

Pimp your thesis: solutions to exercises.

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1 Basic exercises

After you've created a new project, make sure that you use the `article` class and `a4` paper

```
1 \documentclass[a4paper]{article}
2 \begin{document}
3 (Type your content here.)
4 \end{document}
```

Exercise 1 Setting the language

For correct hyphenation, you can include the package `babel`, you can give the language of your document as an option to the inclusion of this package. Add the package `babel` to the *preamble* of the document and add the option *english*.

Solution

```
1 \documentclass[a4paper]{article}
2 \usepackage[english]{babel}
3 \begin{document}
4 (Type your content here.)
5 \end{document}
```

Exercise 2 Adding the title

This page still looks a bit boring. Remove the default contents of the page (the whole body of the document) and add a *title*, *author* and *date* to the document and display them at the top of the document.

Solution

```
1 \documentclass[a4paper]{article}
2 \usepackage[english]{babel}
3
4 \begin{document}
5 \title{A practise document}
6 \author{The Author}
7 \maketitle
8 (Type your content here.)
9 \end{document}
```

Exercise 3 Time to add some contents

Now you've created a title, it's time to add some contents. Try to reproduce the contents of the box below in \LaTeX :

1 A section containing some difficult characters

In March 2006, Congress raised that ceiling an additional \$0.79 trillion to \$8.97 trillion, which is approximately 68% of GDP. As of October 4, 2008, the “Emergency Economic Stabilization Act of 2008” raised the current debt ceiling to \$11.3 trillion.

A section without a number

As you might have noticed, this section doesn’t have a number.

2 Here’s another section

2.1 This section even has a subsection

And some more text

2.2 Another subsection

2.2 Groceries

A simple list of my groceries:

- 4 eggs
- 1L milk
- 1kg flour

Solution

```

10 %escape inside prevents the percent sign to be interpreted as a comment by lstlisting
11 \section{A section containing some difficult characters}
12 In March 2006, Congress raised that ceiling an additional \$0.79 trillion to \$8.97 trillion,
    which is approximately 68\% of GDP. As of October 4, 2008, the ‘‘Emergency Economic
    Stabilization Act of 2008’’ raised the current debt ceiling to \$11.3 trillion.
13
14 \section*{A section without a number}
15 As you might have noticed, this section doesn’t have a number.
16
17 \section{Here’s another section}
18 \subsection{This section even has a subsection}
19 And some more text
20 \subsection{Another subsection}
21 \subsubsection{Groceries}
22 A simple list of my groceries:
23 \begin{itemize}
24   \item 4 eggs
25   \item 1L milk
26   \item 1kg flour
27 \end{itemize}

```

Exercise 4 Adding the table of contents

To be able to quickly find the right section, it is handy to add a table of contents. Do this by adding the command `\tableofcontents` just below the command you used to display the title, author and date.

Solution

```

7 %preamble
8 \begin{document}
9 \maketitle
10 \tableofcontents
11 (...)
12 \end{document}

```

Exercise 5 Time for some mathematics

Start by including the `amsmath` package in the preamble of the document, you can add this package without any options (just omit the `[option]` part). Now, try to reproduce the following under a new section, called 'Mathematics', in your document. For the equation, use the `equation` environment, the second κ^{-1} should be displayed using in-line math within that sentence.

3 Mathematics**3.1 Debye length**

$$\kappa^{-1} = \sqrt{\frac{\epsilon_0 \epsilon_r k_B T}{2e^2 n_0}} \quad (1)$$

The previous equation shows how the Debye length in an electrolyte can be calculated. κ^{-1} is usually expressed in nanometers (nm).

Solution

```

28 \section{Mathematics}
29 \subsection{Debye length}
30 \begin{equation}
31 \kappa^{-1} = \sqrt{\frac{\epsilon_0 \epsilon_r k_B T}{2 e^2 n_0}}
32 \end{equation}
33 The previous equation shows how the Debye length in an electrolyte can be calculated.
   $\kappa^{-1}$ is usually expressed in nanometers (nm).

```

Exercise 6 Adding a table

It's time to add a table. Add a table such as [Tab. 1](#) to your document. Can you add vertical lines on the sides to close the box? Does this look better?

Table 1: Ingredients for apple crumble

Amount	Ingredient
200 g	flour
100 g	butter
100 g	sugar
2	apples
2 tbsp.	cinnamon

Solution

```

35 \begin{table}
36   \centering
37   \caption{Ingredients for apple crumble}
38   \label{tab:ingredients}
39   \begin{tabular}{|c l|}
40     \hline
41     \textbf{Amount} & \textbf{Ingredient} \\ \hline
42     200 g          & flour \\
43     100 g          & butter \\
44     100 g          & sugar \\
45     2              & apples \\
46     2 tbsp.       & cinnamon \\
47   \end{tabular}
48 \end{table}

```

Exercise 7 Adding an image

It's now time to add an image. Upload an image from your computer to your project in Overleaf. You will see that it is added to the panel with the files on the left side of the window. There you can also see the exact file name. Add the image you just uploaded to your document, including a caption and a label that you can use to refer to this image. Refer to the image using `\ref{yourlabel}`, this will output the number of the figure.

Solution

```

50 \begin{figure}
51   \centering
52   \includegraphics[width=4cm]{protonlogo}
53   \caption{Oh wow a figure!}
54   \label{fig:wowfigure}
55 \end{figure}
56 You can see that I can make figures in Figure \ref{fig:wowfigure}.

```

2 Advanced exercises

These exercises are a little more advanced for those who already have experience with \LaTeX or those who like a challenge right away. The exercises show some neat tricks and some possibilities for a little more than a 'standard' \LaTeX document. The use of [Google](#) may be necessary and is encouraged, as the best way to learn something is to try and work it out yourself.

Exercise 8 More on images

Let's look at one of the things that makes \LaTeX superior over many word processors: the ability to work with vector images. Make a simple graph in your software of choice (Mathematica, Excel, Origin, ...) and save it twice, as .jpg and as .pdf. Now include both images in your document, and place them side by side in a single `figure` environment, with both of the images occupying half of the width of the text. Hint: a line break between the images can be prevented by ending the line with a percent sign (%). Now zoom in and compare the image quality of both images, what do you see? What do you think happens when you print such a page on paper using a (inherently vector-based) laser printer or photocopier? What about text in the images?

Next, place a single caption beneath the images. Sometimes however you may want to put two unrelated images side by side in which case a single caption for both could be

undesired. Try to give each of the images their own caption. Lastly, try and place a figure on the side of the page with the text flowing around it. Hint: look at the package `wrapfig`.

Solution

```

1 %two figures side by side
2 \begin{figure}\centering
3   \includegraphics[width=.3\linewidth]{protonlogo}\hspace{.33\linewidth}% <-- this comment
4   \includegraphics[width=.25\linewidth]{protonlogo}
5   \caption{Left: the Proton logo. Right: a smaller version.}
6   \label{fig:sidebyside}
7 \end{figure}
8
9 %two figures with their own captions
10 \begin{figure}%we use the minipages to split the page in two
11   \begin{minipage}[b]{0.5\linewidth}\centering%minipage of half the linewidth
12     \includegraphics[width=.6\linewidth]{protonlogo}
13     \caption{The logo of U.S.S. Proton}
14     \label{fig:sidebysideleft}
15   \end{minipage}%
16   \begin{minipage}[b]{.5\linewidth}\centering
17     \includegraphics[width=.5\linewidth]{protonlogo}
18     \caption{The logo if it was slightly smaller}
19     \label{fig:sidebysideright}
20   \end{minipage}
21 \end{figure}
22
23 %figure with text flowing around
24 %in preamble:
25 \usepackage{wrapfig}
26
27 %in body:
28 \begin{wrapfigure}{r}{0.25\linewidth}
29   \includegraphics[width=0.23\linewidth]{protonlogo}
30   \caption{The logo of U.S.S. Proton}
31   \label{fig:logo wrapfig}
32 \end{wrapfigure}

```

Exercise 9 More on tables

For basic tables the `tabular` environment provides the necessary tools, but many packages exist for more advanced options such as automatic column spacing. Load the `tabularx` and `booktabs` packages and try to recreate the following table below. Note that the table has columns of even width to a total table width equal to the width of the surrounding text. Furthermore, the top and bottom rules are slightly thicker as the rule separating the column headers from the data. For this example the table is filled with some random numeric values with error, but you can fill your cells with anything you like.

Solution

```

34 %in preamble:
35 \usepackage{tabularx}
36 \usepackage{booktabs}
37 \usepackage{siunitx}%used in this example for displaying numbers with error and unit (\si{}
38   and \num{}), but is not needed for the table itself
39
40 %in body:
41 \begin{table}
42 \caption{measured transfer rates for nanoplatelets of increasing lateral size.}
43 \begin{tabularx}{\linewidth}{X X X X X X}
44 \toprule[1pt]

```

```

44 \textbf{sample} & \textbf{diameter} & \textbf{\$A_{max}\$} & \textbf{\$E_{max}\$} &
   \textbf{\$gamma^r\$} & \textbf{\$Gamma^{np}\$} \\
45 & (nm) & & (eV) & (\si{\kelvin\per\second\squared}) & (\si{\pico\joule\per\second\squared})
   \\ \midrule[0.5pt]
46 NP01 & \num{7.3(2)} & \num{0.80(1)} & \num{1.20(12)} & \num{2.3(1)} & \num{80.1(1)} \\
47 NP02 & \num{8.1(1)} & \num{0.82(1)} & \num{1.18(15)} & \num{2.2(1)} & \num{72.1(1)} \\
48 NP03 & \num{10.1(12)} & \num{0.81(2)} & \num{1.09(27)} & \num{2.1(2)} & \num{69.3(1)} \\
49 NP04 & \num{12.3(2)} & \num{0.89(1)} & \num{0.99(10)} & \num{2.1(1)} & \num{50.7(3)} \\
50 Xi \emph{et al.}[3] & \num{10.7} & \num{0.92(5)} & - & - & \num{48.2(2)} \\
51 \end{tabularx}
52 \end{table}
53

```

Exercise 10 Defining commands

Sometimes, you might want to do the same thing multiple times in L^AT_EX which can get a bit annoying if it consists of the same code over and over with only few changes each time. For this purpose, it is possible to define your own commands in L^AT_EX, starting with a backslash. Such commands can be defined with or without variable arguments, and can contain pretty much any other L^AT_EX commands or text. Commands can be defined in the preamble with the `\newcommand{\mycommand}[1]{definition of my command}` where the optional argument specifies the number of arguments the function takes, and the #1 in the definition is replaced by the first argument of your function, #2 by the second, etc. An example of a function with and without optional arguments is would be something like the following. In the preamble of your document you define the functions:

```

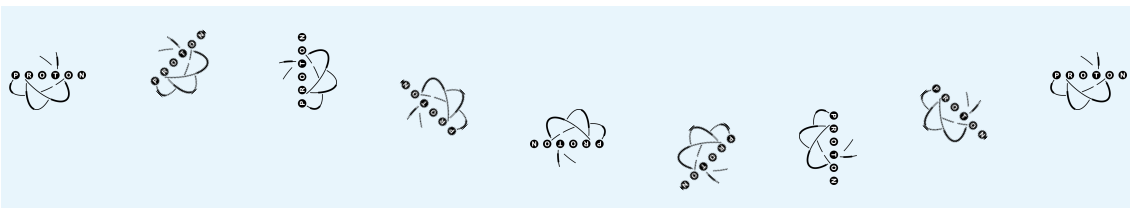
1 \newcommand{\cheese}{\large CHEESE\normalsize}
2 \newcommand{\food}[2]{The #1 food is #2}

```

You can then use these commands in the body of your document:

<pre> 1 I really like \cheese, I think that \cheese\ is the best. \food{worst}{broccoli}. 2 \food{greatest}{\cheese}! </pre>	<p>I really like CHEESE, I think that CHEESE is the best. The worst food is broccoli. The greatest food is CHEESE!</p>
---	--

Try and define a command that places a picture with a width of 1 cm and that takes only one argument: the rotation of the picture. Using your own picture and command, try and produce a line on your page with rotating pictures, evenly spaced over the line:



Hint: for the spacing look at the `\hspace` and `\hfill` commands.

Solution

```

54 %in preamble:
55 \newcommand{\picrot}[1]{\includegraphics[width=1cm,angle=#1]{protonlogo}}
56
57 %in body:
58 \picrot{0}\hfill\picrot{45}\hfill\picrot{90}\hfill\picrot{135}\hfill\picrot{180}\hfill
   \picrot{225}\hfill\picrot{270}\hfill\picrot{315}\hfill\picrot{0}

```

Exercise 11 Making a title page

For a longer report you will typically use the `report` or `book` class rather than `article`. Create a new document, but this time use the `report` class. Instead of using the rather simple `\maketitle` command, create a fully custom title page in the `titlepage` environment that you can create with the `\begin{titlepage}` and `\end{titlepage}` commands.

Exercise 12 Using different page-numbers

It is common in long reports and books to use a different type of page-numbering for the abstract, preface and table of contents, than for the rest of the document. Start with an unnumbered chapter for the abstract, then the table of contents and then some chapters you could typically find in a thesis (Introduction, Methods, Results, etc.). Include a simple bibliography with your method of choice, and find a way to include it in the table of contents. Now try and use Roman numerals (I, II, ...) for the abstract and toc, while starting your normal page-numbers (1, 2, ...) on the first page of the introduction.

Solution

```
1 %before first page
2 \pagenumbering{Roman}
3 (...)
4 \tableofcontents
5 (...)
6
7 \chapter{Introduction}
8 \pagenumbering{arabic}
```

Exercise 13 Challenge yourself!

Think of things you see in theses or books that you like. Are there things you needed for an assignment or thesis but couldn't realise? Is there something you don't know how to do? This is your chance to ask and find out.