This is my *first* document prepared in LaTeX. I typed it on May 20, 2016. We have seen that to typeset something in LaTeX, we type in the text to be typeset together with some LaTeX commands. Words must be separated by spaces (does not matter how many) and lines maybe broken arbitrarily.

The end of a paragraph is specified by a *blank line* in the input. In other words, whenever you want to start a new paragraph, just leave a blank line and proceed.

The numbers 1, 2, 3, etc. are called natural numbers. According to Kronecker, they were made by God; all else being the works of Man.

"Note" the difference in right and left quotes in 'single quotes' and "double quotes".

X-rays are discussed in pages 221–225 of Volume 3—the volume on electromagnetic waves.

Maybe I have now learnt about 1% of LaTeX.
This is the first line.

This is the second line

The TeXnical Institute

Certificate

This is to certify that Mr. N. O. Vice has undergone a course at this institute and is qualified to be a TeXnician.

The Director
The TeXnical Institute

FONTS

A polygon of three sides is called a triangle *and a polygon of four sides is called a* quadrilateral
A polygon of three sides is called a *triangle* and a polygon of four sides is called a *quadrilateral*
A is **A**, B is B

—————— **Split Line** ——————

The TeXnical Institute

CERTIFICATE

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The TeXnical Institute

1 Dividing the document

1.1 Example

In this example, we show how subsections and subsubsections are produced (there are no subsubsubsections). Note how the subsections are numbered.

1.1.1 Subexample

Did you note that subsubsections are not numbered? This is so in the `book` and `report` classes. In the `article` class they too have numbers. (Can you figure out why?)

Note Paragraphs and subparagraphs do not have numbers. And they have *run-in* headings. Though named paragraph we can have several paragraphs of text within this.

Subnote 1 Subparagraphs have an additional indentation too.

Subnote 2 Subparagraphs have an additional indentation too.

Subnote 3 Subparagraphs have an additional indentation too.

2 Example 2

2.1 Example

In this example, we show how subsections and subsubsections are produced (there are no subsubsubsections). Note how the subsections are numbered.

2.1.1 Subexample

Did you note that subsubsections are not numbered? This is so in the `book` and `report` classes. In the `article` class they too have numbers. (Can you figure out why?)

Note Paragraphs and subparagraphs do not have numbers. And they have *run-in* headings. Though named paragraph we can have several paragraphs of text within this.

Subnote 1 Subparagraphs have an additional indentation too.

Subnote 2 Subparagraphs have an additional indentation too.

Subnote 3 Subparagraphs have an additional indentation too

3 Tutorial III

3.1 Bibliography(Literaturverzeichnis)

It is hard to write unstructured and disorganised documents using LaTeX[1].It is interesting to typeset one equation[1, Sec 3.3] rather than setting ten pages of running matter[2, 3]. If the author name is Alex and year 1991, the key can be coded as **ale91** or some such mnemonic string.

References

[1] Leslie Lamport, 1985. *LaTeX—A Document Preparation System—Users Guide and Reference Manual*, Addision-Wesley, Reading.

[2] Donald E. Knuth, 1989. *Typesetting Concrete Mathematics*, TUGBoat, 10(1):31-36.

[3] Ronald L. Graham, Donald E. Knuth, and Ore Patashnik, 1989. *Concrete Mathematics: A Foundation for Computer Science*, Addison-Wesley, Reading.

4 Tutorial IV

4.1 Table of contents, index and glossary

5 Tutorial V

5.1 Displayed Text

5.1.1 Borrowed words

Some mathematicians elevate the spirit of Mathematics to a kind of intellectual aesthetics. It is best voiced by Bertrand Russell in the following lines.

> The true spirit of ....from which all great work springs.

To show it more clearly.

5.1.2 Marking Lists

One should keep the following in mind when using TeX

- ▶ First main item with Black triangle right
  - ☛ The ding 42 in the first level
  - ☛ The ding 42 in the first level
    - ☞ The ding43 in the second level

- ☞ the ding43 in the second level
  - ✍ The ding45 item in the third level
  - ✍ The ding45 item in the third level
- ▶ Second main item with Black triangle right

Being a program, TEX offers a high degree of flexibility.

Such a numbered list is produced by the enumerate environment in LATEX. The above list was produced by the following source.

1. prepare a source file with the extension "tex"
2. Compile it with LATEXto produce a "dvi" file
3. Print the document using a "dvi" driver

The three basic steps in producing a printed document using LATEX are as follows:

1. First Item
2. Second Item
   (a) Use a previewer
   (b) Edit the source if needed
   (c) Recompile
3. Third Item

5.1.3 Descriptions and Definitions

There is a example for the definitions layout.

TEX A typesetting program

Emacs A text editor and also

AbiWord A word processor

l

The real number l is the least upper bound of the set A if it satisfies the following conditions

(1) l is an upper bound of A

(2) if u is an upper bound of A, then $l \leq u$

The second condition is equivalent to

$(2)'$ If $a < l$, then a is not an upper bound of A.

Lets review the notation

- $(0, 1)$ is an *open* interval
- $[0, 1]$ is a *closed* interval

5.1.4 Rows and Columns

Lets take stock of what weve learnt

AbiWord	A word processor
Emacs	A text editor
TEX	A typesetting program
μ_{max}	Maximal Reibwert
$\mathbf{T}_b$	Brake Torque

TEX : A typesetting program

Emacs : A text editor
a programming environment
a mail reader
and a lot more besides

AbiWord : A word processor

The example below illustrates all the tabbing command we've discussed.

Row 1 Column 1	Row 1 Column 2	
	Row 2 Column 2	Row 2 Column 3
		Row 3 Column 3
	Row 4 Column 2	Row 4 Column 3
Row 5 Column 1	Row 5 Column 2	Row 5 Column 3
	Row 6 Column 2	Row 6 Column 3
Row 7 Column 1	Row 7 Column 2	Row 7 Column 3
Row 8 Column 1 Right		
Row 9 Column 1	and Row 9 Column 2	
Row 10 New Column 1	Row 10 New Column 2	
Row 11 New Column 2	Row 11 New Column 2	
Row 12 Old Column 1	Row 12 Old Column 2	Row 12 Old Column 3

Tables The table below shows the sizes of the planets of our solar system.The lr specification immediately after the begintabular indicates there are two columns in the table with the entries in the first column aligned on the left and the entries in the second column aligned on the right.
lcc means 3 Columns = left, center, center.

Planet	Diameter(km)	Mass(T)
Mercury	4878	1
Venus	12104	2
Earth	12756	3
Mars	6794	4
Jupiter	142984	5
Saturn	120536	6
Uranus	51118	7
Neptune	49532	8
Pluto	2274	9

As can be seen, Pluto is the smallest and Jupiter the largest
Here is another example.

Planet	Features
Mercury	Lunar like crust, crustal faulting, small magnetic fields.
Venus	Shrouded in clouds, undulating surface with highlands, plains, lowlands and craters.
Earth	Ocens of water filling lowlands between continents, unique in supporting life, magnetic field.
Mars	Cratered uplands, lowland plains, volcanic regions.
Jupiter	Covered by clouds, dark ring of dust, magnetic field.
Saturn	Several cloud layers, magnetic field, thousands of rings.
Uranus	Layers of cloud and mist, magentic field, some rings.
Neptune	Unable to detect from earth.
Pluto	Unable to detect from earth

Or another way:

Planet	Diameter(km)	Mass
Mercury	4878	1
Venus	12104	2
Earth	12756	3
Mars	6794	4
Jupiter	142984	5
Saturn	120536	6
Uranus	51118	7
Neptune	49532	8
Pluto	2274	9

Here the first few lines and the last lines of the input are as below (the other lines are the same as in the previous example).multicolumn2 means merge the last two columns. the cline2-3 means draws a horizontal line from the 2nd to 3rd column. clinei-j draws a horizontal line from the ith column to the jth column.

Planets	Distance from sun (km)		Mass from sun (km)	
	Maximum	Minimum	Maximum	Minimum
Mercury	4878	1	2	3
Venus	12104	2	3	2
Earth	12756	3	1	5
Mars	6794	4	5	88
Jupiter	142984	5	1	99
Saturn	120536	6	3	21
Uranus	51118	7	2	2
Neptune	49532	8	8	0
Pluto	2274	9	1	2

Next comes th **Array package**: The mwd specifier produces a column of width wd just like the p specifier, but with the text aligned vertically in the middle unlike the p specifier which aligns the text with the topline. (The table on the left, incidently, was produced by the same input as above but with p instead of m).

Planet	Mean distance from sun (km)
Mercury	4878
Venus	12104
Earth	12756
Mars	6794
Jupiter	142984
Saturn	120536
Uranus	51118
Neptune	49532
Pluto	2274

Planet	Distance from sun (million km)	
	Maximum	Minimum
Mercury	69.4	46.8
Venus	109.0	107.6
Earth	152.6	147.4
Mars	249.2	207.3
Jupiter	817.4	741.6
Saturn	1512.0	1346.0
Uranus	3011.0	2740.0
Neptune	4543.0	4466.0
Pluto	7346.0	4461.0

6 Tutorial VI

6.1 Typesetting Mathematics

6.1.1 The Basics

A mathematical expression occurring in running text (called in-text math) is produced by enclosing it between dollar signs. Thus to produce. The equation representing a straight line in the Cartesian plane is of the form $ax + by + c = 0$, where a, b, c are constants.
This can be done by changing the input as follows: The equation representing a straight line in the Cartesian plane is of the form

$$ax + by + c = 0$$

where a, b, c are constants. Again $$ ax+by+c=0 $$ is the TEX way of producing displayed math. LATEX has the constructs

$$a + b + c = 0$$

or

$$a + b + c = 0$$

also to do this.
It is easily seen that $(x^m)^n = x^{mn}$.
The sequence (x_n) defined by

$$x_1 = 1, \quad x_2 = 1, \quad x_n = x_{n-1} + x_{n-2} \ \ (n > 2)$$

is called the Fibonacci sequence.

$$x_m^n \qquad x_m^n \qquad {x_m}^n \qquad {x^n}_m$$

The sequence

$$2\sqrt{2}\,, \quad 2^2\sqrt{2-\sqrt{2}}\,, \quad 2^3\sqrt{2-\sqrt{2+\sqrt{2}}}\,, \quad 2^4\sqrt{2-\sqrt{2+\sqrt{2+\sqrt{2+\sqrt{2}}}}}\,, \ \ldots$$

converge to π.

Next is Custom Commands:

$$(x_1, x_2, \ldots, x_n), (y_1, y_2, \ldots, y_m), (a_1, a_2, \ldots, a_p)$$

The equation representing a straight line in the Cartesian plane is of the form

$$ax + by + c = 0 \tag{1-1}$$

where a, b, c are constants.

$$ax + by + c = 1 \tag{6.1.1}$$

Maxwell's equations:

$$B' = -\nabla \times E, \tag{6.1.2a}$$
$$E' = \nabla \times B - 4\pi j, \tag{6.1.2b}$$

$$z = \overbrace{\underbrace{x}_\text{real} + i \underbrace{y}_\text{imaginary}}^\text{complex number}$$

https://en.wikibooks.org/wiki/LaTeX/Advanced_Mathematics

$$\begin{aligned} \cos 2x + \sin 2x &= 1 & \qquad \cosh 2x - \sinh 2x &= 1 \\ \cos 2x - \sin 2x &= \cos 2x & \qquad \cosh 2x + \sinh 2x &= \cosh 2x \end{aligned}$$

$$\begin{aligned} \cos 2x + sin 2x &= 1 \\ \cos 2x - \sin 2x &= \cos 2x \end{aligned} \quad \text{and} \quad \begin{aligned} \cosh 2x - \sinh 2x &= 1 \\ \cosh 2x + \sinh 2x &= \cosh 2x \end{aligned} \tag{6.1.3}$$

$$|x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{if } x \leq 0 \end{cases} \tag{6.1.4}$$

6.1.2 The Matrix

The system of equations:

$$x + y - z = 1 \tag{6.1.5}$$
$$x - y + z = 1 \tag{6.1.6}$$
$$x + y + z = 1 \tag{6.1.7}$$

can be written in matrix terms as

$$\begin{pmatrix} 1 & 1 & -1 \\ 1 & -1 & 1 \\ 1 & 1 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}. \tag{6.1.8}$$

Here, the matrix $\begin{pmatrix} 1 & 1 & -1 \\ 1 & -1 & 1 \\ 1 & 1 & 1 \end{pmatrix}$ is invertible.

A general $m \times n$ matrix is of the form:

$$\begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \dots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix} \tag{6.1.9}$$

$$\left.\begin{aligned} u_x &= v_y \\ u_y &= -v_x \end{aligned}\right\} \quad \text{Cauchy-Riemann Equations}$$

$$(x+y)2-(x-y)2=((x+y)+(x-y))\,((x+y)-(x-y))=4xy \tag{6.1.10}$$

$$\left(\sum_{k=1}^{n}|x_k y_k|\right)^2 \leq \left(\sum_{k=1}^{n}|x_k|\right)\left(\sum_{k=1}^{n}|y_k|\right)$$

For n-tuples of complex numbers $(x_1, x_2, \ldots, x_n)$ and $(y_1, y_2, \ldots, y_n)$ of complex numbers

$$\left(\sum_{k=1}^{n}|x_k y_k|\right)^2 \leq \left(\sum_{k=1}^{n}|x_k|\right)\left(\sum_{k=1}^{n}|y_k|\right)$$

$$1-\binom{n}{1}\frac{1}{2}+\binom{n}{2}\frac{1}{2^2}-\cdots-\binom{n}{n-1}\frac{1}{2^{n-1}}=0 \tag{6.1.11}$$

Since (x_n) converges to 0, there exists a positive integer p such that

$$|x_n| < \tfrac{1}{2} \quad \text{for all } n \geq \pi$$

The Christoffel symbol $\left\{{ij \atop k}\right\}$ of the second kind is related to the Christoffel symbol $\left[{ij \atop k}\right]$ of the first kind by the equation

$$\begin{Bmatrix} ij \\ k \end{Bmatrix} = g^{k1}\begin{bmatrix} ij \\ 1 \end{bmatrix} + g^{k2}\begin{bmatrix} ij \\ 2 \end{bmatrix}$$

Thus we get:

$$0 \to A \xrightarrow[\text{monic}]{f} B \xrightarrow[\text{epi}]{g} C \to 0$$

Euler not only proved that the series $\displaystyle\sum_{n=1}^{\infty}\frac{1}{n^2}$ converges, but also that $\sum_{n=1}^{\infty}\frac{1}{n^2}$

$$\sum_{n=1}^{\infty}\frac{1}{n^2}=\frac{\pi^2}{6}$$

Thus $\lim\limits_{x\to\infty}\int_0^x \frac{\sin x}{x}\,\mathrm{d}x = \frac{\pi}{2}$ and so by definition,

$$\int_0^\infty \frac{\sin x}{x}\,\mathrm{d}x = \frac{\pi}{2} \qquad \text{and} \qquad \int\limits_0^\infty \frac{\sin x}{x}\,\mathrm{d}x = \frac{\pi}{2}$$

There is another reason for tweaking the math fonts. Recently, the International Standards Organization (ISO) has established the recognized typesetting standards in mathematics. Some of the points in it are,

1. Simple variables are represented by italic letters as a, x.
2. Vectors are written in boldface italic as a, x.
3. Matrices may appear in sans serif as in $\mathbf{A}, \mathbf{X}$.
4. The special numbers e, i and the differential operator d are written in *upright* roman. For example, e^2, i, $\mathrm{d}x$.

7 Tutorial VII

7.1 Typesetting Theorems

In Mathematical documents we often have special statements such as *axioms*(which are nothing but the assumptions made) and *theorems*(which are the conclusions obtained, sometimes known by ohter names like propositions or lemmas). These are often typeset in different font to distinguish them from surrounding text and given a name and a number for subsequent reference.

Theorem 7.1 (Euclid)**.** *The sum of the angles of a triangle is* $180°$.

Theorem 7.2 (Ly)**.** *The sum of the angles of a normal triangle is* $180°$.

Definition 1. A triangle is the figure formed by joining each pair of three non collinear points by line segments.

Theorem 7.3 (Euclid)**.** *The number of primes is infinite.*

Proof. This follows easily from the equation

$$(x+y)^2 = x^2 + y^2 + 2xy \qquad \blacksquare$$

8 Tutorial VIII

8.1 Several Kinds of Boxes

$\boxed{\text{A few words of advice}}$

$\boxed{\text{Text in a box}}$ $\boxed{\text{Text in a box}}$

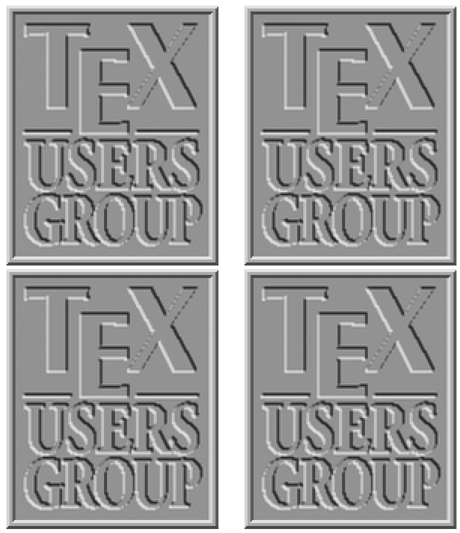
9 Tutorial IX

9.1 Floats

Figures are really problematical to present in a document because they never split between pages. This leads to bad page breaks which in turn leave blank space at the bottom of pages. For fine-tuning that document, the typesetter has to adjust the page breaks manually. But LaTeX provides floating figures which automatically move to suitable locations. So the positioning of figures is the duty of LaTeX.
Floating figures are created by putting commands in a figure environment. The contents of the figure environment always remains in one chunk, floating to produce good page breaks. The following commands put the graphic from figure.eps inside a floating figure:

Figure 1: Tex Users Group

Anotherway LaTeX provides floating figures which automatically move to suitable locations. So the positioning of figures is the duty of LaTeX.
Floating figures are created by putting commands in a figure environment. The contents of the figure environment always remains in one chunk, floating to produce good page breaks. The following commands put the graphic from figure.eps inside a floating figure:



(a) the 1st subfigure (b) the 2rd subfigure