOption{thref}{\PackageInfo{\basename}{Option 'thref' loaded}}
\item \def\label#1{\@ifnextchar[{{\label@optarg{#1}}}{\thm@makelabel{#1}}}
\item \def\thm@makelabel#1{\@bbsphack\edef\thm@tmp{\expandafter\expandafter\expandafter\thm@meaning\expandafter\meaning\csname\InTheoType Keyword\endcsname\relax}}\protected@write\@auxout{}{\string\newlabel{#1}{{\@currentlabel}{\thepage}}\thm@tmp}\@eesphack}
\item \def\label@optarg#1[\#2]{{\@bsphack\protected@write\@auxout{}{\string\newlabel{#1}{{\@currentlabel}{\thepage}}\[#2\]}\@esphack}
\end{enumerate}

\@thm@makelabel: If no optional argument is given, the keyword of the current environment type is used instead.
\newlabel: The original definition, extended with the optional argument which is appended to the \newlabel-command to be written to the .aux-file.

\newlabel The original behavior of \newlabel (called when evaluating the .aux-file) is also adapted.

Original syntax: \newlabel{(\label)}{{\{section\}\{page\}}}\}

Modified syntax: \newlabel{(\label)} {{\{section\}\{page\}}}\}[(\type)\]

Definition of \newlabel: \def\newlabel{\@newl@bel r}.

Therefore, the modification is encoded into the \@newl@bel macro:

\begin{verbatim}
\def\@newl@bel#1#2#3{\%\ifcheckpackage{babel}{\@safe@activestrue}\relax\%
  \ifdefined{#1@#2}\relax\%
  \else\global\@namedef{#1@#2}{#3}\relax\%
  \ifnextchar[\set@label@type{#1}{#2}\]\%
  \relax\%
  \set@label@type{#1}{#2}{\%
  \expandafter\expandafter\ifx\csname r@#1@type\endcsname\None\%
  \PackageWarning{ref}{\texttt{thref}: Reference Type of '#1' on page \thepage \space undefined}\G@refundefinedtrue\%
  \else\csname r@#1@type\endcsname~\fi\%
  \expandafter\@setref\csname r@#1\endcsname \@firstoftwo{#1}\%
  \}\%
  \}\%
\end{verbatim}

the macro is called with three arguments (same as originally):

#1=r,
\langle\textit{labelname}\rangle := #2 is the label name,
#3 is a pair (section, page-number) consisting of the values needed for \ref and \pageref, respectively.

Line 649: adaptation to babel

Lines 650–655: The original definition (both standard \LaTeX{} and babel).

Line 656: if an optional argument follows (containing the environment-type), continue with \set@label@type, otherwise return (the original behavior).

Lines 658,659: set \texttt{\r@\langle\textit{labelname}\rangle@type} to the type of the respective environment.

\texttt{\thref} \texttt{\thref} is an adaptation of \ref:

\begin{verbatim}
\def\thref#1\%\expandafter\ifx\csname r#1@type\endcsname\None\%
\PackageWarning{\basename}{\texttt{thref}: Reference Type of '#1' on page \thepage \space undefined}\G@refundefinedtrue\%
  \thepage \spacesave undeefined]\G@refundefinedtrue\%
\else\csname r#1@type\endcsname~\fi\%
\expandafter\\@ref\csname r#1\endcsname \@firstoftwo{#1}\%
\end{verbatim}

Lines 660,665: similar to \ref.

Line 649: if a legal theorem type is given, then output \texttt{\r@\langle\textit{labelname}\rangle@type} and avoid linebreaking between the type and the number.

7.1.8 Generation of Theorem Lists

The following macros are are needed for the generation of theorem-lists. We will document it for the theorem \begin{definition}[optional], which we assume to be the first definition at all and which is placed on page 5.

48
\thm@thmcaption This macro, used internally, strips of the outer brackets from the second argument and calls \thm@thmcaption. It’s typically called like this:

\thm@thmcaption{definition}{{Definition}{1}{optional}}

(internal name of the environment, output keyword, running number, optional text)

\def\thm@thmcaption#1#2{\thm@@thmcaption{#1}#2}

\thm@@thmcaption is called from \thm@caption; it writes an appropriate entry to the .thm-file.

\def\thm@@thmcaption#1#2#3#4{\thm@parseforwriting{#2}\let\thm@tmpii\thm@tmp\thm@parseforwriting{#4}\edef\thm@t{{\thm@tmpii}{#3}{\thm@tmp}}\addcontentsline{thm}{#1}{\thm@t}}

Arguments: \textlangle env \textrangle := #1 is the internal environment name, \textlangle output name \textrangle := #2 is its keyword to be used in the output, \textlangle #3 \textrangle is the running number, and \textlangle #4 \textrangle is the optional text argument in the header.

Lines 668,669: the command sequence for the output keyword is prepared by \thm@parseforwriting (which returns \thm@tmpii) and then stored in \thm@tmpii.

Line 670: the optional text is also prepared by \thm@parseforwriting

Lines 671,672: The output is collected and written into the .aux file, which will forward it to the theorem-file.

The following two macros are just shortcuts, often needed for the output of one single line in the theorem-lists. The first one is used in unnamed lists, the second one in named. Warning: Don’t remove the leading \let, since you will get wrong \if-\fi-nesting without it, if you don’t use hyperref.

\thm@thmline@noname

\def\thm@thmline@noname#1#2#3#4{%\@dottedtocline{-2}{0em}{2.3em}%{\protect\numberline{#2}#3}%{#4}}

\thm@thmline@name

\def\thm@thmline@name#1#2#3#4{%\@dottedtocline{-2}{0em}{2.3em}%{#1 \protect\numberline{#2}#3}%{#4}}

\thm@thmline This is another short one, which only discards the outer brackets from the first argument and calls \thm@thmline. It’s normally called like this:

\thm@thmline{Definition}{1}{optional}{5}

\def\thm@thmline#1#2{\thm@thmline#1#2}

\thm@lgobble The next macro is used to ignore all theorem-sets, which should not be listed.

\long\def\thm@lgobble#1#2{\ignorespaces}
The following four macros set up the predefined list-types. To do so, they define the internal macros \texttt{\thm@@thmlstart} (containing the code to be executed at the beginning of the list), \texttt{\thm@@thmlend} (code to be executed at the end of the list) and \texttt{\thm@@thmline} (code to be executed for every line). In order to gain compatibility with \texttt{newthm.sty}, we decided not to make this commands inaccessible to the user. But we recommend not using these commands, because they may disappear in later distributions.

\begin{verbatim}
\theoremlistall  This one implements the type all.
684 \def\theoremlistall{%
685 \let\thm@@thmlstart=\relax
686 \let\thm@@thmlend=\relax
687 \let\thm@@thmline=\thm@@thmline@noname}
\end{verbatim}

\begin{verbatim}
\theoremlistallname  And here's the type allname.
688 \def\theoremlistallname{%
689 \let\thm@@thmlstart=\relax
690 \let\thm@@thmlend=\relax
691 \let\thm@@thmline=\thm@@thmline@name}
\end{verbatim}

\begin{verbatim}
\theoremlistoptional  This one is the list-type opt. In case of [hyperref], the fifth argument, which is provided by \texttt{hyperref.sty} is automatically given to \texttt{\thm@@thmline@noname}.
692 \def\theoremlistoptional{%
693 \let\thm@@thmlstart=\relax
694 \let\thm@@thmlend=\relax
695 \def\thm@@thmline##1##2##3##4{%
696 \ifa\empty##3% 
697 \else% 
698 \thm@@thmline@noname{##1}{##2}{##3}{##4}
699 \fi}
\end{verbatim}

\begin{verbatim}
\theoremlistoptname  And the last type, optname. In case of [hyperref], the fifth argument, which is provided by \texttt{hyperref.sty} is automatically given to \texttt{\thm@@thmline@name}.
700 \def\theoremlistoptname{%
701 \let\thm@@thmlstart=\relax
702 \let\thm@@thmlend=\relax
703 \def\thm@@thmline##1##2##3##4{%
704 \ifa\empty##3% 
705 \else% 
706 \thm@@thmline@name{##1}{##2}{##3}{##4}
707 \fi}
\end{verbatim}

\textbf{Theoremlists and Hyperref} Since the \texttt{hyperref}-package redefines \texttt{\contentsline}, we must redefine some commands to handle this:

1. Let the different versions of \texttt{\thm@@thmline@..} take a 5th argument, the one provided by \texttt{hyperref}.
2. Don't use hyperref's \texttt{\contentsline}: restore the normal definition at the beginning of \texttt{\thm@processlist} (see there).
3. Let \texttt{\thm@1gobble} take a 3rd argument, the one provided by hyperref.
4. Do the hyperlinks manually in the different versions of \texttt{thm@thmline} as defined by the theoremytypes.

\DeclareOption{hyperref}{%
    \def\thm@thmline@noname#1#2#3#4#5{%
        \ifx\%#5\%
            \@dottedtocline{-2}{0em}{2.3em}%
            \protect\numberline{#2}#3%
        \else
            \ifhy@linktocpage\relax\relax
                \@dottedtocline{-2}{0em}{2.3em}%
                \protect\numberline{#2}#3%
            \else
                \hyper@linkstart{link}{#5}{#4}\hyper@linkend
            \fi
        \fi}
    \def\thm@thmline@name#1#2#3#4#5{%
        \ifx\%#5\%
            \@dottedtocline{-2}{0em}{2.3em}%
            #1 \protect\numberline{#2}#3%
        \else
            \ifhy@linktocpage\relax\relax
                \@dottedtocline{-2}{0em}{2.3em}%
                #1 \protect\numberline{#2}#3%
            \else
                \hyper@linkstart{link}{#5}{#4} \hyper@linkend
            \fi
        \fi}
    \def\thm@thmline#1#2#3{
        \thm@@thmline@noname{#1}{#2}{#3}{#4}{#5}
    }
    \long\def\thm@lgobble#1#2#3{
        \ignorespaces}
    \def\theoremlistoptional{%
        \let\thm@@thmlstart=\relax
        \let\thm@@thmlend=\relax
        \def\thm@@thmline##1##2##3##4##5{%
            \ifx\empty##3\%
                \else
                    \thm@@thmline@noname{##1}{##2}{##3}{##4}{##5}
                \fi
        }%
    }%
    \def\theoremlistoptname{%
        \let\thm@@thmlstart=\relax
        \let\thm@@thmlend=\relax
        \def\thm@@thmline##1##2##3##4##5{%
            \ifx\empty##3\%
                \else
                    \thm@@thmline@name{##1}{##2}{##3}{##4}{##5}
                \fi
        }%
    }%}
\theoremlisttype  The next one is the user-interface for selecting the list-type. It simply calls \texttt{\thm@thml@\langle \textit{type} \rangle}, if the given \texttt{\langle \textit{type} \rangle} is defined.

\begin{verbatim}
def\theoremlisttype#1{\%
  $\@ifundefined{thm@thml@#1}\$
    {$\PackageError{\basename}{Listtype \#1 not defined}\@eha}\$
    {\csname thm@thml@#1\endcsname}}%
\end{verbatim}

Now, here is the code, which maps the types – selected by \texttt{\theoremlisttype} – to the defined macros.

\begin{verbatim}
\def\thm@thml@all{\theoremlistall}
\def\thm@thml@opt{\theoremlistoptional}
\def\thm@thml@optname{\theoremlistoptname}
\def\thm@thml@allname{\theoremlistallname}
\end{verbatim}

\newtheoremlisttype  According to the given documentation, this one can be used to define new list-types. It’s done by defining the macro \texttt{\thm@thml@\langle \textit{type} \rangle}, which \textit{locally} redefines the commands \texttt{\thm@thmlstart}, \texttt{\thm@@thmline} and \texttt{\thm@@thmlend}.

\begin{verbatim}
def\newtheoremlisttype#1#2#3#4{\%
  $\@ifundefined{thm@thml@#1}\$
    {$\PackageError{\basename}{List type \#1 not defined}\@ehc}\$
    {\expandafter\let\csname thm@thml@#1\endcsname\relax
     \newtheoremlisttype\langle#1\rangle\{#2\}{#3}\{#4\}}\%
\end{verbatim}

\renewtheoremlisttype  if the list type to be redefined is already defined, make it undefined and define it.

\begin{verbatim}
def\renewtheoremlisttype#1#2#3#4{\%
  $\@ifundefined{thm@thml@#1}\$
  \expandafter\let\csname thm@thml@#1\endcsname\relax
  \newtheoremlisttype\langle#1\rangle\{#2\}{#3}\{#4\}}\%
\end{verbatim}

\thm@definelthm  For each theorem-set, we need to setup two commands. Thus, the next macro is called by \texttt{\newtheoremlist}. It defines the command \texttt{\langle \textit{theorem-set} \rangle} and \texttt{\thm@listdo\langle \textit{theorem-set} \rangle}, which initially discard the input by calling \texttt{\thm@lgobble}. The first one is called for each theorem when you are generating lists. The second one is called, if you’ve added something with \texttt{\addtotheoremfile}.

\begin{verbatim}
def\thm@definelthm#1{\%
  \expandafter\gdef\csname l@#1\endcsname{\thm@lgobble}\%
  \expandafter\gdef\csname thm@listdo#1\endcsname{\thm@lgobble}}
\end{verbatim}

\thm@inlistdo  If in some case, you’ve written additional text into the theorem-file by \texttt{\addtotheoremfile}, this one is called internally. It simply discards the first argument and strips of the outer brackets from the second one.

\begin{verbatim}
\long\def\thm@inlistdo#1#2{#2}\%
\end{verbatim}
\listtheorems  Now we need the user-interface for generating lists. This is done by the next macro. We set the \texttt{tocdepth} to $-2$ to assure that the predefined list-types work. After storing the names of the theorem-sets, we call \texttt{\thm@processlist}, which actually generates the list.

\begin{verbatim}
786 \def\listtheorems#1{\begingroup
787 \c@tocdepth=-2\%
788 \def\thm@list{#1}\thm@processlist
789 \endgroup}
\end{verbatim}

\thm@processlist  To generate the specified list, we redefine globally the commands \texttt{\l@⟨theorem-set⟩} and \texttt{\thm@listdo⟨theorem-set⟩}. Remember that these initially were set to ignore everything. After reading in the theorem-file, we redefine the mentioned commands to discard everything again. We need to define the macros globally for dealing with complex, user-defined, list-types.

\begin{verbatim}
790 \def\thm@processlist{\%
791 \begingroup\%
792 \typeout{** Generating table of \thm@list}%
793 \def\contentsline##1{\csname l@##1\endcsname}%
794 \thm@@thmlstart
795 \@for\thm@currentlist:=\thm@list\do{\%
796 \ifx\thm@currentlist\@empty\else\%
797 \expandafter\gdef\csname l@\thm@currentlist\endcsname{\thm@thmline}%
798 \expandafter\gdef\csname thm@listdo\thm@currentlist\endcsname{\thm@inlistdo}%
799 \fi\%
800 }%
801 \@input{\jobname .thm}%
802 \thm@@thmlend%
803 \@for\thm@currentlist:=\thm@list\do{\%
804 \ifx\thm@currentlist\@empty\else\%
805 \expandafter\gdef\csname l@\thm@currentlist\endcsname{\thm@lgobble}%
806 \expandafter\gdef\csname thm@listdo\thm@currentlist\endcsname{\thm@lgobble}%
807 \fi\%
808 }%
809 \endgroup}
\end{verbatim}

\thm@enablelistoftheorems  Up to now, we’ve set up various macros for writing and reading the theorem-file. Thus, it’s time to set up the file itself. This is done by the next macro. We simply took the lines for \texttt{@starttoc} from the \LaTeX-base and changed some things. The main intention to copy \texttt{@starttoc} is that we don’t want the file to be input when it is set up – like it’s done by \texttt{@starttoc}.

\begin{verbatim}
810 \def\thm@enablelistoftheorems{\%
811 \begingroup\%
812 \makeatletter\%
813 \if@filesw\%
814 \expandafter\newwrite\csname tf@thm\endcsname\%
815 \immediate\openout \csname tf@thm\endcsname \jobname.thm\relax\%
816 \fi\%
817 \@nobreakfalse\%
818 \endgroup}
\end{verbatim}

\addtheoremline  By \texttt{\addtheoremline⟨⟨theorem-set⟩⟩⟨⟨entry⟩⟩}, the user can insert an extra entry into the theorem-file. \texttt{\addtheoremline*} calls the internal macro \texttt{\nonum@addtheoremline},
otherwise \num@addtheoremline is called. \num/nonum@addtheoremline\{\langle\text{theorem-set}\rangle\}\{\langle\text{entry}\rangle\} calls \num/nonum@addtheoremline\{\langle\text{theorem-set}\rangle\}\{\langle\text{entry}\rangle\} which are defined when \langle\text{theorem-set}\rangle is declared (cf. \@nthm and \@nthm). turn calls \num/nonum@addtheoremline\{\langle\text{keyword}\rangle\}\{\langle\text{entry}\rangle\} which write information to the theorem file.

\def\addtheoremline{\@ifstar{\nonum@addtheoremline}{\num@addtheoremline}}
\def\nonum@addtheoremline#1{\csname nonum@addtheoremline#1\endcsname}\
\def\num@addtheoremline#1{\csname num@addtheoremline#1\endcsname}
\@nonum@addtheoremline
\@num@addtheoremline
\@nonum@addtheoremline and \@nonum@addtheoremline write the actual entries to the .thm file.
Syntax: \@nonum/nonum@addtheoremline\{\langle\text{theorem-set}\rangle\}\{\langle\text{keyword}\rangle\}\{\langle\text{entry}\rangle\}
\def\@nonum@addtheoremline#1#2#3{\thm@parseforwriting{#3}\
edef\thm@t{{#2}{}{\thm@tmp}}\addcontentsline{thm}{#1}{\thm@t}}
\@num@addtheoremline
\def\@num@addtheoremline#1#2#3{\thm@parseforwriting{#3}\
edef\thm@t{{#2}{\csname the#1\endcsname}{\thm@tmp}}\addcontentsline{thm}{#1}{\thm@t}}
\addtotheoremfile
To write any addtional stuff into the theorem-file, the next macro is used. It first checks, if the optional name of a theorem-set is given. In that case, the macro \@@addtotheoremfile, otherwise \@addtotheoremfile is used to write the stuff into the file.
\long\def\addtotheoremfile{}\@ifnextchar[\@@addtotheoremfile{\@addtotheoremfile}
\@addtotheoremfile
Write additional stuff for all theorems.
\long\def\@addtotheoremfile#1{}\@ifnextchar[\@@addtotheoremfile{\@addtotheoremfile}
\@addtotheoremfile
Write additional stuff for a given theorem-set.
\long\def\@addtotheoremfile\{#1\}\{#2\}{}\@ifnextchar[\@@addtotheoremfile{\@addtotheoremfile}
\@addtotheoremfile
Write additional stuff for a given theorem-set.
\long\def\@addtotheoremfile\{#1\}\{#2\}{}\@ifnextchar[\@@addtotheoremfile{\@addtotheoremfile}
\@addtotheoremfile
This one is called from the theorem-file to insert the additional stuff for a theorem-set.
\long\def\theoremlistdo\#1\#2{}\csname thm@listdo#1\endcsname\{#1\}\{#2\}{}

Now we assure, that the theorem-file is activated. This is done by inserting a hook at the end of the document.
\AtEndDocument{\thm@enablelistoftheorems}
7.1.9 Auxiliary macros

For generating theorem-lists, we need to write informations into a separate file. Because we don’t want to expand this information, we parse it specially for writing.

\def\thm@meaning#1->#2\relax{#2}% remove "macro: ->"
\long\def\thm@parseforwriting#1{%
    \def\thm@tmp{#1}%
    \edef\thm@tmp{\expandafter\thm@meaning\meaning\thm@tmp\relax}}

In some countries it’s usual to number theorems with greek letters:

\theorem@checkbold
For correctness, we need to check if a bold font is active. This is done by the following macro:
\def\theorem@checkbold{\if b\expandafter\@car\f@series\@nil\boldmath\fi}

\@greek
Accoding to \LaTeX-base, this is the internal command for generating lowercase greek numberings.
\def\@greek#1{\theorem@checkbold%\ifcase#1\or$\alpha$\or$\beta$\or$\gamma$\or$\delta$\or$\varepsilon$%\or$\zeta$\or$\eta$\or$\vartheta$\or$\iota$\or$\kappa$\or$\lambda$\or$\mu$\or$\nu$\or$\xi$\or$\omicron$\or$\varpi$\or$\varrho$\or$\varsigma$\or$\tau$\or$\upsilon$\or$\varphi$\or$\chi$\or$\psi$\or$\omega$\else\@ctrerr\fi}

\@Greek
According to \LaTeX-base, this is the internal command for generating uppercase greek numberings.
\def\@Greek#1{\theorem@checkbold%\ifcase#1\or A\or B\or$\Gamma$\or$\Delta$\or E%\or Z\or H\or$\Theta$\or I\or$\Lambda$\or M%\or N\or$\Xi$\or O\or$\Pi$\or$\Sigma$\or T%\or$\Upsilon$\or$\Phi$\or X\or$\Psi$\or$\Omega$\else\@ctrerr\fi}

\greek
Accoding to \LaTeX-base, this is the user interface for lowercase greek numberings.
\def\greek#1{\@greek{\csname c@#1\endcsname}}

\Greek
According to \LaTeX-base, this is the user interface for uppercase greek numberings.
\def\Greek#1{\@Greek{\csname c@#1\endcsname}}

7.1.10 Other Things

After declaring several package-options, we need to process the specified ones. The additional \relax was mentioned by Rainer Schöpf at DANTE’97.
\ProcessOptions\relax

Now we set up the default theorem listtype. Make sure this is called after processing the options. Otherwise, ntheorem will break with hyperref.
\theoremlistall

If automatical configuration is not disabled by [noconfig], it is checked if the file ntheorem.cfg exists and in this case the definitions in this file are read. If it does not exist and the option standard was specified, the file ntheorem.std is used.
\ifx\thm@noconfig\@undefined
\InputIfFileExists{ntheorem.cfg}%
{\PackageInfo{\basename}{Local config file ntheorem.cfg used}}%
\fi
7.2 The Standard Configuration

\begin{verbatim}
\setcounter{section}{7}
\section{The Standard Configuration}
\newcommand{\theoremnumbering}{arabic}
\newcommand{\theoremstyle}{plain}
\newcommand{\theoremsymbol}{\ensuremath{\_\Box}}
\newcommand{\theorembodyfont}{\itshape}
\newcommand{\theoremheaderfont}{\normalfont\bfseries}
\newcommand{\theoremseparator}{\normalfont}
\newenvironment{Theorem}{\begin{quote}Theorem\end{quote}}{}
\newenvironment{theorem}{\begin{quote}Theorem\end{quote}}{}
\newenvironment{Satz}{\begin{quote}Satz\end{quote}}{}
\newenvironment{satz}{\begin{quote}satz\end{quote}}{}
\newenvironment{Proposition}{\begin{quote}Proposition\end{quote}}{}
\newenvironment{proposition}{\begin{quote}Proposition\end{quote}}{}
\newenvironment{Lemma}{\begin{quote}Lemma\end{quote}}{}
\newenvironment{lemma}{\begin{quote}Lemma\end{quote}}{}
\newenvironment{Korollar}{\begin{quote}Korollar\end{quote}}{}
\newenvironment{korollar}{\begin{quote}korollar\end{quote}}{}
\newenvironment{Corollary}{\begin{quote}Corollary\end{quote}}{}
\newenvironment{corollary}{\begin{quote}Corollary\end{quote}}{}
\newenvironment{Example}{\begin{quote}Example\end{quote}}{}
\newenvironment{example}{\begin{quote}Example\end{quote}}{}
\newenvironment{Beispiel}{\begin{quote}Beispiel\end{quote}}{}
\newenvironment{beispiel}{\begin{quote}Beispiel\end{quote}}{}
\newenvironment{Bemerkung}{\begin{quote}Bemerkung\end{quote}}{}
\newenvironment{bemerkung}{\begin{quote}Bemerkung\end{quote}}{}
\newenvironment{Anmerkung}{\begin{quote}Anmerkung\end{quote}}{}
\newenvironment{anmerkung}{\begin{quote}Anmerkung\end{quote}}{}
\newenvironment{Remark}{\begin{quote}Remark\end{quote}}{}
\newenvironment{remark}{\begin{quote}Remark\end{quote}}{}
\newenvironment{Definition}{\begin{quote}Definition\end{quote}}{}
\newenvironment{definition}{\begin{quote}Definition\end{quote}}{}
\newenvironment{Proof}{\begin{quote}Proof\end{quote}}{}
\newenvironment{proof}{\begin{quote}Proof\end{quote}}{}
\newenvironment{Beweis}{\begin{quote}Beweis\end{quote}}{}
\newenvironment{beweis}{\begin{quote}Beweis\end{quote}}{}
\newenvironment{\qedsymbol{\ensuremath{\_\blacksquare}}}
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8 History and Acknowledgements

8.1 The endmark-Story (Wolfgang May)

In 1995, I started a hack for setting endmarks semiautomatically at the end of displayed formulas. The work on \texttt{thmmarks.sty} was initiated in October 1996 by a thread asking for a routine for setting endmarks in \texttt{de.comp.tex} founded by Boris Piwinger. Version 0.1 incorporated the main features for setting endmarks automagically by using the .\texttt{aux} file. Version 0.2 included some bugfixes and was the first one accessible on the internet. Boris suggested to include \texttt{fleqn} and \texttt{leqno} which has been done in version 0.3 (which was never made public). Since at this point, \texttt{thmmarks.sty} was incompatible to the widely used \texttt{theorem.sty} written by Frank Mittelbach, in Version 0.4, the features of \texttt{theorem.sty} have been integrated. To version 0.5, the case of “empty” end symbols has been handled, \texttt{\textbackslash qed} has been added (also suggested by Boris), and the handling of theoremstyles by \texttt{\textbackslash newtheoremstyle} has been included.

For version 0.6, the handling of endmarks in displaymaths has been changed in order to adjust them with the bottom of the displayed math. Version 0.6 was the first one announced in \texttt{comp.text.tex}. For version 0.7, I added the handling of \texttt{amsmath} features, suggested by my colleague Peter Neuhaus. Versions 0.71 and 0.72 incorporated minor bugfixes.

8.2 Lists, Lists, Lists (Andreas Schlechte)

I often saw questions on theoremlists in the german newsgroup \texttt{de.comp.text.tex}, but I never spent any attention on those postings. This changed in summer 1996, when I needed those lists for myself. Thus, I asked the holy question. But none of the given answers satisfied my wish for a simple, easy to use and short solution. I decided to take a look at Frank Mittelbachs \texttt{theorem.sty}. First I didn’t understand much of the code, but Bernd Raichle helped me a lot by answering my boring questions and I finally understood it.

I started the coding and within a few days, a first experimental version was born. Not only that I had implemented the lists, I also inserted a separator and a flexible numbering of the theorems.

After a long period of testing, I wanted to share the new features with other \TeX-Freaks and wrote an article for the “Die \TeXnische Komödie” (Journal of german tug, DANTE e.V.). As soon as I had sent the article to DANTE, I got first reactions on the style. Gerd Neugebauer gave me many hints. I hided several cryptical notations in easy definitions and improved the user interface.

In January 1997, I released “newthm” to the world and it was uploaded to the CTAN-Archives. Few days later I sent my files to Frank Mittelbach in order to show him my extensions. He told me, that already other extensions were made, and that it would be good to combine alltogether.

8.3 Let’s come together

With version 0.8, in February 1997, the combination of \texttt{thmmarks.sty} with \texttt{newthm.sty} to \texttt{ntheorem.sty} has been started. On April 21, 1997, version 0.94 beta has been made public as version 1.0.

In course of the development, the following changes were made:
You should create the list of changes by

\texttt{makeindex -s gglo.ist -o ntheorem.gls ntheorem.glo}

and running \texttt{latex ntheorem.drv} again.

8.4 Acknowledgements

This place is dedicated to all those, who helped us developing our separate styles and this combined package. Thanks to (listed in alphabetical order):

Frank Mittelbach, Gerd Neugebauer, Boris Piwinger, Bernd Raichle, Rainer Schöpf, Didier Verna.