AMTH142

Lecture 4

\LaTeX — Alignment

In this lecture we will look at various topics to do with alignment — tables, matrices and aligning equations.

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Reading:
   NSSI \S2.11.5 and \S3.5
   User’s Guide for the \texttt{amsmath} Package:
   http://mcs.une.edu.au/~amth142/docs/amsmath.ps
1 Tables

1.1 Simple Tables

Tables are created with the \texttt{tabular} environment.

Example:

\begin{center}
\begin{tabular}{lcl}

Name & Date & Formula \\

Newton & 1687 & $F = ma$ \\

Einstein & 1905 & $E = mc^2$

\end{tabular}
\end{center}

Notes:

1. Tables are usually placed in the centre of the page, hence the \texttt{center} environment.

2. Directly after the \texttt{\begin{tabular}} command, the number and alignment of the columns in the table is specified. The alignments are \texttt{l} – left, \texttt{c} – center, and \texttt{r} – right. In our example \{lcl\} specifies three columns with the indicated alignments.

3. Within each line of the table columns are separated by an \texttt{ampersand}, \&, and the line terminated by \texttt{\\\n
1.2 Adding Lines

1. Vertical lines are indicated by a \texttt{\|} between alignment specifiers.

2. Horizontal lines are indicated by the command \texttt{\hline} at the appropriate position.
Example:

\begin{center}
\begin{tabular}{|l|c|}
\hline
Name & Date & Formula \\
\hline
Newton & 1687 & $F = ma$ \\
Einstein & 1905 & $E = mc^2$ \\
\hline
\end{tabular}
\end{center}

1.3 multicol

The \texttt{multicol} command can be used to to spread items across columns of a table.

Example:

\begin{center}
\begin{tabular}{|l|c|}
\hline
\texttt{multicol}\{3\}\{c\}\{Physics Formulas\} \\
\hline
Name & Date & Formula \\
\hline
Newton & 1687 & $F = ma$ \\
Einstein & 1905 & $E = mc^2$ \\
\hline
\end{tabular}
\end{center}
2 Arrays

The \texttt{array} environment is the mathematical equivalent of the \texttt{tabular} environment. It is used to align complicated formulas.

Example:

\begin{verbatim}
\textbf{A} = \left[ \begin{array}{cccc}
  a_{11} & a_{12} & \cdots & a_{1n} \\
  a_{21} & a_{22} & \cdots & a_{2n} \\
  \vdots & \vdots & \ddots & \vdots \\
  a_{m1} & a_{m2} & \cdots & a_{mn}
\end{array} \right]
\end{verbatim}

\begin{verbatim}
y = \left\{ \begin{array}{c}
  -1 \text{ for } x < 0 \\
  0 \text{ for } x = 0 \\
  1 \text{ for } x > 0
\end{array} \right\}
\end{verbatim}

Note the use of \texttt{\textbackslash right.} as an invisible right bracket.

In the next two subsections we will see alternative ways of doing these examples using the \texttt{amsmath} package.

2.1 Matrices

The \texttt{amsmath} package provides a convenient way of formatting matrices. There are a number of different environments which enclose matrices in different types of braces:
As for tables and arrays, the matrix elements are separated by & and the line terminated by \\. Unlike tables and arrays, matrices do not need alignment specifiers.

Example:

\begin{eqnarray}
\mathbf{A} & = & \begin{bmatrix} 1 & 2 & 3 \\
4 & 5 & 6 \\
7 & 8 & 9 \end{bmatrix}
\end{eqnarray}

2.2 cases

The following example shows how to use the \texttt{cases} environment and is also a good example of spacing in mathematics mode.
Example:

\[
\begin{align*}
\text{y} &= \begin{cases} 
-1 & \text{for } x < 0 \\
0 & \text{for } x = 0 \\
1 & \text{for } x > 0
\end{cases} \\
\end{align*}
\]

3 Aligning Equations

Standard \LaTeX has a \texttt{eqnarray} environment for aligning equations, (see NSSI §3.5), but the \texttt{amsmath align} environment is more convenient. The align environment produces numbered equations, the examples below use \texttt{align*} which leaves equations unnumbered.

Example:

\[
\begin{align*}
\text{F(x)} &= \int_0^x \sin t \; dt \\
&= - \cos x
\end{align*}
\]
\begin{align*}
\frac{d}{dx} \sin x &= \cos x \\
\frac{d}{dx} e^x &= e^x \\
\frac{d}{dx} \cos x &= -\sin x \\
\frac{d}{dx} \log x &= \frac{1}{x}
\end{align*}

\begin{equation}
F(x) = \int_0^x \sin t \, dt
= -\cos x
\end{equation}