An Extension of the LaTeX theorem environment*

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Abstract

The macros described in this paper yield an extension of the LaTeX theorem mechanism. It is designed is to satisfy the different requirements of various journals. Thus, the layout of the "theorems" can be manipulated by determining a "style". This article describes not only the use, but also the definition, of the necessary macros.

Preface to version 2.2

For LaTeX 2ε this package did not need any fundamental changes. I only modified the messages generated so that theorem layout styles will show up with the `\listfiles` command and cleaned the section on the New Font Selection Scheme since this is now included in LaTeX.

Preface to version 2.1

This version is identical to 2.0g described in *TUGboat* 10#3 except for some internal defaults which are now set depending on the used font selection scheme.

This was done to avoid unpleasant surprises if the new font selection scheme is in force. For further details see section 3 and [1].

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, and remarks are all instances of "theorems". The "header" of these structures is composed of a label (such as THEOREM or REMARK) and a number which serializes an item in the sequence of items with the same label.

Shortly after the introduction of LaTeX at the Fachbereich Mathematik in Mainz, the desire to manipulate the layout of "theorems" arose. In Mainz, the following two conventions came into general use:

1. The number of the theorem is shown in the margin.
2. There is a line break at the end of the theorem header.

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Additionally, some journals require different formats which depend on the "sort of theorem": e.g. often remarks and definitions are set in `\upshape`, while `\itshape` is employed for main theorems.

Confronted with these requirements, a theorem environment was developed in Mainz which allows separate determination of the layout of the "theorems sets", comparable to `\pagestyle`.

2 The user interface

2.1 Defining new theorem sets

`\newtheorem` As in the original LaTeX version, the command `\newtheorem` defines a new "theorem set" or "theorem-like structure". Two required arguments name the new environment 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}{bar3}[section]` The theorem set `foo3` (printed name `bar3`) 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.

`\theoremstyle` Additionally, the command `\theoremstyle` can define the layout of various, or all, theorem sets. It should be noted that any theorem set defined by `\newtheorem` is typeset in the `\theoremstyle` that is current at the time of the definition. Thus, the following

```
\theoremstyle{break}        \newtheorem{Cor}{Corollary}
\theoremstyle{plain}        \newtheorem{Exa}{Example}[section]
```

leads to the result that the set `Cor` is formatted in the style `break`, while the set `Exa` and all the following ones are formatted in the style `plain`, unless another `\theoremstyle` follows. Since the definitions installed by `\newtheorem` are global, one also can limit `\theoremstyle` locally by grouping braces.

`\theorembodyfont` The choice of the font for the theorem body is completely independent of the chosen `\theoremstyle`; this has proven to be very advantageous. For example,

```
{\theorembodyfont{\upshape}          \newtheorem{Rem}{Remark}}
```

defines a theorem set `Rem`, which will be set in `\upshape` in the current layout (which in our example is `plain`). As with `\theoremstyle`, the `\theorembodyfont` chosen is that current at the time of `\newtheorem`. If `\theorembodyfont` is not specified or one defines `\theorembodyfont{}`, then the font used will be that defined by the `\theoremstyle`.

`\theoremheaderfont` It is also possible to customize the font used for the theorem headers. This is, however, a global declaration, and therefore there should be at most one `\theoremheaderfont` declaration in the preamble.[1]

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

[1] If it is actually necessary to have different header fonts, one has to define new theorem styles (substituting the desired font) or specify the information directly in the `\newtheorem` declaration (the unclean variant).

Since the definition of theorem sets should—most sensibly—be placed in the preamble, we only allow installation there. It is therefore possible to release the memory used here after `\begin{document}`, in order to make room for other applications.

2.2 Existing theorem styles

The following theorem styles exist to date:

`plain`	This theorem style emulates the original LaTeX definition, except that additionally the parameters `\theorem...skipamount` are used.
`break`	In this style, the theorem header is followed by a line break.
`marginbreak`	The theorem number is set in the margin, and there is a line break as in `break`.
`changebreak`	Like `break`, but with header number and text interchanged.
`change`	Header number and text are interchanged, without a line break.
`margin`	The number is set in the left margin, without a line break.

All styles (except `plain`) select `\slshape` as the default `\theorembodyfont`.

2.3 Examples

Given the above theorem sets `Cor`, `Exa` and `Rem`, suppose that the preamble also contains the declarations:

```
\theoremstyle{marginbreak}    \newtheorem{Lem}[Cor]{Lemma}
\theoremstyle{change}
\theorembodyfont{\itshape}          \newtheorem{Def}[Cor]{Definition}

\theoremheaderfont{\scshape}
```

Then the following are some typical examples of the typeset output resulting from their use.

COROLLARY 1
This is a sentence typeset in the theorem environment `Cor`.

EXAMPLE 2.1 *This is a sentence typeset in the theorem environment* `Exa`.

REMARK 1 This is a sentence typeset in the theorem environment `Rem`.

2 LEMMA (BEN USER)
This is a sentence typeset in the theorem environment `Lem`.

3 DEFINITION (VERY IMPRESSIVE DEFINITION) *This is a sentence typeset in the theorem environment* `Def`.

The last two examples show the effect of the optional argument to a theorem environment (it is the text typeset in parentheses).

3 Special Considerations

Theoremheader and body are implemented as a unit. This means that the `\theoremheaderfont` will inherit characteristics of the `\theorembodyfont` in LaTeX 2ε. Thus, if for example `\theorembodyfont` is `\itshape` and `\theoremheaderfont` is `\bfseries` the font selected for the header will have the characteristics 'bold extended italic'. If this is not desired one should set the `\theoremheaderfont` to something like

```
\theoremheaderfont{\normalfont\bfseries}
```

i.e. supplying all necessary font informations explicitly.

4 Acknowledgements

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References

[1] M. GOOSSENS, F. MITTELBACH and A. SAMARIN. The LaTeX Companion. Addison-Wesley, Reading, Massachusetts, 1994.

[2] LAMPORT, LESLIE. `latex.tex`, version 2.09, date Feb. 1990.