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Template Single-work

Sample with LaTeX explanation

Event
SuSe 2023
M. Sc. Geodesy and Geoinformatics,
Hydrography
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Lecturer:
Lecturer 1
Lecturer 2
Lecturer 3

Submit: DD^{xx} Month, 2023

Contents

1 General

Welcome to my LaTeX template for geodesy students at HCU!
Here I give an overview of the structure and formatting in a LaTeX-document. The end product of one or more related LaTeX-files is always a PDF file that even contains bookmarks.

For the LaTeX-code or file or folder names in the PDF, I use a code block that does not appear in the listings directory:

```
\LaTeX-code can then be placed here.
```

1.1 Structure of a LaTeX-document

This template is constructed from the LaTeX-files as follows:

- Main document (`main.tex` or `LaTeX_template_2023.tex`)
  Depending on which program you use, the PDF will be named after this file!
- Title page (`titlepage.tex`)
  The title page is designed here. Since mainly own commands are used here, hardly anything has to be changed here.
- Text (`text.tex`)
  The whole content is written here. It is also advisable to do this in one file and not one file per chapter, as most LaTeX-software displays the content separately (the table of contents, so to speak). This makes it easier to jump back and forth between the headings.
- References (`References.bib`)
  BibTeX file that lists the sources in its own way. This is used for citing and for the bibliography.
- Appendix (`appendix.tex`)
  Files or other material can be attached here.

You also need a `Data`-folder to store all the PDFs, images, etc. that will be included in the course of the work.

1.1.1 Main document

The main document always starts with a definition of a class. For reports `article` is a suitable choice:

```
% \documentclass[12pt,a4paper]{article}


% This is a comment in LaTeX
% At beginning there is no %-character !!
% (But here LaTeX needs it for compiling)
```

I have also commented on most of this in the document itself. After that, a global setting was made for indenting paragraphs. Then come numerous packages that are useful for many things.

```
\usepackage[package options]{package name}
```

On the internet you can always find numerous tips for each package. The header and footer are defined at the end of the included and defined packages.

Font LaTeX uses the font Computer Modern by default, which is a serif font. However, in scientific documents sans-serif fonts are more commonly used. For this reason, it is recommended to switch the font. There are many fonts available at `https://tug.org/FontCatalogue/` and instructions on how to include them. The fonts Arimo and Arev are recommended.

For special characters used in German, such as umlauts, it is necessary to use the `\usepackage[T1]{fontenc}` so that it is displayed correctly both in the PDF and when copying from it.

```
% Set font
% more on https://tug.org/FontCatalogue/
\usepackage[sfdefault]{arimo}
\usepackage[T1]{fontenc}
```

Hereafter, the custom commands begin, where you enter your own data. To show a few examples:

```
% Enter the information here:
\newcommand{\Writer}{Sur- Lastname}
\newcommand{\Mail}{surname.lastname}
\newcommand{\Register}{xxxxxxx} % insert register number
\newcommand{\Module}{Module long}
```

A custom command is defined as follows:

```
\newcommand{\own}{own command}
% thus, it becomes
This is an \own. % to:
```

This is an own command.
More information can be found at `https://en.overleaf.com/learn/latex/Commands`.

Now, the actual document can be started with the following command, with more commands to follow:

```
\begin{document}


\end{document}
```

Here, you can already see that commands must always start and end. Each command can have its own options. In the `document` command, the structure of the document is now defined and built with the files described in Chapter 1.1:

```
\include{titlepage}


\pagenumbering{Roman}
\tableofcontents


\newpage
\pagenumbering{arabic}
\spacing{1.5}
\include{text}
```

```
% ... see at file ...
\include{appendix}
```

Here, the title page, table of contents, and other documents are included. If they are commented out (%), they can be „deleted“ from the final product.

Directories The directories are created once and are to be used repeatedly. Firstly, the sources are included through the `References.bib`, where the citation style (`apacite` for APA-style) is also defined:

```
% References
\nocite{*}
\bibliographystyle{apacite}
\bibliography{References} % bbl, blg files
```

Afterwards, the list of figures

```
% List of figures
\listoffigures
\addcontentsline{toc}{section}{List of Figures}
```

and the table of tables, where you can also turn on or off a comment.

```
% List of tables
\listoftables
\addcontentsline{toc}{section}{List of Tables}
% Display the comment if needed:
% \vspace{0.2cm}
% \noindent
% ... (see file)
```

Finally, the code directory:

```
% List of listings
\lstlistoflistings
\addcontentsline{toc}{section}{Listings}
```

1.1.2 Title Page

The `titlepage.tex` file is/should be used to design the title page. However, since it mainly contains custom commands as placeholders, there is little need to make changes here. This template can also be used as a template for group assignments. In this case, it can be adapted accordingly (possibly, a separate template for group assignments will also be created).
However, the following commands should be considered for a title page:

```
\begin{titlepage}
    \thispagestyle{empty}
\pdfbookmark[1]{Title page}{Title page}
    % ...
\end{titlepage}
```

This command defines the title page and removes the header and footer style from this page. In addition, a PDF bookmark can be set for the title page so that the reader can directly click on it later.
If only the title page is defined, LaTeX creates its own title page!

1.1.3 Text

The text, i.e., the content of the report, is written in the file `text.tex`. How to do this is explained in chapter 2. Otherwise, one can also consult the internet. A few small templates can also be found in the additional file `Makros.tex` to ensure consistency. This file should be replaced by custom commands in the main document to have a consistent environment.

1.1.4 References

The references are saved together in a `References.bib` file. This is a BibTeX file in which one can also write LaTeX code. However, there are a few things to consider.

```
@book{label_bsp_2023,
    author = "Lastname1, Firstname1 AND Lastname2, Firstname2",
    title = {{Example Title}},
```

```
    publisher = "Example Publisher",
    year = 2023
}
```

This is an example of a book reference. There are also other types of references that have different required and optional attributes.

There are also helper programs for this, such as Citavi or `https://zbib.org`, but their results must be absolutely adapted.
How to cite using the packages included and defined here is explained in chapter **??**.

1.1.5 Appendix

The appendix (`appendix.tex`) is used to attach files or materials to the report. For example, assignment descriptions, Python files (and results), as well as other things. One can give each appendix a `\section{}` and also assign a `\label{}` so that one can refer to them in the text. This must start with the following command, after which the appendices can be included:

```
\appendix
\section{Material} \label{app:material}
```

1.2 Software for LaTeX

It is recommended to use www.overleaf.com or a local program that can compile LaTeX (VSCode, TeXstudio, etc.).
Please inform yourself how to set it up in each case!

2 Examples

In this chapter, I would like to discuss the various topics in a scientific paper in the field of „Geodesy & Geoinformatics“:

2.1 Headings

Headings are probably the most important means of structuring the content of a paper.

```
\section{Heading}
\subsection{Subheading}
\subsubsection{Sub-subheading}
\paragraph{Paragraph}
```

For clarity in the document, it is recommended to insert two blank lines before each heading (especially when working with others or sharing your document with others). In case of overlong headings, the text extends beyond the margin. The following command can help in such cases:

```
\section[Heading]{\texorpdfstring{Heading tex}{Heading pdf}}
```

In this case, the text in the square brackets is responsible for the table of contents, while the other strings control the formatting and display in the PDF.

2.2 Text-formatting

Text can also be formatted as *italic*, **bold**, ***bold & italic***, and underlined.

```
\textit{italic}
\textbf{bold}
\textbf{\textit{bold & italic}}
\underline{underlined}
```

But text can also be changed in size:

`\Huge` Huge

`\huge`	huge
`\LARGE`	LARGE
`\Large`	Large
`\large`	large
`\small`	small
`\footnotesize`	footnotesize
`\scriptsize`	scriptsize
`\tiny`	tiny

The command can be enclosed either in curly brackets `{\LARGE Text}` or in a command:

LARGE

```
\begin{center}
    \begin{LARGE}
        LARGE
    \end{LARGE}
\end{center}
```

2.2.1 Text Color

To display text in a different color, the command `\textcolor{color}{text}` is used. The color is defined in the main document.

I am in HCU blue.

I am in red.

I am gray.

```
\textcolor{HCU}{I am in HCU blue.}\\
\textcolor{red1}{I am in red.}\\
\textcolor{mygray}{I am gray.}
```

Alternatively, the new command `\HCUcolor{}` can be used:

I am in HCU blue.

2.2.2 Quotation Marks

"This is in normal quotation marks." And here is normal text.

„This is in correct quotation marks.“ And here is normal text.

```
"This is in normal quotation marks." And here is normal text.


\glqq This is in correct quotation marks.\grqq{} And here is normal text.
```

Thus, one can use `\glqq` for opening and `\grqq{}` (brackets important for spacing) for closing quotation marks.

Or one can use the new command `\Quotationmarks{}`:
„I am in quotation marks.“

2.3 Paragraphs

Option 1 as shown in section 2.3.1:

```
Here is paragraph 1.
% There is an empty line in between (this is just a comment)
Here is paragraph 2.
```

Option 2 as shown in section 2.3.2:

```
Here is paragraph 1.\\
% There is an empty line in between (this is just a comment)
Here is paragraph 2.
```

Option 2 looks better.

2.3.1 Simple paragraph formation

Pain is a complex and subjective experience that is difficult to define. While it is generally seen as an unpleasant sensation, it can also have positive associations, such as signaling healing or growth. However, most people try to avoid pain whenever possible, and it is often associated with negative emotions like fear, anxiety, and sadness.

Despite its negative associations, pain serves an important function in alerting us to potential danger or harm. It can also motivate us to take action to alleviate the pain and prevent further injury. Overall, while pain is not something we seek out, it is an integral part of the human experience.

2.3.2 Clearer paragraph formation

Pain is a complex and subjective experience that is difficult to define. While it is generally seen as an unpleasant sensation, it can also have positive associations, such as signaling healing or growth. However, most people try to avoid pain whenever possible, and it is often associated with negative emotions like fear, anxiety, and sadness.

Despite its negative associations, pain serves an important function in alerting us to potential danger or harm. It can also motivate us to take action to alleviate the pain and prevent further injury. Overall, while pain is not something we seek out, it is an integral part of the human experience.

2.4 Referencing

As shown in Chapter 1, it is possible to set different headings and write the text. Now you already have a label and a reference set. Here are a few examples of labels:

```
\label{sec:heading}
\label{fig:figure}
\label{tab:table}
\label{eq:formula}
\label{lst:listing}
\label{app:appendix}
```

The abbreviations at the beginning provide a clearer assignment, but they are not mandatory. These can be referenced with `\ref{label}`, but `\autoref{label}` is also possible, although the latter does not always provide the desired output. For example, `\autoref{}` is helpful when referring to figures or tables in the text, as it also adds the type of object. However, headings are not prefixed with a correct object type:

Figure 1, Table 1, section 2 or chapter 2

If you want to refer to them in brackets, you can use `\ref{}` again:
(Fig. 1, Tab. 1, Chap. 2)

2.5 Citations

I like to quote from a specialized book (Witte, Sparla, & Blankenbach, 2020, p. xx ff.). Or directly Witte et al. (2020, p. xx ff.).

```
\cite[p. xx ff.]{example_label_2023} % indirect
\citeA[p. xx ff.]{example_label_2023} % direct
```

But if you have two sources, you can also combine the individual attributes:

```
(\citeauthor{9783879076581}, \citeyearNP{9783879076581}, p. xx; ...)
```

(Witte et al., 2020, p. xx; ...)

2.6 Figures

Figures can be implemented as follows:

Figure 1: HCU logo

Source:

It is recommended to leave a blank line between paragraphs and figures.

```
\begin{figure}[H]
    \centering
    \includegraphics[width=0.75\textwidth]{Data/File}
    \caption{Caption}
```

```
        \caption*{Source: \citeA[p. xx]{}}
        \label{fig:my_label}
    \end{figure}
```

The `[H]` needs to be set to ensure that the figure is inserted exactly there. Additional options can be specified in the square brackets of the `\includegraphics[options]{path/filename}` command.

With a short command (see *README.md* or *main document*) you can insert the above image as follows:

```
\figureWithSource{hcu_logo.pdf}{HCU-Logo}{Source}{HCU-logo}
```

2.6.1 Two Figures

Sometimes it is desirable to display two figures side-by-side. This can be achieved using subfigures:

```
\begin{figure}[H]
    \begin{subfigure}[c]{0.48\textwidth}
        \includegraphics[width=\textwidth]{Data/}
        \subcaption{}
        \label{fig:}
    \end{subfigure}
    \hfill
    \begin{subfigure}[c]{0.48\textwidth}
        \includegraphics[width=\textwidth]{Data/}
        \subcaption{}
        \label{fig:}
    \end{subfigure}
    \caption{}
    \caption*{Source: \citeA[]{}}
    \label{fig:}
\end{figure}
```

2.7 Tables

Tables cannot be created as easily in LaTeX as in Word or Excel. The easiest way is to create an Excel file with all the calculations and then paste it into TableGenerator using File ... Paste table data ..., then adjust as needed. Afterwards, the code for LaTeX can be generated and inserted. Additional options for headers, labels, and layout can also be defined.

This	is	just
a	little	test
for	LaTeX	!!!

Table 1: Test Table

source can also be added here

Das `[H]` muss noch gesetzt werden, damit die Tabelle genau dort eingefügt wird und das Layout besser aussieht. Die Table 1 sieht als Code wie folgt aus:

```
\begin{table}[H]
    \centering
    \begin{tabular}{|c|c|c|}
        \hline
        This    & is        & just  \\ \hline
        a       & little    & test  \\ \hline
        for     & \LaTeX{}  & !!!   \\ \hline
    \end{tabular}
    \caption{Test Table} \label{tab:Test}
    \caption*{source can also be added here}
\end{table}
```

2.8 Formulas

There are several options here. In the text:

The Pythagorean theorem is: $c^2 = a^2 + b^2$.

Just like that, which is not recommended:

$$\int_{-\infty}^{+\infty} e^{-x^2} dx = \sqrt{\pi} \cdot \frac{1}{2}$$

Or like this, which is highly recommended:

$$c^2 = a^2 + b^2 \tag{2.1}$$

```
\begin{equation}
    \numberwithin{equation}{section}
    Formel \label{eq:formula} \\
\end{equation}
```

It is also helpful to use a formula editor.

When working with matrices (or vectors) or words within formulas, it is recommended to use `\mathbf{}` for matrices (or vectors) and `\text{}` or `\textbf{}` for words. For example:

$$\hat{\mathbf{x}} = \left(\mathbf{A}^\mathbf{T}\mathbf{A}\right)^{-1}\mathbf{A}^\mathbf{T}\ell \tag{2.2}$$

$$M = \frac{\text{map distance}}{\text{distance in nature}} = \frac{s_K}{s_N} = \frac{1}{m} \tag{2.3}$$

2.9 Listings (Python Code)

Python code can be included in LaTeX documents in two different ways. The first option is to directly include the code in the document as shown below:

```
1 # Libraries
2 from mpl_toolkits.basemap import Basemap
3 import matplotlib.pyplot as plt
4 # Initialize the map
5 map = Basemap(llcrnrlon=-160, llcrnrlat=-60, urcrnrlon=160,
   urcrnrlat=70)
6 # Continent and countries!
7 map.drawmapboundary(fill_color="#A6CAE0")
8 map.fillcontinents(color="#e6b800", lake_color="#e6b800")
```

```
9   map.drawcountries(color="white")
10  plt.show()
```

Listing 1: Basemap-Anwendung

or else from an existing file

```
1  conn = None
2  try:
3      # create a TCP socket
4      # SOCK_STREAM: Stream Socket (TCP) use the Internet Protocol (IP)
       for routing
5      # AF_INET: Address family for IPv4
6      s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)

8      # Bind the socket to the endpoint (IP address and port)
9      # Note: The parameter is a tuple.
10     s.bind( ( TCP_IP, TCP_PORT ) )
```

Listing 2: TCP-Server

2.10 Bullet Lists

Bullet lists can be used for the inventory:

- Trimble S7 (serial number: VE72)
- 2 reflectors with tripod and optical plumb
- 3 tripods

```
\begin{itemize}
 \setlength{\itemsep}{-2pt} % here the distance can be chosen
 \item Trimble S7 (serial number: VE72)
 \item 2 reflectors with tripod and optical plumb
 \item 3 tripods
\end{itemize}
```

However, if no distance is specified, it looks like this:

- Trimble S7 (serial number: VE72)

- 2 reflectors with tripod and optical plumb
- 3 tripods

Therefore, it is advisable to reduce this distance. Additional text can also be inserted under each point as if one were creating a paragraph (\\):

- Trimble S7 (serial number: VE72)
  Here is some additional text.
- 2 reflectors with tripod and optical plumb
- 3 tripods

This can also be formulated as follows with a standardized command:

```
\ownItems{
    \item Trimble S7 (serial number: VE72)\\
    Here is some additional text.
    \item 2 reflectors with tripod and optical plumb
    \item 3 tripods
}
```

2.11 Spacing

Spacing can be adjusted both horizontally and vertically, and can also be filled. Sometimes it is necessary to adjust spacing for better layout:
Text on the left but also on the right.

One centimeter below on the right side.

```
Text on the left \hfill but also on the right.


\vspace{10mm}
{\hfill One centimeter below on the right side.}
```

The commands are `\hfill`, `\vfill`, `\hspace{}` and `\vspace{}`, whereby the latter two can also be written with an asterisk (*) between the command and the brackets if you want to force the spacing.

2.12 Minipages

Sometimes it's better to place text and images side by side. Here, two `minipage` are useful:

There is no one who loves pain itself, who seeks after it and wants to have it, simply because it is pain, unless it is to occur in some circumstances in which toil and pain can procure him some great pleasure. To take a trivial example, which of us ever undertakes laborious physical exercise, except to obtain some advantage from it?

There is no one who loves pain itself, who seeks after it and wants to have it, simply because it is pain, unless it is to occur in some circumstances in which toil and pain can procure him some great pleasure. To take a trivial example, which of us ever undertakes laborious physical exercise, except to obtain some advantage from it?

```
\begin{minipage}[H]{0.48\textwidth}

\end{minipage}
\hfill
\begin{minipage}[H]{0.48\textwidth}

\end{minipage}\\
```

More than two minipages can also be placed side by side. The column width should never add up to 1, and a horizontal distance is also useful for a beautiful layout. Almost everything can be used or designed in minipages as usual. It is recommended to make a paragraph (\\) before and after.

2.13 Columns

Columns are rather not that useful, unless you don't want to use a minipage, because here the content is divided evenly:

There is no one who loves pain itself, who seeks after it and wants to have it, simply because it is pain, unless it is to occur in some circumstances in which toil and pain can procure him some great pleasure. To take a trivial example, which of us ever un-

dertakes laborious physical exercise, except to obtain some advantage from it? There is no one who loves pain itself, who seeks after it and wants to have it, simply because it is pain, unless it is to occur in some circumstances in which toil and pain can procure him some great pleasure. To take a trivial example, which of us ever undertakes laborious physical exercise, except to obtain some advantage from it?

```
\begin{multicols}{2}


\end{multicols}
```

Here, too, the number of columns can be increased:

There is no one who loves pain itself, who seeks after it and wants to have it, simply because it is pain, unless it is to occur in some circumstances in which toil and pain can procure him some great pleasure. To take a trivial example, which of us ever undertakes laborious physical exercise, except to obtain some advantage from it? There is no one who loves pain itself, who seeks after it and wants to have it, simply because it is pain, unless it is to occur in some circumstances in which toil and pain can procure him some great pleasure. To take a trivial example, which of us ever undertakes laborious physical exercise, except to obtain some advantage from it?

2.14 Embed PDF pages

If you want to add a PDF page, as for the attachment, so that there is no blank page, use the command included in `Makros.tex`.

If you want to insert a PDF as a raster, for example presentation slides, the command `\includepdf[options]{filepath}` is recommended (see `Makros.tex`). There you can define the PDF pages and the raster (`nup=<columns>x<rows>`). The command `pagecommand={}` preserves the header and footer.

2.15 Different breaks

If a page is well-formatted and a page break should occur, one of the following commands can be used:

```
\pagebreak
\newpage
```

If a line break is desired instead, the following command is recommended:

```
\linebreak
```

2.16 Comment

To leave comments to yourself or your co-authors while writing, you can use the following command:

```
\ownComment{Here is a comment.}
```

This command is then displayed as follows and must be commented out or deleted **before submission**:
Here is a comment.

3 Closing Words

These were a lot of impressions in LaTeX and I hope this template will help you.

If you have any questions, feel free to write to me or create an issue on GitHub. Thank you very much!
Also, make sure to check GitHub regularly!

Have fun writing and good luck with your studies.
Fabian Bloch

P.S.: You can also upload a ZIP file to Overleaf via „New Project... Upload Project“.

References

Witte, B., Sparla, P., & Blankenbach, J. (2020). *Vermessungskunde für das Bauwesen mit Grundlagen des Building Information Modeling (BIM) und der Statistik* (9th ed.). Wichmann Verlag.

List of Figures

List of Tables

Listings

A Appendix

But I must explain to you how all this mistaken idea of denouncing pleasure and praising pain was born and I will give you a complete account of the system, and expound the actual teachings of the great explorer of the truth, the master-builder of human happiness. No one rejects, dislikes, or avoids pleasure itself, because it is pleasure, but because those who do not know how to pursue pleasure rationally encounter consequences that are extremely painful. Nor again is there anyone who loves or pursues or desires to obtain pain of itself, because it is pain, but because occasionally circumstances occur in which toil and pain can procure him some great pleasure. To take a trivial example, which of us ever undertakes laborious physical exercise, except to obtain some advantage from it?

But who has any right to find fault with a man who chooses to enjoy a pleasure that has no annoying consequences, or one who avoids a pain that produces no resultant pleasure? On the other hand, we denounce with righteous indignation and dislike men who are so beguiled and demoralized by the charms of pleasure of the moment, so blinded by desire, that they cannot foresee the pain and trouble that are bound to ensue; and equal blame belongs to those who fail in their duty through weakness of will, which is the same as saying through shrinking from toil and pain. These cases are perfectly simple and easy to distinguish. In a free hour, when our power of choice is untrammelled and when nothing prevents our being able to do what we like best, every pleasure is to be welcomed and every pain avoided.

But in certain circumstances and owing to the claims of duty or the obligations of business it will frequently occur that pleasures have to be repudiated and annoyances accepted. The wise man therefore always holds in these matters to this principle of selection: he rejects pleasures to secure other greater pleasures, or else he endures pains to avoid worse pains. But I must explain to you how all this mistaken idea of denouncing pleasure and praising pain was born and I will give you a complete account of the system, and expound the actual teachings of the great explorer of the truth, the master-builder of human happiness. No one rejects, dislikes, or avoids pleasure itself, because it is pleasure, but because those who do not know how to pursue pleasure rationally encounter consequences that are extremely painful.

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To take a trivial example, which of us ever undertakes laborious physical exercise, except to obtain some advantage from it? But who has any right to find fault with a man who chooses to enjoy a pleasure that has no annoying consequences, or one who avoids a pain that produces no resultant pleasure? On the other hand, we denounce with righteous indignation and dislike men who are so beguiled and demoralized by the charms of pleasure of the moment, so blinded by desire, that they cannot foresee the pain and trouble that are bound to ensue; and equal blame belongs to those who fail in their duty through weakness of will, which is the same as saying through shrinking from toil and pain. These cases are perfectly simple and easy to distinguish.

In a free hour, when our power of choice is untrammelled and when nothing prevents our being able to do what we like best, every pleasure is to be welcomed and every pain avoided. But in certain circumstances and owing to the claims of duty or the obligations of business it will frequently occur that pleasures have to be repudiated and annoyances accepted. The wise man therefore always holds in these matters to this principle of selection: he rejects pleasures to secure other greater pleasures, or else he endures pains to avoid worse pains. But I must explain to you how all this mistaken idea of denouncing pleasure and praising pain was born and I will give you a complete account of the system, and expound the actual teachings of the great explorer of the truth, the master-builder of human happiness.

No one rejects, dislikes, or avoids pleasure itself, because it is pleasure, but because those who do not know how to pursue pleasure rationally encounter consequences that are extremely painful. Nor again is there anyone who loves or pursues or desires to obtain pain of itself, because it is pain, but because occasionally circumstances occur in which toil and pain can procure him some great pleasure. To take a trivial example, which of us ever undertakes laborious physical exercise, except to obtain some advantage from it? But who has any right to find fault with a man who chooses to enjoy a pleasure that has no annoying consequences, or one who avoids a pain that produces no resultant pleasure?

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