Introduction to LaTeX

Muhammad Qasim Pasta
mqpasta@uit.edu
qasimpasta.info

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Outline

Introduction

LaTeX is an open-source document preparation system that produces high-quality output. *It is not a word processor*

Advantages:

- High quality
- Portability (Win, Mac, Linux)
- Stability and Interchangeability - no issue of versions
- largely adopted for scientific publications and/or technical writing

LaTeX Basics

LaTeXis written in code similar to HTML, then compiled like a C program.

LaTeX:

- is a type-sensitive language.
- is not WYSIWYG.
- is not a word processor.
- needs an editor for creating text files. [Texmaker]
- needs external viewer to view output files. [Acrobat reader]

LaTeX Input

- We can use any text editor to edit LaTeX files. We will use `Texmaker/Latexbase.com` for our examples.
- Whitespaces are mostly ignored by LaTeX.
- There are several reserved characters, which have special meaning e.g., `# $ % ^ & { } ~ \`
- Grouping is done by using braces.
- All LaTeX commands start with a backslash.
- Spaces after commands are ignored.
- Some commands requre parameter(s).
- Some parameters are optional.
- LaTeX comments preceded by %.

Basic Document Structure

Following is a general document structure for a LaTeX file.

```
% comments
\documentclass{...}

%
% definitions, macros, packages, etc
% come here
%

\begin{document}
% LaTeX document text comes here
\end{document}
```

Example Document

Example

```
\documentclass{article}

\begin{document}
\title{Hello, World!}
\author{Qasim Pasta}
\date{March 9, 2018}
\maketitle

\begin{abstract}
  Showing off my new skills.
\end{abstract}
\section{Introduction}
  This is some introduction. You can add whatever you want.
  Line breaks are ignored. What
Spaces     are ignored too.
\end{document}
```

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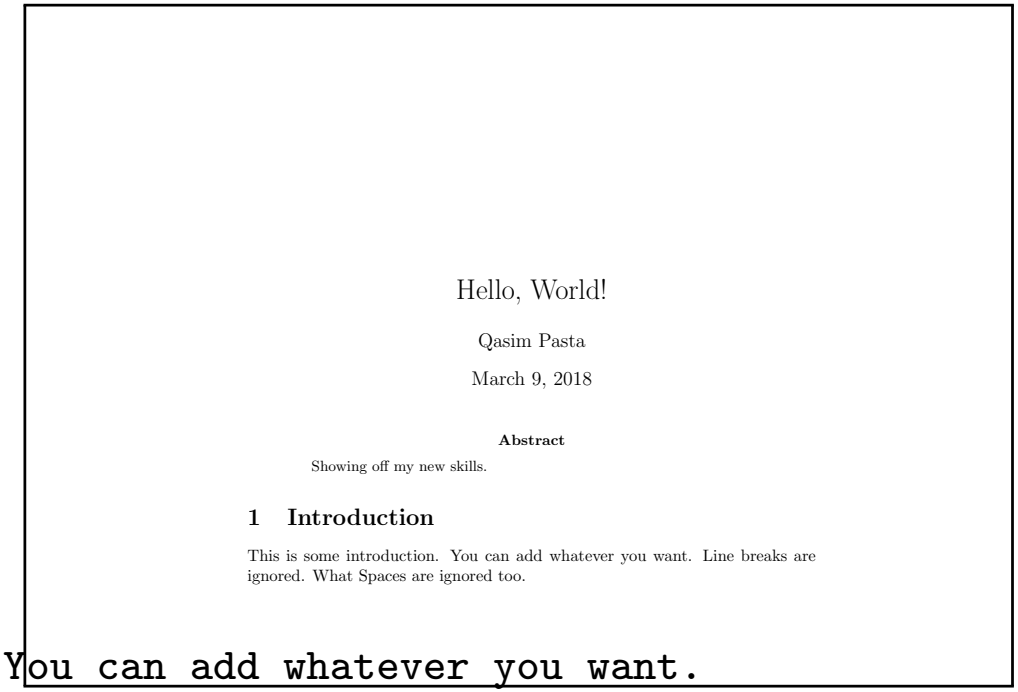
Output



Hello, World!

Qasim Pasta

March 9, 2018

Abstract

Showing off my new skills.

1 Introduction

This is some introduction. You can add whatever you want. Line breaks are ignored. What Spaces are ignored too.

Document Classes and Packages

Some useful/important classes.

`article`:	the most common LaTeX document class.
`report`:	for creating report like documents (theses).
`letter`:	for typesetting letters.
`book`:	for creating books.
`IEEEtran`:	IEEE transaction papers.

Some useful packages.

`geometry`:	for adjusting margins
`graphicx`:	for importing image files
`amsmath`:	for additional math commands

Sectioning Commands

Command	**Level**	
`\part`	-1	not for letters
`\chapter`	0	only for books and reports
`\section`	1	not for letters
`\subsection`	2	–
`\subsubsection`	3	–
`\paragraph`	4	–
`\subparagraph`	5	–

Line and Page Breaks

LaTeX handles **line breaks** and **page breaks** automatically. However, this can be forced e.g.,

- `\\` will enforce new line
- `\par` will start new paragraph
- `\newpage` will enforce new page

Handling Fonts

`\tiny`	Hello World!
`\scriptsize`	Hello World!
`\footnotesize`	Hello World!
`\normalsize`	Hello World!
`\large`	Hello World!
`\Large`	Hello World!
`\LARGE`	Hello World!
`\huge`	Hello World!
`\Huge`	Hello World!

- It is possible to have fonts larger than `\Huge`.
- `\textbf{Hello World!}` gives **Hello World!**
- `\textit{Hello World!}` gives *Hello World!*
- `\texttt{Hello World!}` gives `Hello World!`
- `\textsf{Hello World!}` gives Hello World!

Basic Maths

- $ sign used for in-line equations e..g. $n = 5 + x$
- `\begin{equation} \end{equation}` used for equation with numbering. e.g.

$$n = 5 + x \tag{1}$$

- `\[ \]` used for equation without numbering. e.g.

$$n = 5 + x$$

Some Examples

`$n^2 \log n + 3 n = o(n^3)$` gives us $n^2 \log n + 3n = o(n^3)$

```
\[\lim_{n\to\infty} \sum_{j = 1}^n \frac{1}{2^j} = 2\]
```

$$\lim_{n\to\infty} \sum_{j=1}^{n} \frac{1}{2^j} = 2$$

```
\begin{equation}\sum_{j=1}^{n} = \frac{n(n+1)}{2}\end{equation}
```

$$\sum_{j=1}^{n} = \frac{n(n+1)}{2} \tag{2}$$

More Math

The Greek alphabet:

```
\alpha, \beta,    \gamma, \delta, \epsilon, \zeta,
\eta,   \theta,   \iota,  \kappa, \lambda,  \mu,
\nu,    \xi,      o,      \pi,    \rho,     \sigma,
\tau,   \upsilon, \psi,   \omega.
```

$$\alpha, \beta, \gamma, \delta, \epsilon, \zeta, \eta, \theta, \iota, \kappa, \lambda, \mu, \nu, \xi, o, \pi, \rho, \sigma, \tau, \upsilon, \psi, \omega.$$

Math functions:

```
\sin,  \cos,  \tan,  \cot, \log, \ln,
\sinh, \cosh, \tanh, \exp, \max, \min,
\arccos, \arcsin, \arctan.
```

$$\sin, \cos, \tan, \cot, \log, \ln, \sinh, \cosh, \tanh,$$

$$\exp, \max, \min, \arccos, \arcsin, \arctan .$$

Logical Symbols

Conjunction:	$p \wedge q$	`$p \wedge q$`
Disjunction:	$p \vee q$	`$p \vee q$`
Negation:	$\neg p$	`$\neg p$`
Implication:	$p \rightarrow q$	`$p \rightarrow q$`
Bi-implication:	$p \leftrightarrow q$	`$p \leftrightarrow q$`
Equivalence:	$p \equiv q$	`$p \equiv q$`
There-exists:	$\exists x$	`$\exists x$`
Follows:	$A \vdash B$	`$p \vdash q$`
For-all:	$\forall x$	`$\forall x$`

Dots and Lines

- `$A[1..n]$` : $A[1..n]$
- `$\{1, 2, \ldots, 10\}$` : $\{1, 2, \ldots, 10\}$
- `$a_1 \leq a_2 \leq \cdots \leq a_n$` : $a_1 \leq a_2 \leq \cdots \leq a_n$
- `$10.\overline{9}$`: $10.\overline{9}$
- `$\overbrace{\underbrace{2+2+\cdots+2}_n + n}^{n+1}=3n$`:

$$\overbrace{\underbrace{2+2+\cdots+2}_{n}+n}^{n+1}=3n$$

More Examples

```
\int d^n x e^{-x^T Bx + v^Tx} = \frac{(\sqrt{\pi})^n}{\sqrt{B}}\exp
\left[\frac{1}{4}v^T B^{-1}v\right] \equiv \mathcal{M}.
```

$$\int d^n x e^{-x^T Bx + v^T x} = \frac{(\sqrt{\pi})^n}{\sqrt{B}} \exp\left[\frac{1}{4} v^T B^{-1} v\right] \equiv \mathcal{M}.$$

```
\Gamma(z) = \frac{e^{-\gamma z}}{z} \prod_{n=1}^\infty
\left(1 + \frac{z}{n}\right)^{-1} e^{z/n}
```

$$\Gamma(z) = \frac{e^{-\gamma z}}{z} \prod_{n=1}^{\infty} \left(1 + \frac{z}{n}\right)^{-1} e^{z/n}$$

```
D(a_n;s)=\prod_{p} \mathrm{BG}_p(a_n;p^{-s})
```

$$D(a_n; s) = \prod_{p} \mathrm{BG}_p(a_n; p^{-s})$$

Matrices

$$A = \begin{pmatrix} 10 & 3 \\ 2 & 14 \end{pmatrix}, \quad B = \begin{bmatrix} -1 & 12 & 3 \\ 7 & 0 & 143 \end{bmatrix}, \quad C = \begin{vmatrix} -1 & 99 & 0.23 \\ 2 & 1 & 0.1257 \\ +8 & 54 & 6.1 \end{vmatrix}.$$

```
\[
A= \left(\begin{array}{cc}
              10 &  3\\
               2 & 14 \end{array}\right), \;\;
B = \left[\begin{array}{rrr}
              -1 & 12 &   3\\
               7 &  0 & 143\end{array}\right], \;\;
C = \left|\begin{array}{rcl}
              -1 & 99 & 0.23\\
               2 &  1 & 0.1257\\
              +8 & 54 & 6.1\end{array}\right|.
\]
```

Tables

Position	Name	Total Score	% Score
First	Abc D. Efg	200	100
Second	Xyz Xyz	198	96
Third	Ijk Lmno	150	75

Table 1: Contest score and names

Tables

Position	Name	Total Score	% Score
First	Abc D. Efg	200	100
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Table 1: Contest score and names

```
\begin{table}[t]\centering
\begin{tabular}{|r|lcr|}\hline
{\bf Position} & {\bf Name} & {\bf Total Score} & {\bf \% Score} \\\hline
First & Abc D. Efg & 200 & 100 \\\hline
Second & Xyz Xyz & 198 &  96 \\\hline
Third & Ijk Lmno & 150 & 75 \\\hline
\end{tabular}
\caption{Contest score and names}\label{fig:c_score}
\end{table}

Here we refer Table~\ref{fig:c_score}.
```

Here we refer Table 1.

Tables

3.14159
16.2
123.456

```
\begin{tabular}{r@{.}l}
  3   & 14159 \\
  16  & 2     \\
  123 & 456   \\
\end{tabular}
```

Importing Pictures

- Add `\usepackage{graphicx}` in preamble.
- We can import `.pdf`, `.jpg`, `.png` files.

`\includegraphics{uitlogo.jpg}`

`\includegraphics[angle=90]{uitlogo.jpg}`

Thank You

The End.