

# The agopt\_ex package\*

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## Abstract

The agopt\_ex package is an aid to generate exercise sheets for the Optimization Research Group, TU Kaiserslautern.

The agopt\_ex package defines:

- environments for exercises and solutions,
- two layout variants (classic and modern, respectively, the latter containing a colored AG logo); includes a nice footer and predefined macros for a “in-class” and “take-home” sections,
- various ways to decide whether or not the solutions should be included in the output, including an *auto-magic*<sup>®</sup> mechanism,
- a number of useful features and macros.

This package documentation shows how to use the package by describing all package options and (re)defined macros. The corresponding source code snippets are included at the appropriate place for easy customization (and, of course, for instructional reasons).

## 1 Package Loading

### 1.1 Package Options

#### Language Settings

**german** Define the language of the exercise sheet. The default is **german**. This option influences various textual elements of the exercise sheet.

**english**

```
1 \def\ublanguage{german}
2 \DeclareOption{german}{
3   \def\ublanguage{german}
4 }
5 \DeclareOption{english}{
6   \def\ublanguage{english}
7 }
```

---

\*This document corresponds to agopt\_ex v0.3.1, dated 2012/02/10. Obtain the newest version at <http://github.com/supermihi/latex>

## Toggle Solution Output

`solution` These options define whether or not solutions should be included in the output document or not. If neither  
`nosolution` option is present, *auto-magic* detection is enabled.  
With *auto-magic* detection, the solutions are output if and only if the jobname contains the string “olution” (in english mode) or “oesung” (in german mode). Note that this is not a typo; the first letter is omitted in order to be case insensitive. If you need a different detection string, redefine the `\solutionfilename` macro.  
The jobname is normally the name of the source file without the `.tex` extension, but can be overridden in (pdf)latex, xelatex etc. with the `-jobname=NAME` option. This allows for a convenient workflow: Create a single `.tex` file, e.g. `exercise1.tex`, then run

- `xelatex exercise1`
- `xelatex -jobname=solution1 exercise1`

(substitute `xelatex` with your favourite  $\text{\TeX}$  engine, e.g. `pdflatex`, `latex`, ...) in order to generate `exercise1.pdf` (without solutions) and `solution1.pdf` (including solutions). The bash script `xeloetex` distributed together with this package shows how to merge both steps into one command that can be used as compile command in your favourite  $\text{\TeX}$  editor.

```
8 \newif\ifautoshowanswers
9 \newif\ifshowanswers
10 \showanswersfalse
11 \autoshowanswerstrue
12 \DeclareOption{solution}{\showanswerstrue\autoshowanswersfalse}
13 \DeclareOption{nosolution}{\showanswersfalse\autoshowanswersfalse}
```

## Choose Layout


`classic` Defines the style of the exercise sheet. `modern` uses a colored graphical logo of the AG in the title (as in  
`modern` this document). `classic` resembles the classical exercise sheet style which hasn't changed for the past 30 years.

```
14 \newif\ifmodern
15 \DeclareOption{modern}{\moderntrue}
16 \DeclareOption{classic}{\modernfalse}
17 \moderntrue % the default
```

This closes the options section.

```
18 \ProcessOptions\relax
```

## 1.2 Fonts

The package configures  $\text{\TeX}$  to use fonts of the Linux Libertine  family and the Euler math font. The implementation differs for (pdf)latex and xelatex. For this package to work with xelatex, you need to have the Linux Libertine and Linux Biolinum OpenType fonts installed.

```
19 \RequirePackage{ifxetex}
20 \RequirePackage{ifthen}
21 \ifxetex
```

```

22 \RequirePackage{amsfonts,amssymb}
23 \RequirePackage{euler}
24 \RequirePackage{xltextra}
25 \RequirePackage{xunicode}
26 \RequirePackage{polyglossia}
27 \defaultfontfeatures{Mapping=tex-text} % needed for -- and --- to work
28 \setromanfont[Numbers=Proportional]{Linux Libertine O}
29 \setsansfont[Numbers=Proportional]{Linux Biolinum O}
30 \ifthenelse{\equal{\ublanguage}{german}}{
31 \setdefaultlanguage{german}
32 }{
33 \setdefaultlanguage[variant=american]{english}
34 }
35 \else
36 \ifthenelse{\equal{\ublanguage}{german}}{
37 \usepackage[ngerman]{babel}
38 }{
39 \usepackage[american]{babel}
40 }
41 \RequirePackage{libertine}
42 \RequirePackage[T1]{fontenc}
43
44 \usepackage{euler}
45 \fi

```

### 1.3 Required Packages

The following packages are needed by agopt\_ex:

```

46 \RequirePackage{amsmath}
47 \RequirePackage{geometry}
48 \RequirePackage{hyperref}
49 \RequirePackage{fancyhdr}
50 \RequirePackage{zref-totpages}
51 \RequirePackage{prettyref}
52 \RequirePackage{url}
53 \RequirePackage{xspace}

```

## 2 Providing Lecture and Exercise Parameters

The following lecture and tutorial data should be set in every exercise sheet.

<code>\Lecture</code>	Specify the name of the lecture (e. g. “Praktische Mathematik: Lineare und Netzwerkoptimierung”).
	54 <code>\def\Lecture#1{\def\lecture{#1}}</code>
<code>\LectureShort</code>	Specify a short name of the lecture, used in the footer (e. g. “PraMa Optimierung”).
	55 <code>\def\LectureShort#1{\def\lectureshort{#1}}</code>
<code>\Sheetnumber</code>	Specify the exercise sheet number.
	56 <code>\def\Sheetnumber#1{\def\sheetnumber{#1}}</code>

<code>\Deadline</code>	Specify the deadline for turn-in exercises. May include additional information such as “in the lecture” or “into the mailboxes in building 48”. 57 <code>\def\Deadline#1{\def\deadline{#1}}</code>
<code>\IssueDate</code>	Specify the date when the sheet was issued. 58 <code>\def\IssueDate#1{\def\issuedate{#1}}</code>
<code>\Lecturer</code>	Specify the name of the lecturer. 59 <code>\def\Lecturer#1{\def\lecturer{#1}}</code>
<code>\Operator</code>	Specify the name of the exercise operator. 60 <code>\def\Operator#1{\def\operator{#1}}</code>
<code>\Semester</code>	Specify the current semester or term (e. g. “winter term 2012”). 61 <code>\def\Semester#1{\def\semester{#1}}</code>
<code>\Homepage</code>	This optional parameter defines a homepage for the exercises. If it is used, the document output will contain a note where to download exercises. 62 <code>\def\Homepage#1{\def\homepage{#1}}</code>
<code>\Inclassdate</code>	This optional parameter defines the date for in-class exercises. 63 <code>\def\InclassDate#1{\def\inclassdate{#1}}</code>

The parameters defined by the above macros can be accessed by their lowercase equivalents.

```

64 \def\lecture{Default lecture name}
65 \def\lectureshort{PraMa Optimierung}
66 \def\sheetnumber{1}
67 \def\deadline{24.12.1970}
68 \def\issuedate{06.12.1970}
69 \def\lecturer{Lecturer}
70 \def\operator{Exercise Operator}
71 \def\semester{Semester}
72 \def\homepage{}

```

## 2.1 Change Default Textual Elements

The words used for “Exercise”, “Sheet” etc. can be modified by redefining the following commands:

```

73 \ifthenelse{\equal{\ublanguage}{german}}{
74   \def\solutiontext{L"osung}
75   \def\exercisetext{Aufgabe}
76   \newcommand{\exerciseshheettext}{\ "Ubungsblatt}
77   \def\withsolutiontext{mit L"osung}
78   \def\pagetext{Seite}
79   \def\pointstext{Punkte}
80   \def\solutionsheettext{L"osungsblatt}
81   \def\deadlinetext{Abgabe bis}
82   \def\solutionfilename{oesung}
83   \def\lecturetext{Vorlesung}

```

```

84 \newcommand{\exercisestext}{\ "Ubungen}
85 \newcommand{\homepagetext}{Dieses \ "Ubungsblatt sowie weitere %
86 Informationen zur \ "Ubung sind unter \url{\homepage} erh\ "altlich.}
87 \newcommand{\inclasstexttitle}{Pr\ "asenz\ "ubungen}
88 \newcommand{\inclasstext}{(Zur Bearbeitung in der \ "Ubung am \inclassdate)}
89 \newcommand{\takehometexttitle}{Haus\ "ubungen}
90 \newcommand{\takehometext}{Bitte bis \deadline{ } abgeben.}
91 \newcommand{\deadlinepre}{\textbf{Abgabefrist: }}
92 }{
93 \def\solutiontext{Solution}
94 \def\exercisetext{Exercise}
95 \def\exercisheettext{Exercise Sheet}
96 \def\solutionsheettext{Solution Sheet}
97 \def\withsolutiontext{including solutions}
98 \def\pagetext{Page}
99 \def\pointstext{points}
100 \def\deadlinetext{Due date:}
101 \def\solutionfilename{olution}
102 \def\lecturetext{Lecture}
103 \def\exercisestext{Exercises}
104 \newcommand{\homepagetext}{Download of exercises at \url{\homepage}}
105 \newcommand{\inclasstexttitle}{In-Class Exercises}
106 \newcommand{\inclasstext}{(To be done in the tutorial on \inclassdate)}
107 \newcommand{\takehometexttitle}{Turn-In Exercises}
108 \newcommand{\takehometext}{Please hand in by \deadline{}}
109 \newcommand{\deadlinepre}{\textbf{Deadline: }}
110 }

```

For example, if you wish to name exercises “Problem” rather than “Exercise”, simply put

```
\renewcommand{\exercisetext}{Problem}
```

in your preamble.

## 3 Typesetting Exercises and Solutions

### 3.1 Exercises

**exercise** The exercise environment is used in the following way:

```
\begin{exercise} [<title>] {<points>}
```

```
...
```

```
\end{exercise}
```

The parameter *<points>* will be typeset in parenthesis after the exercise title, unless it is empty. If the optional *<title>* is given, the exercise title is typeset after the exercise number, separated by an endash (–). Exercises are numbered by a special counter (`exercise`); the number is displayed in the style *x.y* where *x* is the sheet number and *y* the exercise number on the sheet. You can thus use `\label` and `\ref` for exercise refercening as well as `\theexercise` to output the current exercise number.

As an example, the code

```
\begin{exercise}[$P \neq NP$]{4}
```

Prove that  $P$  is a proper subset of  $NP$ .

will be output as

### Exercise 1.1 – $P \neq NP$ (4 points)

Prove that  $P$  is a proper subset of  $NP$ .

```

111 \newcommand{\exheader}[1]{\par\vspace{2.5mm}\noindent{\bfseries #1}\par\vspace{1.5mm}}
112 \newcounter{exercise}
113 \setcounter{exercise}{0}
114 \newenvironment{exercise}[2][{}]{%
115 {%
116   \refstepcounter{exercise}
117   \exheader{\exercisetext{} \sheetnumber.\arabic{exercise}
118   \ifthenelse{\equal{#1}{}}{-- #1}
119   \ifthenelse{\equal{#2}{}}{({#2 \pointstext})}}
120 }%
121 {\par\vspace{2mm}}

```

Subexercises can be typeset with usual `\enumerate` environments. In order not to mix up exercise and subexercise numbering, this package sets the first-order enumeration labelling to alphabetic numbering and the second order to arabic:

```

122 \RequirePackage{enumitem}
123 \setlist[enumerate,1]{label=\alph*}
124 \setlist[enumerate,2]{label=\arabic*.}

```

## 3.2 Solutions

**solution** The `solution` environment can be used to create a sample solution. You can decide whether or not solutions will be included in the output, in order to distinguish between exercise and solution sheets (see Section 1.1).

The `solution` environment is used as follows:

```

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

```

For example, the code

```

\begin{solution}
  Base clause: Let  $N=1$ , then obviously  $P=NP$ .
\end{solution}

```

will be output to (if solution output is active)

### Solution 1.1:

Base clause: Let  $N = 1$ , then obviously  $P = NP$ .

### 3.3 Implementation of the Auto-Magic Solution Feature

If neither `solution` nor `nosolution` is provided as package option, test if the `\jobname` contains the (language specific) word for “solution”. The test requires the `xstring` package.

```
125
126 \ifautoshowanswers
127 \RequirePackage{xstring}
128 \IfSubStr*{\jobname}{\solutionfilename}{
129   \showanswerstrue
130 }{
131   \showanswersfalse
132 }
133 \fi
134 \newenvironment{solution}{%
135 {%
136   \ifshowanswers
137     \exheader{\solutiontext{}} \sheetnumber.\arabic{exercise}:}
138   \else
139     \par\vspace*{0pt}%
140     \setbox\z@\vbox\bgroup
141   \fi
142 }{%
143   \ifshowanswers
144     %
145   \else
146     \egroup
147   \fi
148 }%
```

### 3.4 In-Class and Take-Home Exercises

`\inclass` These optional macros create a title that marks the begin of the “in-class” or “take-home” part, respectively,  
`\takehome` of the exercise sheet.

```
149 % marks if an exercise type (inclass, takehome) was explicitly chosen, because otherwise the layout
150 % has to automatically print the deadline information.
151 \newif\ifexplicittype
152 \explicittypefalse
153 \newcommand{\inclass}{\par{\large
154 \ifmodern\txtsc{\inclasstexttitle}\else\MakeUppercase{\inclasstexttitle}\fi}\\
155 (\inclasstext)\par
156 \explicittypetrue
157 }
158 \newcommand{\takehome}{\par{\large
159 \ifmodern\txtsc{\takehometexttitle}\else\MakeUppercase{\takehometexttitle}\fi}\\
160 (\takehometext)\par
161 \explicittypetrue
162 }
```

## 4 Miscellaneous Features

### 4.1 PDF parameters

This package sets some PDF parameters according to the exercise sheet definition.

```
163 \hypersetup{%
164   pdftitle={\lecture, \exercisheettext{} \sheetnumber}, %
165   pdfauthor={Optimization Research Group}, %
166   pdfcreator={\ifxetex XeLaTeX \else LaTeX2e \fi}}
```

### 4.2 Referencing Exercises and Solutions

This package defines to reference formats for the prettyref package which can be used to reference exercises and solutions, respectively. Example:

Use the graph of `\prettyref{ex:dijkstra}` and ...

Would be typeset as, say,

Use the graph of Exercise 2 and ...

```
167 \newreformat{ex}{\exercisetext~\ref{#1}}
168 \newreformat{solution}{\solutiontext~\ref{#1}}
```

### 4.3 Headers and Footers

`agopt_ex` uses `fancyhdr` to set an empty header and a nice footer. You can modify the following default layout if you wish.

```
169 \pagestyle{fancy}
170 \fancyhead{}
171 \renewcommand{\headrulewidth}{0pt}
172 \renewcommand{\footrulewidth}{.4pt}
173 \cfoot{\ifshowanswers\solutionsheettext{}\else\exercisheettext{}\fi} \sheetnumber}
174 \rfoot{\pagetext{} \thepage/\ztotpages}
175 \lfoot{\lectureshort}
```

## 5 Implementation of the Layouts

The modern layout uses `tikz` to draw the logo.

```
176 \ifmodern
177 \RequirePackage{tikz}
178 \definecolor{tublau}{rgb}{0.125,0.34,0.68}
179 \renewcommand{\maketitle}{
180   \hrule\vspace{2mm}
181   \begin{minipage}{0.55\textwidth}
182     {\sffamily \lecture{} / \semester\\
183     \LARGE \scshape \exercisheettext{} \sheetnumber %
184     \ifshowanswers%
185       {\Large{} (\withsolutiontext)}%
186     \fi\\
```



```

187 \small \upshape \itshape \rmfamily \deadlinetext{} \deadline{}
188 \end{minipage}
189 \begin{minipage}{0.44\textwidth}
190 \begin{flushright}
191 \begin{tikzpicture}[klumpen/.style={minimum size=4mm,rectangle},
192                 every edge/.append style={very thick},scale=.9]
193 \node[fill=red,klumpen] (k1) at (0,0) {};
194 \node[fill=tublau,klumpen] (k2) at (2,0) {} edge (k1);
195 \node[fill=tublau,klumpen] (k3) at (2,-1) {} edge(k2);
196 \node[fill=red,klumpen] (k4) at (5,-1) {} edge(k3);
197 \node[font={\sffamily\bfseries\fontsize{15}{16}\selectfont}] at (1,-.5) {OPT};
198 \node[font={\sffamily\fontsize{8}{7}\selectfont},anchor=west] at (2.3,-.5)
199   {\begin{minipage}{2.6cm}Optimization\Research Group\end{minipage}};
200 \end{tikzpicture}
201 \end{flushright}
202 \end{minipage}\vspace{2mm}\hrule
203 \begin{center}\small
204 \textbf{\lecturetext:} \lecture\\
205 \textbf{\exercisestext:} \operator
206 \end{center}\vspace{-2mm}
207 \ifthenelse{\equal{\homepage}{}}{}{\{
208 {\small \homepagetext}
209 }
210 }

```

This is the implementation of the classic layout.

```

211 \else
212 \renewcommand{\maketitle}{
213 \begin{minipage}{0.49\textwidth}
214 \begin{flushleft}
215 Technische Universit\at Kaiserslautern\\
216 Fachbereich Mathematik\\
217 \issuedate
218 \end{flushleft}
219 \end{minipage}
220 \begin{minipage}{0.49\textwidth}
221 \begin{flushright}
222 \lecture\\
223 \operator\\
224 \semester
225 \end{flushright}
226 \end{minipage}
227
228 \begin{center}
229 {\Large \bfseries \lecture}\\[0.6cm]
230 {\Large \bfseries%
231 \ifshowanswers%
232 \solutionsheettext}%
233 \else
234 \exercisesheettext}%
235 \fi} \sheetnumber}\\[1cm]

```

```

236 \end{center}
237 }
238 % URL at end of document
239 \AtEndDocument{%
240 \ifexplicittype
241 \else
242 \par
243   \deadlinepre\takehometext
244 \fi
245 \ifthenelse{\equal{\homepage}{}}{}{{
246 \begin{center}
247 \vfill{\small \homepagetext}
248 \end{center}
249 }
250 }
251 \fi

```

## Change History

v0.1		v0.3	
General: Initial version . . . . .	1	General: A first complete proof-read, again lots of small changes . . . . .	1
v0.2		v0.3.1	
General: Largely rewritten . . . . .	1	General: Fixed modern layout, added URL to doc- umentation . . . . .	1
v0.2.1			
General: Add font definitions . . . . .	1		
v0.2.2			
General: Improve on AG logo . . . . .	1		

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