Contents

Chapter 1

Das gute Zeug

1.1 Document classes & differences

`\documentclass[...]{report, article, book, beamer}`
e.g. `\documentclass[11pt,a4paper]{report}`

1.1.1 Differences with regard to available commands and environments

- `book` and `report` feature the `\chapter` sectioning command, while `article` doesn't.
- In `book` and `report` , `\appendix` will cause `\chapter`s to be typeset as "Appendix X" instead of "Chapter X". For article, this isn't applicable.
- `book` and `report` will start a new page for `\part`s , while `article` won't.
- `book` offers the `\frontmatter` , `\mainmatter` , and `\backmatter` commands to control page numbering (Roman for the front matter, arabic elsewhere) and numbering of sectioning titles (no numbering in the front and back matter), while `report` and `article` don't.
- `book` *doesn't* offer the `abstract` environment, while `report` and `article` *do*.

1.1.2 Differences with regard to default settings

- The `book` class uses the `twoside` class option (which means different margins and header-s/footers for even and odd pages), while `report` and `article` use `oneside` .
- The `book` class uses the `twoside` class option (which means different margins and header-s/footers for even and odd pages), while `report` and `article` use `oneside` .
- `book` uses `openright` (new parts and chapters start on "right" pages, adding a blank page before if necessary), while `report` uses `openany` . (Note that "right" means an odd page in twoside mode, but any page in oneside mode.) For `article` , the distinction between `openright` and `openany` isn't applicable.
- `book` uses the `headings` pagestyle for non-chapter-starting pages, while `report` and `article` always use `plain` .
- `book` and `report` use `titlepage` (the title page and – if applicable – the `abstract` environment will be typeset on pages of their own), while `article` uses `notitlepage` .

- For `book` and `report` , the lowest-level sectioning command which is numbered and incorporated into the table of contents is `\subsection` , while for article it is `\subsubsection` .
- `book` and `report` will use the arguments of `\chapter` s and `\section` s for running headings (if such headings are present), while `article` will use `\section` s and `\subsection` s.
- `book` and `report` will number floats (figures, tables etc.), equations, and footnotes per chapter, while `article` will number them continuously. Note that footnotes – even when numbered per chapter – do not feature a chapter prefix.
- `book` and `report` will use `\bibname` (which defaults to "Bibliography") for the heading of bibliographic references, while article will use `\refname` (which defaults to "References").

1.2 Packages

1.2.1 Math

```
\usepackage{amsmath} % adds a lot of math stuff
\usepackage{mathtools} % fixes some amsmath things and adds more
\usepackage{amssymb} % adds a lot of math symbols
\usepackage{amsfonts} % stuff like \mathbb
\usepackage{mathrsfs} % for \mathscr
```

1.2.2 Fancy page style

```
\usepackage{fancyhdr}
```

1.2.3 Colors

```
\usepackage{color}
%or even better (adds names like \RoyalPurple)
\usepackage[dvipsnames]{xcolor}
```

Defining colors

`\definecolor{name}{HTML}{RRGGBB}` , we can could also use `rgb` or `gray` instead of `HTML` .

The option `[dvipsnames]` from `xcolor` defines PascalCase color names like in css like ' `MidnightBlue` '.

Using colors

`\colorbox {blue}{fundal}` - fundal

`\fcolorbox {Black}{White}{text}` - text - `\fcolorbox{margine}{fundal}{text}`

`\pagecolor{White}`

or `\color {red} hello \color {black}` - hello

or `{\color {red} hello}` - hello

1.2.4 Images

```
%preable
\usepackage{graphicx}
\usepackage{epstopdf}% for eps images

%in document
\includegraphics[scale=.4, angle=45]{something}
\includegraphics[width=3cm, height=4cm]{something}
\includegraphics[width=0.5\textwidth]{something}
```

Tell where the images are, relative to main `.tex` file:
`\graphicspath{ {./images/} {./images2/} }`

1.2.5 Figure

```
\begin{figure}[!hbt]
  \includegraphics[width=\textwidth]{plot}
  \caption{Caption}\label{plot}
\centering
\end{figure}
```

Note: You can use `wrapfigure` for wraping text around a figure. See `wraptable`. Options:

`h`	place here - kinda
`h!`	place here - more strict
`t`	top of the page
`b`	bottom of the page
`p`	on a special page

Two figures inline:

```
\begin{figure}[!hbt]
  \centering
  \includegraphics[height = 3cm]{stema.eps}
  \hspace{3cm}
  \includegraphics[width = 3cm]{Escher_Relativity.jpg}
  \caption[Imagini\^{i}n linie]{Stema Facult\u{a}\c{t}ii de Matematic\u{a}
    \c{s}i \textit{Relativitate} de M.C. Escher (1953)}\label{Stema_Escher2}
\end{figure}
```

Note: We can use minipages to number them separately.

To number them separately but within the same main number use `subfigure` (Requires the package `subfigure`):

```
\begin{figure}[!htb]
  \centering
  \subfigure[Stema Facult\u{a}\c{t}ii de Matematic\u{a}]{
    \includegraphics[height=3cm]{stema.eps}\label{Stema4}}
  \hspace{3cm}
  \subfigure[\textit{Relativitate} de M.C. Escher (1953)]{
    \includegraphics[width=3cm]{Escher_Relativity.jpg}\label{Escher4}
```

```
  }\\
  \caption{Stema Facult\u{a}\c{t}ii de Matematic\u{a}
    \c{s}i \textit{Relativitate} de M.C. Escher (1953)}\label{Stema_Escher4}}
\end{figure}
```

1.2.6 Unicode - fancy quotes

```
\usepackage[T1]{fontenc}
% allows inserting unicode directly in latex (i.e. from keyboard)
\usepackage[utf8]{inputenc} % \noncurs
```

`\quotesinglbase`	‚	Single low-9 quotation mark
`\quotedblbase`	„	Double low-9 quotation mark
`\guillemetleft`	«	Left-pointing double angle quotation mark
`\guillemetright`	»	Right-pointing double angle quotation mark
`\guilsinglleft`	‹	Single left-pointing angle quotation mark
`\guilsinglright`	›	Single right-pointing angle quotation mark
'	’	Single high quotation mark
`	‘	Single high-6 quotation mark
``	“	Double high-6 quotation mark
''	”	Double high-9 quotation mark
"	"	Double high-straight quotation mark

```
\begin{center}
\quotedblbase Cze\'s\'c'' czy ,,dzien dobry''. \\
\textquotedblleft Hello\textquotedblright{}
or ``Hi''.\\
\guillemetleft Bonjour\guillemetright{}.
\end{center}
```

„Cześć” czy „dzien dobry”.
“Hello” or “Hi”.
«Bonjour».

1.2.7 Centering and setting font sizes

Quick Usage:

```
\usepackage{sectsty}
\chaptertitlefont{\centering\LARGE}
\sectionfont{\Large}
```

Long list (tl;dr - executes ... before printing whatever it says): $\notin \mathscr{C}$

```
\allsectionsfont{...}
\partfont{... }
\chapterfont{...}
\sectionfont{...}
\subsectionfont{...}
\subsubsectionfont{...}
\paragraphfont{...}
\subparagraphfont{...}
\minisecfont{...}
\partnumberfont{...}
\parttitlefont{...}
\chapternumberfont{...}
\chaptertitlefont{...}
```

1.2.8 Links and references

```
\usepackage{hyperref}
\hypersetup{colorlinks=true, linkcolor=cyan, citecolor=green,
  filecolor=black, urlcolor=blue}
```

More in References and labels

1.2.9 Dots after chapters in table of contents

`\usepackage {tocloft}`

`\renewcommand{\cftchapleader}{\cftdotfill{\cftdotsep}}`

If we are in `article` , we use:

`\renewcommand{\cftsecleader}{\cftdotfill{\cftdotsep}}`

Note: if this command is misspelled the error doesn't appear immediately, but when a chapter is added to the Table of Contents.

1.3 Environments

1.3.1 Text alignment

`\begin{center} Centered \end{center}`

`\begin{flushleft} Left \end{flushleft}`

`\begin{flushright} Right \end{flushright}`

1.3.2 Mini Page

Useful for putting things side by side

Usage

```
\begin{minipage}[adjusting]{width of the minipage}
 Text | Images | ...
\end{minipage}
```

Adjustment

When adjusting the choices is: `c` (centers), `t` (top) and `b` (bottom). By default, `c` is used for centering. It is aligned by `t` and/or `b` at the highest (top line) and/or at the lowest line (bottom line).

Further options

Besides there are still further options, which however in practical application the minipage does not play a role like the height and the adjustment (again `c` , `t` and `b`) within the minipage.

Example of further options: `\begin{minipage}[t][5cm][b]{0,5\textwidth}`

This minipage now has a defined height of 5cm, and the content will now be aligned to the bottom of the minipage.

Hint

A mistake that is often made is, there is a blank line between the `\end{minipage}` and `\begin{minipage}` left. Then the pages are no longer together.

Example

```
\begin{minipage}[t]{0.3\textwidth}
  \includegraphics[width=\textwidth]{pic1}
\end{minipage}
```

1.3.3 Others

For `abstract`, `titlepage`, `thebibliography`, see Document Structure.

For math stuff, see Math[1].

1.4 Romanian Names and diacritics

1.4.1 Quick way $\notin \mathscr{C}$

```
\usepackage[romanian]{babel}
```

1.4.2 Long way

```
\renewcommand{\contentsname}{Cuprins}
\renewcommand{\chaptername}{Capitolul}

\renewcommand{\bibname}{B\lowercase{ibliografie}}
\renewcommand{\refname}{B\lowercase{ibliografie}} %in article

\renewcommand{\appendixname}{Anexa}
\renewcommand{\indexname}{I\lowercase{ndice}}
\renewcommand{\abstractname}{Rezumatul lucr\u{a}rii}
\renewcommand{\listtablename}{Lista de tabele}
\renewcommand{\listfigurename}{Lista de figuri}
```

Note: don't combine The Long way with The Quick way.

1.4.3 Proper diacritics $\notin \mathscr{C}$

```
\usepackage {combelow}
```

`\cb {s} \cb {t}, not \c {s} \c {t}` - ș ț, not ş ţ

Easier diacritics:

```
\code{\usepackage[romanian]{babel}}
\useshorthands{'}
\defineshorthand{'t}{\cb{t}}
```

[1] Natürlich

1.5 Macro definitions $\notin \mathscr{C}$

```
  \newcommand{\mat}[1]{\mathcal{M}_{#1}(\mathbb{R})}
% this "*" makes it that it complains if a \par is encountered
\newcommand*{\dx}[1][x]{\, \mathrm{d}#1}
\renewcommand{\contentsname}{Cuprins}


\usepackage{xparse}
% O, o optional, m= mandatory
\DeclareDocumentEnvironment{problema}{O {1} o m}{
  \begin{enumerate}[leftmargin=*]
    \addtocounter{enumi}{#1}
    \item
}{
  \end{enumerate}
  \IfValueT{#2}{\cppcode{#2}}
}
\newenvironment{\name}{begin}{end}
```

Using `\renewcommand` inside an environment will make that definition local to the environment.
Note: remember to add "`\\`" before the command name (ie. not `\newcommand {foo}{}`)

1.6 Fancy Headers

1.6.1 Main Commands

```
% inside the document
\pagestyle{fancy}
\thispagestyle{fancy} % only for one page
\lhead{\nouppercase{\leftmark}}
\chead{\chaptername}
\rhead{\rightmark}
\lfoot{\thechapter}
\cfoot{\thepage}
\rfoot{\thesection}

\fancyhf{} % reset the fancy settings
```

1.6.2 Page Styles

`empty`	Empty headers and footers
`plain`	The default, just the page number
`myheadings`	The page number in header - right on even pages and left on odd pages

1.6.3 Information commands

`\thepage`	the current page number
`\thechapter`	the number of the current chapter

`\thesection`	the number of the current section
`\chaptername`	the word chapter or equivalent in the current language
`\leftmark`	the name& number of the current level I structure (Chapter for reports and books classes; Section for articles) in uppercase letters.
`\rightmark`	the name and number of the current next to top-level structure (Section for reports and books; Subsection for articles) in uppercase letters.

1.7 References and labels

Requires `\usepackage {hyperref}`.

1.7.1 Labels

`\label {aLabel}` -
`\ref {aLabel}` - 1.7.1
`\ref *{aLabel}` - 1.7.1
`\nameref {aLabel}` - Labels
`\nameref *{aLabel}` - Labels
`\pageref {aLabel}` - 9
`\autoref {aLabel}` - subsection 1.7.1
`\hyperref [aLabel]{here}` - here
`\url {run:/usr/bin/firefox}` - `run:/usr/bin/firefox`
`\href {run:/usr/bin/firefox}{here}` - here
`\cite {author/19}` - [1]
`\cite [Chapter IV]{author/19}` - [1, Chapter IV]
`\eqref {aLabel}` - (1.7.1)

Adding "*" to `\...ref` will not create a clickable thing (the text is black).

Not adding `\phantomsection` before a link or reference might not center the page properly e.g. `\phantomsection\label{bLabel}`

1.7.2 Web Links

`\href {http://example.com/}{here}` - here
`\url {http://example.com/}` - `http://example.com/`
`\href {mailto:my_addr@a.com}{my\_addr@a.com}` - my_addr@a.com
`\nolinkurl` makes it so LaTeX doesn't complain about an invalid url
`\href {mailto:my_addr@a.org}{\nolinkurl {my_addr@a.org}}` - `my_addr@a.org`

1.7.3 Settings

Using `\usepackage[hidelinks]{hyperref}` will make links black.

Short way

```
\hypersetup{colorlinks=true, linkcolor=cyan, citecolor=green,
  filecolor=black, urlcolor=blue}
```

Full way $\notin \mathscr{C}$

```
\hypersetup{
    bookmarks=true,         % show bookmarks bar?
    unicode=false,          % non-Latin characters in Acrobat's bookmarks
    pdftoolbar=true,        % show Acrobat's toolbar?
    pdfmenubar=true,        % show Acrobat's menu?
    pdffitwindow=false,     % window fit to page when opened
    pdfstartview={FitH},    % fits the width of the page to the window
    pdftitle={My title},    % title
    pdfauthor={Author},     % author
    pdfsubject={Subject},   % subject of the document
    pdfcreator={Creator},   % creator of the document
    pdfproducer={Producer}, % producer of the document
    pdfkeywords={keyword1, key2, key3}, % list of keywords
    pdfnewwindow=true,      % links in new PDF window
    colorlinks=false,       % false: boxed links; true: colored links
    linkcolor=red,          % color of internal links
    citecolor=green,        % color of links to bibliography
    filecolor=magenta,      % color of file links
    urlcolor=cyan,          % color of external links
    %if colorlinks=false:
    linkbordercolor={1 0 0},% color of frame around internal links
    citebordercolor={0 1 0},% color of frame around citations
    urlbordercolor={0 1 1}  % color of frame around URL links
}
```

Note: The explicit RGB specification is only allowed for the border colors (like linkbordercolor etc.), while the others may only assigned to named colors.

1.8 Footnotes

1.8.1 Usage

`Text\footnote {hi there} more text.` - Text[2] more text.

To use whatever number:

`\footnote [9]{fn 2}` - [9]

To define footnote style:

`\renewcommand {\thefootnote }{\roman {footnote}}` - [iii] or

`\renewcommand {\thefootnote }{\fnsymbol {footnote}}\footnote {fn 4}` - [§]

Reset footnotes:

`\setcounter {footnote}{0}` -

For continuous footnotes:

`\usepackage {chngcntr}`

[2] hi there
[9] fn 2
[iii] like so
[§] fn 4

1.8.2 Number footnotes continuously in all chapters

In `book` and `report` footnotes are reset every chapter, to number them continuously do this: `\counterwithout{footnote}{chapter}` [1]

1.8.3 Forcing footnotes when it doesn't work

In math mode[2] and tables `\footnote` doesn't work. Instead use `\footnotemark [18]` - [18]

`\footnotetext [18]{Hi there}` -

e.g. `foo\footnote {not shown}` - foo[3] this is inside a table

e.g. `bar\footnotemark` - bar[4] this is inside a table

e.g. `baz\footnotemark` - baz[5] this is inside a table

e.g. `\footnotetext {Now shown}` -

Note: Using multiple `\footnotemark`s might not number them properly

e.g. `\footnotetext {Now shown 2}` -

1.9 Symbols

1.9.1 The bane of students

```
$\backslash$ \textbackslash
$\sharp$ \#
\checkmark - ✓
\LaTeX - LaTeX
\copyright - ©
```

1.9.2 Diacritics

`\^{a}`	â	circumflex	`\={o}`	ō	macron accent
`\`{o}`	ò	grave accent	`\b {o}`	o̲	bar under the letter
`\'{o}`	ó	acute accent	`\.{o}`	ȯ	dot over the letter
`\^{o}`	ô	circumflex	`\d {u}`	ụ	dot under the letter
`\"{o}`	ö	umlaut, trema or dieresis	`\r {a}`	å	ring over the letter
`\H {o}`	ő	Hungarumlaut	`\u {o}`	ŏ	breve over the letter
`\~{o}`	õ	tilde	`\v {s}`	š	caron/háček
`\c {c}`	ç	cedilla	`\t {oo}`	o͡o	tie over the two letters
`\cb {s}`	ș	comma bellow	`\i \j`	ıȷ	dotless i and j
`\k {a}`	ą	ogonek	`\o`	ø	slashed o
`\l {}`	ł	barred l	`\ss`	ß	scharfes s

[1] Requires the package `chngcntr`

[2] but not in the `equation` environment

[18] Hi there

[5] Now shown

[5] Now shown 2

1.10 Spacing

1.10.1 Indentaion

```
\noindent not indenting otherwise indented text\\
\indent indenting otherwise unindented text
```

not indenting otherwise indented text
indenting otherwise unindented text

1.10.2 Vertical (that way ↓)

`\par` - Next paragraph (like `\\` but with indent)

`\newpage \pagebreak \clearpage` - duh

`\smallskip \medskip \bigskip` - duh

`\cleardoublepage` - in book mode goto next odd page

`\\[10cm] \vspace{10pt}` - vertical space of height (might require newline after)

`\vfill` - add spaces till the end of page

1.10.3 Horizontal (that way →)

`\-` - hyphenation point

e.g. `Panzer\-kampf\-wagen VI Tiger Aus\-füh\-rung B ,,Königs\-tiger''` - Panzerkampf-wagen VI Tiger Ausführung B „Königstiger”
alternative: `\hyphenation{Panzer-kampf-wagen}`

`\hspace{10pt}` - exact unit - might be negative `M\hspace{-9pt}M` - MM

`\!` - negative space

`\thinspace \medspace \thickspace` ⟺ `\, \: \;` - duh

`~ \ \quad \qquad` - bigger

e.g. `a\, b\: c\; d~e\ f\quad g\qquad h` - a b c d e f g h

`\vfill` - add spaces till the end of line

`\dotfill` - add dots till the end of line

```
Hello \hfill there\\
General \dotfill Kenobi
```

Hello there
General ..... Kenobi

Note: `~` is non breaking space.

1.10.4 Line spacing $\notin \mathscr{C}$

```
\linespread{1.3} % ~1.5
\linespread{1.6} % ~2
\setstretch{2} % 2
```

or:

```
\singlespacing
\doublespacing

\begin{singlespace}  ...\end{singlespace}
\begin{doublespace}  ...\end{doublespace}
```

```
\begin{onehalfspace}  ...\end{onehalfspace}
\begin{spacing}{factor}  ...\end{spacing}{factor}
```

1.11 ~~Pointless~~ Miscellaneous

1.11.1 Striketrough

`\usepackage {soul}` `\st {text}` - ~~text~~

1.11.2 Page Numbers

`\thispagestyle {empty}`	no page number
`\pagenumbering {roman}`	roman i ii
`\pagenumbering {Roman}`	Roman I II
`\pagenumbering {arabic}`	arabic
`\pagenumbering {alph}`	alph - a b
`\pagenumbering {Alph}`	alph - A B

`\pagenumbering` resets the counter, use `\setcounter{page}{7}` afterwards to set the counter
It can be useful to do something like this:

```
\pagenumbering{roman}
<The table of contents, introduction ...>
\pagenumbering{arabic}
```

1.11.3 Self explanatory

```
\include{smth.txt}
\input{smth.txt} % same as include, but without a \clearpage in front
\tableofcontents
\listoffigures
\listoftables

\newpage
\clearpage
```

Chapter 2

Math

2.1 Math mode

- **Inline** can be entered by using `$...$` or `\(...\)`, or by using the environment `math`
- **Displayed** mode can be entered using `\[...\]` or with the environment `displaymath`. Using the environment `equation` automatically numbers the equation.
  `equation*` and `displaymath` are functionally equivalent

e.g. `\[F(x) = \int f(x)\, dx \]` -

$$F(x) = \int f(x)\, dx$$

e.g. `$F(x) = \int f(x)\,dx$` - $F(x) = \int f(x)\, dx$

Note: Adding `fleq` in the `\documentclass` options aligns equations to the left

Most spaces are ignored, and must be specified manually. **Note:** LaTeX complains if you leave empty lines in math mode.

Adding `\numberwithin{equation}{section}` will reset equation numbers every section. `chapter` may also be used.

2.1.1 Bold Math

```
this doesn't work: \textbf{Text $f$}\\
this works: \textbf{Text} $\boldsymbol{f}$
```

this doesn't work: **Text** f
this works: **Text** $\boldsymbol{f}$

2.1.2 Font size

`\displaystyle`	$\int$
`\textstyle`	$\int$
`\scriptstyle`	$\int$
`\scriptscriptsyle`	$\int$

Declaring `\everymath{\displaystyle}` in the preamble will force `\displaystyle` in all math environments

2.2 Environments

Note: Adding `\nonumber` to an otherwise numbered environments cancels the numbering.
Note: Adding more white space than needed inside `align` and `aligned` makes latex complain.
Since "a picture is worth a thousand words", just look at this:

2.2.1 align

Writing `\allowdisplaybreaks` in the preamble allows splitting an equation written in `align` on multiple pages.

```
\begin{align}
  a &= 3\\
    &= 2 + 1 \nonumber \\
    &= 2 + \sigma(0)
\end{align}
```

$$a = 3 \tag{2.1}$$
$$= 2 + 1$$
$$= 2 + \sigma(0) \tag{2.2}$$

Adding small interjections to align:

```
\begin{minipage}{3in}
\begin{align*}
\intertext{If}
   A &= \sigma_1+\sigma_2\\
   B &= \rho_1+\rho_2\\
\intertext{then}
C(x) &= e^{Ax^2+\pi}+B
\end{align*}
\end{minipage}
```

If

$$A = \sigma_1 + \sigma_2$$
$$B = \rho_1 + \rho_2$$

then

$$C(x) = e^{Ax^2+\pi} + B$$

2.2.2 aligned

Like align but used inside math mode. Useful for numbering multiple lines once.

```
\begin{equation}
\begin{aligned}
  a &= 3\\
    &= 2 + \sigma(0)
\end{aligned}
\end{equation}
```

$$\begin{aligned} a &= 3 \\ &= 2 + \sigma(0) \end{aligned} \tag{2.3}$$

2.2.3 eqnarray

People on the internet say "don't use `eqnarray`" so we won't talk about it.

2.2.4 subequations

```
\begin{subequations}
\begin{align}
  a &= 3\\
  &= 2 + \sigma(0)
\end{align}
\end{subequations}
```

$$a = 3 \tag{2.4a}$$
$$= 2 + \sigma(0) \tag{2.4b}$$

or:

```
\begin{subequations}
\begin{equation}
  a = 3\label{blasphemy}
\end{equation}
Therefore:
\begin{equation}
  \int_0^1\sqrt{1-x^2} dx = \frac{3}{4}
\end{equation}
\end{subequations}

The equation \eqref{blasphemy} %(\ref{blasphemy})
is obviously false\footnote{
  Unless you are an engineer}.
```

$$a = 3 \tag{2.5a}$$

Therefore:

$$\int_0^1 \sqrt{1-x^2}dx = \frac{3}{4} \tag{2.5b}$$

The equation (2.5a) is obviously false[a].

[a] Unless you are an engineer

2.2.5 cases

Useful for functions with multiple branches.

```
\[f(x) =
\begin{cases}
  \int\frac{\sin(x)}{x},&\text{daca } x \neq 0,\\
  1,&\text{daca } x=0.
\end{cases}
\]
```

$$f(x) = \begin{cases} \int \frac{\sin(x)}{x}, & \text{daca } x \neq 0, \\ 1, & \text{daca } x = 0. \end{cases}$$

With displaystyle:

```
\[f(x) =
\begin{dcases}
  \int\frac{\sin(x)}{x},&\text{daca } x \neq 0,\\
  1,&\text{daca } x=0.
\end{dcases}
\]
```

$$f(x) = \begin{cases} \displaystyle\int \frac{\sin(x)}{x}, & \text{daca } x \neq 0, \\ 1, & \text{daca } x = 0. \end{cases}$$

If there's a lot of plain text on the right[1]:

```
\[f(x) =
  \begin{dcases*}
    \int \frac{\sin(x)}{x},&daca $x \neq 0$,\\
    1,& daca $x=0$.
  \end{dcases*}
\]
```

$$f(x) = \begin{cases} \displaystyle\int \frac{\sin(x)}{x}, & \text{daca } x \neq 0, \\ 1, & \text{daca } x = 0. \end{cases}$$

Nice spacing:

```
%\newcommand{\parti}[2]{\frac{\partial #1}
%  {\partial #2}}
\[f(x, y) =
\begin{dcases}
  \parti{g}{x}\,,&\text{daca } x y \geq 0,\\[0.5em]
  \parti{g}{y}\,,&\text{daca } x y < 0,
\end{dcases}
\]
```

$$f(x,y) = \begin{cases} \dfrac{\partial g}{\partial x}, & \text{daca } xy \geq 0, \\[0.5em] \dfrac{\partial g}{\partial y}, & \text{daca } xy < 0, \end{cases}$$

[1] same goes for `cases*`

vs

```
\[f(x, y) =
\begin{dcases}
 \parti{g}{x},&\text{daca } x y \geq 0,\\
 \parti{g}{y},&\text{daca } x y < 0,
\end{dcases}
\]
```

$$f(x,y) = \begin{cases} \dfrac{\partial g}{\partial x}, & \text{daca } xy \geq 0, \\ \dfrac{\partial g}{\partial y}, & \text{daca } xy < 0, \end{cases}$$

2.2.6 matrix

For writing matrices with more columns (default is 10): `\setcounter{MaxMatrixCols}{15}`

Environment name	Surrounding delimiter
pmatrix	()
bmatrix	[]
Bmatrix	{}
vmatrix	|
Vmatrix	||

```
\[
A_{m,n} =
 \begin{pmatrix}
  a_{1,1} & a_{1,2} & \cdots & a_{1,n} \\
  a_{2,1} & a_{2,2} & \cdots & a_{2,n} \\
  \vdots  & \vdots  & \ddots & \vdots  \\
  a_{m,1} & a_{m,2} & \cdots & a_{m,n}
\end{pmatrix}
\]
```

$$A_{m,n} = \begin{pmatrix} a_{1,1} & a_{1,2} & \cdots & a_{1,n} \\ a_{2,1} & a_{2,2} & \cdots & a_{2,n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m,1} & a_{m,2} & \cdots & a_{m,n} \end{pmatrix}$$

Nicer spacing:

```
\begin{equation*}
  \begin{bmatrix*}[r]
    x    & -y+y' & z+z'\medskip  \\
    u    &  v    & w   \medskip  \\
    -r-r'&  s    & -t
  \end{bmatrix*}
\end{equation*}
```

$$\begin{bmatrix} x & -y+y' & z+z' \\ u & v & w \\ -r-r' & s & -t \end{bmatrix}$$

`hline` adds a horizontal line. Adding a `|` like below adds a vertical line.

```
\[
\begin{array}{c|c}
  1 & 2 \\
  \hline
  3 & 4
 \end{array}
\]
```

$$\begin{array}{c|c} 1 & 2 \\ \hline 3 & 4 \end{array}$$

```
\[
M = \bordermatrix{~ & x & y \cr
                  A & 1 & 0 \cr
                  B & 0 & 1 \cr}
\]
```

$$M = \begin{array}{c} \\ A \\ B \end{array} \begin{array}{c} \begin{array}{cc} x & y \end{array} \\ \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \end{array}$$

```
A matrix in text must be set smaller:
$\bigl(\begin{smallmatrix}
a&b \\ c&d
\end{smallmatrix} \bigr)$
to not increase leading in a portion of text.
```

A matrix in text must be set smaller: $\left(\begin{smallmatrix} a & b \\ c & d \end{smallmatrix}\right)$ to not increase leading in a portion of text.

```
\[
  \boldsymbol{\beta} =
     (\beta_1,\beta_2,\dotsc,\beta_n)
\]
```

$$\boldsymbol{\beta} = (\beta_1, \beta_2, \dots, \beta_n)$$

Adding a "*" after the name allows us to specify alignment:

```
\[
\begin{matrix}
  -1 & 3 \\
  2 & -4
 \end{matrix}
 =
 \begin{matrix*}[r]
  -1 & 3 \\
  2 & -4
 \end{matrix*}
\]
```

$$\begin{matrix} -1 & 3 \\ 2 & -4 \end{matrix} = \begin{matrix*}[r] -1 & 3 \\ 2 & -4 \end{matrix*}$$

2.3 Symbols

Regular

`$+ - = ! / ( ) [ ] < > | ' : *$` - $+ - = ! / ( ) [ ] < > | ' : *$

Greek

Only showing peculiar symbols. Most have intuitive names.

```
\[\begin{matrix}
  \gamma & \eta    & \kappa\\
  \mu    & \nu     & \varphi\\
  \rho   & \varrho & \chi
\end{matrix}\]
```

$$\begin{matrix} \gamma & \eta & \kappa \\ \mu & \nu & \varphi \\ \rho & \varrho & \chi \end{matrix}$$

Operators

Most multiple letter functions have a separate command (eg. `\sin` - sin).

Other peculiar symbols are:

`\liminf` - $\liminf$

`\limsup` - $\limsup$

For declaring custom operators: `\operatorname {atan}(x)` - $\operatorname{atan}(x)$

or if it's used frequently: `\DeclareMathOperator*{\atan}{atan}` (in preamble).

Sums, integrals, and other "big" symbols

`\sum`	$\sum$	`\prod`	$\prod$	`\coprod`	$\coprod$
`\bigoplus`	$\bigoplus$	`\bigotimes`	$\bigotimes$	`\bigodot`	$\bigodot$
`\bigcup`	$\bigcup$	`\bigcap`	$\bigcap$	`\biguplus`	$\biguplus$
`\bigsqcup`	$\bigsqcup$	`\bigvee`	$\bigvee$	`\bigwedge`	$\bigwedge$
`\int`	$\int$	`\oint`	$\oint$	`\iint`	$\iint$
`\iiint`	$\iiint$	`\iiiint`	$\iiiint$	`\idotsint`	$\int\cdots\int$

Fancy braces

```
\[
( a ), [ b ], \{ c \}, | d |, \| e \|,
\langle f \rangle, \lfloor g \rfloor,
\lceil h \rceil, \ulcorner i \urcorner
\]
```

$$(a), [b], \{c\}, |d|, \|e\|, \langle f\rangle, \lfloor g\rfloor, \lceil h\rceil, \ulcorner i\urcorner$$

Fractions

```
\[
x = a_0 + \cfrac{1}{a_1
          + \cfrac{1}{a_2
            + \cfrac{1}{a_3 +\cfrac{1}{a_4} } } }
\]
```

$$x = a_0 + \cfrac{1}{a_1 + \cfrac{1}{a_2 + \cfrac{1}{a_3 + \cfrac{1}{a_4}}}}$$

vs

```
\[
x = a_0 + \frac{1}{a_1
          + \frac{1}{a_2
            + \frac{1}{a_3 + \frac{1}{a_4} } } }
\]
```

$$x = a_0 + \frac{1}{a_1 + \frac{1}{a_2+\frac{1}{a_3+\frac{1}{a_4}}}}$$

There's also the option for slanted fractions (requires `\usepackage {xfrac}`):
`\sfrac {1}{2}` - ½

Automatic sizing

```
\[
P\left(A=2\middle|\frac{A^2}{B}>4\right)
\]
```

$$P\left(A = 2\middle|\frac{A^2}{B} > 4\right)$$

Manual sizing

```
\[
  ( \big( \Big( \bigg( \Bigg(
  \frac{\mathrm d}{\mathrm d x} \big( k g(x) \big)
\]
```

$$(\big(\Big(\bigg(\Bigg(\frac{\mathrm{d}}{\mathrm{d}x}(kg(x))$$

Accents

`a' or a ^{}`	$a' \text{ or } a\hat{}$	`a''`	a''
`\hat {a}`	$\hat{a}$	`\bar {a}`	$\bar{a}$
`\grave {a}`	$\grave{a}$	`\acute {a}`	$\acute{a}$
`\dot {a}`	$\dot{a}$	`\ddot {a}`	$\ddot{a}$
`\overrightarrow {AB}`	$\overrightarrow{AB}$	`\overleftarrow {AB}`	$\overleftarrow{AB}$
`\overline {aaaa}`	$\overline{aaaa}$	`\check {a}`	$\check{a}$
`\breve {a}`	$\breve{a}$	`\vec {a}`	$\vec{a}$
`\dddot {a}`	$\dddot{a}$	`\ddddot {a}`	$\ddddot{a}$
`\widehat {ABC}`	$\widehat{ABC}$	`\widetilde {AAA}`	$\widetilde{AAA}$
`\tilde {a}`	$\tilde{a}$	`\underline {a}`	$\underline{a}$
`\underset {u}{abc}`	$\underset{u}{abc}$	`\overset {o}{abc}`	$\overset{o}{abc}$
`\underbrace {abc}`	$\underbrace{abc}$	`\overbrace {abc}`	$\overbrace{abc}$
`\stackrel \frown {AAA}`	$\stackrel{\frown}{AAA}$		

E.g.:

```
\[
  \overline { \overline{A} \cup
    \overline{\overline{B}} }
  = A \cap \overline{B} \, ,\quad
  \text{folosind legile lui De Morgan}
\]
```

$$\overline{\overline{A} \cup \overline{\overline{B}}} = A \cap \overline{B}\,, \quad \text{folosind legile lui De Morgan}$$

Dots

`\dots`	$\dots$	generic dots (ellipsis), to be used in text (outside formulae as well). It automatica
`\ldots`	$\ldots$	similar to the previous, but no whitespace management
`\cdots`	$\cdots$	centered dots
`\vdots`	$\vdots$	vertical dots
`\ddots`	$\ddots$	diagonal dots
`\iddots`	$\iddots$	inverse diagonal dots (requires the package `mathdots`)
`\hdotsfor {n}`	$\dots\dots$	a row of dots spanning n columns.

Other operators

Binary and relation

`<`	$<$	`>`	$>$	`=`	$=$	`\doteq`	$\doteq$
`\leq`	$\leq$	`\geq`	$\geq$	`\equiv`	$\equiv$	`\approx`	$\approx$
`\ll`	$\ll$	`\gg`	$\gg$	`\cong`	$\cong$	`\simeq`	$\simeq$
`\subset`	$\subset$	`\supset`	$\supset$	`\sim`	$\sim$	`\propto`	$\propto$
`\subseteq`	$\subseteq$	`\supseteq`	$\supseteq$	`\parallel`	$\parallel$	`\nparallel`	$\nparallel$
`\nsubseteq`	$\nsubseteq$	`\nsupseteq`	$\nsupseteq$	`\asymp`	$\asymp$	`\bowtie`	$\bowtie$
`\sqsubset`	$\sqsubset$	`\sqsupset`	$\sqsupset$	`\vdash`	$\vdash$	`\dashv`	$\dashv$

`\sqsubseteq`	$\sqsubseteq$	`\sqsupseteq`	$\sqsupseteq$	`\smile`	$\smile$	`\frown`	$\frown$
`\preceq`	$\preceq$	`\succeq`	$\succeq$	`\prec`	$\prec$	`\succ`	$\succ$
`\in`	$\in$	`\ni`	$\ni$	`\notin`	$\notin$	`\neq`	$\neq$
`\mid`	$\mid$	`\perp`	$\perp$	`\models`	$\models$	`\therefore`	$\therefore$
`\sphericalangle`	$\sphericalangle$	`\measuredangle`	$\measuredangle$	`\leqslant`	$\leqslant$	`\geqslant`	$\geqslant$
`\subsetneq`	$\subsetneq$	`\varsubsetneq`	$\varsubsetneq$	`\subsetneqq`	$\subsetneqq$	`\subseteqq`	$\subseteqq$
`\nleq`	$\nleq$	`\ngeq`	$\ngeq$	`\nsim`	$\nsim$	`\nleqslant`	$\nleqslant$

`\pm`	$\pm$	`\mp`	$\mp$	`\cup`	$\cup$	`\cap`	$\cap$
`\div`	$\div$	`\times`	$\times$	`\vee`	$\vee$	`\wedge`	$\wedge$
`\ast`	$\ast$	`\star`	$\star$	`\sqcup`	$\sqcup$	`\sqcap`	$\sqcap$
`\setminus`	$\setminus$	`\smallsetminus`	$\smallsetminus$	`\uplus`	$\uplus$	`\wr`	$\wr$
`\dagger`	$\dagger$	`\ddagger`	$\ddagger$	`\bigtriangleup`	$\bigtriangleup$	`\bigtriangledown`	$\bigtriangledown$
`\cdot`	$\cdot$	`\odot`	$\odot$	`\triangleleft`	$\triangleleft$	`\diamond`	$\diamond$
`\oplus`	$\oplus$	`\ominus`	$\ominus$	`\circ`	$\circ$	`\amalg`	$\amalg$
`\oslash`	$\oslash$	`\otimes`	$\otimes$	`\bigcirc`	$\bigcirc$	`\bullet`	$\bullet$

Logic and arrows

`\exists`	$\exists$	`\nexists`	$\nexists$	`\rightarrow` or `\to`	$\rightarrow$	`\leftarrow` or `\gets`	$\leftarrow$
`\forall`	$\forall$	`\neg`	$\neg$	`\mapsto`	$\mapsto$	`\leftrightarrow`	$\leftrightarrow$
`\land`	$\land$	`\lor`	$\lor$	`\leftrightharpoons`	$\leftrightharpoons$	`\leftrightarrows`	$\leftrightarrows$
`\top`	$\top$	`\bot`	$\bot$	`\implies`	$\implies$	`\Rightarrow`	$\Rightarrow$
`\emptyset`	$\emptyset$	`\varnothing`	$\varnothing$	`\iff`	$\iff$	`\Leftrightarrow`	$\Leftrightarrow$
`\langle`	$\langle$	`\rangle`	$\rangle$	`\vert`	$\vert$	`\Vert`	$\Vert$
`\angle`	$\angle$	`\backslash`	$\backslash$	`\mid`	$\mid$	`\\|`	$\|$
`\uparrow`	$\uparrow$	`\downarrow`	$\downarrow$	`\Uparrow`	$\Uparrow$	`\Downarrow`	$\Downarrow$
`\nrightarrow`	$\nrightarrow$	`\longmapsto`	$\longmapsto$	`\varsubsetneq`	$\varsubsetneq$	`\Leftarrow`	$\Leftarrow$
`\leadsto`	$\leadsto$	`\updownarrow`	$\updownarrow$	`\longrightarrow`	$\longrightarrow$	`\Longrightarrow`	$\Longrightarrow$
`\nearrow`	$\nearrow$	`\searrow`	$\searrow$	`\swarrow`	$\swarrow$	`\nwarrow`	$\nwarrow$

Other symbols

`\partial`	∂	`\imath`	$\imath$	`\Re`	$\Re$	`\nabla`	∇	`\aleph`	$\aleph$	`\square`	$\square$
`\eth`	$\eth$	`\jmath`	$\jmath$	`\Im`	$\Im$	`\Box`	$\Box$	`\beth`	$\beth$	`\blacksquare`	$\blacksquare$
`\hbar`	$\hbar$	`\ell`	ℓ	`\wp`	$\wp$	`\infty`	∞	`\gimel`	$\gimel$	`\&`	$\&$

More non-math symbols are at page 11.

Misc

`x \equiv a \pmod {b}`	$x \equiv a \pmod b$
`a \bmod {b}`	$a \bmod b$
`\sqrt [5]{n}`	$\sqrt[5]{n}$
`\frac {a}{b}`	$\frac{a}{b}$

```
\left ( \frac {a}{b} \right )
\left \{ \frac {a}{b} \right .
```

$$\left (\frac {a}{b} \right) \quad \left \{ \frac {a}{b} \right .$$

Limits

```
\lim _{x \to \infty }
\lim \limits _{x \to \infty }
\lim \nolimits _{x \to \infty }
```

$$\lim _{x \to \infty } \quad \lim \limits _{x \to \infty } \quad \lim \nolimits _{x \to \infty }$$

```
\sum _{k = 0}^\infty
\sum \limits _{k = 0}^\infty
\sum \nolimits _{k = 0}^\infty
```

$$\sum _{k = 0}^\infty \quad \sum \limits _{k = 0}^\infty \quad \sum \nolimits _{k = 0}^\infty$$

Multiple things in limit:

```
\[\sum\limits_{\substack{
   0<i<m \\
   0<j<n
  }} ^{\substack{1\\2}}
P(i,j)
\]
```

$$\sum_{\substack{0<i<m \\ 0<j<n}} ^{\substack{1\\2}} P(i,j)$$

Things over and below arrows and equals

Requires the package `\usepackage {extarrows}`.

```
\[
 A \overset{!}{=} B; A \stackrel{!}{=} B
\]
\[
  x \overset{text}{\Longrightarrow} y
\]
```

$$A \overset{!}{=} B; A \stackrel{!}{=} B$$

$$x \overset{text}{\Longrightarrow} y$$

Or, for longer text:

```
\[A \xlongequal{\text{long text}} B \]
\[A \xleftarrow{\text{this way}} B
  \xrightarrow[\text{bottom }]{\text{top}} C
\]
```

$$A \xlongequal{\text{long text}} B$$

$$A \xleftarrow{\text{this way}} B \xrightarrow[\text{bottom }]{\text{top}} C$$

Horizontal braces:

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

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

Nicer spacing on equals:

`$y \xlongequal {\hspace {-4pt}\mathrm {def}\hspace {-4pt}}f(x)$` - $y \xlongequal {\hspace {-4pt}\mathrm {def}\hspace {-4pt}} f(x)$

To make integrals look like this $\int_a^b$:

`\int\limits_a^b`

or, if it's used frequently, add this in preamble to make all look like this:

`\usepackage[intlimits]{amsmath}`

Boxed equations

```
\begin{equation}
 \boxed{x^2+y^2 = z^2}
\end{equation}
```

$$\boxed{x^2 + y^2 = z^2} \tag{2.6}$$

```
\fbox{
 \addtolength{\linewidth}{-2\fboxsep}%
 \addtolength{\linewidth}{-2\fboxrule}%
 \begin{minipage}{\linewidth}
  \begin{equation}
   x^2+y^2=z^2
  \end{equation}
 \end{minipage}
}
```

$$x^2 + y^2 = z^2 \tag{2.7}$$

Nice vertical space

```
\centering
%not really well shown here but \, can be useful
$\int f(x)\,dx$ vs $\frac{a}{b} \cdot x$\\
$(x - y) \in \R, \quad \forall x, y \in \R$
```

$\int f(x)\,dx$ vs $\frac{a}{b} \cdot x$
$(x - y) \in \mathbb{R}, \quad \forall x, y \in \mathbb{R}$

1. Text over and under arrows:

2. Theorems: `\usepackage {amsthm}`

2.4 Equations Naming and number placement

```
\begin{equation}
f(x) = y \tag{Fancy Thing}\label{fThing}
\end{equation}
We defined this \eqref{fThing}
```

$$f(x) = y \tag{Fancy Thing}$$

We defined this (Fancy Thing)

No parens:

```
\begin{equation}
f(x) = y \tag*{Fancy Thing}\label{fThing2}
\end{equation}
We defined this \eqref{fThing2}
```

$$f(x) = y \tag*{Fancy Thing}$$

We defined this (Fancy Thing)

Adding `leqno` in documentclass options like below will put the numbers on the left.

`\documentclass[a4paper,leqno]{article}`

2.5 Theorem environments

Note: `\emph` might be useful inside theorems

2.5.1 Without `asmthm`

```
\newtheorem{theo}{Teorema}
%the [theo] signifies that all these environments share the same counter
\newtheorem{corol}[theo]{Corolarul}
\newtheorem{defin}[theo]{Defini\c{t}ia}
\newtheorem{exem}[theo]{Exemplul}
\newtheorem{exer}[theo]{Exerci\c{t}iul}
\newtheorem{lema}[theo]{Lema}
\newtheorem{prop}[theo]{Propozi\c{t}ia}
\newtheorem{rem}[theo]{Remarca}
\newenvironment{proof}{\noindnt\textbf{Demonstratie.}}{\hfill\rule{.5em}{.5em}}
```

That square is made using `\rule[raise]{width}{thickness}` (raise means above or below the baseline)

This will number theorems continuously throughout the document. To reset the counter each chapter/ section define like so: `\newtheorem{theo}{Teorema}[chapter]`

Adding `[Some name]` will name that theorem.

```
\begin{theo}[Trichotomy theorem]
  Let $x \in \R, y \in \R$, $(x = y) \lor (x < 0)
  \lor (x > 0)$.
\end{theo}
\begin{proof}
  The proof is trivial and left as
  an exercise to the reader.
\end{proof}
\begin{corol}
$x \neq 0 \implies (x < 0) \lor (x > 0)$
\end{corol}
```

Teorema 1 (Trichotomy theorem)**.** *Let* $x \in \mathbb{R}, y \in \mathbb{R}$, $(x = y) \lor (x < 0) \lor (x > 0)$.

Demonstraţie. The proof is trivial and left as an exercise to the reader. ■

Corolarul 2. $x \neq 0 \implies (x < 0) \lor (x > 0)$

2.5.2 With `asmthm`

Adding a "*" after `\newtheorem` will not number any theorem of that type like so: `\newtheorem*{rem}[theo]{Remarca}`

Theorem styles:

Name	Appearance
`plain`	**Theorem 1.** *Some text.*
`definition`	**Definition 1.** Some text.
`remark`	*Remark 1.* Some text.

Custom theorems: $\notin \mathscr{C}$

```
\newtheoremstyle{stylename}% name of the style to be used
  {spaceabove}% measure of space to leave above the theorem. E.g.: 3pt
  {spacebelow}% measure of space to leave below the theorem. E.g.: 3pt
```

```
  {bodyfont}% name of font to use in the body of the theorem
  {indent}% measure of space to indent
  {headfont}% name of head font
  {headpunctuation}% punctuation between head and body
  {headspace}% space after theorem head; " " = normal interword space
  {headspec}% Manually specify head
```

```
\theoremstyle{plain} %the default style
\newtheorem{theo}{Teorema}[section]
\newtheorem{corol}[theo]{Corolarul}
\newtheorem{prop}{Propozi\c{t}ia}[section]
\theoremstyle{definition}
\newtheorem{defin}{Defini\c{t}ia}[section]
\newtheorem{exem}{Exemplul}[section]
```

Proof now becomes:

```
  \renewcommand*{\proofname}{\noindent\textbf{Demonstra\c{t}ie.}}
```

To replace the Q.E.D. symbol: $\notin \mathscr{C}$

```
\renewcommand{\qedsymbol}{$\blacksquare$}
```

```
\begin{theo}
  This is a theorem $f = 0$.
\end{theo}
\begin{proof}
Here is the proof:
\[a^2 + b^2 = c^2 \qedhere\]
\end{proof}

\begin{proof}
Here is another proof:
\[a^2 + b^2 = c^2 \]
\end{proof}
```

Teorema 3. *This is a theorem* $f = 0$.

Demonstraţie. Here is the proof:

$$a^2 + b^2 = c^2$$ ■

Demonstraţie. Here is another proof:

$$a^2 + b^2 = c^2$$

■

Doing something like this might be useful to add a symbol at the end:

```
\newenvironment{exem}{\begin{example}}{\hfill$\diamond$\end{example}}
```

Chapter 3

Tables and lists

3.1 Tables

3.1.1 The `tabular` environment

```
\begin{tabular}[pos]{table spec}
```

Note: a very common mistake is not defining the centering (ie `\begin {tabular}{l l}\end {tabular}`)

The `table spec` argument tells LaTeX the alignment to be used in each column and the vertical lines to insert.

The number of columns isn't specified, since it's inferred by looking at the number of arguments provided.

Things you can add inside `table spec` :

`l`	left justified column
`c`	center justified column
`r`	right justified column
`p{'width'}`	paragraph column with text vertically aligned at the top
`m{'width'}`	paragraph column with text vertically aligned in the middle (requires array package)
`b{'width'}`	paragraph column with text vertically aligned at the bottom (requires array package)
`|`	vertical line
`||`	double vertical line

To specify a font format (such as bold, italic, etc.) for an entire column, you can add `>{\format}` before you declare the alignment. For example `\begin{tabular}{ >{\bfseries}l c >{\itshape}r }` . This requires the package `array` .

```
\begin{tabular}{|l|c|r || p{1cm}|m{1cm}|b{1cm}|}
l & c & r & p & m &b\\
\hfill l \hfill & \hfill c &\hfil r \hfil &
\hfill p \hfill & \hfill m &\hfil b \hfil\\
aaa & bbb & ccc &
AAA BBB CCC DDD&
AAA BBB CCC DDD&
AAA BBB CCC DDD\\
\end{tabular}
```

l	c	r	p	m	b
l	c	r	p	m	b
aaa	bbb	ccc	AAA BBB CCC DDD	AAA BBB CCC DDD	AAA BBB CCC DDD

By default, if the text in a column is too wide for the page, LaTeX won't automatically wrap

it. Using `p{'width'}` you can define a special type of column which will wrap-around the text as in a normal paragraph.

In `p` `m` `b` the text is always left aligned. we could use `\hfill` to override this, sometimes `\hfil` can also be useful.

Multiple columns can be defined at the same time using `*{count}{table spec}`. E.g:

```
\begin{tabular}{*{2}{l} *{2}{|c} |}
a & b & c& d\\
aaa & bbb & ccc& ddd
\end{tabular}
```

a	b	c	d
aaa	bbb	ccc	ddd

The optional parameter `pos` specifies the vertical position relative to the baseline of the surrounding text. You can use:

`b` bottom
`c` center (default)
`t` top

For adding horizontal lines we use `\hline` or `\hline\hline` for a double line.

```
Foo \quad
\begin{tabular}[b]{|l|| r | c|}\hline
Name & Math & LaTeX \\[0.3cm]\hline\hline
\L{}ucasz & 8 & 9 \\\hline
Wojtek & 12 & 1 \\\hline
\end{tabular} bar \ldots
```

Foo

Name	Math	LaTeX
Łucasz	8	9
Wojtek	12	1

bar ...

```
Foo \quad
\begin{tabular}[c]{|m{2cm}|| m{1.5cm} | m{1.5cm}|}\hline
Country & Flammen\-werfer & Panzerkampfwagen  \\\hline\hline
Russia & - & - \\\hline
Germany & \checkmark & \checkmark \\\hline
\end{tabular} bar \ldots
```

Foo

Country	Flammen-werfer	Panzerkampfwagen
Russia	-	-
Germany	✓	✓

bar ...

3.1.2 `wraptable`

This requires the package `wrapfig` Usage:

```
\begin{wraptable}[number_of_lines]{pos}{width}
```

- `number_of_lines` The number of lines. May be omitted.
- `pos` The horizontal alignment; you can use `l` or `r`.
- `width` Width to be reserved for the table.

```
We have a nice table below:

\begin{wraptable}[9]{r}{12cm}
\vspace{-11pt}
\hspace{20pt}
\begin{tabular}[c]{|l|| *9{l|} }\hline
  Country & Best song & Known for \\\hline\hline
  Russia & Siuda Kalatuszek & Putin's lifetime rule \\\hline
  Serbia & Crni Bombarder & Rakija and Kosovo \\\hline
  Poland & Hej soko\l{}y & Bisons and their grass \\\hline
  Finland & S\"akkij\"arven polkka & Suomi Perkele \\\hline
  Germany & Westerwaldlied & Losing both world wars \\\hline
\end{tabular}
\hspace{5pt}
\end{wraptable}
I have no idea what to put here, so I'll put this:
Nuapurista kuulu se polokan tahti jalakani pohjii kutkutti.
Ievan \"aiti se tytt\"o\"os\"a vahti vaan kyll\"ah\"an Ieva sen jutkutti,
sill\"a ei meit\"a silloin kiellot haittaa kun my\"o tanssimme laiasta laitaan.
Salivili hipput tupput t\"appyt \"appyt tipput hilijalleen.
```

We have a nice table below:

Country	Best song	Known for
Russia	Siuda Kalatuszek	Putin's lifetime rule
Serbia	Crni Bombarder	Rakija and Kosovo
Poland	Hej sokoły	Bisons and their grass
Finland	Säkkijärven polkka	Suomi Perkele
Germany	Westerwaldlied	Losing both world wars

I have no idea what to put here, so I'll put this: Nuapurista kuulu se polokan tahti jalakani pohjii kutkutti. Ievan äiti se tyttöösä vahti vaan kyllähän Ieva sen jutkutti, sillä ei meitä silloin kiellot haittaa kun myö tanssimme laiasta laitaan. Salivili hipput tupput täppyt äppyt tipput hilijalleen.

Note: We can't use `wraptable` inside theorem environments

Note: We can use `wrapfigure` with a similar syntax for inserting figures

`\cline{i-j}` draws a line from column `i` to `j`.

3.1.3 `multirow`s and `multicolumn`s

This requires the package `multirow`. Usage:

```
\multicolumn{count}{alignment}{content}
\multirow{count}{width}{content}
```

Where:

- `alignment` can be `l`, `c`, `r`.
- `width` is the minimum cell width, can be `*` to be adjusted automatically.

```
\begin{center}
\begin{tabular}{| l | *{3}{l|}l |} \hline
  \multirow{2}{*}{Country} & \multicolumn{3}{c|}{Food} & \multirow{2}{*}{Beverage}\\
  \cline{2-4}              & Soup & Main dish & Dessert & \\ \hline\hline
  Germany & Biersuppe & Bratwurst & Lebkuchen & Weizenbier\\\hline
  Russia  & Borscht & Stroganoff & Syrniki & Kvass\\\hline
  Poland  & Ch\l{}odnik & Go\l{}\k{a}bki & P\k{a}czek & Gorza\l{}ka \\\hline
\end{tabular}
\end{center}
```

Country	Food			Beverage
	Soup	Main dish	Dessert	
Germany	Biersuppe	Bratwurst	Lebkuchen	Weizenbier
Russia	Borscht	Stroganoff	Syrniki	Kvass
Poland	Chłodnik	Gołąbki	Pączek	Gorzałka

If we want to set the min width by writing `\multirow{2}{3cm}{Country}` we need to use `\hfill` (or `\hfil`) to center it. `\centering` can also be used

```
\begin{tabular}{| l | l|} \hline
  \multirow{2}{3cm}{\centering Country} & A \\
  \cline{2-2}&              B \\ \hline\hline

  \multirow{2}{3cm}{\hfill Country \hfill} & A \\
  \cline{2-2}&              B \\ \hline\hline

  \multirow{2}{3cm}{\hfil Country \hfil} & A \\
  \cline{2-2}&              B \\ \hline\hline

  \multirow{2}{3cm}{Country} & A \\
  \cline{2-2}&              B \\ \hline
\end{tabular}
```

Country	A
	B

Country	A
	B

Country	A
	B

Country	A
	B

3.1.4 arraystrectch

Redefining spacing between lines `\renewcommand{\arraystretch}{factor}`

```
\renewcommand{\arraystretch}{1.5}
\begin{tabular}{| l | l|} \hline
  \multirow{2}{3cm}{\centering Country} & A \\
  \cline{2-2}&              B \\ \hline
\end{tabular}
```

Country	A
	B

If we want to scale the table: requires `graphics`

```
  \resizebox{7cm}{1.4cm}{
  \renewcommand{\arraystretch}{1.5}
  \begin{tabular}{|l|l||c|c||*{3}{c|}}\hline
    \multicolumn{2}{|c||}{ }&
    \multicolumn{2}{c||}{Regimul disciplinei}&
    \multicolumn{3}{c|}{Numar de ore/sapt.}\\
    \cline{3-7} \multicolumn{2}{|c||}{ } &
    Obligatorie& Optionala & Curs &
    Sem.  & Lab.\\ \hline\hline
    \multirow{3}{*}{Sem.  I} & Disciplina 1 &
    \checkmark& -- & 3 & 2 & 1\\ \cline{2-7}&
    Disciplina 2 &\checkmark & -- & 2 &
    1 & 1\\\cline{2-7}
    & Disciplina 3 & -- &\checkmark &
    2 & 2 & -\\\cline{1-7}
    \multirow{2}{*}{Sem.  II} &
    Disciplina 4 &\checkmark&
    -- & 2 & - & 3\\ \cline{2-7}
    & Disciplina 5 & -- &\checkmark &
    2 & 2 & -\\ \hline
  \end{tabular}
\renewcommand{\arraystretch}{1}
}
```

		Regimul disciplinei		Numar de ore/sapt.		
		Obligatorie	Optionala	Curs	Sem.	Lab.
Sem. I	Disciplina 1	✓	–	3	2	1
	Disciplina 2	✓	–	2	1	1
	Disciplina 3	–	✓	2	2	-
Sem. II	Disciplina 4	✓	–	2	-	3
	Disciplina 5	–	✓	2	2	-

```
\begin{tabular}{cc|c|c|c|c|l}
\cline{3-6}
& & \multicolumn{4}{ c| }{Primes} \\ \cline{3-6}
& & 2 & 3 & 5 & 7 \\ \cline{1-6}
\multicolumn{1}{ |c  }{\multirow{2}{*}{Powers} } &
\multicolumn{1}{ |c| }{504} & 3 & 2 & 0 & 1 &     \\ \cline{2-6}
\multicolumn{1}{ |c  }{}                          &
\multicolumn{1}{ |c| }{540} & 2 & 3 & 1 & 0 &     \\ \cline{1-6}
\multicolumn{1}{ |c  }{\multirow{2}{*}{Powers} } &
\multicolumn{1}{ |c| }{gcd} & 2 & 2 & 0 & 0 & min \\ \cline{2-6}
\multicolumn{1}{ |c  }{}                          &
\multicolumn{1}{ |c| }{lcm} & 3 & 3 & 1 & 1 & max \\ \cline{1-6}
\end{tabular}
```

		Primes			
		2	3	5	7
Powers	504	3	2	0	1
	540	2	3	1	0
Powers	gcd	2	2	0	0
	lcm	3	3	1	1

min

max

3.1.5 Colored tables

This requires the package `colortbl` .

This defines: `\rowcolor{red}` , `\cellcolor{blue}` and `\columncolor{MidnightBlue}`

```
\begin{tabular}{l | l | >{\columncolor{red}} l | l}
\rowcolor{red} A & B  &\cellcolor{blue} C & D\\
%A & \rowcolor{blue} A & C \\
A & \cellcolor{green} B & C & D\\
A & B & C & D\\
\end{tabular}
```

A	B	C	D
A	B	C	D
A	B	C	D

3.1.6 `table` environment

This is very similar to `figure` (page 4).

```
\begin{table}[pos]
```

Where `pos` can be `h` - here, `t` - top, `b` - bottom. It's useful to set `pos` to `!hbt` meaning force it here, if not possible put it on the bottom, else at the top.

```
\begin{centering}
\begin{table}[h]
  \caption{A nice table}\label{nice_table}
  \begin{tabular}{l | l}
    this & is\\
    vert & nice\\
  \end{tabular}
\end{table}
\end{centering}

This is a nice table: \ref{nice_table}.
```

Table 3.2: A nice table

this	is
vert	nice

This is a nice table: 3.2.
Note: `\listoftable` will print a list of tables

3.1.7 `tabularx`

This requires the package `tabularx`.

It stretches the table to

```
\begin{tabularx}{\textwidth}{ |X|X|X|X| }
  \hline
  label 1 & label 2 & label 3 & label 4 \\
  \hline
  item 1  & item 2  & item 3  & item 4  \\
  \hline
\end{tabularx}
```

label 1	label 2	label 3	label 4
item 1	item 2	item 3	item 4

3.1.8 `longtable`

This requires the package `longtable`.

```
\begin{longtable}[pos]{table spec}
```

Does everything that `tabular` does and more:

- can be split on multiple pages
- can be labeled
- is centered (by default), by setting the optional argument `pos` to `r` or `l` we can change this
- can have captions

```
\begin{longtable}{l l}\label{longTable}
  We finally & finished tables \\
  yay & yay \\
\end{longtable}
\bigskip
Table \ref{longTable} is a nicer table.
```

We finally	finished tables
yay	yay

Table 3.3 is a nicer table.

Note: `sidewaystable` might be useful for sideways tables.

3.2 Lists

There are 3 main environments to use lists: `enumerate`, `itemize` and `description`.

New items are inserted with `\item [sym]`.

There's a default vertical space between items. This space can be modified by writing `\setlength{\itemsep}{5mm}` after `\begin{env}`.

We can nest those a maximum of 4 times.

```
\begin{enumerate}
  \item Operating systems
  \begin{enumerate}\setlength{\itemsep}{0mm}
  \item[J.] Linux
  \item Windows
  \item DOS
  \item BSD
  \end{enumerate}
\item Programing languages
  \begin{description}
    \item[1] \texttt{C++}
    \item[b] \texttt{D}
    \item[III] \texttt{F\#}
  \end{description}
\end{enumerate}
```

1. Operating systems
   J. Linux
   (a) Windows
   (b) DOS
   (c) BSD
2. Programing languages

1 `C++`

b `D`

III `F#`

3.2.1 `enumerate`

Items can be labeled (the other 2 can't).

This redefines the labels names (see Page Numbers):

```
\renewcommand{\labelenumi}{\Roman{enumi}.}
\renewcommand{\labelenumii}{(\arabic{enumii})}
\renewcommand{\labelenumiii}{(\alph{enumiii})}
\renewcommand{\labelenumiv}{(\roman{enumiv})}
```

We can redefine the numbering using:

```
\renewcommand{\theenumi}{\Roman{enumi}.}
\renewcommand{\theenumii}{(\arabic{enumii})}
\renewcommand{\theenumiii}{(\alph{enumiii})}
\renewcommand{\theenumiv}{(\roman{enumiv})}
```

```
\renewcommand{\theenumi}{Point \Alph{enumi}}
\renewcommand{\labelenumi}{I \Alph{enumi}}
\begin{enumerate}
\item First\label{first}
\item Second
\end{enumerate}
We reference an item \ref{first}
```

I A First

I B Second

We reference an item Point A

If we use the package `enumitem` we can change the indent:

```
\begin{enumerate}
\item Level 1
  \begin{enumerate}[leftmargin=0cm]
    \item Level 2
    \end{enumerate}
\item Also Level 1
  \begin{enumerate}
    \item Also Level 2
  \end{enumerate}
\end{enumerate}
```

1. Level 1

(a) Level 2

2. Also Level 1

    (a) Also Level 2

Using `enumitem` also allows us to have two separate lists with continuous numbering:

```
\begin{enumerate}
\item First
\end{enumerate}
Some text
\begin{enumerate}[resume]
\item Second
\end{enumerate}
```

1. First

Some text

2. Second

3.2.2 `itemize`

`itemize` can also have it's symbols changed:

```
  \renewcommand{\labelitemi}{$\bigstar$}
  \renewcommand{\labelitemii}{$\checkmark$}
  \renewcommand{\labelitemiii}{$\sharp$}
  \renewcommand{\labelitemiv}{$\maltese$}
  \begin{itemize}
    \item Foo
\end{itemize}
```

★ Foo

Chapter 4

The rest

4.1 Page Size, layout and units

4.1.1 Page Size

The `geometry` package

```
\usepackage {geometry}
\geometry{a4paper,left=30mm,right=20mm,top=20mm,bottom=30mm}
```

Or:

```
\usepackage[a4paper,left=30mm,right=20mm,top=20mm,bottom=30mm]{geometry}
```

Options

`a4paper`	specifies usage of a4 paper - the one true paper size[1]
`screen`	a special paper size for use in presentations[2]
`paperweight`	width of the paper. `paperwidth=30cm`
`landscape`	landscape mode
`portrait`	portrait mode
`centering`	auto centering
`twoside`	`left` and `right` are swapped on even and odd pages

For more, see Figure 1.

4.1.2 Units

- pt - a point is 1/72.27 inch, that means about 0.351 mm in non freedom units
- mm - millimeter
- cm - centimeter
- in - inch
- ex - roughly the height of an "x" in the current font
- em - roughly the width of an "M" (uppercase) in the current font

[1] the one true paper size (apart from others in the A series) is wunderbar as it was made by german engineers with mathematics in mind. This german sheet of engineering has a width of precisely $\sqrt[4]{2}/4$m and a height of precisely $1/(4\sqrt[4]{2})$m, or about 210×297mm and has an area of exactly 1/16m.

[2] For actual presentations use `screen,centering` and the `slide` class.

4.2 Document Structure

4.2.1 Main structure

```
\part{Part}
\chapter{C} % not found in article
\section{S}
\subsection{SS}
\subsubsection{SSS}
\paragraph{P}
\subparagraph{SP}
```

Adding `[Short title]` will add that short name in the Table contents.
Adding a * will not add the structure to Table of contents and will not number it.
To add it to the Table of contents use: `\addcontentsline{toc}{section}{My name}`

4.2.2 Title page

```
% preamble:
\title{\LaTeX{} CheatSheet}
\author{\L{}ucasz Zieli\'nski
 \thanks{Dzi\k{e}ki \'swiatu}}
\date{\today}
%first thing in document
\begin{titlepage}
 \maketitle
\end{titlepage}
```

LaTeX CheatSheet

Łucasz Zieliński[1]
November 16, 2019

[1]Dzięki światu

4.2.3 Appendix, abstract

```
\appendix
\chapter{something}
bla

\begin{abstract}
Bla bla
\end{abstract}
```

4.2.4 Bibliography

```
% 99 = max num of entries
\begin{thebibliography}{99}
  \bibitem{author/19} The Author, A book, 2019
\end{thebibliography}
```

Bibliografie

[1] The Author, A book, 2019

Citing

```
\hrulefill\\
  Cite from bibliography\cite{author/19}.\\
  Cite from bibliography\cite[Chapter VI, VII]{author/19}.
```

4.2.5 Index

In some editors the index must be compiled separately (with `Ctrl-Shift-I`).

```
%in preamble
\usepackage{makeidx}
\makeindex

% in doc (at the end)
\phantomsection
% index is not added by default to tableofcontents
\addcontentsline{toc}{chapter}{Index}
\printindex

Add word to index: \index{Entry}
Doing it like this groups them:  \index{Convergenta!in $L^{p}$}
```

4.2.6 Pdfbookmark

```
\pdfbookmark[1]{Cuprins}{Cuprins}
```

4.3 Font styles

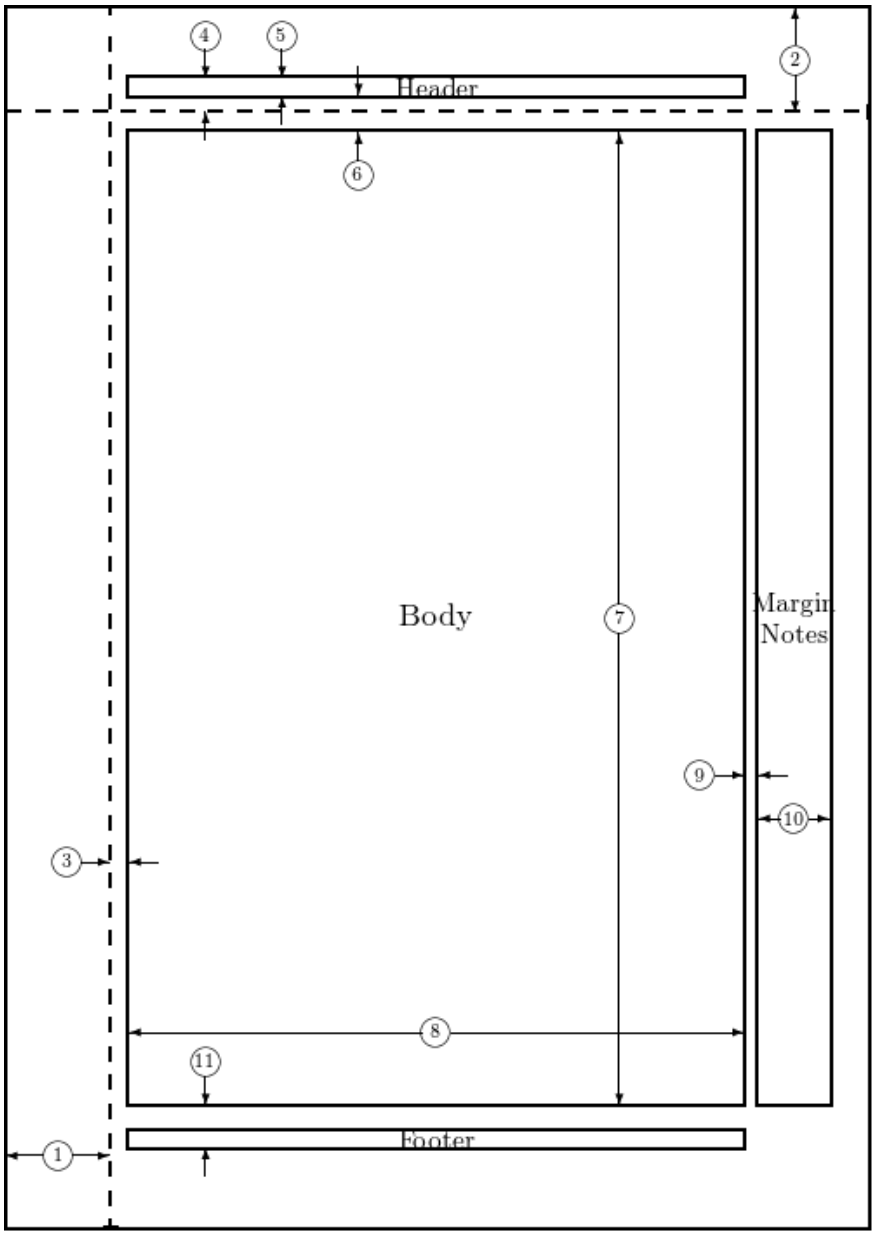
4.3.1 Text mode

`\textnormal {Normal}`	Normal	The default font
`\textrm {Roman}`	Roman	Roman font
`\textsf {Sans}`	Sans	Sans serif
`\texttt {Typewriter}`	Typewriter	Teletype - monospace font
`\emph {Emph \emph {nested}}`	*Emph* nested	Emphasis. Might be nested
`\textbf {Bold}`	**Bold**	Boldface
`\textmd {Medium}`	Medium	Medium - default

`\textup {Upright}`	Upright	Upright shape - default
`\textit {abcx - Italics}`	*abcx - Italics*	Italic shape
`\textsl {abcx - Slanted}`	*abcx - Slanted*	Slanted shape
`\textsc {Small Caps}`	Small Caps	Small Capitals
`\uppercase {Uppercase $F=x$}`	UPPERCASE $F = X$	Uppercase
`\lowercase {Lowercase $F=x$}`	lowercase $f = x$	Lowercase
`\tiny {tiny}`	tiny	tiny
`\scriptsize {script}`	script	scriptsize
`\footnotesize {footnote}`	footnote	footnote
`\small {small}`	small	small
`\normalsize {normalsize}`	normalsize	normal - default
`\large {large}`	large	large
`\Large {Large}`	Large	Large
`\LARGE {LARGE}`	LARGE	LARGE
`\huge {huge}`	huge	huge
`\Huge {Huge}`	Huge	Huge

4.3.2 Math mode

`\text {ABC\ i\ abc\ 123}`	ABC i abc 123	Enter text mode
`\mathnormal {ABC\ i\ abc\ 123}`	$ABC\ i\ abc\ 123$	Default
`\mathrm {ABC\ i\ abc\ 123}`	$\mathrm{ABC\ i\ abc\ 123}$	Roman - one word functions
`\mathit {ABC\ i\ abc\ 123}`	$\mathit{ABC\ i\ abc\ 123}$	Italics - words spaced more naturally
`\mathbf {ABC\ i\ abc\ 123}`	$\mathbf{ABC\ i\ abc\ 123}$	Boldface
`\mathsf {ABC\ i\ abc\ 123}`	$\mathsf{ABC\ i\ abc\ 123}$	Sans serif
`\mathtt {ABC\ i\ abc\ 123}`	$\mathtt{ABC\ i\ abc\ 123}$	Teletype - monospaced
`\mathfrak {ABC\ i\ abc\ 123}`	$\mathfrak{ABC\ i\ abc\ 123}$	Fraktur
`\mathcal {ABC\ I\ DEF}`	$\mathcal{ABC\ I\ DEF}$	Calligraphy - of note $\mathcal{M}$atrix (uppercase only)
`\mathbb {ABC\ I\ DEF}`	$\mathbb{ABC\ I\ DEF}$	Blackboard bold - of note $\mathbb{R}$ (uppercase only)
`\mathscr {ABC\ I\ DEF}`	$\mathscr{ABC\ I\ DEF}$	Script - Super $\mathscr{F}$ancy (uppercase only)




```
 1   one inch + \hoffset          2   one inch + \voffset
 3   \oddsidemargin = 13pt        4   \topmargin = -23pt
 5   \headheight = 12pt           6   \headsep = 25pt
 7   \textheight = 674pt          8   \textwidth = 426pt
 9   \marginparsep = 10pt        10   \marginparwidth = 50pt
11   \footskip = 30pt                 \marginparpush = 5pt (not shown)
     \hoffset = 0pt                   \voffset = 0pt
     \paperwidth = 597pt              \paperheight = 845pt
```

Figure 1: More options for Page layout