Theorem Environments

LaTeX for Math and Science

Fall 2007 Week 5

Structure of a Theorem Environment

- \newtheorem{*environment name*}{*displayed name*}
- \newtheorem{thm}{Theorem}

```
\begin{thm}
This is a theorem.
\end{thm}
```

Theorem 1
This is a theorem.

A Full Snippet

```
\documentclass{amsart}
\usepackage{amsmath,amssym,amsthm}

\newtheorem{thm}{Theorem}

\begin{document}

\begin{thm}
This is an amazing theorem.
\end{thm}

\end{document}
```

Banishing Numbering...

Like other math environments, theorems don't have to be numbered.

- \newtheorem*{*environment name*}{*displayed name*}
- \newtheorem*{thm2}{Theorem}

```
\begin{thm2}
This is an unnumbered
theorem.
\end{thm2}
```

Theorem

This is an unnumbered theorem.

Or Lots of Numbers

In general, every `\newtheorem` has its own counter. For example, if we have theorem declarations `\newtheorem{thm1}{Theorem}` and `\newtheorem{theorem}{Theorem}` in the preamble, we can get a mess like:

```
\begin{thm1}
Stuff
\end{thm1}
\begin{theorem}
Other stuff
\end{theorem}
```

Theorem 1
Stuff.

Theorem 1
Other stuff.

Or Lots of Numbers

We can avoid that mess by linking the numbering:

```
\newtheorem{cor}[theorem]{Corollary}
```

```
\begin{theorem}
A theorem.
\end{theorem}
\begin{cor}
A corollary.
\end{cor}
```

Theorem 2

A theorem.

Corollary 3

A corollary.

Theorem numbers can be linked with sections, subsections, chapters and so on.

- `\newtheorem{`**env. name**`}{`**display name** `}[`link`]`
- `\newtheorem{sectheorem}{Theorem}[section]`

```
\begin{sectheorem}
A theorem numbered with
the section.
\end{sectheorem}
```

Theorem 1.1

A theorem numbered with the section.

Named Theorems

```
\begin{theorem}[Dead Guy's Name]
Some dead guy's theorem.
\end{theorem}
```

Theorem 4 (Dead Guy's Name)

Some dead guy's theorem.

Changing Styles

What happens when you don't want italicised theorems?
`\theoremstyle` to the rescue!

```
\newtheorem{thm}{Theorem}
\newtheorem{thm1}{Theorem}
\newtheorem{theorem}{Theorem}
\newtheorem{sectheorem}{Theorem}[section]
\newtheorem{cor}[theorem]{Corollary}
\newtheorem*{thm2}{Theorem}
\theoremstyle{definition}
\newtheorem{defn}{Definition}
\theoremstyle{remark}
\newtheorem*{remark}{Note}
```

The Different Styles

- plain: The default; plain heading, italicised text
- definition: plain heading, plain text
- remark: italicised heading, plain text

A Bonus

`amsthm` provides a bonus: the `proof` environment.

Proof.

This could be the proof of something. Note the Halmos box at the end. Using `\begin{proof}[something]` replaces the word "proof" with "something". Typically, the heading will be italicised. □

Defining Commands

- `\newcommand{\name}[arguments]{command}`
- `\newcommand{\bR}{\mathbb{R}}`
- `\newcommand{bold}[1]{\mathbf{#1}}`
- `\newenvironment{name}[arguments]{at begin}`
  `{at end}`

Useful Information

- Up to 9 arguments are allowed.
- You can't open a brace in the "at begin" commands and close it in the "at end".
- Using `\ensuremath` will force math mode:
  `\newcommand{\bR}{\ensuremath{\mathbb{R}}}`
- `\renewcommand` and `\renewenvironment` will override already existing definitions. This is very very dangerous!
- One optional argument is possible. It will be #1 and it's default value goes in brackets after the number of arguments. `\command[opt]{mand}`