

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

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Abstract

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

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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 [Koh12c]. 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

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 [Koh12a] for details and customization options).

The `hwexam` class additionally accepts the options `report`, `book`, `chapter`, `part`, and `showignores`, of the `omdoc` package [Koh12b] on which it is based and passes them on to that. For the `extrefs` option see [Koh12d].

2.2 Assignments

`assignment` This package supplies the `assignment` environment that groups problems into 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` (for the assignment title; this is referenced in the title of the assignment sheet), `type` (for the assignment type; e.g. “quiz”, or “homework”), `given` (for the date the assignment was given), and `due` (for the date the assignment is 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 vertical space accordingly. `\testnewpage` makes a new page in `test` mode, and `\testemptypage` generates an empty page with the cautionary message that this page was intentionally left empty.

`testheading` 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)

December 12, 2013

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

\includeassignment

number
title
type
given
due

The \includeassignment macro can be used to include 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**, **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.

2.5 Support for MathHub

Much of the \LaTeX content is hosted on **MathHub** (<http://MathHub.info>), a portal and archive for flexiformal mathematics. **MathHub** offers GIT repositories (public and private escrow) for mathematical documentation projects, online and offline authoring and document development infrastructure, and a rich, interactive reading interface. The **modules** package supports repository-sensitive operations on **MathHub**.

Note that **MathHub** has two-level repository names of the form $\langle group \rangle / \langle repo \rangle$, where $\langle group \rangle$ is a **MathHub**-unique repository group and $\langle repo \rangle$ a repository name that is $\langle group \rangle$ -unique. The file and directory structure of a repository is arbitrary – except that it starts with the directory **source** because they are Math Archives in the sense of [Hor+11]. But this structure can be hidden from the \LaTeX author with **MathHub**-enabled versions of the **modules** macros.

$\backslash\text{includemhassignment}$ The $\backslash\text{includemhassignment}$ macro is a variant of $\backslash\text{importmodule}$ with repository support. Instead of writing

```
 $\backslash\text{defpath}\{\text{MathHub}\}\{\text{/user/foo/lmh/MathHub}\}$ 
 $\backslash\text{includeassignment}[\text{pts}=7]\{\backslash\text{MathHub}\{\text{fooMH/bar/source/baz/foobar}\}\}$ 
```

we can simply write (assuming that $\backslash\text{MathHub}$ is defined as above)

```
 $\backslash\text{includemhassignment}[\text{fooMH/bar}]\{\text{baz/foobar}\}$ 
```

Note that the $\backslash\text{importmhmodule}$ form is more semantic, which allows more advanced document management features in **MathHub**.

If **baz/foobar** is the “current module”, i.e. if we are on the **MathHub** path $\dots\text{MathHub/fooMH/bar}\dots$, then stating the repository in the first optional argument is redundant, so we can just use

```
 $\backslash\text{includemhassignment}\{\text{baz/foobar}\}\{\text{foobar}\}$ 
```

Of course, neither \LaTeX nor \LaTeXML know about the repositories when they are called from a file system, so we can use the $\backslash\text{mhcurrentrepos}$ macro from the **modules** package to tell them. But this is only needed to initialize the infrastructure in the driver file. In particular, we do not need to set it in each module, since the $\backslash\text{importmhmodule}$ macro sets the current repository automatically.

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 \LaTeX TRAC [sTeX].

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.

`hwexam.dtx` generates four files: `hwexam.cls` (all the code between `<*cls>` and `</cls>`), `hwexam.sty` (between `<*package>` and `</package>`) and their L^AT_EXML bindings (between `<*ltxml.cls>` and `</ltxml.cls>` and `<*ltxml.sty>` and `</ltxml.sty>` respectively). We keep the corresponding code fragments together, since the documentation applies to both of them and to prevent them from getting out of sync.

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.

```
1 <*cls>
2 \DeclareOption{test}{\PassOptionsToPackage{\CurrentOption}{hwexam}}
3 \DeclareOption{multiple}{\PassOptionsToPackage{\CurrentOption}{hwexam}}
4 \DeclareOption{showmeta}{\PassOptionsToPackage{\CurrentOption}{metakeys}}
5 \DeclareOption{extrefs}{\PassOptionsToPackage{\CurrentOption}{sref}}
6 \DeclareOption{notes}{\PassOptionsToPackage{\CurrentOption}{problem}}
7 \DeclareOption{hints}{\PassOptionsToPackage{\CurrentOption}{problem}}
8 \DeclareOption{solutions}{\PassOptionsToPackage{\CurrentOption}{problem}}
9 \DeclareOption{pts}{\PassOptionsToPackage{\CurrentOption}{problem}}
10 \DeclareOption{min}{\PassOptionsToPackage{\CurrentOption}{problem}}
11 \DeclareOption{boxed}{\PassOptionsToPackage{\CurrentOption}{problem}}
12 \DeclareOption{extract}{\PassOptionsToPackage{\CurrentOption}{problem}}
13 \DeclareOption*{\PassOptionsToClass{\CurrentOption}{omdoc}}
14 \ProcessOptions
15 </cls>
16 <*ltxml.cls>
17 # -*- CPERL -*-
18 package LaTeXML::Package::Pool;
19 use strict;
20 use LaTeXML::Package;
21 use LaTeXML::Util::Pathname;
22 use Cwd qw(cwd abs_path);
23 DeclareOption('test',,sub {PassOptions('hwexam','sty',ToString(Digest(T_CS('\CurrentOption'))))})
24 DeclareOption('multiple',sub {PassOptions('hwexam','sty',ToString(Digest(T_CS('\CurrentOption'))))})
25 DeclareOption('showmeta',sub {PassOptions('metakeys','sty',ToString(Digest(T_CS('\CurrentOption'))))})
26 DeclareOption('extrefs',sub {PassOptions('sref','sty',ToString(Digest(T_CS('\CurrentOption'))))})
27 DeclareOption('notes',sub {PassOptions('problem','sty',ToString(Digest(T_CS('\CurrentOption'))))})
28 DeclareOption('hints',sub {PassOptions('problem','sty',ToString(Digest(T_CS('\CurrentOption'))))})
29 DeclareOption('solutions',sub {PassOptions('problem','sty',ToString(Digest(T_CS('\CurrentOption'))))})
30 DeclareOption('pts',sub {PassOptions('problem','sty',ToString(Digest(T_CS('\CurrentOption'))))})
31 DeclareOption('min',sub {PassOptions('problem','sty',ToString(Digest(T_CS('\CurrentOption'))))})
32 DeclareOption('boxed',sub {PassOptions('problem','sty',ToString(Digest(T_CS('\CurrentOption'))))})
33 DeclareOption('extract',sub {PassOptions('problem','sty',ToString(Digest(T_CS('\CurrentOption'))))})
```

```

34 DeclareOption(undef,sub {PassOptions('omdoc','cls',ToString(Digest(T_CS('\CurrentOption')))); }
35 ProcessOptions();
36 </ltxml.cls>

```

We load `article.cls`, and the desired packages. For the L^AT_EXML bindings, we make sure the right packages are loaded.

```

37 <*cls>
38 \LoadClass{omdoc}
39 \RequirePackage{stex}
40 \RequirePackage{hwexam}
41 \RequirePackage{graphicx}
42 \RequirePackage{a4wide}
43 \RequirePackage{amssymb}
44 \RequirePackage{amstext}
45 \RequirePackage{amsmath}
46 </cls>
47 <*ltxml.cls>
48 LoadClass('omdoc');
49 RequirePackage('stex');
50 RequirePackage('hwexam');
51 RequirePackage('graphicx');
52 RequirePackage('amssymb');
53 RequirePackage('amstext');
54 RequirePackage('amsmath');
55 </ltxml.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.

```

56 <*package>
57 \DeclareOption{showmeta}{\PassOptionsToPackage{\CurrentOption}{metakeys}}
58 \newif\iftest\testfalse
59 \newif\ifsolutions\solutionsfalse
60 \DeclareOption{test}{\testtrue\solutionsfalse}
61 \newif\ifmultiple\multiplefalse
62 \DeclareOption{multiple}{\multipletrue}
63 \DeclareOption*{\PassOptionsToPackage{\CurrentOption}{problem}}
64 \ProcessOptions
65 </package>

```

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

```

66 <*package>
67 \RequirePackage{keyval}[1997/11/10]
68 \RequirePackage{problem}
69 </package>

```

Here comes the equivalent header information for L^AT_EX_{ML}, we also initialize the package inclusions. Since L^AT_EX_{ML} does not handle options yet, we have nothing to do.

```
70 <*lxml>
71 # -*- CPERL -*-
72 package LaTeXML::Package::Pool;
73 use strict;
74 use LaTeXML::Package;
75 RequirePackage('problem');
76 </lxml>
```

Then we register the namespace of the requirements ontology

```
77 <*lxml>
78 RegisterNamespace('assig'=>"http://omdoc.org/ontology/assignments#");
79 RegisterDocumentNamespace('assig'=>"http://omdoc.org/ontology/assignments#");
80 </lxml>
```

5.2 Assignments

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

```
81 <*package>
82 \srefaddidkey{assig}
83 \addmetakey{assig}{number}
84 \addmetakey*{assig}{title}
85 \addmetakey{assig}{type}
86 \addmetakey{assig}{given}
87 \addmetakey{assig}{due}
```

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.

```
88 \def\given@due#1#2{%
89 \ifx\assig@given\@empty
90 \ifx\assig@due\@empty\else#1 Due \assig@due #2\fi%
91 \else%assig@given non-empty
92 #1Given \assig@given%
93 \ifx\assig@due\@empty\else, Due \assig@due\fi #2\fi}
```

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.

`assignment@titleblock` This macro prints the title block of a section. If the `multiple` package option is given we make a section heading out of this, and if not, a title block. Note that as `problems` are numbered by section, we also set the section counter in the latter case.

```
94 \ifmultiple
```

```

95 \def\assignment@titleblock{%
96 \ifx\assig@number\@empty\stepcounter{section}\else\setcounter{section}{\assig@number}\fi%
97 \section*{\protect\document@hwexamtype~\arabic{section}:\~\assig@title%
98 \ifx\assig@title\@empty\strut\\fi\given@due()}%
99 \addcontentsline{toc}{section}%
100 {\document@hwexamtype~\arabic{section}}:\~%
101 \string\importmodules{\imported@modules}\assig@title}%
102 \setcounter{problem}{0}}
103 \else% multiple
104 \def\assignment@titleblock{%
105 \ifx\assig@number\@empty\stepcounter{section}\else\setcounter{section}{\assig@number}\fi%
106 \begin{center}\bf
107 \Large\@title\strut\\
108 \document@hwexamtype~\assig@number:\~\assig@title\strut\\
109 \large\given@due()
110 \end{center}}
111 \fi %multiple

```

assignment@process@keys this macro collects the keys from its argument and corrects them from the outside.

```

112 \def\assignment@process@keys#1{\metasetkeys{assig}{#1}}
113 \ifx\inclassig@title\@empty\else\def\assig@title{\inclassig@title}\fi
114 \ifx\inclassig@type\@empty\else\def\assig@type{\inclassig@type}\fi
115 \ifx\inclassig@number\@empty\else\def\assig@number{\inclassig@number}\fi
116 \ifx\inclassig@due\@empty\else\def\assig@due{\inclassig@due}\fi
117 \ifx\inclassig@given\@empty\else\def\assig@given{\inclassig@given}\fi

```

for this to work we need to define the \inclassig macros in case no \includeassignment is ever called.

```

118 \def\inclassig@title{}
119 \def\inclassig@type{}
120 \def\inclassig@number{}
121 \def\inclassig@due{}
122 \def\inclassig@given{}

```

assignment

```

123 \newenvironment{assignment}[1][\assignment@process@keys{#1}%
124 \assignment@titleblock%
125 \def\currentsectionlevel{assignment\xspace}%
126 \def\Currentsectionlevel{Assignment\xspace}%
127 \ignorespaces}{}
128 \</package>
129 \<*!xml>
130 DefEnvironment('{assignment} OptionalKeyVals:assig',
131 "<omdoc:omgroup ?&KeyVal{#1,'id'}(xml:id='&KeyVal{#1,'id'}')() "
132 . "assig:dummy='for the namespace'"
133 . "<omdoc:metadata>"
134 . "<dc:title>"
135 . "Assignment ?&KeyVal{#1,'num'}(&KeyVal{#1,'num'})() "
136 . "?&KeyVal{#1,'title'}(&KeyVal{#1,'title'})")

```



```

137 .      "</dc:title>"
138 .      "&KeyVal(#1,'given')(<omdoc:meta property='assig:given'>&KeyVal(#1,'given')</omdoc:meta>)"
139 .      "&KeyVal(#1,'due')(<omdoc:meta property='assig:due'>&KeyVal(#1,'due')</omdoc:meta>())"
140 .      "&KeyVal(#1,'pts')(<omdoc:meta property='assig:pts'>&KeyVal(#1,'pts')</omdoc:meta>())"
141 .      "</omdoc:metadata>"
142 .      "#body"
143 . "</omdoc:omgroup>\n",
144 afterDigest=> sub {
145   my ($stomach, $kv) = @_;
146   my $kvi = LookupValue('inclassig');
147   my @keys = qw(id num title pts given due);
148   my @vals = $kvi && map($kvi->getValue($_), @keys);
149   foreach my $i(0..$#vals) {
150     $kv->setValue($keys[$i],$vals[$i]) if $vals[$i];
151   };#$
152 </ltxml>

153 <*package>
154 \def\assig@default@type{Assignment}
155 \addmetakey[\assig@default@type]{document}{hwexamtype}
156 </package>

```

5.3 Including Assignments

The next command is essentially a glorified `\include` statement, it just sets some internal macros first that overwrite the local points, ¹

```

157 <*package>
158 \addmetakey{inclassig}{number}
159 \addmetakey{inclassig}{title}
160 \addmetakey{inclassig}{type}
161 \addmetakey{inclassig}{given}
162 \addmetakey{inclassig}{due}
163 \newcommand\includeassignment[2][\metasetkeys{inclassig}{#1}\include{#2}]
164 \newcommand\inputassignment[2][\metasetkeys{inclassig}{#1}\input{#2}]
165 </package>
166 <*ltxml>
167 DefMacro('includeassignment [] {}', sub {
168   my ($stomach, $arg1, $arg2) = @_;
169   AssignValue('inclassig',$arg1) if $arg1;
170   (Invocation(T_CS('input'),$arg2)->unlist);
171 });
172 DefMacro('inputassignment [] {}','\input{#2}');
173 </ltxml>

```

5.4 Typesetting Exams

```

174 <*package>

```

¹EDNOTE: these keys should be done with `\addmetakey`

```

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

180 \addmetakey{testheading}{min}
181 \addmetakey{testheading}{duration}
182 \addmetakey{testheading}{reqpts}
183 \newenvironment{testheading}[1][\metasetkeys{testheading}{#1}
184 {\noindent\large{Name: \hfill Matriculation Number:\hspace*{2cm}\strut\\[1ex]
185 \begin{center}\Large\textbf{\@title}\\[1ex]\large\@date\\[3ex]\end{center}
186 {\textbf{You have
187 \ifx\test@heading@duration\empty\testheading@min minutes\else\testheading@duration\fi
188 (sharp) for the test}};\ Write the solutions to the sheet.}\par\noindent
189
190 \newcount\check@time\check@time=\testheading@min
191 \advance\check@time by -\theassignment@totalmin
192 The estimated time for solving this exam is {\theassignment@totalmin} minutes,
193 leaving you {\the\check@time} minutes for revising your exam.
194
195 \newcount\bonus@pts\bonus@pts=\theassignment@totalpts
196 \advance\bonus@pts by -\testheading@reqpts
197 You can reach {\theassignment@totalpts} points if you solve all problems. You will only need
198 {\testheading@reqpts} points for a perfect score, i.e.\ {\the\bonus@pts} points are
199 bonus points. \vfill
200 \begin{center}
201 {\Large\em
202 % You have ample time, so take it slow and avoid rushing to mistakes!\\[2ex]
203 Different problems test different skills and knowledge, so do not get stuck on
204 one problem.}\vfill\par\correction@table \\[3ex]
205 \end{center}}
206 {\newpage}
207 \end{package}
208 \end{ltxml}
209 DefEnvironment('{testheading}OptionalKeyVals:omdoc','');
210 \end{ltxml}

211 \end{package}
212 \def\testspace#1{\iftest\vspace*{#1}\fi}
213 \def\testnewpage{\iftest\newpage\fi}
214 \def\testemptypage{\iftest\begin{center}This page was intentionally left
215 blank for extra space\end{center}\vfill\ject\else\fi}
216 \end{package}
217 \end{ltxml}
218 DefConstructor('\testspace{','');
219 DefConstructor('\testnewpage','');
220 DefConstructor('\testemptypage','');
221 \end{ltxml}

```

`\@problem` This macro acts on a problem's record in the *.aux file. Here we redefine it to generate the correction table.

```

222 <*package>
223 \def\@problem#1#2#3{\stepcounter{assignment@probs}
224 \def\@test{#2}\ifx\@test\@empty\else\addtocounter{assignment@totalpts}{#2}\fi
225 \def\@test{#3}\ifx\@test\@empty\else\addtocounter{assignment@totalmin}{#3}\fi
226 \xdef\correction@probs{\correction@probs & #1}%
227 \xdef\correction@pts{\correction@pts & #2}
228 \xdef\correction@reached{\correction@reached &}}
229 </package>

```

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

```

230 <*package>
231 \newcounter{assignment@probs}
232 \newcounter{assignment@totalpts}
233 \newcounter{assignment@totalmin}
234 \def\correction@probs{prob.}%
235 \def\correction@pts{total}%
236 \def\correction@reached{reached}%
237 \stepcounter{assignment@probs}
238 \def\correction@table{\begin{tabular}{|l|*{\theassignment@probs}{c|}|p{3cm}|}\hline%
239 &\multicolumn{\theassignment@probs}{c|}|%
240 {\footnotesize To be used for grading, do not write here} &\\\hline
241 \correction@probs & Sum & grade\\\hline
242 \correction@pts & \theassignment@totalpts & \strut\hspace{3cm}\strut\\\hline
243 \correction@reached & & \[.7cm]\hline
244 \end{tabular}}
245 </package>

```

5.5 Support for MathHub

`\includemhassignment` The `\includemhassignment` saves the current value of `\mh@currentrepos` in a local macro `\mh@@repos`, resets `\mh@currentrepos` to the new value if one is given in the optional argument, and after importing resets `\mh@currentrepos` to the old value in `\mh@@repos`.

```

246 <ltxml>RawTeX('
247 <*ltxml | package>
248 \newcommand\includemhassignment[2][\metasetkeys{inclassig}{#1}%
249 \edef\mh@@repos{\mh@currentrepos}%
250 \ifx\inclassig@mhrepos\@empty\else\mhcurrentrepos\inclassig@mhrepos\fi%
251 \input{\MathHub{\mh@currentrepos/source/#2}}%
252 \mhcurrentrepos\mh@@repos}
253 </ltxml | package>
254 <ltxml>');

```

5.6 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

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

```

Finally, we need to terminate the file with a success mark for perl.

```
255 <ltxml>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.

L^AT_EX^{ML}, 4–7

References

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