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

```
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 v0.4, dated 2012/10/17. Obtain the newest version at `http://github.com/supermihi/latex`

Toggle Solution Output

solution
nosolution
These options define whether or not solutions should be included in the output document or not. If neither 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`

(substitude `xelatex` with your favourite LaTeX 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.

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

Choose Location

kaiserslautern
koblenz
Selects the location, where Kaiserslautern is the default.

```
14 \newif\ifkoblenz
15 \koblenzfalse
16 \DeclareOption{koblenz}{\koblenztrue}
17 \DeclareOption{kaiserslautern}{\koblenzfalse}
```

Choose Layout

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

```
18 \newif\ifmodern
19 \DeclareOption{modern}{\moderntrue}
20 \DeclareOption{classic}{\modernfalse}
21 \moderntrue % the default
```

This closes the options section.

```
22 \ProcessOptions\relax
```

1.2 Fonts

The package configures 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.

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

1.3 Required Packages

The following packages are needed by agopt_ex:

```
50 \RequirePackage{amsmath}
51 \RequirePackage{geometry}
52 \RequirePackage{hyperref}
53 \RequirePackage{fancyhdr}
54 \RequirePackage{zref-totpages}
55 \RequirePackage{prettyref}
56 \RequirePackage{url}
57 \RequirePackage{xspace}
```

2 Providing Lecture and Exercise Parameters

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

\Lecture	Specify the name of the lecture (e. g. "Praktische Mathematik: Lineare und Netzwerkoptimierung").

```
58 \def\Lecture#1{\def\lecture{#1}}
```

\LectureShort	Specify a short name of the lecture, used in the footer (e. g. "PraMa Optimierung").

```
59 \def\LectureShort#1{\def\lectureshort{#1}}
```

\Sheetnumber	Specify the exercise sheet number.

```
60 \def\Sheetnumber#1{\def\sheetnumber{#1}}
```

\Deadline	Specify the deadline for turn-in exercises. May include additional information such as "in the lecture" or "into the mailboxes in building 48".

```
61 \def\Deadline#1{\def\deadline{#1}}
```

\IssueDate	Specify the date when the sheet was issued.

```
62 \def\IssueDate#1{\def\issuedate{#1}}
```

\Lecturer	Specify the name of the lecturer.

```
63 \def\Lecturer#1{\def\lecturer{#1}}
```

\Operator	Specify the name of the exercise operator.

```
64 \def\Operator#1{\def\operator{#1}}
```

\Semester	Specify the current semester or term (e. g. "winter term 2012").

```
65 \def\Semester#1{\def\semester{#1}}
```

\Homepage	This optional parameter defines a homepage for the exercises. If it is used, the document output will contain a note where to download exercises.

```
66 \def\Homepage#1{\def\homepage{#1}}
```

\InclassDate	This optional parameter defines the date for in-class exercises.

```
67 \def\InclassDate#1{\def\inclassdate{#1}}
```

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

```
68 \def\lecture{Default lecture name}
69 \def\lectureshort{PraMa Optimierung}
70 \def\sheetnumber{1}
71 \def\deadline{}
72 \def\issuedate{06.12.1970}
73 \def\lecturer{Lecturer}
74 \def\operator{Exercise Operator}
75 \def\semester{Semester}
76 \def\homepage{}
```

2.1 Change Default Textual Elements

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

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

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

will be output as

Exercise 1.1 – P $\neq$ NP (4 points)

Prove that P is a proper subset of NP.

```
115 \newcommand{\exheader}[1]{\par\vspace{2.5mm}\noindent{\bfseries #1}\par\vspace{1.5mm}}
116 \newcounter{exercise}
117 \setcounter{exercise}{0}
118 \newenvironment{exercise}[2][{}]%
119 {%
120   \refstepcounter{exercise}
121   \exheader{\exercisetext{} \sheetnumber.\arabic{exercise}
122   \ifthenelse{\equal{#1}{}}{}{-- #1}
123   \ifthenelse{\equal{#2}{}}{}{(#2 \pointstext)}}
124 }%
125 {\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:

```
126 \RequirePackage{enumitem}
127 \setlist[enumerate,1]{label=\alph*)}
128 \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} [⟨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.

```
129
130 \ifautoshowanswers
131 \RequirePackage{xstring}
132 \IfSubStr*{\jobname}{\solutionfilename}{
133   \showanswerstrue
134 }{
135   \showanswersfalse
136 }
137 \fi
138 \newenvironment{solution}[1][{}]%
139 {%
140   \ifshowanswers
141     \exheader{\solutiontext{} \sheetnumber.\arabic{exercise}}%
142     \ifthenelse{\equal{#1}{}}{}{ (#1 \pointstext)}:}
143   \else
144     \par\vspace*{0pt}%
145     \setbox\z@\vbox\bgroup
146   \fi
147 }{%
148   \ifshowanswers
149     %
150   \else
151     \egroup
152   \fi
153 }%
```

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 exersice sheet.

```
154 % marks if an exercise type (inclass, takehome) was explicitly chosen, because otherwise the layout
155 % has to automatically print the deadline information.
156 \newif\ifexplicittype
157 \explicittypefalse
158 \newcommand{\inclass}{\par{\large
159 \ifmodern\textsc{\inclasstexttitle}\else\MakeUppercase{\inclasstexttitle}\fi}\\
160 (\inclasstext)\par
161 \explicittypetrue
162 }
163 \newcommand{\takehome}{\par{\large
164 \ifmodern\textsc{\takehometexttitle}\else\MakeUppercase{\takehometexttitle}\fi}\\
165 (\takehometext)\par
166 \explicittypetrue
167 }
```

4 Miscellaneous Features

4.1 PDF parameters

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

```
168 \hypersetup{%
169   pdftitle={\lecture, \exercisesheettext{} \sheetnumber}, %
170   pdfauthor={\ifkoblenz Mathematisches Institut, Universität Koblenz\else Optimization Research Group, TU Kai
171   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 ...

```
172 \newrefformat{ex}{\exercisetext~\ref{#1}}
173 \newrefformat{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.

```
174 \pagestyle{fancy}
175 \fancyhead{}
176 \renewcommand{\headrulewidth}{0pt}
177 \renewcommand{\footrulewidth}{.4pt}
```

```
178 \cfoot{\ifshowanswers\solutionsheettext{}\else\exercisesheettext{}\fi{} \sheetnumber}
179 \rfoot{\pagetext{} \thepage/\ztotpages}
180 \lfoot{\lectureshort}
```

5   Implementation of the Layouts

The modern layout uses tikz to draw the logo.

```
181 \newcommand{\titledateline}{%
182     \ifthenelse{\equal{\deadline}{}}%
183         {\inclasstext}%
184         {\deadlinetext{} \deadline{}}%
185 }
186 \ifmodern
187 \RequirePackage{tikz}
188 \definecolor{tublau}{rgb}{0.125,0.34,0.68}
189 \renewcommand{\maketitle}{
190 \hrule\vspace{2mm}
191 \ifkoblenz
192     \begin{minipage}{0.65\textwidth}
193 \else
194     \begin{minipage}{0.55\textwidth}
195     \fi
196 {\sffamily \lecture{}\;\textbullet\;\semester\\
197 \LARGE \scshape  \exercisesheettext{} \sheetnumber %
198 \ifshowanswers%
199  {\Large{} (\withsolutiontext)}%
200 \fi\\
201 \small \upshape \itshape \rmfamily \titledateline}
202 \end{minipage}
203 \ifkoblenz
204     \begin{minipage}{0.34\textwidth}
205     \else
206         \begin{minipage}{0.44\textwidth}
207     \fi
208 \begin{flushright}
209 \ifkoblenz
210     \includegraphics[width=0.8\textwidth]{koblenzlogo}
211 \else
212 \begin{tikzpicture}[klumpen/.style={minimum size=4mm,rectangle},
213                     every edge/.append style={very thick},scale=.9]
214 \node[fill=red,klumpen] (k1) at (0,0) {};
215 \node[fill=tublau,klumpen] (k2) at (2,0) {} edge (k1);
216 \node[fill=tublau,klumpen] (k3) at (2,-1) {} edge(k2);
217 \node[fill=red,klumpen] (k4) at (5,-1) {} edge(k3);
218 \node[font={\sffamily\bfseries\fontsize{15}{16}\selectfont}] at (1,-.5) {OPT};
219 \node[font={\sffamily\fontsize{8}{7}\selectfont},anchor=west] at (2.3,-.5)
220   {\begin{minipage}{2.6cm}Optimization\\Research Group\end{minipage}};
221 \end{tikzpicture}
222 \fi
```

```
223 \end{flushright}
224 \end{minipage}\vspace{2mm}\hrule
225 \begin{center}\small
226 \textbf{\lecturetext:} \lecturer\\
227 \textbf{\exercisestext:} \operator
228 \end{center}\vspace{-2mm}
229 \ifthenelse{\equal{\homepage}{}}{}{
230 {\small \homepagetext}
231 }
232 }
```

This is the implementation of the classic layout.

```
233 \else
234 \renewcommand{\maketitle}{
235 \begin{minipage}{0.49\textwidth}
236 \begin{flushleft}
237 \ifkoblenz
238     Universit\"at Koblenz-Landau, Campus Koblenz\\
239     Mathematisches Institut\\
240 \else
241     Technische Universit\"at Kaiserslautern\\
242     Fachbereich Mathematik\\
243     \fi
244 \issuedate
245 \end{flushleft}
246 \end{minipage}
247 \begin{minipage}{0.49\textwidth}
248 \begin{flushright}
249 \lecturer\\
250 \operator\\
251 \semester
252 \end{flushright}
253 \end{minipage}
254
255 \begin{center}
256 {\Large \bfseries \lecture}\\[0.6cm]
257 {\Large \bfseries%
258 \ifshowanswers%
259   \solutionsheettext{}%
260 \else
261   \exercisesheettext{}%
262 \fi{} \sheetnumber}\\[1cm]
263 \end{center}
264 }
265 % URL at end of document
266 \AtEndDocument{%
267 \ifexplicittype
268 \else
269 \par
270   \deadlinepre\takehometext
271 \fi
```

```
272 \ifthenelse{\equal{\homepage}{}}{}{
273 \begin{center}
274 \vfill{\small \homepagetext}
275 \end{center}
276 }
277 }
278 \fi
```

Change History

Index

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.

Deadline: Please hand in by 24.12.2039