WIKIBOOKS

LaTeX/Lengths

In TeX, a length is

- a floating point number followed by a unit, optionally followed by a stretching value;

```
3.5pt plus 1pt minus 2pt
```

- a floating point factor followed by a macro that expands to a length.

```
1.7\textwidth
```

Contents

Units

First, we introduce the LaTeX measurement units. All LaTeX units are two-letter abbreviations. You can choose from a variety of units. Here are the most common ones.[1]

Abbreviation	Definition	Value in points (pt)	Value in micrometers (*µ*m)
pt	a point is 1/72.27 inch, that means about 0.0138 inch.	1	351.46
mm	a millimeter	2.84 = 7227/2540	1000
cm	a centimeter	28.4 = 7227/254	10000
in	inch	72.27	25400
ex	roughly the height of an 'x' **in the current font**	*undefined, depends on the font used*	
em	roughly the width of an 'M' (uppercase) **in the current font**	*undefined, depends on the font used*	

The point is the default unit and 1pt is the default length. All other units are converted to the point by a fixed ratio.

Here are some less common units.[2]

Abbreviation	Definition	Value in points (pt)	Value in micrometers (μm)
bp	a big point is 1/72 inch, that means about 0.0139 inch.	1.00375 = 803/800	352 7/9
pc	pica	12	4218
dd	didot	1.070 = 1238/1157	376
cc	cicero (12 didot)	12.84 = 14856/1157	4512
nd	new didot	1.067 = 685/642	375
nc	new cicero (12 new didot)	12.80 = 1370/107	4500
sp	scaled point	0.000015 = 1/65536	0.00536

Box lengths

A box in TeX is characterized by three lengths:

- *depth*
- *height*
- *width*

See Boxes.

Length manipulation

You can change the values of the variables defining the page layout with two commands. With this one you can set a new value for an existing length variable:

```
\setlength{\mylength}{length}
```

with this other one, you can add a value to the existing one:

```
\addtolength{\mylength}{length}
```

You can create your own length with the command, and you must create a new length before you attempt to set it:

```
\newlength{\mylength}
```

You may also set a length from the size of a text with one of these commands:

```
\settowidth{\mylength}{some text}
\settoheight{\mylength}{some text}
\settodepth{\mylength}{some text}
```

The `calc` package provides also the function `\settototalheight{\mylength}{some text}`

When using these commands, you may duplicate the text that you want to use as reference if you plan to also display it. But LaTeX also provides **`\savebox`** to avoid this duplication. You may wish to look at the example below to see how you can use these. See Boxes for more details.

You can also define stretched values. A stretching value is a length preceded by `plus` or `minus` to specify to what extent `tex` is authorized to change the length. Example:

```
\setlength{\parskip}{10pt plus 5pt minus 3pt}
```

It means that `tex` will try to use a length of 10pt; if it is underfull, it will raise the length up to a maximum of 15pt; if it is overfull, it will lower the length up to a minimum of 7pt.

Note that it is not mandatory to specify both the `plus` and the `minus` values, but if you do, `plus` must be placed before `minus`.

To print a length, you can use the **`\the`** command:

```
\the\textwidth
```

Plain TeX

To create a new length:

```
\newdimen\mylength
```

To set a length:

```
\mylength=1.5in
```

To view, it is the same as with LaTeX, using the command **`\the`**.

LaTeX default lengths

Common length macros are:

\baselineskip
: The normal vertical distance between lines in a paragraph.

\baselinestretch
: A factor multiplying \baselineskip. Has to be set with `\renewcommand{\baselinestretch}{factor}`

\columnsep
: The distance between columns.

\columnwidth
: The width of the column.

\evensidemargin
: The margin for 'even' pages (think of a printed booklet).

\linewidth
: The width of a line in the local environment.

\oddsidemargin
: The margin for 'odd' pages (think of a printed booklet).

\paperwidth
: The width of the page.

\paperheight
: The height of the page.

\parindent
: The normal paragraph indentation.

\parskip
: The extra vertical space between paragraphs.

\tabcolsep
: The default separation between columns in a tabular environment.

\textheight
: The height of text on the page.

\textwidth
: The width of the text on the page.

\topmargin
: The size of the top margin.

\unitlength
: Units of length in `picture` environment.

Fixed-length spaces

To insert a fixed-length space, use:

```
\hspace{length}
\vspace{length}
```

`\hspace` stands for horizontal space, `\vspace` for vertical space.

If such a space should be kept even if it falls at the end or the start of a line, use `\hspace*` instead.

If the space should be preserved at the top or at the bottom of a page, use the starred version of the command, **\vspace*****, instead of **\vspace**. If you want to add space at the beginning of the document, without anything else written before, then you may use

```
{ \vspace*{length} }
```

It's important you use the **\vspace*** command instead of **\vspace**, otherwise LaTeX can silently ignore the extra space.

TeX features some macros for fixed-length spacing.

\smallskip
: Inserts a small space in vertical mode (between two paragraphs).

\medskip
: Inserts a medium space in vertical mode (between two paragraphs).

\bigskip
: Inserts a big space in vertical mode (between two paragraphs).

The vertical mode is during the process of assembling boxes "vertically", like paragraphs to build a page. The horizontal mode is during the process of assembling boxes "horizontally", like letters to build a word or words to build a paragraph.

The fact they are vertical mode commands mean they will be ignored (or fail) in horizontal mode such as in the middle of a paragraph. The first token next to a double linebreak is still in vertical mode if it does not expand to characters.

```
% WRONG!
Some words.
\bigskip
Let's continue.

%% CORRECT!
Some words.

\bigskip
Let's continue.
```

Rubber/Stretching lengths

The command:

```
\stretch{factor}
```

generates a special rubber space where `factor` is a number, possibly a float. It stretches until all the remaining space on a line is filled up. If two **\hspace**`{`**\stretch**`{factor}}` commands are issued on the same line, they grow according to the stretch factor.

```
x \hspace{ \stretch{1} } x \hspace{ \stretch{3} } x
```

```
x      x                  x
```

The same way, you can stretch vertically:

```
\maketitle
\vspace{ \stretch{1} }
Some comments.
\vspace{ \stretch{1} }
\tableofcontents
```

You can also use **\fill** instead of **\stretch**{1}.

The **\stretch** command, in connection with **\pagebreak**, can be used to typeset text on the last line of a page, or to center text vertically on a page.

There are 'shortcut commands' for stretching with factor 1 (*i.e.* with **\stretch**{1} or **\fill**): **\hfill** and **\vfill**.

Example:

```
\maketitle
\vfill
Some comments.
\vfill
\tableofcontents
```

Fill the rest of the line

Several macros allow filling the rest of the line -- or stretching parts of the line -- in different manners.

- **\hfill** will produce empty space.
- **\dotfill** will produce dots.
- **\hrulefill** will produce a rule.

Examples

Resize an image to take exactly half the text width :

```
\includegraphics[width=0.5\textwidth]{mygraphic}
```

Make distance between items larger (inside an itemize environment) :

```
\addtolength{\itemsep}{0.5\baselineskip}
```

Use of **\savebox** to resize an image to the height of the text:

```
% Create the holders we will need for our work
\newlength{\mytitleheight}
\newsavebox{\mytitletext}
% Create the reference text for measures
\savebox{\mytitletext}{%
  \Large\bfseries This is our title%
}
\settoheight{\mytitleheight}{ \usebox{\mytitletext} }
% Now creates the actual object in our document
\framebox[\textwidth][l]{%
  \includegraphics[height=\mytitleheight]{my_image}%
  \hspace{2mm}%
  \usebox{\mytitletext}%
}
```

References

1. http://www.giss.nasa.gov/tools/latex/ltx-86.html
2. http://anonscm.debian.org/cgit/debian-tex/texlive-bin.git/tree/texk/web2c/pdftexdir/pdftex.web?h=debian/2015.20150524.37493-5#n10460

See also

- University of Cambridge > Engineering Department > computing help > LaTeX > Squeezing Space in LaTeX (http://www-h.eng.cam.ac.uk/help/tpl/textprocessing/squeeze.html)
