# LaTeX

- A typesetting package for formatting and creating documents. Created by L. Lamport based on TeX designed by D. Knuth.
  - Alphanumeric source files are compiled into formatted documents
  - Formatting happens at compile time using style files and manual formatting commands
  - Manual formating commands are added as keywords (similar to HTML)
  - Provides good support for mathematical formulas
  - LaTeX is generally not WYSIWYG

# Writing a Document

- Most of the formatting and final layout in LaTeX is done automatically using information contained in style files.
  - Generic styles come with the system and many conferences or journals provide style files that ensure compliance with their formatting requirements.
  - Concentrate on the content of your document and leave the formating and placement of figures and tables to LaTeX

# Creating the Document

- The *latex* command compiles the document into a *dvi* format document file. You can look at this file using *xdvi*
  - *dvips creates a Postscript document from the dvi file.*
  - *ps2pdf* can convert Postscript to *PDF*
- Alternatively *pdflatex* can create *PDF* in one step.
  - But: Postscript is usually better for printing

# File Types

- A number of file types are used to create a LaTeX document
  - LaTeX source document

    document_filename.*tex*
  - DVI document (created by *latex* document_filename)

    document_filename.*dvi*
  - PostScript document (from *dvips* document_filename *-o*)

    document_filename.*ps*
  - PDF document (created by *pdflatex* document_filename)

    document_filename.*pdf*
  - BibTeX reference data file

    reference_filename.*bib*

# Special Characters

- All formatting keywords in LaTeX are preceded by a \ character.
- Text after a % character is interpreted as comments
- The & character is used for formatting
- The ~ character is used to introduce additional whitespace between words
- The $ character delineates in-lined mathematics
- \\ produces a line break
- An empty line precedes a new paragraph
- Other reserved characters include # _ { }

# A Basic Document

- Document classes define the type and style of the document.

  *\documentclass[*style definitions*]{*document type*}*

- Additional style definitions and macros can be included as packages

  *\usepackage{*package name*}*

- The actual content is put inside a document environment

  *\begin{document}*

  …

  *\end{document}*

# Titles and Sections

- The title is generated using the following keywords

  *title*{your title}

  *author*{author name}

  *date*{date to appear in title}

  *maketitle*

- Sections in the document are generated using sectioning keywords

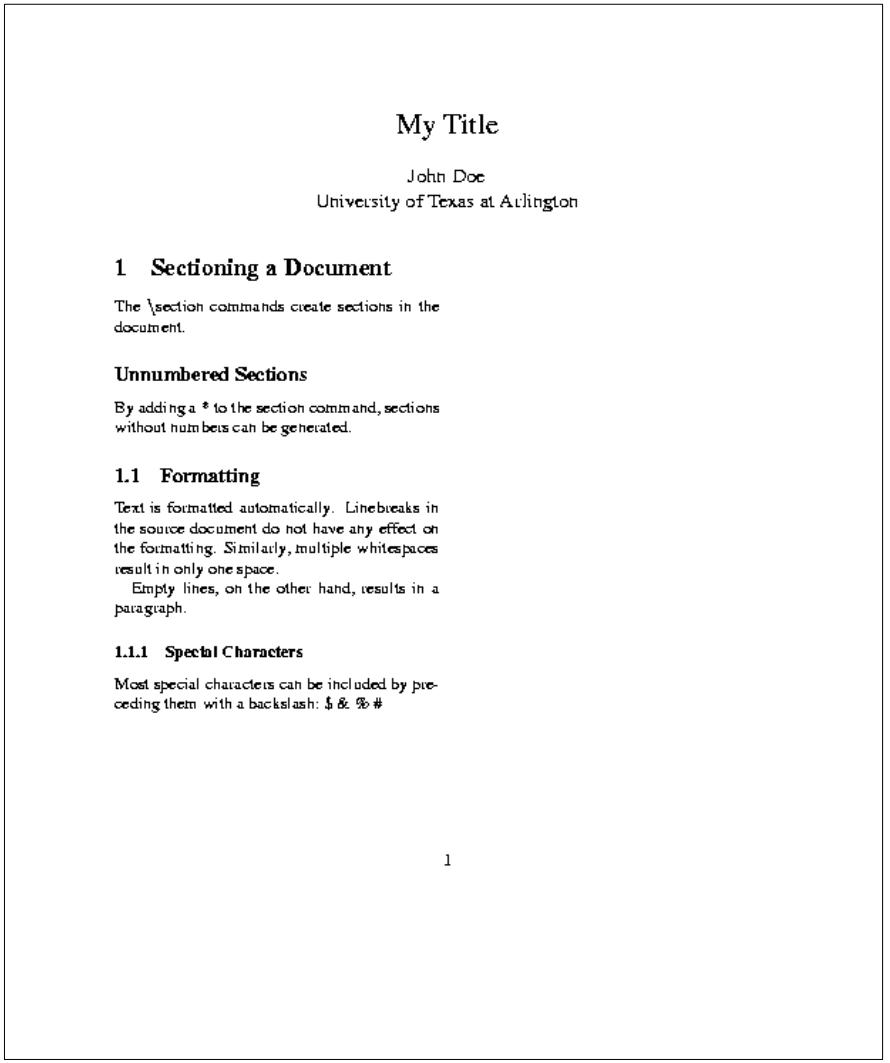
  *section*{section heading} *or* *section**{...}

  *subsection*{...} *or* *subsection**{...}

  *subsubsection*{...} *or* *subsubsection**{...}

# Example 1

```
\documentclass[12pt,twocolumn]{article}
\usepackage{times}

\begin{document}

\title{My Title}
\author{John Doe \\  This University}
\date{}

\maketitle

\section{Sectioning a Document}

The $\backslash$section commands create sections in the document.

\subsection*{Unnumbered Sections}

By adding a * to the section command, sections without numbers can be generated.

\subsection{Formatting}

Text is formatted automatically. Linebreaks in the source document do not have any effect on the formatting. Similarly, multiple whitespaces result in only one space.

Empty lines, on the other hand, results in a paragraph.

\subsubsection{Special Characters}

Most special characters can be included by preceding them with a backslash: \$ \& \% \#

\end{document}
```



My Title

John Doe
University of Texas at Arlington

**1 Sectioning a Document**

The \section commands create sections in the document.

**Unnumbered Sections**

By adding a * to the section command, sections without numbers can be generated.

**1.1 Formatting**

Text is formatted automatically. Linebreaks in the source document do not have any effect on the formatting. Similarly, multiple whitespaces result in only one space.

Empty lines, on the other hand, results in a paragraph.

**1.1.1 Special Characters**

Most special characters can be included by preceding them with a backslash: $ & % #

1

# Text Types and Special Text

- A number of text style and font changes can be initiated in the document
  - *bf* - bold face
  - *it* - italics
  - *em* - emphasize
  - *tiny* *small* *footnotesize* *normalsize* *large* *Large* *huge* *Huge* - change of font size
- Footnotes can be added directly

  *footnote*{footnote text}

# Environments

- Environments are used to include special types of content that has special formatting requirements

  *\begin{...}*

  ...

  *\end{...}*

  - Parts of the document can be centered

    *\begin{center}*

    ...

    *\end{center}*

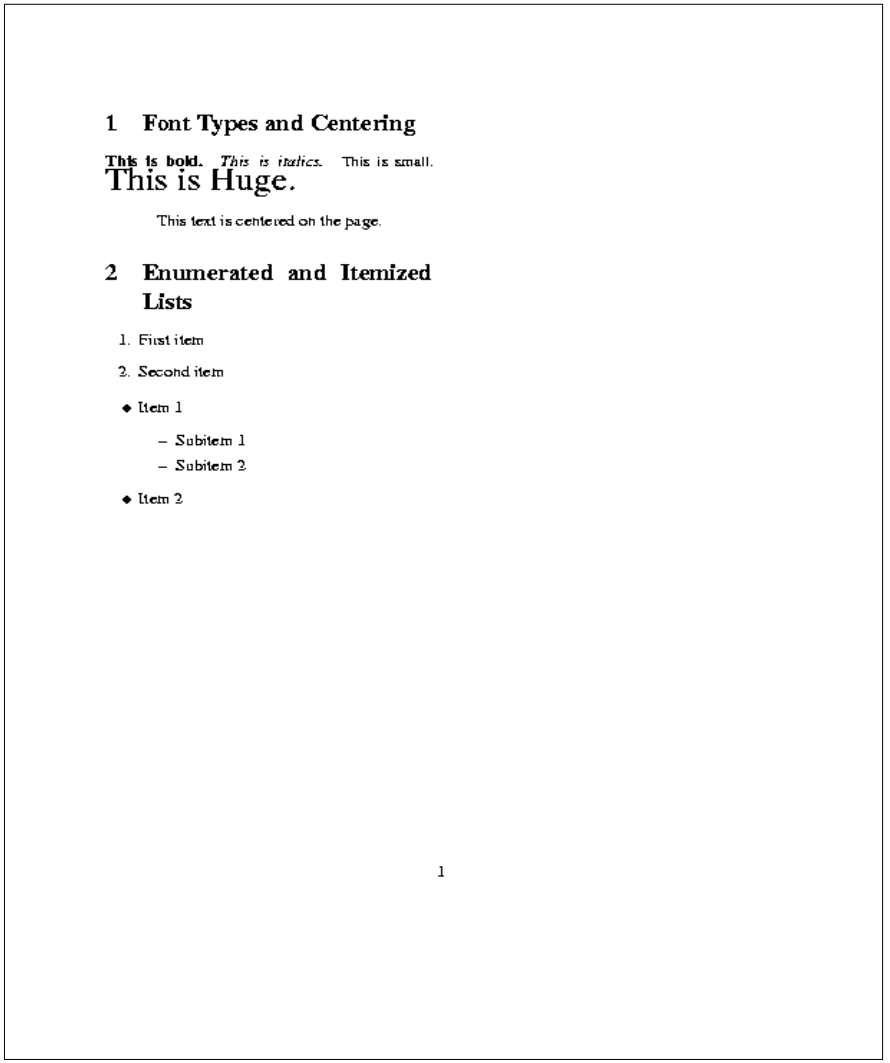
  - Lists can be itemized, enumerated, descriptions, etc.

    *\begin{enumerate}*
    *\item{...}*
    *\end{enumerate}*

    *\begin{itemize}*
    *\item{...}*
    *\end{itemize}*

# Example 2

```
\documentclass[12pt,twocolumn]{article}
\usepackage{times}

\begin{document}

\section{Font Types and Centering}

{\bf This is bold.} {\it This is italics.}
{\small This is small.} {\Huge This is Huge.}

\begin{center}
This text is centered on the page.
\end{center}

\section{Enumerated and Itemized Lists}

\begin{enumerate}
  \item{First item}
  \item{Second item}
\end{enumerate}

\begin{itemize}
 \item{Item 1}
   \begin{itemize}
     \item{Subitem 1}
     \item{Subitem 2}
   \end{itemize}
 \item{Item 2}
\end{itemize}

\end{dobcument}
```



1 Font Types and Centering

**This is bold.** *This is italics.* This is small.
This is Huge.

This text is centered on the page.

2 Enumerated and Itemized Lists

1. First item
2. Second item

- Item 1
  - Subitem 1
  - Subitem 2
- Item 2

1

# Figures and Tables

- Figures and tables are environments that can be included either directly or as floating objects.
  - Figures can be included in encapsulated Postscript format. Using the epsf package makes this easier

    *\include{epsf}* (this goes before *\begin{document}*)

    *\epsfxsize*=width of figure

    *\epsffile{*filename*}*
  - Floating figures get placed by LaTeX according to given preferences and should have captions

    *\begin{figure}[*location preferences*]*

    ...

    *\caption{*figure caption*}*

    *\end{figure}*

# Tables

- Tables are created using the *tabular* environment

  \begin{tabular}{table layout}

  \end{tabular}

- Floating *tables* get placed by LaTeX and should have captions

  \begin{table}[location preferences]

  ...

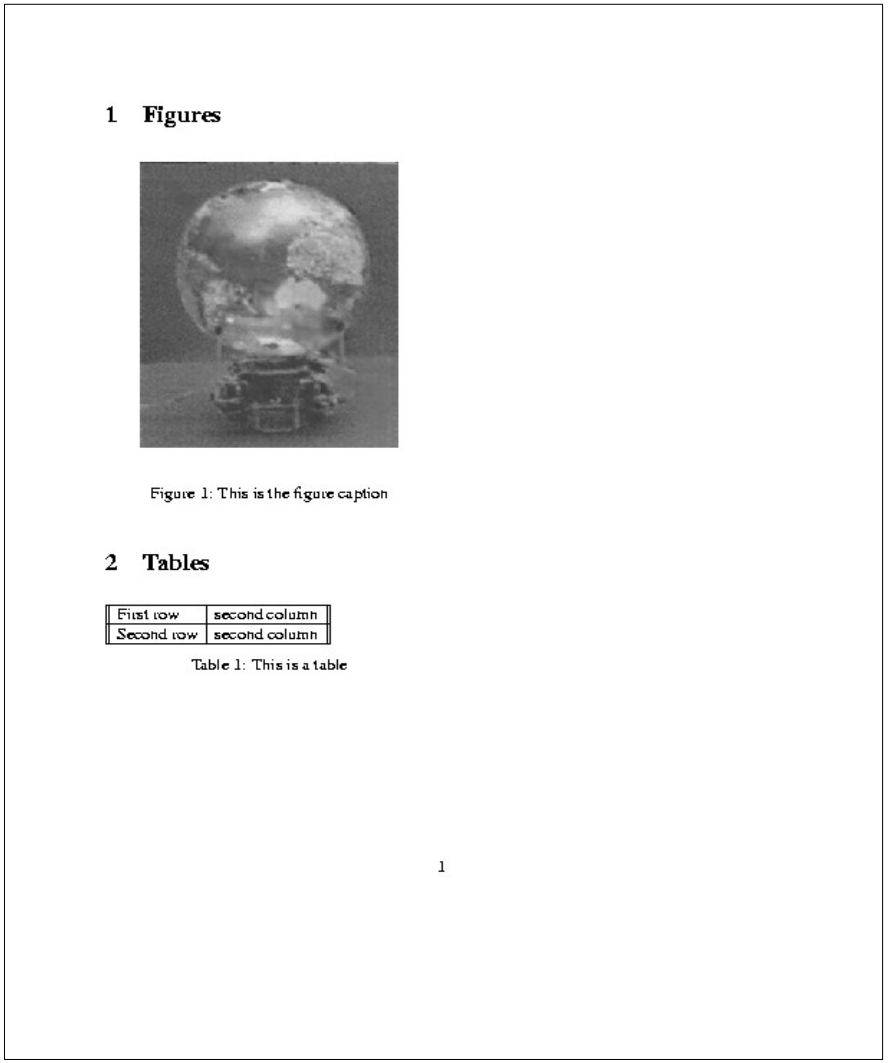
  \caption{caption text}

  \end{table}

It is a good idea to make figures and tables floating

# Example 3

```
\documentclass[12pt,twocolumn]{article}
\usepackage{times}

\input{epsf}
\newcommand{\cepsffig}[1]
        {\begin{center}{\mbox{\epsffile{#1}}}\end{center}}

\begin{document}

\section{Figures}

\begin{figure}[htb]
  \epsfxsize=2.5in
  \cepsffig{thing_globe.ps}
  \caption{This is the figure caption}
\end{figure}

\section{Tables}

\begin{table}[htb]
\begin{tabular} {||l|c||}
\hline
First row & second column\\ \hline
Second row & second column \\ \hline
\end{tabular}
\caption{This is a table}
\end{table}

\end{document}
```



1 Figures

Figure 1: This is the figure caption

2 Tables

| | |
|---|---|
| First row | second column |
| Second row | second column |

Table 1: This is a table

1

# Mathematics and Equations

- LaTeX includes a vast variety of mathematical symbols and formatting capabilities.
- Equations can be included either in-lined, as separate equation lines, or as numbered equations
  - In-lined equations are delineated by *$* signs.

    *... $ your equation $ ...*
  - Separate equations are created as

    *\[ your equation \]*
  - Numbered equations are created using

    *\begin{equation}*

    *...*

    *\end{equation}*

# Mathematics

- Many symbols are already defined. Also, A M S has a package with additional mathematical symbols.
  - Greek symbols:

    *\alpha \Alpha \beta \gamma ...*
  - Subsctipts and superscripts:

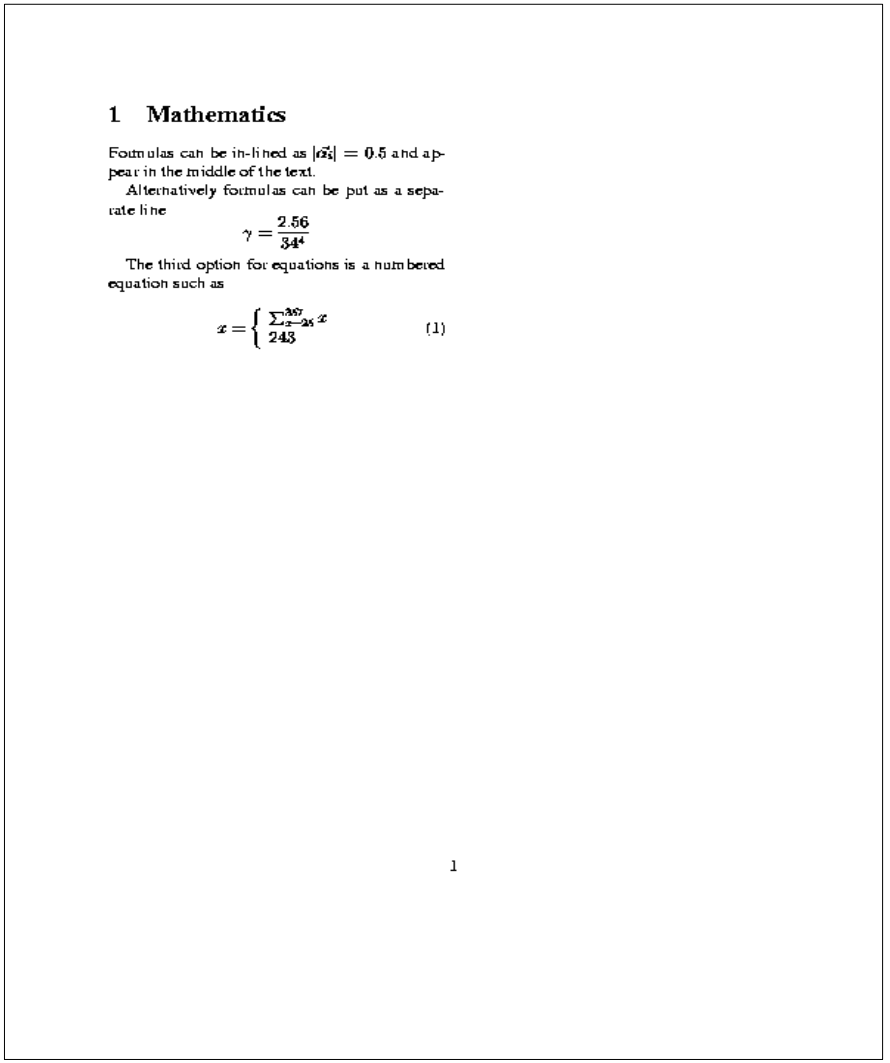
    symbol_{subscript}  symbol^{superscript}
  - Fractions:

    *\frac{*numerator*}{*denumerator*}*
  - Sums and products:

    *\sum  \prod*
  - And much much more ...
- Symbols in equations are automatically scaled to the appropriate size

# Example 4

```
\documentclass[12pt,twocolumn]{article}
\usepackage{times}

\begin{document}

\section{Mathematics}

Formulas can be in-lined as $ | \vec{\alpha_{i}} | = 0.5$ and appear
in the middle of the text.

Alternatively formulas can be put as a separate line
\[ \gamma = \frac{2.56}{34^{4}} \]

The third option for equations is a numbered equation such as

\begin{equation}
x = \left\{ \begin{array}{l} \sum_{x=25}^{357} x \\
                            243 \end{array} \right.
\end{equation}

\end{document}
```



1 Mathematics

Formulas can be in-lined as $|\vec{\alpha_i}| = 0.5$ and appear in the middle of the text.

Alternatively formulas can be put as a separate line

$$\gamma = \frac{2.56}{34^4}$$

The third option for equations is a numbered equation such as

$$x = \begin{cases} \sum_{x=25}^{357} x \\ 243 \end{cases} \quad (1)$$

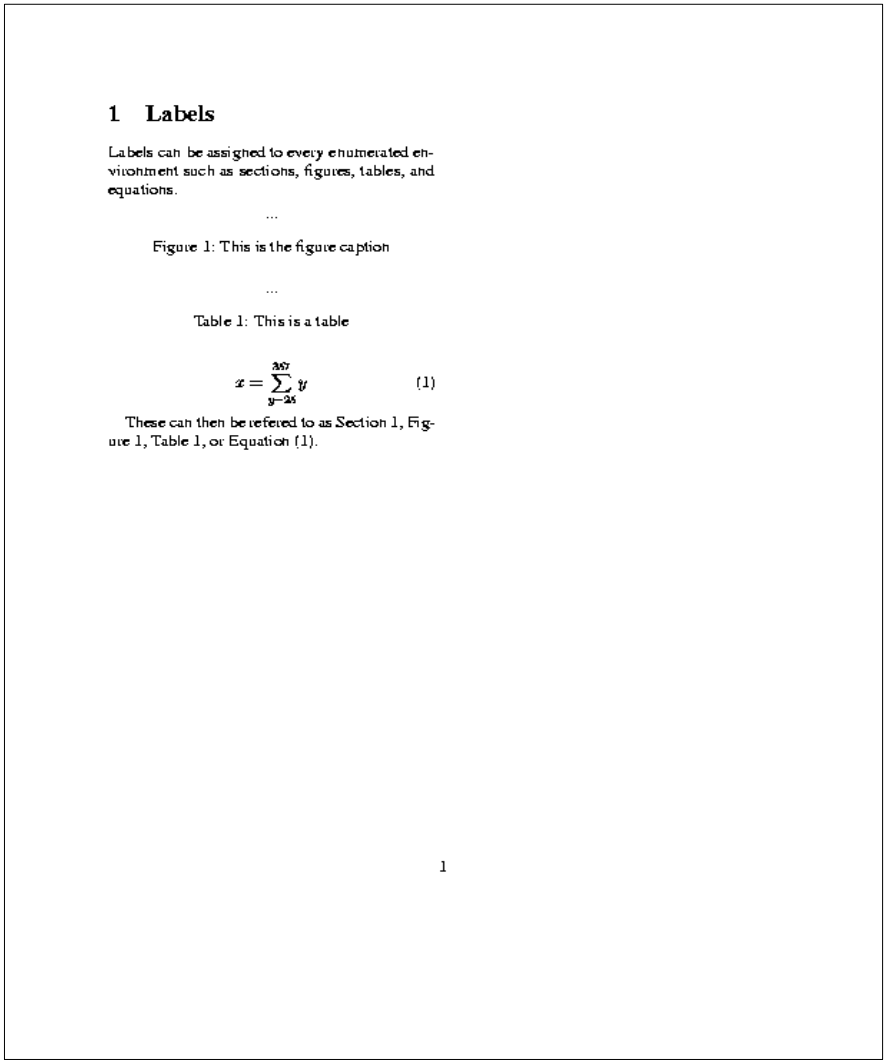
1

# Cross References

- References to sections, captioned environments, and numbered equations can be generated automatically
  - To make them referenceable, a label is assigned directly after the section or caption command or inside the equation environment using *\label{*labelname*}*
  - A reference is included using *\ref{*labelname*}*
- LaTeX permits forward and backward references
- To make references appear, the *latex* command might have to be run twice (once to assign the correct reference text to the label and a second time to include it into the document)

# Example 5

```
\documentclass[12pt,twocolumn]{article}
\usepackage{times}

\begin{document}

\section{Labels}
\label{se:sec}

Labels can be assigned to every numbered environment such as
sections, figures, tables, and equations.

\begin{figure}[htb]
  \centering ...
\caption{This is the figure caption}
\label{fi:fig}
\end{figure}

\begin{table}[htb]
  \centering ...
\caption{This is a table}
\label{ta:table}
\end{table}

\begin{equation}
x = \sum_{y=25}^{357}  y
\label{eq:equ}
\end{equation}

These can be referred to as Section~\ref{se:sec}, Figure~\ref{fi:fig},
Table~\ref{ta:table}, or Equation~(\ref{eq:equ}).

\end{document}
```



1 Labels

Labels can be assigned to every enumerated environment such as sections, figures, tables, and equations.

...

Figure 1: This is the figure caption

...

Table 1: This is a table

$$x = \sum_{y=25}^{357} y \qquad (1)$$

These can then be refered to as Section 1, Figure 1, Table 1, or Equation (1).

1

# Bibliography and Citations

- A bibliography can be included manually or be generated automatically from a flat file database using the *bibtex* command.
  - Manually included bibliographical data uses the bibliography environemnt

    *begin{thebibliography}*{longest label}
    *bibitem{label}* reference
    ...
    *end{thebibliography}*
  - Citations in the text are made similar to references to sections

    *cite{*label}

# BibTeX

- BibTeX extracts references from one or more data files, formats them according to the given bibliography style and includes them into the document.
  - Different records are used for different publications

    *@InProceedings {...}* *@Article {...}* *@Book {...}*
    *@MastersThesis {...}* *@PhdThesis{...}* *@TechReport{...}*

  - Data is entered in a set of fields

```
publication type {label,
   Key={key},
   Author={author list},
   Title={title},
   ...
}
```

# BibTeX

- The reference section and individual references are created according to the given bibliography style.

  *bibliographystyle*{citation style} defines the style
  *bibliography*{data files} includes the references

- BibTeX automatically includes all cited references and includes them in the reference section.
  - Citations are included in the text using

    *cite*{label}

  - Additional references can be included in the reference section using

    *nocite*{label}

- To create references, run *latex*, *bibtex*, then *latex* again

# Example 6

BibTeX file:

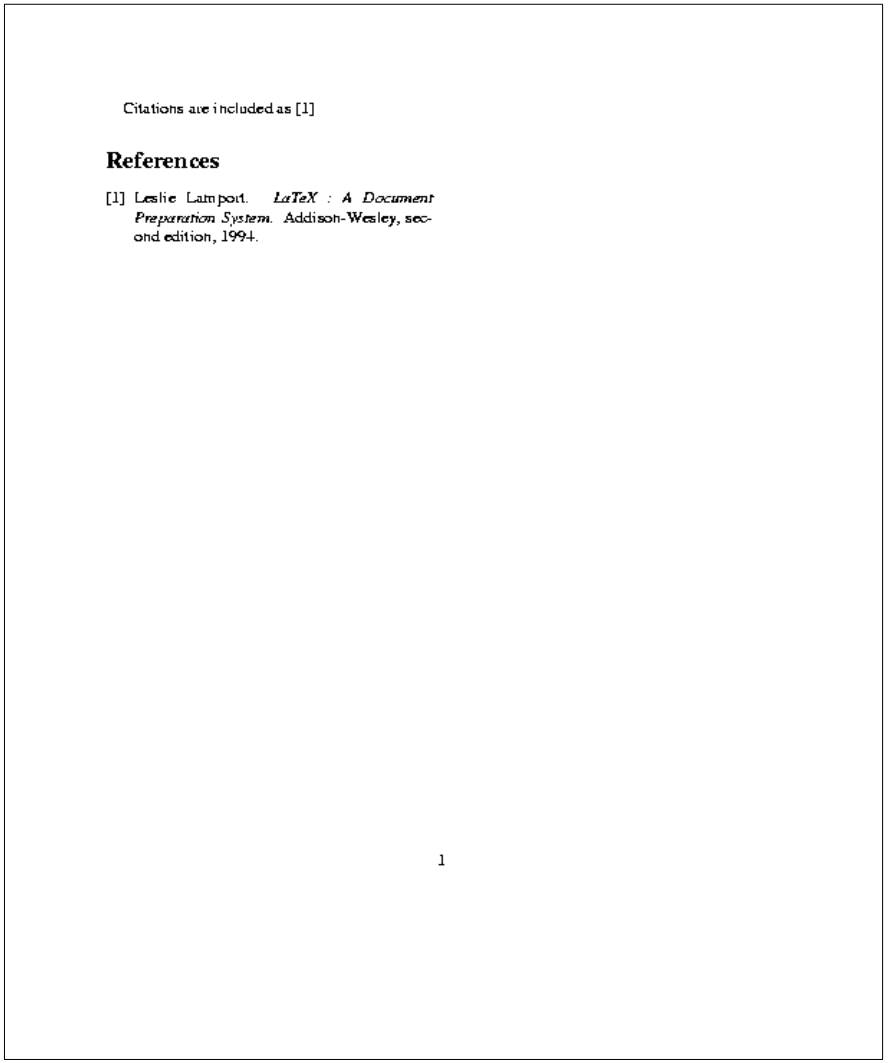
```
@BOOK{Lam94,
   Author = {Leslie Lamport},
   Title = {LaTeX : A Document Preparation System},
   Edition = {Second},
   Publisher = {Addison-Wesley},
   Year = {1994}
}
```

LaTeX file:

```
\documentclass[12pt,twocolumn]{article}
\usepackage{times}

\begin{document}

Citations are included as \cite{Lam94}

\bibliographystyle{plain}
\bibliography{refs}

\end{document}
```

BibTeX-created .bbl file:

```
\begin{thebibliography}{1}

\bibitem{Lam94}
Leslie Lamport.
\newblock {\em LaTeX : A Document Preparation System}.
\newblock Addison-Wesley, second edition, 1994.

\end{thebibliography}
```



Citations are included as [1]

**References**

[1] Leslie Lamport. *LaTeX : A Document Preparation System*. Addison-Wesley, second edition, 1994.

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# Resources

- On-line reference for LaTeX2e:

  http://www.sci.usq.edu.au/staff/robertsa/LaTeX/latex2e.html

  http://www.math.harvard.edu/texman/

- LaTeX reference books:

  - Leslie Lamport, LaTeX: A Document Preparation System, 2nd Edition, Addison-Wesley, 1994.

  - Helmut Kopka & Patrick W. Daly, A Guide to LaTeX, Addison-Wesley