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 containig 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*® 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.

```
\def\ublanguage{german}
\DeclareOption{german}{
  \def\ublanguage{german}
}
\DeclareOption{english}{
  \def\ublanguage{english}
}
```

*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` `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.

```
\newif\ifautoshowanswers
\newif\ifshowanswers
\showanswersfalse
\autoshowanswerstrue
\DeclareOption{solution}{\showanswerstrue\autoshowanswersfalse}
\DeclareOption{nosolution}{\showanswersfalse\autoshowanswersfalse}
```

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.

```
\newif\ifmodern
\DeclareOption{modern}{\moderntrue}
\DeclareOption{classic}{\modernfalse}
\moderntrue % the default
```

This closes the options section.

```
\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.

```
\RequirePackage{ifxetex}
\RequirePackage{ifthen}
\ifxetex
```

```
  \RequirePackage{amsfonts,amssymb}
  \RequirePackage{euler}
  \RequirePackage{xltxtra}
  \RequirePackage{xunicode}
  \RequirePackage{polyglossia}
  \defaultfontfeatures{Mapping=tex-text} % needed for -- and --- to work
  \setromanfont[Numbers=Proportional]{Linux Libertine O}
  \setsansfont[Numbers=Proportional]{Linux Biolinum O}
  \ifthenelse{\equal{\ublanguage}{german}}{
  \setdefaultlanguage{german}
  }{
   \setdefaultlanguage[variant=american]{english}
}
\else
  \ifthenelse{\equal{\ublanguage}{german}}{
   \usepackage[ngerman]{babel}
  }{
   \usepackage[american]{babel}
  }
  \RequirePackage{libertine}
  \RequirePackage[T1]{fontenc}

  \usepackage{euler}
\fi
```

1.3 Required Packages

The following packages are needed by agopt_ex:

```
\RequirePackage{amsmath}
\RequirePackage{geometry}
\RequirePackage{hyperref}
\RequirePackage{fancyhdr}
\RequirePackage{zref-totpages}
\RequirePackage{prettyref}
\RequirePackage{url}
\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”).

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

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

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

`\Sheetnumber` Specify the exercise sheet number.

```
\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”.

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

`\IssueDate` Specify the date when the sheet was issued.

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

`\Lecturer` Specify the name of the lecturer.

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

`\Operator` Specify the name of the exercise operator.

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

`\Semester` Specify the current semester or term (e. g. “winter term 2012”).

```
\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.

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

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

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

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

```
\def\lecture{Default lecture name}
\def\lectureshort{PraMa Optimierung}
\def\sheetnumber{1}
\def\deadline{24.12.1970}
\def\issuedate{06.12.1970}
\def\lecturer{Lecturer}
\def\operator{Exercise Operator}
\def\semester{Semester}
\def\homepage{}
```

2.1 Change Default Textual Elements

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

```
\ifthenelse{\equal{\ublanguage}{german}}{
  \def\solutiontext{L\"osung}
  \def\exercisetext{Aufgabe}
  \newcommand{\exercisesheettext}{\"Ubungsblatt}
  \def\withsolutiontext{mit L\"osung}
  \def\pagetext{Seite}
  \def\pointstext{Punkte}
  \def\solutionsheettext{L\"osungsblatt}
  \def\deadlinetext{Abgabe bis}
  \def\solutionfilename{oesung}
  \def\lecturetext{Vorlesung}
```

```
  \newcommand{\exercisestext}{\"Ubungen}
  \newcommand{\homepagetext}{Dieses \"Ubungsblatt sowie weitere %
  Informationen zur \"Ubung sind unter \url{\homepage} erh\"altlich.}
  \newcommand{\inclasstexttitle}{Pr\"asenz\"ubungen}
  \newcommand{\inclasstext}{(Zur Bearbeitung in der \"Ubung am \inclassdate)}
  \newcommand{\takehometexttitle}{Haus\"ubungen}
  \newcommand{\takehometext}{Bitte bis \deadline{} abgeben.}
  \newcommand{\deadlinepre}{\textbf{Abgabefrist: }}
}{
  \def\solutiontext{Solution}
  \def\exercisetext{Exercise}
  \def\exercisesheettext{Exercise Sheet}
  \def\solutionsheettext{Solution Sheet}
  \def\withsolutiontext{including solutions}
  \def\pagetext{Page}
  \def\pointstext{points}
  \def\deadlinetext{Due date:}
  \def\solutionfilename{olution}
  \def\lecturetext{Lecture}
  \def\exercisestext{Exercises}
  \newcommand{\homepagetext}{Download of exercises at \url{\homepage}}
  \newcommand{\inclasstexttitle}{In-Class Exercises}
  \newcommand{\inclasstext}{(To be done in the tutorial on \inclassdate)}
  \newcommand{\takehometexttitle}{Turn-In Exercises}
  \newcommand{\takehometext}{Please hand in by \deadline{}}
  \newcommand{\deadlinepre}{\textbf{Deadline: }}
}
```

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 – $\mathsf{P} \neq \mathsf{NP}$ (4 points)

Prove that P is a proper subset of NP.

```
\newcommand{\exheader}[1]{\par\vspace{2.5mm}\noindent{\bfseries #1}\par\vspace{1.5mm}}
\newcounter{exercise}
\setcounter{exercise}{0}
\newenvironment{exercise}[2][{}]%
{%
  \refstepcounter{exercise}
  \exheader{\exercisetext{} \sheetnumber.\arabic{exercise}
  \ifthenelse{\equal{#1}{}}{}{-- #1}
  \ifthenelse{\equal{#2}{}}{}{(#2 \pointstext)}}
}%
{\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:

```
\RequirePackage{enumitem}
\setlist[enumerate,1]{label=\alph*)}
\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 $\mathsf{N} = 1$, then obviously $\mathsf{P} = \mathsf{NP}$.

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.

```
\ifautoshowanswers
\RequirePackage{xstring}
\IfSubStr*{\jobname}{\solutionfilename}{
 \showanswerstrue
}{
 \showanswersfalse
}
\fi
\newenvironment{solution}%
{%
  \ifshowanswers
    \exheader{\solutiontext{} \sheetnumber.\arabic{exercise}:}
  \else
    \par\vspace*{0pt}%
    \setbox\z@\vbox\bgroup
  \fi
}{%
  \ifshowanswers
    %
  \else
    \egroup
  \fi
}%
```

3.4 In-Class and Take-Home Exercises

`\inclass` `\takehome`

These optional macros create a title that marks the begin of the "in-class" or "take-home" part, respectively, of the exersice sheet.

```
% marks if an exercise type (inclass, takehome) was explicitly chosen, because otherwise the layout
% has to automatically print the deadline information.
\newif\ifexplicittype
\explicittypefalse
\newcommand{\inclass}{\par{\large
\ifmodern\textsc{\inclasstexttitle}\else\MakeUppercase{\inclasstexttitle}\fi}\\
(\inclasstext)\par
\explicittypetrue
}
\newcommand{\takehome}{\par{\large
\ifmodern\textsc{\takehometexttitle}\else\MakeUppercase{\takehometexttitle}\fi}\\
(\takehometext)\par
\explicittypetrue
}
```

4 Miscellaneous Features

4.1 PDF parameters

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

```
\hypersetup{%
  pdftitle={\lecture, \exercisesheettext{} \sheetnumber}, %
  pdfauthor={Optimization Research Group}, %
  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 ...

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

```
\pagestyle{fancy}
\fancyhead{}
\renewcommand{\headrulewidth}{0pt}
\renewcommand{\footrulewidth}{.4pt}
\cfoot{\ifshowanswers\solutionsheettext{}\else\exercisesheettext{}\fi{} \sheetnumber}
\rfoot{\pagetext{} \thepage/\ztotpages}
\lfoot{\lectureshort}
```

5 Implementation of the Layouts

The modern layout uses tikz to draw the logo.

```
\ifmodern
\RequirePackage{tikz}
\definecolor{tublau}{rgb}{0.125,0.34,0.68}
\renewcommand{\maketitle}{
\hrule\vspace{2mm}
\begin{minipage}{0.55\textwidth}
{\sffamily \lecture{} / \semester\\
\LARGE \scshape  \exercisesheettext{} \sheetnumber %
\ifshowanswers%
  {\Large{} (\withsolutiontext)}%
\fi\\
```

```
\small \upshape \itshape \rmfamily \deadlinetext{} \deadline{}}
\end{minipage}
\begin{minipage}{0.44\textwidth}
\begin{flushright}
\begin{tikzpicture}[klumpen/.style={minimum size=4mm,rectangle},
                    every edge/.append style={very thick},scale=.9]
 \node[fill=red,klumpen] (k1) at (0,0) {};
 \node[fill=tublau,klumpen] (k2) at (2,0) {} edge (k1);
 \node[fill=tublau,klumpen] (k3) at (2,-1) {} edge(k2);
 \node[fill=red,klumpen] (k4) at (5,-1) {} edge(k3);
 \node[font={\sffamily\bfseries\fontsize{15}{16}\selectfont}] at (1,-.5) {OPT};
 \node[font={\sffamily\fontsize{8}{7}\selectfont},anchor=west] at (2.3,-.5)
   {\begin{minipage}{2.6cm}Optimizaton\\Research Group\end{minipage}};
\end{tikzpicture}
\end{flushright}
\end{minipage}\vspace{2mm}\hrule
\begin{center}\small
 \textbf{\lecturetext:} \lecturer\\
 \textbf{\exercisestext:} \operator
\end{center}\vspace{-2mm}
\ifthenelse{\equal{\homepage}{}}{}{
{\small \homepagetext}
}
}
```

This is the implementation of the classic layout.

```
\else
\renewcommand{\maketitle}{
\begin{minipage}{0.49\textwidth}
\begin{flushleft}
Technische Universit\"at Kaiserslautern\\
Fachbereich Mathematik\\
\issuedate
\end{flushleft}
\end{minipage}
\begin{minipage}{0.49\textwidth}
\begin{flushright}
\lecturer\\
\operator\\
\semester
\end{flushright}
\end{minipage}

\begin{center}
{\Large \bfseries \lecture}\\[0.6cm]
{\Large \bfseries%
\ifshowanswers%
  \solutionsheettext{}%
\else
  \exercisesheettext{}%
\fi{} \sheetnumber}\\[1cm]
```

```
\end{center}
}
% URL at end of document
\AtEndDocument{%
\ifexplicittype
\else
\par
  \deadlinepre\takehometext
\fi
\ifthenelse{\equal{\homepage}{}}{}{
\begin{center}
\vfill{\small \homepagetext}
\end{center}
}
}
\fi
```

Change History

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General: Initial version 1
v0.2
General: Largely rewritten 1
v0.2.1
General: Add font definitions 1
v0.2.2
General: Improve on AG logo 1
v0.3
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v0.3.1
General: Fixed modern layout, added URL to documentation 1

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Deadline: Please hand in by 24.12.2039