Discrete Mathematics

(LaTeX)

Pramod Ganapathi
Department of Computer Science
State University of New York at Stony Brook

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What is LaTeX?

Definition

- LaTeX is pronounced as lay-tech
- LaTeX is a document formatting system used to create professional-looking documents
- LaTeX is free
- TeX (the core of LaTeX) is created by Donald Knuth
  LaTeX (a wrapper on TeX) is created by Leslie Lamport
- LaTeX documents look aesthetically beautiful
- LaTeX uses mathematical formulas to typeset characters

Where is LaTeX used?

Applications

- LaTeX is extensively used to write research papers, technical articles and reports, and scientific books
- LaTeX is also used to write resumes, CVs, homework assignments, exams, software documentations, posters, flyers, and slideshows

Why learn LaTeX?

Motivation

- To write beautiful mathematics
- To create nice tables
- To create systematic bibliographies
- To create consistent layout
- To automate document preparation
- To make use of a huge number of packages

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Most important motivation

- LaTeX separates content and presentation
- User can focus only on content and can use an existing template for presentation

What is the history of LaTeX?

Time	Event
1960s	Tools to write books were largely handled by publishers who used platform-dependent proprietary software
1968-78	Donald Knuth, the father of the analysis of algorithms, works for 10 years to create a platform-independent and completely free digital typographical system called TeX
1978	Knuth releases TeX; Knuth says: "TeX is intended for the creation of beautiful books - and especially for books that contain a lot of mathematics."
1985	Leslie Lamport releases LaTeX, which is a wrapper on TeX, to make the features easily accessible
1986	Lamport agrees to hand over the maintenance and development to the LaTeX project team
1994	LaTeX2e is released
Now	LaTeX3 is being developed

How to obtain LaTeX?

Source

- Online: https://www.overleaf.com
- Offline: Install (on Windows, Linux, Mac)
  1. MiKTeX - a LaTeX system
  2. TeXstudio - a beautiful editor

First program

program.pdf

```
Hello, World!
```

First program

program.pdf

Hello, World!

program.tex

```
\documentclass{article}

\begin{document}
Hello, World!
\end{document}
```

Preamble

program.pdf

Hello, World!

program.tex

```
\documentclass[12pt, letterpaper]{article}
\usepackage[utf8]{inputenc}

\begin{document}
Hello, World!
\end{document}
```

Title, author(s), date

program.pdf

Title of the Article

Author(s)

January 24, 2021

Hello, World!

Title, author(s), date

program.pdf

Title of the Article

Author(s)

January 24, 2021

Hello, World!

program.tex

```
\documentclass[12pt, letterpaper]{article}
\usepackage[utf8]{inputenc}

\title{Title of the Article}
\author{Author(s)}
\date{\today{}}

\begin{document}
\maketitle
Hello, World!
\end{document}
```

Comments

program.pdf

```
Hello, World!
```

Comments

program.pdf

Hello, World!

program.tex

```
Hello, World!
% This is a comment. It will not be printed in the output.
```

Text style

program.pdf

Bold *italics* underline
Bold-italics-underline

Text style

program.pdf

Bold *italics* underline
Bold-italics-underline

program.tex

```
\textbf{Bold} \textit{italics} \underline{underline}

\textbf{\textit{\underline{Bold-italics-underline}}}
```

Lists

program.pdf

Unordered list:

- Item
- Item

Ordered list:

1. First item
2. Second item

Lists

program.pdf

Unordered list:

- Item
- Item

Ordered list:

1. First item
2. Second item

program.tex

```
Unordered list:
\begin{itemize}
\item Item
\item Item
\end{itemize}

Ordered list:
\begin{enumerate}
\item First item
\item Second item
\end{enumerate}
```

Paragraphs

program.pdf

This is paragraph 1. Bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla.
This is paragraph 2. Bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla.

Line
New line

Paragraphs

program.pdf

This is paragraph 1. Bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla.
This is paragraph 2. Bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla bla.

Line
New line

program.tex

```
This is paragraph 1. Bla bla bla bla bla bla bla bla bla bla bla bla bla
bla bla bla bla bla bla bla bla bla bla bla bla bla.

This is paragraph 2. Bla bla bla bla bla bla bla bla bla bla bla bla bla
bla bla bla bla bla bla bla bla bla bla bla bla bla.\\

Line\\
New line
```

Sections

program.pdf

1 Section

Description for the section

1.1 Subsection

Description for the subsection

1.1.1 Subsubsection

Description for the subsubsection

1.2 Subsection

Description for the subsection

Sections

program.pdf

1 Section

Description for the section

1.1 Subsection

Description for the subsection

1.1.1 Subsubsection

Description for the subsubsection

1.2 Subsection

Description for the subsection

program.tex

```
\section{Section}
Description for the section

\subsection{Subsection}
Description for the subsection
\subsubsection{Subsubsection}
Description for the subsubsection
\subsection{Subsection}
Description for the subsection
```

Tables

program.pdf

Please refer to Table 1 for a summary.

cell1	cell2	cell3
cell4	cell5	cell6
cell7	cell8	cell9

Table 1: Table title.

Tables

program.pdf

Please refer to Table 1 for a summary.

cell1	cell2	cell3
cell4	cell5	cell6
cell7	cell8	cell9

Table 1: Table title.

program.tex

```
Please refer to Table \ref{tab:data} for a summary.

\begin{table}
\begin{tabular}{|c|c|c|}
\hline
cell1 & cell2 & cell3 \\ \hline
cell4 & cell5 & cell6 \\ \hline
cell7 & cell8 & cell9 \\ \hline
\end{tabular}
\caption{Table title.}
\label{tab:data}
\end{table}
```

Images

program.pdf

Figure 1: A beautiful flower.

Please refer to Figure 1 for a diagram.

Images

program.pdf

Figure 1: A beautiful flower.

Please refer to Figure 1 for a diagram.

program.tex

```
\documentclass{article}
\usepackage{graphicx}
\graphicspath{{images/}}

\begin{document}
\begin{figure}
\centering
\includegraphics[width=0.1\textwidth]{latex-flower}
\caption{A beautiful flower.}
\label{fig:flower}
\end{figure}
Please refer to Figure \ref{fig:flower} for a diagram.
\end{document}
```

Mathematics

program.pdf

Inline mode: $(a+b)^2$ is an inline expression.
Display mode: (numbered and unnumbered)

$$(a+b)^2 = a^2 + b^2 + 2ab \tag{1}$$

$$(a+b)^2 = a^2 + b^2 + 2ab$$

Mathematics

program.pdf

Inline mode: $(a+b)^2$ is an inline expression.
Display mode: (numbered and unnumbered)

$$(a+b)^2 = a^2 + b^2 + 2ab \tag{1}$$

$$(a+b)^2 = a^2 + b^2 + 2ab$$

program.tex (use amsmath package)

```
Inline mode: $(a+b)^2$ is an inline expression.

Display mode: (numbered and unnumbered)
\begin{equation}
(a + b)^2 = a^2 + b^2 + 2ab
\end{equation}
\begin{equation*}
(a + b)^2 = a^2 + b^2 + 2ab
\end{equation*}
```

Resources

Resources

- All CTAN packages
  https://ctan.org/pkg/:A
- Important packages
  https://en.wikibooks.org/wiki/LaTeX/Package_Reference
- TikZ and PGF packages for diagrams
  http://www.texample.net/tikz/examples/all/
- LaTeX templates
  https://www.overleaf.com/latex/templates
  https://www.latextemplates.com/
- Mathematical symbols
  http://web.ift.uib.no/Teori/KURS/WRK/TeX/symALL.html
  https://oeis.org/wiki/List_of_LaTeX_mathematical_symbols
  https://www.caam.rice.edu/~heinken/latex/symbols.pdf
  https://math.uoregon.edu/wp-content/uploads/2014/12/compsymb-1qyb3zd.pdf