`hwexam.sty/cls`: An Infrastructure for formatting Assignments and Exams*

Michael Kohlhase
FAU Erlangen-Nürnberg
`http://kwarc.info/kohlhase`

October 3, 2020

Abstract

The `hwexam` package and class allows individual course assignment sheets and compound assignment documents using problem files marked up with the `problem` package.

Contents

*Version v1.1 (last revised 2019/03/20)

1 Introduction

The `hwexam` package and class supplies an infrastructure that allows to format nice-looking assignment sheets by simply including problems from problem files marked up with the `problem` package [**Kohlhase:problem:git**]. It is designed to be compatible with `problems.sty`, and inherits some of the functionality.

2 The User Interface

2.1 Package and Class Options

`mh` The `hwexam` class takes the `mh` option that turns on MathHub support; see [**Kohlhase:mss:git**]

The `hwexam` package and class take the options `solutions`, `notes`, `hints`, `pts`, `min`, and `boxed` that are just passed on to the `problems` package (cf. its documentation for a description of the intended behavior).

`showmeta` If the `showmeta` option is set, then the metadata keys are shown (see [**Kohlhase:metakeys:git**] for details and customization options).

The `hwexam` class additionally accepts the options `report`, `book`, `chapter`, `part`, and `showignores`, of the `omdoc` package [**Kohlhase:smomdl:git**] on which it is based and passes them on to that. For the `extrefs` option see [**Kohlhase:sref:git**].

2.2 Assignments

`assignment` This package supplies the `assignment` environment that groups problems into
`number` assignment sheets. It takes an optional KeyVal argument with the keys `number` (for the assignment number; if none is given, 1 is assumed as the default or — in multi-assignment documents — the ordinal of the `assignment` environment),
`title` `title` (for the assignment title; this is referenced in the title of the assignment
`type` sheet), `type` (for the assignment type; e.g. "quiz", or "homework"), `given` (for
`given` the date the assignment was given), and `due` (for the date the assignment is due).
`due`

2.3 Typesetting Exams

`multiple` Furthermore, the `hwexam` package takes the option `multiple` that allows to combine multiple assignment sheets into a compound document (the assignment sheets are treated as section, there is a table of contents, etc.).

`test` Finally, there is the option `test` that modifies the behavior to facilitate formatting tests. Only in `test` mode, the macros `\testspace`, `\testnewpage`, and `\testemptypage` have an effect: they generate space for the students to solve the given problems. Thus they can be left in the LaTeX source.

`\testspace` `\testspace` takes an argument that expands to a dimension, and leaves ver-
`\testnewpage` tical space accordingly. `\testnewpage` makes a new page in `test` mode, and
`\testemptypage` `\testemptypage` generates an empty page with the cautionary message that this page was intentionally left empty.

testheading
duration
min
reqpts

Finally, the `\testheading` takes an optional keyword argument where the keys `duration` specifies a string that specifies the duration of the test, `min` specifies the equivalent in number of minutes, and `reqpts` the points that are required for a perfect grade.

```
\title{320101 General Computer Science (Fall 2010)}
\begin{testheading}[duration=one hour,min=60,reqpts=27]
  Good luck to all students!
\end{testheading}
```

formats to

Name: Matriculation Number:

320101 General Computer Science (Fall 2010)

October 3, 2020

You have one hour(sharp) for the test;
Write the solutions to the sheet.
The estimated time for solving this exam is 58 minutes, leaving you 2 minutes for revising your exam.
You can reach 30 points if you solve all problems. You will only need 27 points for a perfect score, i.e. 3 points are bonus points.

Different problems test different skills and knowledge, so do not get stuck on one problem.

	To be used for grading, do not write here								
prob.	1.1	2.1	2.2	2.3	3.1	3.2	3.3	Sum	grade
total	4	4	6	6	4	4	2	30	
reached									

good luck

Example 1: A generated test heading.

2.4 Including Assignments

\inputassignment

The `\inputassignment` macro can be used to input an assignment from another file. It takes an optional KeyVal argument and a second argument which is a path to the file containing the problem (the macro assumes that there is only one `assignment` environment in the included file). The keys `number`, `title`, `type`,

number
title
type

given
due

`given`, and `due` are just as for the `assignment` environment and (if given) overwrite the ones specified in the `assignment` environment in the included file.

3 Limitations

In this section we document known limitations. If you want to help alleviate them, please feel free to contact the package author. Some of them are currently discussed in the sTeX GitHub repository [**sTeX:github:on**].

1. none reported yet.

4 Implementation: The hwexam Class

The functionality is spread over the `hwexam` class and package. The class provides the `document` environment and pre-loads some convenience packages, whereas the package provides the concrete functionality.

4.1 Class Options

To initialize the `hwexam` class, we declare and process the necessary options by passing them to the respective packages and classes they come from.

```
⟨*cls⟩
\DeclareOption*{
  \PassOptionsToClass{\CurrentOption}{omdoc}
  \PassOptionsToPackage{\CurrentOption}{stex}
  \PassOptionsToPackage{\CurrentOption}{hwexam}
  \PassOptionsToPackage{\CurrentOption}{tikzinput}
}
\ProcessOptions
```

We load `omdoc.cls`, and the desired packages. For the LaTeXML bindings, we make sure the right packages are loaded.

```
\LoadClass{omdoc}
\RequirePackage{stex}
\RequirePackage{hwexam}
\RequirePackage{tikzinput}
\RequirePackage{graphicx}
\RequirePackage{a4wide}
\RequirePackage{amssymb}
\RequirePackage{amstext}
\RequirePackage{amsmath}
```

Finally, we register another keyword for the `document` environment. We give a default assignment type to prevent errors

```
\newcommand\assig@default@type{\hwexam@assignment@kw}
\addmetakey[\assig@default@type]{document}{hwexamtype}
\def\document@hwexamtype{\assig@default@type}
⟨/cls⟩
```

5 Implementation: The hwexam Package

5.1 Package Options

The first step is to declare (a few) package options that handle whether certain information is printed or not. Some come with their own conditionals that are set by the options, the rest is just passed on to the `problems` package.

```
⟨*package⟩
\newif\if@hwexam@mh@\@hwexam@mh@false
```

```
\DeclareOption{mh}{\@hwexam@mh@true}
\newif\iftest\testfalse
\DeclareOption{test}{\testtrue}
\newif\ifmultiple\multiplefalse
\DeclareOption{multiple}{\multipletrue}
\DeclareOption*{\PassOptionsToPackage{\CurrentOption}{problem}}
\ProcessOptions
```

Then we make sure that the necessary packages are loaded (in the right versions).

```
\RequirePackage{keyval}[1997/11/10]
\if@hwexam@mh@\RequirePackage{hwexam-mh}\fi
\RequirePackage{problem}
```

`\hwexam@*@kw` For multilinguality, we define internal macros for keywords that can be specialized in `*.ldf` files.

```
\newcommand\hwexam@assignment@kw{Assignment}
\newcommand\hwexam@given@kw{Given}
\newcommand\hwexam@due@kw{Due}
\newcommand\hwexam@testemptypage@kw{This page was intentionally left blank for extra
  space}%
\newcommand\correction@probs@kw{prob.}%
\newcommand\correction@pts@kw{total}%
\newcommand\correction@reached@kw{reached}%
\newcommand\correction@sum@kw{Sum}%
\newcommand\correction@grade@kw{grade}%
\newcommand\correction@forgrading@kw{To be used for grading, do not write here}
```

For the other languages, we set up triggers

```
\AfterBabelLanguage{ngerman}{\input{hwexam-ngerman.ldf}}
\AfterBabelLanguage{finnish}{\input{hwexam-finnish.ldf}}
\AfterBabelLanguage{french}{\input{hwexam-french.ldf}}
\AfterBabelLanguage{russian}{\input{hwexam-russian.ldf}}
```

5.2 Assignments

Then we set up a counter for problems and make the problem counter inherited from `problem.sty` depend on it. Furthermore, we specialize the `\prob@label` macro to take the assignment counter into account.

```
\newcounter{assignment}
\numberproblemsin{assignment}
\renewcommand\prob@label[1]{\arabic{assignment}.#1}
```

We will prepare the keyval support for the `assignment` environment.

```
\srefaddidkey{assig}
\addmetakey{assig}{number}
\addmetakey*{assig}{title}
\addmetakey{assig}{type}
\addmetakey{assig}{given}
\addmetakey{assig}{due}
\addmetakey[false]{assig}{loadmodules}[true]
```

The next three macros are intermediate functions that handle the case gracefully, where the respective token registers are undefined.

The `\given@due` macro prints information about the given and due status of the assignment. Its arguments specify the brackets.

```
\newcommand\given@due[2]{%
\ifx \inclassig@given\@empty
\ifx \assig@given\@empty
\ifx \inclassig@due\@empty
\ifx \assig@due\@empty% all empty do nothing
\else #1%
\fi
\else #1%
\fi
\else #1%
\fi
\else #1%
\fi
\ifx\inclassig@given\@empty
\ifx\assig@given\@empty% do nothing
\else \hwexam@given@kw\xspace \assig@given%
\fi
\else \hwexam@given@kw\xspace \inclassig@given%
\fi
\ifx \inclassig@due\@empty
\ifx \assig@due\@empty% do nothing
\else
\ifx \inclassig@given\@empty
\ifx \assig@given\@empty% do nothing
\else ,~%
\fi
\else ,~%
\fi
\fi
\else
\ifx \inclassig@given\@empty
\ifx \assig@given\@empty% do nothing
\else ,~%
\fi
\else ,~%
\fi
\fi
\ifx \inclassig@due\@empty
\ifx \assig@due\@empty% do nothing
\else \hwexam@due@kw\xspace \assig@due%
\fi
\else \hwexam@due@kw\xspace \inclassig@due%
\fi
\ifx \inclassig@given\@empty
\ifx \assig@given\@empty
```

```
\ifx \inclassig@due\@empty
\ifx \assig@due\@empty% all empty do nothing
\else #2%
\fi
\else #2%
\fi
\else #2%
\fi
\else #2%
\fi
}
```

`\assignment@title` This macro prints the title of an assignment, the local title is overwritten, if there is one from the `\inputassignment`. `\assignment@title` takes three arguments the first is the fallback when no title is given at all, the second and third go around the title, if one is given.

```
\newcommand\assignment@title[3]
{\ifx\inclassig@title\@empty% if there is no outside title
\ifx\assig@title\@empty{#1}\else{#2\assig@title{#3}}\fi
\else{#2}\inclassig@title{#3}\fi}% else show the outside title
```

`\assignment@number` Like `\assignment@title` only for the number, and no around part.

```
\newcommand\assignment@number%
{\ifx\inclassig@number\@empty% if there is no outside number
\ifx\assig@number\@empty\else\assig@number\fi
\else\inclassig@number\fi}% else show the outside number
```

With them, we can define the central `assignment` environment. This has two forms (separated by `\ifmultiple`) in one we make a title block for an assignment sheet, and in the other we make a section heading and add it to the table of contents. We first define an assignment counter

`assignment` For the `assignment` environment we delegate the work to the `@assignment` environment that depends on whether `multiple` option is given.

```
\newenvironment{assignment}[1][]{\metasetkeys{assig}{#1}\sref@target%
\edef\@@num{\assignment@number}%
\ifx\@@num\@empty\stepcounter{assignment}\else\setcounter{assignment}{\@@num}\fi%
\setcounter{problem}{0}%
\def\current@section@level{\document@hwexamtype}%
\sref@label@id{\document@hwexamtype \thesection}%
\begin{@assignment}}
{\end{@assignment}}
```

In the multi-assignment case we just use the `omdoc` environment for suitable sectioning.

```
\def\@@asstitle{\protect\document@hwexamtype~\arabic{assignment}%
\assignment@title{}{\;(}{)\;} -- \given@due{}{}}
\ifmultiple
\newenvironment{@assignment}%
```

```
{\ifx\assig@loadmodules\@true
\begin{omgroup}[loadmodules]{\@@asstitle}
\else
\begin{omgroup}{\@@asstitle}
\fi}
{\end{omgroup}}
```

for the single-page case we make a title block from the same components.

```
\else
\newenvironment{@assignment}
{\begin{center}\bf
\Large\@title\strut\\
\document@hwexamtype~\arabic{assignment}\assignment@title{\;}{:\;}{\\}%
\large\given@due{--\;}{\;--}
\end{center}}
{}
\fi% multiple
```

5.3 Including Assignments

`\in*assignment` This macro is essentially a glorified `\include` statement, it just sets some internal macros first that overwrite the local points Importantly, it resets the `inclassig` keys after the input.

```
\addmetakey{inclassig}{number}
\addmetakey*{inclassig}{title}
\addmetakey{inclassig}{type}
\addmetakey{inclassig}{given}
\addmetakey{inclassig}{due}
\addmetakey{inclassig}{mhrepos}
\clear@inclassig@keys%initially
\newcommand\includeassignment[2][]{\metasetkeys{inclassig}{#1}%
\newpage\input{#2}\clear@inclassig@keys}
\newcommand\inputassignment[2][]{\metasetkeys{inclassig}{#1}%
\input{#2}\clear@inclassig@keys}
```

5.4 Typesetting Exams

`\quizheading`

```
\addmetakey{quizheading}{tas}
\newcommand\quizheading[1]{\def\@tas{#1}%
\large\noindent NAME: \hspace{8cm}  MAILBOX:\\[2ex]%
\ifx\@tas\@empty\else%
\noindent TA: \@for\@I:=\@tas\do{{\Large$\Box$}\@I\hspace*{1em}}\\[2ex]\fi}
```

`\testheading`

```
\addmetakey{testheading}{min}
\addmetakey{testheading}{duration}
\addmetakey{testheading}{reqpts}
\newenvironment{testheading}[1][]{\metasetkeys{testheading}{#1}
```

```
{\noindent\large{}Name: \hfill Matriculation Number:\hspace*{2cm}\strut\\[1ex]
\begin{center}\Large\textbf{\@title}\\[1ex]\large\@date\\[3ex]\end{center}
{\textbf{You have
\ifx\testheading@duration\@empty\testheading@min minutes\else\testheading@duration\fi
(sharp) for the test}};\\ Write the solutions to the sheet.}\par\noindent

\newcount\check@time\check@time=\testheading@min
\advance\check@time by -\theassignment@totalmin
The estimated time for solving this exam is {\theassignment@totalmin} minutes,
leaving you {\the\check@time} minutes for revising your exam.

\newcount\bonus@pts\bonus@pts=\theassignment@totalpts
\advance\bonus@pts by -\testheading@reqpts
You can reach {\theassignment@totalpts} points if you solve all problems. You will only need
{\testheading@reqpts} points for a perfect score, i.e.\ {\the\bonus@pts} points are
bonus points. \vfill
\begin{center}
  {\Large\em
%  You have ample time, so take it slow and avoid rushing to mistakes!\\[2ex]
  Different problems test different skills and knowledge, so do not get stuck on
  one problem.}\vfill\par\resizebox{\textwidth}{!}{\correction@table}\\[3ex]
\end{center}}
{\newpage}
```

`\testspace`

```
\newcommand\testspace[1]{\iftest\vspace*{#1}\fi}
```

`\testnewpage`

```
\newcommand\testnewpage{\iftest\newpage\fi}
```

`\testemptypage`

```
\newcommand\testemptypage[1][]{\iftest\begin{center}\hwexam@testemptypage@kw\end{center}\vfill\
```

`\@problem` This macro acts on a problem's record in the `*.aux` file. Here we redefine it (it was defined to do nothing in `problem.sty`) to generate the correction table.

```
\renewcommand\@problem[3]{\stepcounter{assignment@probs}
\def\@@pts{#2}\ifx\@@pts\@empty\else\addtocounter{assignment@totalpts}{#2}\fi
\def\@@min{#3}\ifx\@@min\@empty\else\addtocounter{assignment@totalmin}{#3}\fi
\xdef\correction@probs{\correction@probs & #1}%
\xdef\correction@pts{\correction@pts & #2}
\xdef\correction@reached{\correction@reached &}}
```

`\correction@table` This macro generates the correction table

```
\newcounter{assignment@probs}
\newcounter{assignment@totalpts}
\newcounter{assignment@totalmin}
\def\correction@probs{\correction@probs@kw}%
\def\correction@pts{\correction@pts@kw}%
\def\correction@reached{\correction@reached@kw}%
```

```
\def\after@correction@table{}%
\stepcounter{assignment@probs}
\newcommand\correction@table{\resizebox{\textwidth}{!}{%
\begin{tabular}{|l|*{\theassignment@probs}{c|}|l|}\hline%
&\multicolumn{\theassignment@probs}{c||}%|
{\footnotesize\correction@forgrading@kw} &\\\hline
\correction@probs & \correction@sum@kw & \correction@grade@kw\\\hline
\correction@pts &\theassignment@totalpts & \\\hline
\correction@reached & & \\[.7cm]\hline
\end{tabular}}
\ifx\after@correction@table\@empty\else\strut\par\noindent\after@correction@table\fi}
```
⟨/package⟩

5.5 Leftovers

at some point, we may want to reactivate the logos font, then we use

```
here we define the logos that characterize the assignment
\font\bierfont=../assignments/bierglas
\font\denkerfont=../assignments/denker
\font\uhrfont=../assignments/uhr
\font\warnschildfont=../assignments/achtung

\newcommand\bierglas{{\bierfont\char65}}
\newcommand\denker{{\denkerfont\char65}}
\newcommand\uhr{{\uhrfont\char65}}
\newcommand\warnschild{{\warnschildfont\char 65}}
\newcommand\hardA{\warnschild}
\newcommand\longA{\uhr}
\newcommand\thinkA{\denker}
\newcommand\discussA{\bierglas}
```