

# Package ethuebung for ETH Exercise Sheets

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This package provides a unified way of typing exercises for ETH Zurich. While you type in logically all aspects of your exercise using provided L<sup>A</sup>T<sub>E</sub>X macros (title, text, hints, solution, etc.), it is rendered according to some standard style (yet remaining highly customizable), and provides different versions of the sheet for distributing to students (without the solutions), or for TA's (with solutions).

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## 1 Quick Start Guide and Simple Usage.

Copy the style file `ethuebung.sty` into the same directory as your exercise sheet  $\text{\LaTeX}$  file. No other files are needed (no logo images etc. are needed as they are packaged with the style file). Start off with the following minimal template.

```
\documentclass[11pt,a4paper]{article}

\usepackage{ethuebung} % comment this and uncomment next line for solutions
%\usepackage[sol]{ethuebung} % uncomment for solutions

\UebungLecture{Microstructures of molten cheese.}
\UebungProf{Prof. Zebigboss}
\UebungSemester{HS 2999}

\UebungsblattNumber{1}

\begin{document}
\MakeUebungHeader

\exercise{Title of the exercise.}

In this exercise, you will be asked to do some work.

\begin{exenumerate}
\item Solve the following equation.
  \begin{align}
x^2 = 1 \setminus .
\end{align}
\hint{There might be more than one solution.}

  \begin{solution}
    Write here the solution to this exercise.
  \end{solution}
\end{exenumerate}

\end{document}
```

If you want the **German** version of the template, simply pass the `[german]` option to the `\usepackage` directive (see also Sec. 3.3),

```
\usepackage[deutsch]{ethuebung} % German version, "Uebungsblatt"
%\usepackage[deutsch,sol]{ethuebung} % German version, "Musterloesung"
```

Obviously you'll have to fill in the title of your lecture, the lecturer and the semester accordingly using the `\UebungLecture` (page 4), `\UebungProf` (page 4) or `\UebungLecturer` (page 4), and `\UebungSemester` (page 4) commands. Use the `\UebungsblattNumber` (page 4) command to specify the number of the exercise sheet (usually increases by one every week). Don't forget the `\MakeUebungHeader` (page 4) command at the beginning of the document to actually draw the header.

Write the solutions to each exercise inline, using a `\begin{loesung}...\end{loesung}` (page 10) or `\begin{solution}...\end{solution}` (page 10) environment. When you compile the code above, then the solutions will not appear.

If you want to generate a solutions sheet with the solutions displayed (eg. for the TA's or for the students after they handed in), then simply change the two lines:

```
\usepackage{ethuebung} % comment this and uncomment next line for solutions
%\usepackage[sol]{ethuebung} % uncomment for solutions
```

to:

```
%\usepackage{ethuebung} % comment this and uncomment next line for solutions
\usepackage[sol]{ethuebung} % uncomment for solutions
```

Recompile the sheet, and the solutions will be displayed.

## 2 What This Package Does

This package provides a unified way of typing exercises for ETH Zurich. While you type in logically all aspects of your exercise using provided L<sup>A</sup>T<sub>E</sub>X macros (title, text, hints, solution, etc.), it is rendered according to some standard style (yet remaining highly customizable), and provides different versions of the sheet for distributing to students (without the solutions), or for TA's (with solutions).

ex numbering

both ex sheet/solution sheet

- eqns in solution numbered by themselves - can attach pdfs for solution

## 3 Setting Up The Exercise Sheet

### 3.1 Lecture, Lecturer, Semester

Setting up the exercise sheet is just a matter of calling a small number of commands before the beginning of your document, in the preamble. See the template given in Sec. 1. These lines could be for example:

```
\UebungLecture{Microstructures of molten cheese.}
\UebungProf{Prof. Zebigboss}
\UebungSemester{HS 2999}

\UebungsblattNumber{1}
```

`\UebungLecture{...}` This command sets the title of your lecture to the given argument. The lecture title is displayed in the main exercise header.

`\UebungProf{...}` Use this command to set the professor or lecturer of the course to the given argument.

`\UebungLecturer{...}` This command is an exact alias of `\UebungProf`.

`\UebungSemester{...}` This command sets the semester that will be displayed in the header.

`\UebungsblattNumber{...}` This sets the exercise sheet number to the given argument. The exercise sheet number usually starts at 1, and increases every week as more exercise sheets are distributed.

**TIP** These commands should be called in the preamble, but they just internally expand to an internal macro definition. So technically they can be called whenever you want. Just call them before calling any other macro that actually uses those values, e.g. `\MakeUebungHeader` (page 4). Calling such a macro a second time with a different value overrides the previous value.

### 3.2 Exercise Sheet Header

The page header is generated automatically by the package, however you should call the command `\MakeUebungHeader` explicitly at the beginning of the document.

`\MakeUebungHeader` Draws the main header of the exercise sheet, in three parts, with ETH logo, centered title, and professor/semester displayed on the right. And a horizontal line under those.

The header automatically displays the right title, according to whether the exercise sheet

without the solutions or with the solutions is displayed, respectively printing “Series” or “Solutions”. The appropriate titles are also automatically displayed in German when the `german` package option is provided.

**TIP** If you want to display some other string, like “Exercise Sheet”, this title can be customized using commands `\UebungsblattTitleSeries` (page 12) and `\UebungsblattTitleSolutions` (page 12). The font can also be changed, use `\UebungsblattTitleFont` (page 12). The header itself is highly customizable, see Sec. 6.1.

### 3.3 Exercise Sheet Language: German or English

```
\usepackage[deutsch]{ethuebung} % German version, "Uebungsblatt"
```

will provide you the German version of the exercise sheet. Simply adding the `sol` package option will provide you the “Musterlösung”:

```
\usepackage[deutsch,sol]{ethuebung} % German version, "Musterloesung"
```

**TIP** This package option does nothing else than redefining (re-customizing) the sheet title for exercises and for solutions, the exercise label using the commands `\UebungsblattTitleSeries` (page 12) etc. documented in section 6. It also automatically includes the L<sup>A</sup>T<sub>E</sub>X `babel` package with the `[german]` option.

## 4 Exercises

### 4.1 `\uebung`: a new exercise

Use `\uebung` or `\exercise` to introduce a new exercise, and specify a title for your exercise.

```
\uebung{<Exercise Title>} Similar to a LATEX \section command, this command starts the definition of a new exercise. The exercises are automatically numbered. An adequate label is displayed with the current exercise number, and the exercise title is printed in bold italic font (by default).
```

The exercise is internally implemented as a L<sup>A</sup>T<sub>E</sub>X `\paragraph`. The numbering is taken care of by an internal counter (`uebcounter`).

The label and title font of the exercise can be highly customized by using or redefining for example the commands `\UebungLabel` (page 13), `\UebungExTitleFont` (page 13), `\theuebcounter` (page ??) etc.

`\exercise{...}` Exactly the same as `\uebung`.

**[ ! ]** Commands `\uebung` and `\exercise` produce exactly the same output, in the same language, which is the language of the sheet. By default, the language is English, but it can be changed to German by specifying the `[deutsch]` package option. The label can also independently be changed, see `\UebungLabel` (page 13).

## 4.2 The `\begin{exenumerate}...\end{exenumerate}` environment

`\begin{exenumerate} ... \end{exenumerate}`  
This environment provides a `enumerate`-like environment, with labels (a), (b), ... by default, with which you can split an exercise into several parts. Use `\item` for each part, as for `itemize` and `enumerate`.

Such `\begin{exenumerate}...\end{exenumerate}` environments can be nested up to two levels (by default), and the second level will be numbered (by default) (i), (ii), ... .

These environments may be broken and resumed, and their numbering will be automatically resumed correctly and reset for each exercise. This is useful to add comments or to introduce new concepts between different parts of an exercise.

For example:

Consider the setting in which one applies a positive voltage between the source and the gate leads. Answer the following questions.

`\begin{exenumerate}`

`\item % This is (a)`

Calculate quantity blah blah for this setting.

`\item % This is (b)`

What happens at the edge of the sample with this setting?

`\end{exenumerate}`

Now, consider setting a {\em negative} voltage instead.

`\begin{exenumerate}`

`\item % This item will automatically be labelled (c).`

Recalculate the quantity blah blah for this setting.

```
\end{exenumerate}
```

Last but not least, you can refer to different parts of the exercise with L<sup>A</sup>T<sub>E</sub>X's usual `\label{...}` and `\ref{...}` commands, as for example:

```
\begin{exenumerate}
\item % This is item (a)
  \label{expart:FirstQuestion}
  Prove Fermat's big theorem.

\item % This is item (b)
  Convince yourself that question~\ref{expart:FirstQuestion} is
  quite difficult.
  % this will display "Convince yourself that question (a) ..."

\end{exenumerate}
```

You may change the default labelling, (a), (b), ..., by specifying your label format as `\begin{exenumerate}[format]`, for example:

```
\begin{exenumerate}[A)]
\item This is A)
\item This is B)
\end{exenumerate}
```

The syntax is the one used by the `\begin{enumerate}...\end{enumerate}` environment (in the `enumerate`<sup>1</sup> package, or in the `enumitem`<sup>2</sup> package with `shortlabels` options).

**TIP** Internally the package `enumitem` is used, with option `shortlabels`. This allows the use as described above of the (old) `enumerate` syntax, as well as the new (but unfortunately more cryptic and verbose) `enumitem` syntax, `[label=(\roman*)]`. See section 6.2 for commands available to customize the `\begin{exenumerate}...\end{exenumerate}` environment, in particular `\UebungLabelEnum`.

### 4.3 Hints

Hints can be introduced with the `\hint` and `\hints` commands.

<sup>1</sup><http://mirrors.ctan.org/macros/latex/required/tools/enumerate.pdf>

<sup>2</sup><http://mirrors.ctan.org/macros/latex/contrib/enumitem/enumitem.pdf>

`\hint{...}` Displays some text meant as a hint to the student with a label “Hint”. A special font is used (e.g. small and italic)

`\hints{...}` Same as `\hint`, except uses the label “Hints”. Use this when several hints are given at once.

For example:

```
\hint{Remember that a unitary  $U$  satisfies
       $UU^\dagger=U^\dagger U=\mathbb{I}$ .}
```

or, if there are several hints,

```
\hints{Remember that a unitary  $U$  satisfies
       $UU^\dagger=U^\dagger U=\mathbb{I}$ .

      Also, a rotation  $R$  satisfies  $RR^T=R^T R=\mathbb{I}$ .
}
```

**TIP** You can customize the appearance of the hint text, as well as the label used for hints with the `\UebungHinweisLabel` (page 14), `\UebungHinweiseLabel` (page 14), and the `\UebungHinweisFont` (page 13) commands.

`\hinweis{...}` This is exactly the same as `\hint`.

`\hinweise{...}` This is exactly the same as `\hints`.

**[ ! ]** Both `\hinweis` and `\hint` produce the same output in the same language, which is the language of the sheet (English by default, or German if the `deutsch` package option was given).

#### 4.4 Splitting exercises into ‘Sub-Exercises’

You can split exercises into sub-exercises, in the same spirit as when in a regular  $\text{\LaTeX}$  article you split `\section`’s into `\subsection`’s.



`\subuebung {...}` Define a sub-exercise, the title of which will be the argument given. This will number the sub-exercise automatically.

`\subexercise {...}` Exactly the same as `\subuebung`

The following example:

```
\exercise{Quantization of the Electromagnetic Field.}
In this exercise, we will learn to quantize the electromagnetic field.

\subexercise{Classical Case.}
First, here are some questions about classical E-M fields...

...

\subexercise{Quantum Case.}
Now we will quantize the E-M field...

...
```

will appear as:

```
Exercise N.    Quantization of the Electromagnetic Field.
In this exercise ....
...
N.1   Classical Case.    First, here are ...
...
N.2   Quantum Case.    Now we ...
...
```

**TIP**    Leaving an extra (blank) newline between `\subexercise` and the sub-exercise text will produce the sub-exercise text on a new line.

**TIP**    Of course, `\subexercise` is customizable, too. See section 6.2.

## 4.5 Note About Figures

note about figures .....? wrapfigure?

## 5 Solutions

### 5.1 Inline Solutions for Solutions Sheet: `\begin{loesung}...\end{loesung}`

You should write up the solutions for an exercise immediately after the exercise, or between exercise parts, using a `\begin{loesung}...\end{loesung}` environment. When the sheet is compiled in “exercise sheet” mode (the default), then the solutions are simply ignored and not displayed. However, when the package option `sol` is provided, or if the command `\UebungMakeSolutionsSheet` (page 10) is called, then whenever the environment `\begin{loesung}...\end{loesung}` is encountered, a label “Solution” is printed, followed by the contents of the environment. By default, the solution text is printed in a smaller font to make it visually clear that it is the solution to the exercise.

Formatting of the solutions takes care, too, of numbering the equations differently (i.e. (S.1), (S.2), etc.) so equation numbering does not collide with the equation text. Equations are also guaranteed to have the same labels between the exercise and solution versions of the sheet.

The `\begin{loesung}...\end{loesung}` (page 10) environment may appear anywhere in the exercise, and may be repeated. You may have, for example, one general solution at the end of the exercise, or multiple solutions after each exercise part or sub-exercise.

`\begin{loesung} ... \end{loesung}`

Provides solution text to an exercise. The content of this environment is by default hidden, unless in ‘solution sheet’ mode (package option `sol`, or with the command `\UebungMakeSolutionsSheet` (page 10)). If in solution sheet mode, then the contents is formatted using a smaller font (by default) and is preceded by the label “Solution” (or “Lösung” if the sheet is in german, with the `german` package option, see Sec.3.3).

Equations numbered within this environment obey a separate counter and their labels are preceded by a letter “S” (resp. “L” in German), i.e. (S.1), (S.2), ... (resp. (L.1), (L.2), ...), such that it is guaranteed that equation numbering stays consistent between solution sheet mode and exercise sheet mode.

`\begin{solution} ... \end{solution}`

Exactly the same as the `\begin{loesung}...\end{loesung}` environment.

[!]

Both commands `\begin{loesung}...\end{loesung}` and `\begin{solution}...\end{solution}` display their label in the same language, which is the language of the exercise sheet. This defaults to English but may be set to German with the `german` package option (Sec. 3.3).

`\UebungMakeSolutionsSheet` This command has exactly the same effect as providing the `sol` package option. It switches the sheet to “solutions” mode, giving it a “Solutions” title, and displaying all contents provided in `\begin{loesung}...\end{loesung}` environments and `\pdfsolution` (page 11) commands.

## 5.2 PDF Attachment as solution

It is also possible to attach a PDF file with, for example, a scanned hand-written solution. The pages of that file are included at the end of the solutions sheet, with a reference to the page number at the point in the exercise where the solution is referenced, and a title superimposed to the included PDF pages that specify which exercise those pages refer to.

For example, if a solution is scanned as `scanned-solution.pdf`, then you can simply write in your exercise:

```
\exercise{A Nice Exercise}
Show that blah blah blah something cool.

\pdfsolution{scanned-solution.pdf}
```

the `\pdfsolution` command internally expands to a `\begin{solution}...\end{solution}` environment at the point where its called, inserting some text like “The solution is provided on page XYZ”. Then the pages of the specified PDF are appended at the end of the solutions sheet, with on each page printed on top “Solution to exercise NN”.

Obviously, the command expands to nothing if not in solutions mode, and no PDF pages are included in that case.

The inclusion of the PDF is internally accomplished with the `\includepdf` command from the `pdfpages`<sup>3</sup> package.

`\pdfsolution [options]{pdf file}` Specify a PDF file to include which contain the solution to the current exercise. A reference to the page where the solutions will be inserted (at the end of the sheet) is inserted at the current location within a `\begin{solution}...\end{solution}` (page 10) environment. The included pdf pages are given a title on each page specifying which exercise they are the solution to. The `options` are any options that can be passed to `\includepdf` of the `pdfpages` package.

`\pdfloesung [options]{pdf file}` Exact same command as `\pdfsolution`.

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<sup>3</sup><http://mirrors.ctan.org/macros/latex/contrib/pdfpages/pdfpages.pdf>

## 6 Customization

In this section we will present some handy commands to change the way the exercise sheet looks, or to change some defaults to some other values you would prefer.

All `\Uebung***{...}` commands specified in this section internally expand to an internal macro definition, and may be called several times if need be (but it shouldn't need be...). Also, best practice is to call them in the preamble, but things will still work if you call them anywhere else before you call any command that actually uses the values you want to set.

### 6.1 Customizing the Header

`\UebungsblattTitleSeries{...}` Redefines the title of the exercise sheet whenever the sheet is compiled in “exercise” sheet mode, and not in “solutions” sheet mode.  
Default title is “**Series**” (“**Übungsblatt**” in German).

`\UebungsblattTitleSolutions{...}` Redefines the title of the exercise sheet whenever the sheet is compiled in “solutions” mode.  
Default title is “**Solutions**” (“**Musterlösung**” in German).

**TIP** Both commands `\UebungsblattTitleSeries` and `\UebungsblattTitleSolutions` can be specified in the same preamble. The relevant title depending on exercise or solutions mode is automatically selected.

`\UebungsblattTitleFont{...}` Redefines the commands to set the font for the main title. You may use the usual  $\text{\LaTeX}$  commands to manipulate fonts, `\bfseries`, `\large`, `\Large`, `\fontfamily`, `\fontseries`, `\selectfont` etc. It is also possible to pass the name of a macro that expects an argument, e.g. `\underline`, if nothing else follows that macro.  
The default font specification is “`\large\bfseries`”.

## 6.2 Customizing the Exercise Labels and Fonts

`\UebungHinweisFont{...}` Specify the font commands to use to set up the font for the main text produced by the `\hint` (page 7) and `\hints` (page 8) commands.  
This command has the same syntax as the `\UebungsblattTitleFont` (page 12) command.  
Default font is “`\small\em`”.

`\UebungExTitleFont{...}` Specify the font used when displaying the title of an exercise, i.e. the text passed as argument to the `\exercise` (page 6) command.  
This command has the same syntax as the `\UebungsblattTitleFont` (page 12) command.  
Default font is “`\bfseries\em`”.

`\UebungSubExTitleFont{...}` Specify the font used when displaying the title of a sub-exercise, i.e. the text passed as argument to the `\subexercise` (page 9) command.  
This command has the same syntax as the `\UebungsblattTitleFont` (page 12) command.  
Default font is “`\bfseries\em`”.

`\UebungLabel{...}` Specify the text to display to label an exercise. This is typically “Exercise” or “Question”.  
Default value is “**Exercise**”. See also `\uebTheUebungLabel` (page ??).

`\UebungSubLabel{...}` Specify the text to display to label a sub-exercise.  
The default value is empty. See also `\uebTheUebungSubLabel` (page ??).

`\UebungLabelEnum{...}` Specify the label that will be used for each exercise part (e.g. (a), (b), ...) produced by a `\begin{exenumerate}...\end{exenumerate}` (page 6) environment. Here you must specify the label with the format for the `enumitem` package, i.e. for example use any string containing one of the `\roman*`, `\Roman*`, `\alph*`, `\Alph*`, or `\arabic*` commands.  
The default label definition is “`(\alph*)`”.

`\UebungLabelEnumSub{...}` Specify the label that will be used for each nested exercise part, i.e. any `\begin{exenumerate}...\end{exenumerate}` (page 6) environment nested within another `\begin{exenumerate}...\end{exenumerate}` (page 6) environment. The default is (i), (ii), ... As for `\UebungLabelEnum`, the format has to be conform to the `enumitem` package. The default label definition is “`(\roman*)`”.

`\UebungHinweisLabel{...}` Specify what text to display to introduce a hint produced by `\hint` (page 7). You may for example use a colon (‘:’) instead of a period (‘.’) if you prefer. Default text is “**Hint.**” (“**Hinweis.**” in German).

`\UebungHinweiseLabel{...}` Specify what text to display to introduce hints produced by `\hints` (page 8). You may for example use a colon (‘:’) instead of a period (‘.’) if you prefer. Default text is “**Hints.**” (“**Hinweise.**” in German).

**[ ! ]** Note that the same text will be displayed by the `\hint` (page 7) and `\hinweis` (page 8) commands; that text is the one specified to `\UebungHinweisLabel`. The sheet language setting only changes the default value for the hint label. The same applies to the `\hints` (page 8) and `\hinweise` (page 8) commands. Actually, internally, when the `deutsch` package option is given, a call to `\UebungHinweisLabel` is made to set the German version of the label, to replace the initial English version.

### 6.3 Customizing the Solutions Labels and Fonts

### 6.4 Customizable “Composed” Commands

ex label and ‘composition’ (“Exercise”, “Question” and/or “Exercise N.”, “Question N.”) subexercise label and ‘composition’

## 7 Some Internals

.....

## 8 Commands Reference

`\UebungLecture`

Sets the title of your lecture. See page 4.

`\UebungProf`

Sets the name of the professor or lecturer of the course. See page 4.

`\UebungLecturer`

Same as `\UebungProf` (page 4). See page 4.

`\UebungSemester`

Sets the course semester. See page 4.

`\UebungsblattNumber`

Sets the current exercise sheet number. See page 4.

`\UebungsblattTitleSeries`

Set the title for the exercise sheet (when not in solutions mode). See page 12.

`\UebungsblattTitleSolutions`

Set the title for the solutions sheet (only when in solutions mode, i.e. with `[sol]` package option or with `\UebungMakeSolutionsSheet` (page 10)). See page 12.

## 9 Package Options Reference

`deutsch`

`sol`

`noenum`

`nogeom`