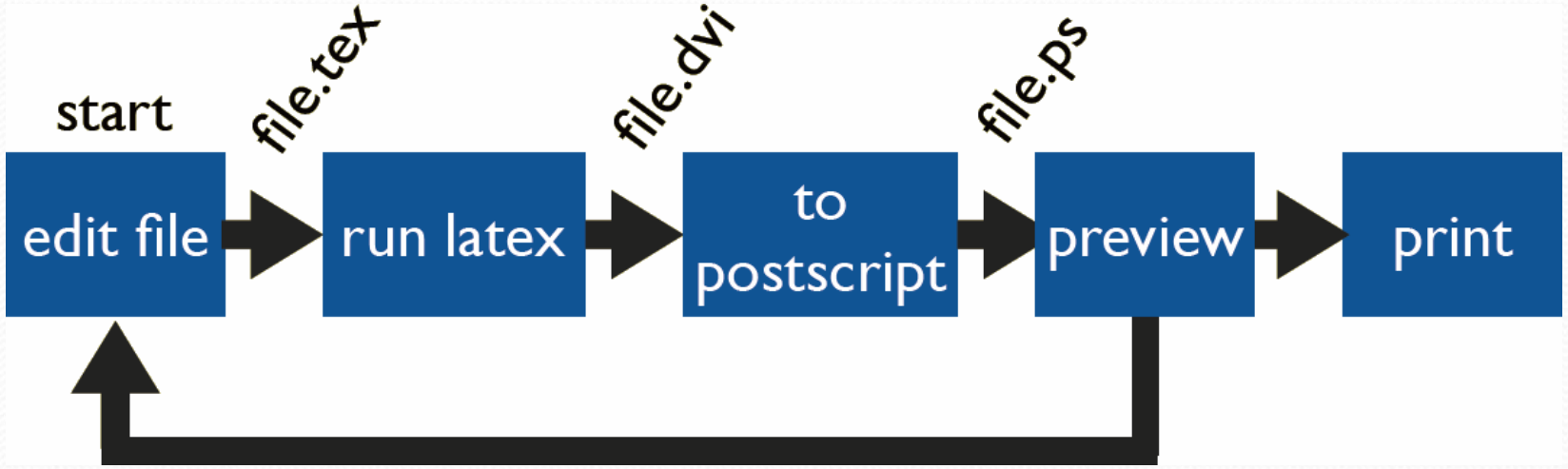
introduction to latex

CPSC 699

Why not use M$ Word?

- Latex is superior for large documents
  - e.g. an MSc thesis
- better presentation of technical matter
  - especially mathematics
- Widely used in academic publication
- Free

Running latex



Compile

- latex example1
  - compile latex source to dvi document
    - dvips -o example1.ps example1
  - convert dvi to postscript
- gv example1.ps
  - view the postscript file
- ps2pdf example1.ps (or dvipdf)
  - convert to pdf if desired

Output

This is a short document to illustrate the basic use of LaTeX.

Simply leave a blank line to get a new paragraph; indentation is automatic.

Mathematical expressions such as $y = 3 \sin x$ are obtained with dollar signs. Equations can be displayed, as in

$$y = 3 \sin x.$$

Numbered equations are also possible:

$$y = 3 \sin x. \tag{1}$$

Because we have labeled this equation we can refer to it without having to know its number. Thus, the preceding equation was number (1).

Powers (superscripts), as in x^2, are obtained with ^; more complicated powers must live in curly braces: $x^{2+\alpha}$.

Likewise, subscripts are obtained with the underscore: y_3 or y_{n+1}.

We can get both with $x_{n+1}^{2+\alpha}$.

Special characters

- \ & $ % ~ _ { } # ^
- if you need to use these
  - precede with \
  - e.g., \& \% _ \{ \}
- \verb means verbatim - no translation
  - everything between the first character after \verb and the next occurrence of that character

Environments

- special treatment for parts of a document
- for example
  - figures
  - equations
  - lists
  - tables
  - verbatim
- consult Lamport for details

```
\begin{itemize}

    \item   Every sentence should
            make sense in isolation.
            Like that one.

    \item   There is a lot to be
            said for brevity.

    \item   Many words can
            ostensibly be deleted.

    \item   Eschew the
            highfalutin.

    \item   Understatement is a
            mindblowingly effective
            weapon.

\end{itemize}
```

Mathematics

- enclose in
  - $$
    - for in-line
    - centered equation environment
    - aka \begin \end{equation*}
  - \begin \end{equation}
    - centered and numbered equation

Greek math

```
\[
    \alpha +  \beta + \gamma
\]

\[
    \Gamma + \Delta + \Theta
\]
```

$$\alpha + \beta + \gamma$$

$$\Gamma + \Delta + \Theta$$

Symbols

```
\[
    \pm \odot \otimes \div
\]

\[
    \nabla \Re \exists \forall
\]

\[
    \le \ge \subset \subseteq \propto \simeq
\]

\[
    \arccos() \cos() \log()  \tan()
\]

\[
    \leftarrow \Leftarrow \mapsto
\]
```

$$\pm \odot \otimes \div$$

$$\nabla \Re \exists \forall$$

$$\leq \geq \subset \subseteq \propto \simeq$$

$$\arccos() \cos() \log() \tan()$$

$$\leftarrow \Leftarrow \mapsto$$

Examples

```
\[
    x = \frac{1+y}{1+2z^2}
\]

\[
    x_3 + y^{n+2} = z\sqrt{b^2-4ac}
\]

\[
    s_n = a_1 + a_2 + \cdots + a_n
\]

\[
    a_n = 3 + (-1)^n, n = 1,2,\ldots,N
\]
```

$$x = \frac{1+y}{1+2z^2}$$

$$x_3 + y^{n+2} = z\sqrt{b^2-4ac}$$

$$S_n = a_1 + a_2 + \cdots + a_n$$

$$a_n = 3 + (-1)^n, n = 1,2,\ldots,N$$

Examples

```
\[
    S_N = \sum_{j=1}^{N} a_j
\]

\[
    \int_{x=0}^\infty e^{-x^2}dx = \frac{\sqrt{\pi}}{2}
\]

\[
    \lim_{n\rightarrow \infty} (1 + x/n)^n = e^x
\]

\[
    \max_{1 \le x \le 2} x + \frac{1}{x} = \frac{5}{2}
\]

\[
    G(x) := \prod_{i=1}n f_i(x)
\]
```

$$S_N = \sum_{j=1}^{N} a_j$$

$$\int_{x=0}^{\infty} e^{-x^2} dx = \frac{\sqrt{\pi}}{2}$$

$$\lim_{n \rightarrow \infty} (1 + x/n)^n = e^x$$

$$\max_{1 \le x \le 2} x + \frac{1}{x} = \frac{5}{2}$$

$$G(x) := \prod_{i=1} n f_i(x)$$

Examples

```
\begin{enumerate}

    \item $ S_N = \sum_{j=1}^{N} a_j $

    \item $ \int_{x=0}^\infty e^{-x^2}dx = \frac{\sqrt{\pi}}{2} $

    \item $ \lim_{n\rightarrow \infty} (1 + x/n)^n = e^x $

    \item $ \max_{1 \le x \le 2} x + \frac{1}{x} = \frac{5}{2} $

    \item $ G(x) := \prod_{i=1}n f_i(x) $

\end{enumerate}
```

1. $S_N = \sum_{j=1}^{N} a_j$
2. $\int_{x=0}^{\infty} e^{-x^2} dx = \frac{\sqrt{\pi}}{2}$
3. $\lim_{n\rightarrow\infty}(1 + x/n)^n = e^x$
4. $\max_{1\le x\le 2} x + \frac{1}{x} = \frac{5}{2}$
5. $G(x) := \prod_{i=1} n f_i(x)$

Examples

```
The system may be written in the matrix--vector
form  $A \mathbf{u} = \mathbf{e}$,
where
\[
    A = \left[
            \begin{array}{ccc}
                1   & 1   & 1  \\
                x   & y   & z  \\
                x^2 & y^2 & z^2
            \end{array}
        \right], \,
    \mathbf{u} = \left[
        \begin{array}{c}
            x \\ y \\ z
        \end{array}
    \right]
\]
and $\mathbf{e} = [1,1,1]^T$.  The determinant of
$A$ is given by
\[
    \left| \begin{array}{ccc}
        1   & 1   & 1   \\
        x   & y   & z   \\
        x^2 & y^2 & z^2
    \end{array} \right| = (x-y)(y-z)(z-x),
\]
so $A$ is nonsingular precisely when the three values
$x,y,z$
are distinct.
```

The system may be written in the matrix–vector form $A\mathbf{u} = \mathbf{e}$, where

$$A = \begin{bmatrix} 1 & 1 & 1 \\ x & y & z \\ x^2 & y^2 & z^2 \end{bmatrix}, \, \mathbf{u} = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

and $\mathbf{e} = [1,1,1]^T$. The determinant of A is given by

$$\begin{vmatrix} 1 & 1 & 1 \\ x & y & z \\ x^2 & y^2 & z^2 \end{vmatrix} = (x-y)(y-z)(z-x),$$

so A is nonsingular precisely when the three values x, y, z are distinct.

Titles

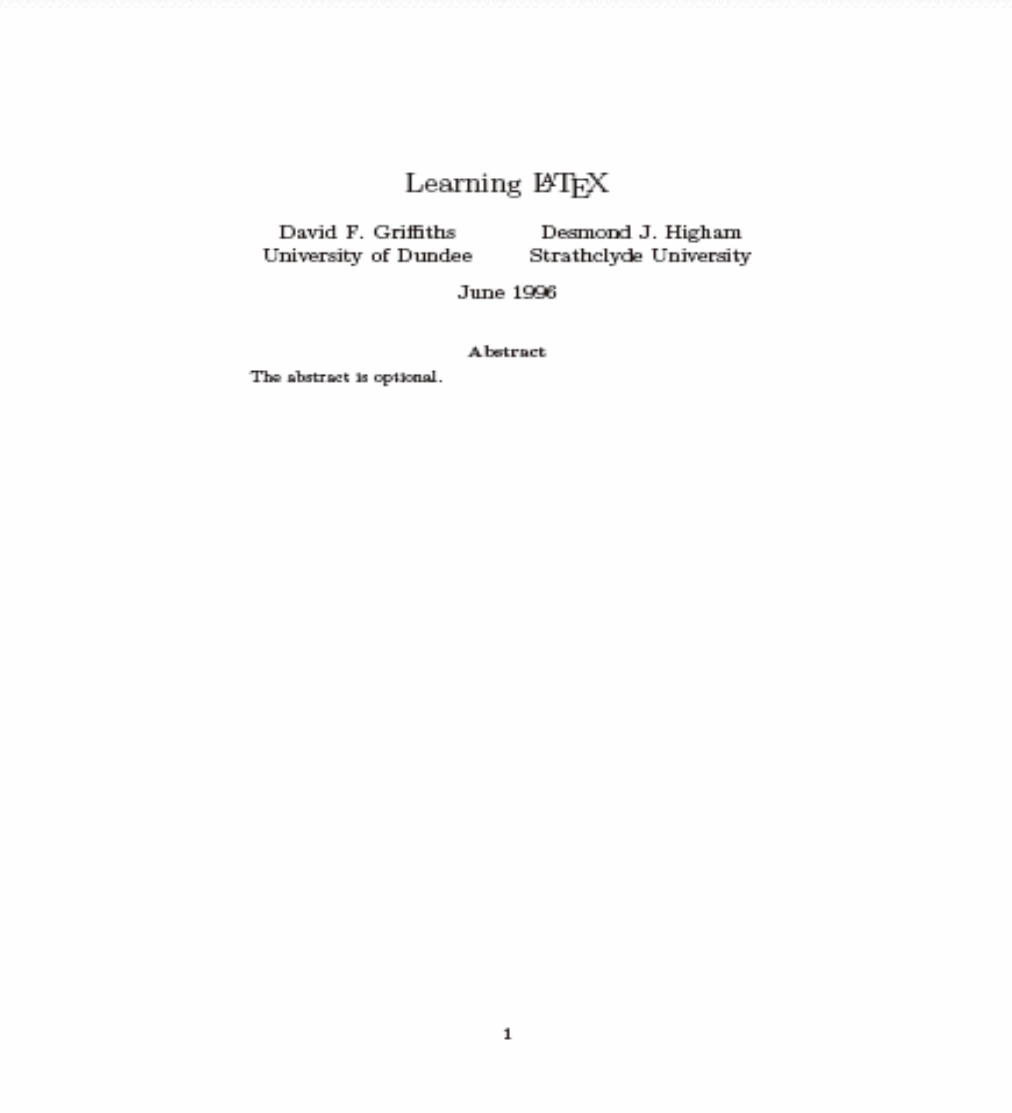
```
\title{Learning \LaTeX}

\author{David F. Griffiths\\
    University of Dundee
   \and
   Desmond J. Higham \\
   Strathclyde University}

\date{June 1996}

\maketitle

\begin{abstract}
    The abstract is optional.
\end{abstract}
```



Learning LaTeX

David F. Griffiths
University of Dundee

Desmond J. Higham
Strathclyde University

June 1996

Abstract

The abstract is optional.

1

Sections

- \section{Section title}
  - \label {sec:mysection}
- \subsection{}
- \subsubsection{}
- \section*{}
  - unnumbered section
- \appendix

Bibliography

- The highly convenient feature in Latex
- Reusable, compact, self-numbering available (as with figures and Tables)

- \bibitem{GavrilovaRokne2000} Gavrilova, M. and Rokne, J. Reliable line segment intersection testing, Computer Aided Design, (2000) 32, 737-745.

Graphics and figures

- several packages to choose from
  - \usepackage {graphics}
    - \includegraphics {filename}
- \usepackage {graphicx}
  - \includegraphics [height=3in] {filename}
- \usepackage{epsfig}
  - \epsfig {figure=filename, width=3in}

Example

```
\documentclass{article}

\usepackage{graphicx}
\usepackage{epsfig}

\begin{document}

Figure~\ref{fig:swarmart} explains everything.

\begin{figure}
    \center
    \begin{tabular}{cc}
        \epsfig{figure=swarm-pic3.eps,width=3in} &
        \includegraphics[width=3in]{SwarmArt2.eps} \\
        (a) & (b)
    \end{tabular}
    \caption{This is how SwarmArt 2003 worked.}
    \label{fig:swarmart}
\end{figure}

\end{document}
```

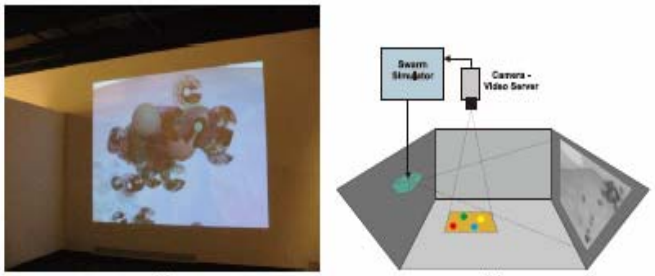


Figure 1: This is how SwarmArt 2003 worked.

Figure 1 explains everything.

Sources

- L. Lamport, Latex a document preparation system user's guide and reference manual, Addison-Wesley, Reading MA, 1985.
- D. F. Griffiths and D. J. Higham, Learning latex, SIAM, Philadelphia PA, 1997.
- Jeff Boyd slides