\LaTeX, A Short Course
Floating Figures, Tables, and Graphics

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August 29, 2008
Tables

- Tables are typeset with in the `tabular` environment.
- The syntax of the `tabular` environment is as follows:
  \begin{tabular} [pos]\{cols}\rows \end{tabular}

- The parameters are:
  - `pos` Controls table position (optional)
  - `cols` Defines number and format of columns.
  - `rows` Table rows (entries in the table).
Options for cols argument are numerous.

For basic operation cols is a string of characters defining table columns:

- l Column contents are left justified.
- r Column contents are right justified.
- c Column contents are centered.

\{wth\} Text is set into lines of width wth aligned with the top of other columns (needed when table cell contents are to be on multiple lines).

Each row consists of the contents of each column separated by &’s and ended with a double backslash (\\).
<table>
<thead>
<tr>
<th>Subject</th>
<th>Course Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPT</td>
<td>115</td>
<td>Principles of Computer Science. Introduces more of the basic concepts of computer science.</td>
</tr>
<tr>
<td>CMPT</td>
<td>461</td>
<td>Intractable problems and models of computation.</td>
</tr>
<tr>
<td>CMPT</td>
<td>859</td>
<td>Topics in Computer Vision. Advanced topics in computer vision are covered in depth.</td>
</tr>
</tbody>
</table>
Tables

- Tables can also be drawn with horizontal and vertical lines between rows and columns as desired.
- To insert a vertical line between a pair of columns, put a \ character between the column entries in the \texttt{cols} argument.
- To insert a horizontal line between rows, put a \texttt{\hline} at the end of a table row (after the double backslash).
- \texttt{\hline} is also acceptable immediately following the \texttt{cols} parameter (draws a horizontal line before the first table row).
- A double pipe \texttt{||} inserts a double vertical line.
- Double horizontal lines are achieved by repeating \texttt{\hline}. 
<table>
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</tr>
</tbody>
</table>
Exercise

- Edit the file `workfiles/table.tex`.
- Typeset the information into a table so it looks like this:

<table>
<thead>
<tr>
<th>Team</th>
<th>W</th>
<th>L</th>
<th>T</th>
<th>Points For</th>
<th>Points Against</th>
<th>Win Pct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saskatchewan</td>
<td>8</td>
<td>1</td>
<td>0</td>
<td>235</td>
<td>134</td>
<td>.889</td>
</tr>
<tr>
<td>Simon Fraser</td>
<td>7</td>
<td>4</td>
<td>0</td>
<td>319</td>
<td>305</td>
<td>.636</td>
</tr>
<tr>
<td>Alberta</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>290</td>
<td>196</td>
<td>.500</td>
</tr>
<tr>
<td>Calgary</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>187</td>
<td>237</td>
<td>.500</td>
</tr>
<tr>
<td>Regina</td>
<td>4</td>
<td>5</td>
<td>0</td>
<td>294</td>
<td>299</td>
<td>.444</td>
</tr>
<tr>
<td>Manitoba</td>
<td>3</td>
<td>5</td>
<td>0</td>
<td>172</td>
<td>249</td>
<td>.375</td>
</tr>
<tr>
<td>British Columbia</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>132</td>
<td>260</td>
<td>.000</td>
</tr>
</tbody>
</table>

Note how table column widths are automatically sized to the widest entry.
The *array* environment works exactly the same as the *tabular* environment, but may only appear in math mode.

The advantage is that each table entry is automatically typeset in math mode without the need to enclose each column entry with $’s.

Although you don’t need to enclose each table entry with $’s, you do need to enclose the entire *array* environment in math mode.

The *array* environment is very useful for typesetting things like matrices by using the desired auto-sized brackets.
Example: A matrix

\[
\mathbf{F} = \left( \begin{array}{ccc}
  a_{11} & a_{12} & a_{13} \\
  a_{21} & a_{22} & a_{23} \\
  a_{31} & a_{32} & a_{33}
\end{array} \right)
\]

Produces the following:

\[
F = \begin{pmatrix}
  a_{11} & a_{12} & a_{13} \\
  a_{21} & a_{22} & a_{23} \\
  a_{31} & a_{32} & a_{33}
\end{pmatrix}
\]
It is possible to instruct \LaTeX{} to place tables and figures where the
will look the “best”, rather than typesetting it at its precise location
in the text source.

This is achieved through the use of the \texttt{table} and \texttt{figure}
environments.

These environments also automatically number tables/figures and let
you define references to them using \texttt{\label{}}.

Another advantage to these environments is that a list of tables/list
of figures can be automatically generated.

We’ll look at tables first...
In the most basic form, you just place your entire \texttt{tabular} environment within the \texttt{table} environment. To get auto-numbering and captioning, use \texttt{\caption{}}:

\begin{table}
\begin{center}
\begin{tabular}{lcp{2in}}
Subject & Course Number & Description \\
CMPT& 115& Principles of Computer Science. Introduces more of the basic concepts of computer science. \\
CMPT& 461& Intractable problems and models of computation.
\end{tabular}
\caption{Some courses to be taught in 2004-2005W}
\label{classtable}
\end{center}
\end{table}
Floating Tables

The source on the previous page typesets:

<table>
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Table 1: Some courses to be taught in 2004-2005W

Note: It is very important that the `\label` command appear after the `\caption` command.
Exercise

- Take the table you made in workfiles/table.tex and enclose it in a table environment. Also center it if you wish.
- Add a caption and a label. Remember the label must appear after the caption and the caption must be outside the \texttt{tabular} environment, but inside the \texttt{table} environment.
- References can be forward! Place a sentence \textit{before} the table in the source that uses \texttt{\ref{}} to refer to the table number before it is “declared”.
- When adding a forward reference, one must run \LaTeX{} twice before the reference will be correctly displayed (a warning will be issued during the first run).
Floating Figures

- The `figure` environment works just like the `table` environment except it uses a different numbering counter.
- There is actually nothing stopping you from putting figures in `table` environments and tables in `figure` environments.
- We will see now how to include images. When using `pdflatex`, you can include images in JPEG, PNG, or PDF formats.
- Encapsulated Postscript (EPS) images can be included if you use `latex` (but we don’t cover this here).
To import images, we need to load the `graphicx` package.

A *package* is just an “extension” to \LaTeX.  

To load the `graphicx` package, we place the following line in the preamble:

\begin{verbatim}
\usepackage{graphicx}
\end{verbatim}

Inclusion of this package defines a command called \verb|\includegraphics|.

The basic usage of this command is

\begin{verbatim}
\includegraphics{filename}
\end{verbatim}
Let's open up `workfiles/figs.tex` to examine more closely how this works.
Sometimes \LaTeX will make a really bad decision about where to put floating figures. To force \LaTeX to place a figure/table exactly where it is defined in the source, add the optional \texttt{[h]} argument:

```latex
\begin{table}\[h\] ...
\end{table}
```

If you really mean it use

```latex
\begin{table}\[h!\] ...
\end{table}
```

\LaTeX will not span tabular environments across a page break. If you need this feature, you need to use the \texttt{longtable} package.
An excellent comprehensive reference on using imported graphics in \LaTeX{} is available from the CTAN:
www.ctan.org/tex-archive/info/epslatex.pdf

NOTE: CTAN is the Comprehensive \TeX{} Archive Network. If you are looking for anything to do with \TeX{} or \LaTeX{} this is a good place to look (http://www.ctan.org).

Many CTAN mirrors also exist.