

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, or optionally the Mathematisches Institut der Universität Koblenz.

The agopt_ex package defines:

- environments for exercises and solutions,
- two layout variants (`classic` and `modern`, respectively, the latter containing a colored logo); includes a nice footer and predefined macros for a “in-class” and “take-home” sections,
- two locations (Kaiserslautern and Koblenz),
- various ways to decide whether or not the solutions should be included in the output, including an *auto-magic*[®] 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 vo.5, dated 2013/04/03. Obtain the newest version at <http://github.com/supermihi/latex>

Load Only the Environments

bare With the `bare` option, only the *exercise* and *solution* environments are loaded (and everything needed by those), but no fonts, desing or whatever else.

```
8 \newif\ifbare
9 \barefalse
10 \DeclareOption{bare}{\baretrue}
```

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 \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 \TeX editor.

```
11 \newif\ifautoshowanswers
12 \newif\ifshowanswers
13 \showanswersfalse
14 \autoshowanswerstrue
15 \DeclareOption{solution}{\showanswerstrue\autoshowanswersfalse}
16 \DeclareOption{nosolution}{\showanswersfalse\autoshowanswersfalse}
```

Choose Location

kaiserslautern Selects the location, where Kaiserslautern is the default.

```
koblenz 17 \newif\ifkoblenz
18 \koblenzfalse
19 \DeclareOption{koblenz}{\koblenztrue}
20 \DeclareOption{kaiserslautern}{\koblenzfalse}
```

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 which hasn’t changed for the past 30 years.

```
21 \newif\ifmodern
```

```

22 \DeclareOption{modern}{\moderntrue}
23 \DeclareOption{classic}{\modernfalse}
24 \moderntrue % the default

```

This closes the options section.

```

25 \ProcessOptions\relax

```

1.2 Fonts

The package configures T_EX to use fonts of the Linux Libertine family and the Euler math font. The implementation differs for (pdf)l_atex and x_el_atex. For this package to work with x_el_atex, you need to have the Linux Libertine and Linux Biolinum OpenType fonts installed.

```

26 \ifbare %
27 %
28 \else
29   \RequirePackage{ifxetex}
30   \RequirePackage{ifthen}
31   \ifthenelse{\equal{\ublanguage}{german}}{
32     \RequirePackage[ngerman]{babel}
33   }{
34     \RequirePackage[american]{babel}
35   }
36   \ifxetex
37     \RequirePackage{amsfonts,amssymb}
38     \RequirePackage{euler}
39     \RequirePackage{xltextra}
40     \RequirePackage{xunicode}
41     \defaultfontfeatures{Mapping=tex-text} % needed for -- and --- to work
42     \setromanfont[Numbers=Proportional]{Linux Libertine O}
43     \setsansfont[Numbers=Proportional]{Linux Biolinum O}
44   \else
45     \RequirePackage{libertine}
46     \RequirePackage[T1]{fontenc}
47
48     \usepackage{euler}
49   \fi
50 \fi

```

1.3 Required Packages

The following packages are needed by agopt_ex:

```

51 \ifbare %
52 %
53 \else
54   \RequirePackage{amsmath}
55   \RequirePackage{geometry}
56   \RequirePackage{hyperref}
57   \RequirePackage{fancyhdr}
58   \RequirePackage{zref-totpages}

```

```

59
60 \RequirePackage{url}
61 \fi
62 \RequirePackage{prettyref}
63 \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”). 64 <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”). 65 <code>\def\LectureShort#1{\def\lectureshort{#1}}</code>
<code>\Sheetnumber</code>	Specify the exercise sheet number. 66 <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”. 67 <code>\def\Deadline#1{\def\deadline{#1}}</code>
<code>\IssueDate</code>	Specify the date when the sheet was issued. 68 <code>\def\IssueDate#1{\def\issuedate{#1}}</code>
<code>\Lecturer</code>	Specify the name of the lecturer. 69 <code>\def\Lecturer#1{\def\lecturer{#1}}</code>
<code>\Operator</code>	Specify the name of the exercise operator. 70 <code>\def\Operator#1{\def\operator{#1}}</code>
<code>\Semester</code>	Specify the current semester or term (e. g. “winter term 2012”). 71 <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. 72 <code>\def\Homepage#1{\def\homepage{#1}}</code>
<code>\InclassDate</code>	This optional parameter defines the date for in-class exercises. 73 <code>\def\InclassDate#1{\def\inclassdate{#1}}</code>

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

```

74 \def\lecture{Default lecture name}
75 \def\lectureshort{PraMa Optimierung}
76 \def\sheetnumber{1}
77 \def\deadline{}
78 \def\issuedate{06.12.1970}

```

```

79 \def\lecturer{Lecturer}
80 \def\operator{Exercise Operator}
81 \def\semester{Semester}
82 \def\homepage{}

```

2.1 Change Default Textual Elements

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

```

83 \ifthenelse{\equal{\ublanguage}{german}}{
84   \def\solutiontext{L"osung}
85   \def\exercisetext{Aufgabe}
86   \newcommand{\exerciseshheettext}{\Ubungsblatt}
87   \def\withsolutiontext{mit L"osung}
88   \def\pagetext{Seite}
89   \def\pointstext{Punkte}
90   \def\solutionsheettext{L"osungsblatt}
91   \def\deadlinetext{Abgabe bis}
92   \def\solutionfilename{oesung}
93   \def\lecturetext{Vorlesung}
94   \newcommand{\exercisestext}{\Ubungen}
95   \newcommand{\homepagetext}{Dieses \Ubungsblatt sowie weitere %
96   Informationen zur \Ubung sind unter \url{\homepage} erh\altlich.}
97   \newcommand{\inclasstexttitle}{Pr"asenz\ubungen}
98   \newcommand{\inclasstext}{Zur Bearbeitung in der \Ubung am \inclassdate}
99   \newcommand{\takehometexttitle}{Haus\ubungen}
100  \newcommand{\takehometext}{Bitte bis \deadline{ } abgeben.}
101  \newcommand{\deadlinepre}{\textbf{Abgabefrist: }}
102 }{
103  \def\solutiontext{Solution}
104  \def\exercisetext{Exercise}
105  \def\exerciseshheettext{Exercise Sheet}
106  \def\solutionsheettext{Solution Sheet}
107  \def\withsolutiontext{including solutions}
108  \def\pagetext{Page}
109  \def\pointstext{points}
110  \def\deadlinetext{Due date:}
111  \def\solutionfilename{olution}
112  \def\lecturetext{Lecture}
113  \def\exercisestext{Exercises}
114  \newcommand{\homepagetext}{Download of exercises at \url{\homepage}}
115  \newcommand{\inclasstexttitle}{In-Class Exercises}
116  \newcommand{\inclasstext}{To be done in the tutorial on \inclassdate}
117  \newcommand{\takehometexttitle}{Turn-In Exercises}
118  \newcommand{\takehometext}{Please hand in by \deadline{ }}
119  \newcommand{\deadlinepre}{\textbf{Deadline: }}
120 }

```

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 referencing 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  $NP$ .  
\end{exercise}
```

will be output as

Exercise 1.1 – $P \neq NP$ (4 points)

Prove that P is a proper subset of NP .

```
121 \newcommand{\exheader}[1]{\par\vspace{2.5mm}\noindent{\bfseries #1}\par\vspace{1.5mm}}  
122 \newcounter{exercise}  
123 \setcounter{exercise}{0}  
124 \newenvironment{exercise}[2][{}]{%  
125 {%  
126   \refstepcounter{exercise}  
127   \exheader{\exercisetext{} \sheetnumber.\arabic{exercise}}  
128   \ifthenelse{\equal{#1}{}}{-- #1}  
129   \ifthenelse{\equal{#2}{}}{(#2 \pointstext)}}  
130 }%  
131 {\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:

```
132 \RequirePackage{enumitem}  
133 \setlist[enumerate,1]{label=\alph*}  
134 \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 so-

lutions 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} [points]
```

```
...
```

```
\end{solution}
```

The optional *points* parameter is typeset in the same way as the *points* argument of the *solution* environment. It may be used to denote the point split in case of subexercises.

For example, the code

```
\begin{solution}[2+2]
  Base clause: Let  $N=1$ , then obviously  $P=NP$ .
\end{solution}
```

will be output to (if solution output is active)

Solution 1.1 (2+2 points):

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.

```
135
136 \ifautoshowanswers
137 \RequirePackage{xstring}
138 \IfSubStr*\jobname*\solutionfilename{%
139   \showanswerstrue
140 }{
141   \showanswersfalse
142 }
143 \fi
144 \newenvironment{solution}[1][{}]{%
145 {%
146   \ifshowanswers
147     \exheader{\solutiontext{} \sheetnumber.\arabic{exercise}}%
148     \ifthenelse{\equal{#1}{}}{\{ ( #1 \pointstext) \}:}%
149   \else
150     \par\vspace*{0pt}%
151     \setbox\z@\vbox\bgroup
152   \fi
153 }{%
154   \ifshowanswers
155     %
156   \else
157     \egroup
158   \fi
159 }%
```

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.

```
160 % marks if an exercise type (inclass, takehome) was explicitly chosen, because otherwise the layout
161 % has to automatically print the deadline information.
162 \ifbare\else
163   \newif\ifexplicittype
164   \explicittypefalse
165   \newcommand{\inclass}{\par{\large
166     \ifmodern\txtsc{\inclasstexttitle}\else\MakeUppercase{\inclasstexttitle}\fi}\\
167     (\inclasstext)\par
168     \explicittypetrue
169   }
170   \newcommand{\takehome}{\par{\large
171     \ifmodern\txtsc{\takehometexttitle}\else\MakeUppercase{\takehometexttitle}\fi}\\
172     (\takehometext)\par
173     \explicittypetrue
174   }
175 \fi
```

4 Miscellaneous Features

4.1 PDF parameters

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

```
176 \ifbare\else
177   \hypersetup{%
178     pdftitle={\lecture, \exercisheettext{} \sheetnumber}, %
179     pdfauthor={\ifkoblenz Mathematisches Institut, Universität Koblenz\else Optimization Research Group, TU H
180     pdfcreator={\ifxetex XeLaTeX \else LaTeX2e \fi}}
181 \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 ...

```
182 \newreformat{ex}{\exercisetext~\ref{#1}}
183 \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.


```

184 \ifbare\else
185   \pagestyle{fancy}
186   \fancyhead{}
187   \renewcommand{\headrulewidth}{0pt}
188   \renewcommand{\footrulewidth}{.4pt}
189   \cfoot{\ifshowanswers\solutionsheettext{}\else\exerciseshheettext{}\fi} \sheetnumber}
190   \rfoot{\pagetext{} \thepage/\ztotpages}
191   \lfoot{\lectureshort}
192 \fi

```

5 Implementation of the Layouts

The modern layout uses tikz to draw the logo.

```

193 \ifbare\else
194   \newcommand{\titledateline}{%
195     \ifthenelse{\equal{\deadline}{}}{%
196       {\inclasstext}%
197       {\deadlinetext{} \deadline{}}}%
198   }
199   \ifmodern
200     \RequirePackage{tikz}
201     \definecolor{tublau}{rgb}{0.125,0.34,0.68}
202     \renewcommand{\maketitle}{
203       \hrule\vspace{2mm}
204       \ifkoblenz
205         \begin{minipage}{0.65\textwidth}
206       \else
207         \begin{minipage}{0.55\textwidth}
208       \fi
209       {\sffamily \lecture{}}\; \textbullet\; \semester\\
210       \LARGE \scshape \exerciseshheettext{} \sheetnumber %
211       \ifshowanswers%
212         {\Large{} (\withsolutiontext)}%
213       \fi\\
214       \small \upshape \itshape \rmfamily \titledateline}
215     \end{minipage}
216     \ifkoblenz
217       \begin{minipage}{0.34\textwidth}
218     \else
219       \begin{minipage}{0.44\textwidth}
220     \fi
221     \begin{flushright}
222     \ifkoblenz
223       \includegraphics[width=0.8\textwidth]{koblenzlogo}
224     \else
225       \begin{tikzpicture}[klumpen/.style={minimum size=4mm,rectangle},
226         every edge/.append style={very thick},scale=.9]
227         \node[fill=red,klumpen] (k1) at (0,0) {};
228         \node[fill=tublau,klumpen] (k2) at (2,0) {} edge (k1);

```

```

229 \node[fill=tublau,klumpen] (k3) at (2,-1) {} edge(k2);
230 \node[fill=red,klumpen] (k4) at (5,-1) {} edge(k3);
231 \node[font={\sffamily\bfseries\fontsize{15}{16}\selectfont}] at (1,-.5) {OPT};
232 \node[font={\sffamily\fontsize{8}{7}\selectfont},anchor=west] at (2.3,-.5)
233 {\begin{minipage}{2.6cm}Optimization\\Research Group\end{minipage}};
234 \end{tikzpicture}
235 \fi
236 \end{flushright}
237 \end{minipage}\vspace{2mm}\hrule
238 \begin{center}\small
239 \textbf{\lecturetext:} \lecturer\\
240 \textbf{\exercisestext:} \operator
241 \end{center}\vspace{-2mm}
242 \ifthenelse{\equal{\homepage}{}}{}{
243 {\small \homepagetext}
244 }
245 }
246

```

This is the implementation of the classic layout.

```

247 \else
248 \renewcommand{\maketitle}{
249 \begin{minipage}{0.49\textwidth}
250 \begin{flushleft}
251 \ifkoblenz
252 Universit\at Koblenz-Landau, Campus Koblenz\\
253 Mathematisches Institut\\
254 \else
255 Technische Universit\at Kaiserslautern\\
256 Fachbereich Mathematik\\
257 \fi
258 \issuedate
259 \end{flushleft}
260 \end{minipage}
261 \begin{minipage}{0.49\textwidth}
262 \begin{flushright}
263 \lecturer\\
264 \operator\\
265 \semester
266 \end{flushright}
267 \end{minipage}
268
269 \begin{center}
270 {\Large \bfseries \lecture}\\[0.6cm]
271 {\Large \bfseries%
272 \ifshowanswers%
273 \solutionsheettext}%
274 \else
275 \exerciseshheettext}%
276 \fi} \sheetnumber\\[1cm]
277 \end{center}

```

```

278 }
279 % URL at end of document
280 \AtEndDocument{%
281 \ifexplicittype
282 \else
283 \par
284 \deadlinepre\takehometext
285 \fi
286 \ifthenelse{\equal{\homepage}{}}{}{{
287 \begin{center}
288 \vfill{\small \homepagetext}
289 \end{center}
290 }
291 }
292 \fi
293 \fi

```

Change History

vo.1	General: Initial version 1	vo.3.1	General: Fixed modern layout, added URL to documentation 1
vo.2	General: Largely rewritten 1	vo.4	General: add Koblenz mode 1
vo.2.1	General: Add font definitions 1	vo.4.1	General: optional points arg for solution environment 1
vo.2.2	General: Improve on AG logo 1	vo.5	General: implement optional bare mode which loads only the environments 1
vo.3	General: A first complete proof-read, again lots of small changes 1		

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Numbers written in *italic* refer to the page where the corresponding entry is described; numbers underlined refer to the code line of the definition; numbers in **roman** refer to the code lines where the entry is used.

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