AN INTRODUCTION TO LATEX

FIRST AUTHOR, SECOND AUTHOR, AND THIRD AUTHOR

CONTENTS

ABSTRACT. In this article, we learn some basics of writing documents using LaTeX.

1. ADVICE

To become comfortable in writing documents using LaTeX you must practice it as much as you can. Whenever you face some problem in writing particular type setting / style / diagram / table etc., use Google search to find out what you are looking for. There are many well written webpages, where you can find solutions for most of the problems you will be facing at the beginning. This is a continuous process, and may takes years of time to become comfortable with using LaTeX. So don't give up at the beginning, and keep practising.

2. BASICS OF A LATEX DOCUMENT

2.1. **Different types of fonts.** Example of various font styles: *italics*, **bold**, `type writer font` etc.
In math mode, you can use: $R, \mathbf{R}, \mathbb{R}, \mathcal{R}, \mathscr{R}, \mathfrak{R}$ etc.
Tiny font: {\tiny a b c d..}
Small font: {\small a b c d..}

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Large font: a, b, c, d..
Extra large font: a, b, c, d...
Huge font: a, b, c, d...
Extra huge font: a, b, c, d...
For more details, see https://en.wikibooks.org/wiki/LaTeX/Fonts.
Accents: á, à, ä etc.
Subscript and superscript: a^2, x_1 etc.
Colouring text: red, dark-red, blue, dark-blue etc.

2.2. **Equations.** Example of an equation:

$$(x+y+z)^2 = x^2+y^2+z^2+2xy+2yz+2zx\,. \tag{2.2.1}$$

When you want to write an equation, which is not fitting into a line, you should use:

$$\begin{aligned}(x_1+x_2+x_3+x_4+x_5+x_6+x_7)^2 &= x_1^2+x_2^2+x_3^2+x_4^2+x_5^2+x_6^2\\ &\quad+2(x_1x_2+x_2x_3+x_3x_4+x_4x_5+x_5x_6)\\ &\quad+2(x_1x_3+x_2x_4+x_3x_5+x_4x_6)\\ &\quad+2(x_1x_4+x_2x_5+x_3x_6)+2(x_1x_5+x_2x_6)+2x_1x_6\end{aligned} \tag{2.2.2}$$

Example of equation array:

$$\begin{aligned}A+B+C &= C+B+A\\ &= B+A+C\\ &= A+C+B\end{aligned} \tag{2.2.3}$$

Example of a matrix:

$$A=\begin{pmatrix}a_{11}&a_{12}&a_{13}\\ a_{21}&a_{22}&a_{23}\\ a_{31}&a_{32}&a_{33}\end{pmatrix} \tag{2.2.4}$$

Example of two matrices side by side:

$$A=\begin{pmatrix}a_{11}&a_{12}&a_{13}\\ a_{21}&a_{22}&a_{23}\\ a_{31}&a_{32}&a_{33}\end{pmatrix}\quad\text{and}\quad B=\begin{bmatrix}a_{11}&a_{12}&a_{13}\\ a_{21}&a_{22}&a_{23}\\ a_{31}&a_{32}&a_{33}\end{bmatrix} \tag{2.2.5}$$

Example of a multiline equation:

$$f(x)=\begin{cases}x^2 & \text{if}\quad 0\le x<\infty,\\ x^3 & \text{if}\quad x\le 0.\end{cases} \tag{2.2.6}$$

2.3. **Theorems, Proposition, Lemma, Corollary etc.**

Proposition 2.3.1. *Let A be a commutative ring with identity. Let $\mathfrak{a}$ be an ideal of A.*

(a) $\mathfrak{a}$ *is a prime ideal of A if and only if $A/\mathfrak{a}$ is an integral domain.*
(b) $\mathfrak{a}$ *is a maximal ideal of A if and only if $A/\mathfrak{a}$ is a field.*

Theorem 2.3.2. *Let A be a commutative ring with identity. Let $\mathfrak{a}$ be an ideal of A.*

(i) $\mathfrak{a}$ *is a prime ideal of A if and only if $A/\mathfrak{a}$ is an integral domain.*
(ii) $\mathfrak{a}$ *is a maximal ideal of A if and only if $A/\mathfrak{a}$ is a field.*

Proof. (i) Write a proof here.
(ii) Write a proof here.

□

Lemma 2.3.3. *Let A be a commutative ring with identity. Let $\mathfrak{a}$ be an ideal of A.*

(I) $\mathfrak{a}$ *is a prime ideal of A if and only if $A/\mathfrak{a}$ is an integral domain.*
(II) $\mathfrak{a}$ *is a maximal ideal of A if and only if $A/\mathfrak{a}$ is a field.*

Now we write a proof of Proposition 2.3.1 here.

Proof of Proposition 2.3.1. Write a proof of Proposition 2.3.1 here. □

Corollary 2.3.4. *content...*

Remark 2.3.5. content...

2.4. **Writing diagrams.** Here is an example of various diagrams.

(i) A simple diagram using `tikzcd`:

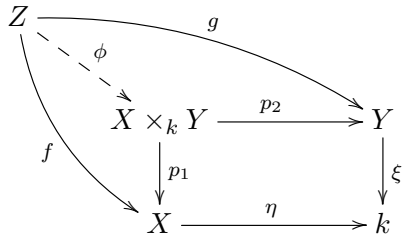
(2.4.1)
$$\begin{array}{ccc} A & \xrightarrow{f} & B \\ \downarrow{\scriptstyle g} & & \downarrow{\scriptstyle h} \\ C & \xrightarrow{i} & D \end{array}$$

(ii) Drawing diagram with curved arrows usign `tikzcd`:

(2.4.2)
$$\begin{array}{ccccc} Z & & \xrightarrow{\quad b \quad} & & \\ & \overset{c}{\searrow} & & & \\ & & X \times_k Y & \xrightarrow[f_Y]{} & Y \\ & \overset{a}{\searrow} & \downarrow{\scriptstyle g_X} & & \downarrow{\scriptstyle g} \\ & & X & \xrightarrow[f]{} & k \end{array}$$

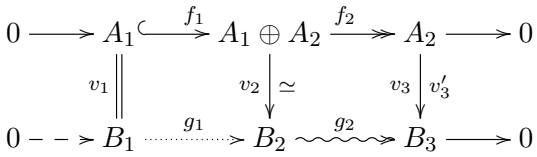
(iii) Drawing diagram with curved arrows usign `xymatrix`:

(2.4.3)

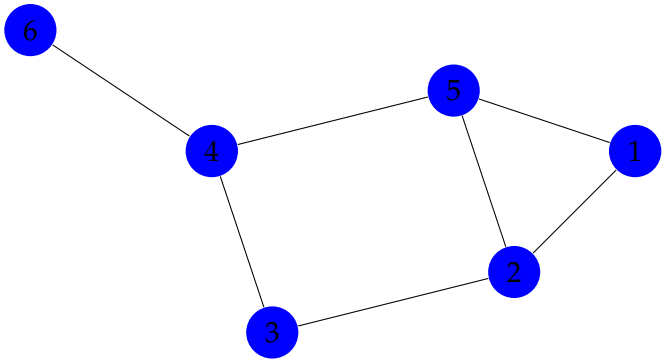


(iv) Diagram using `xymatrix` package.

(2.4.4)



(v) Drawing Graph using `tikzpicture`:



2.5. **Creating tables.** Here we show some simple examples of writing table in LaTeX. For more complicated tables, according to your requirements, you can see the following page: https://www.overleaf.com/learn/latex/Tables.

1	A	B	C
2	D	E	F
3	G	H	I

TABLE 1. Simple Table

Here is an example of two tables placed side by side.

Sample space 1			
1	A	B	C
2	D	E	F
3	G	H	I

TABLE 2. 1st List of items

Sample space 2			
1	A	B	C
2	D	E	F
3	G	H	I

TABLE 3. 2nd List of items

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