The **mathexam** Package*

Jan Hlavacek
Email: jhlavace@svsu.edu

30 July 2007

Abstract

This package can help you typeset exams (mostly in mathematics and related disciplines where students are required to show their calculations followed by one or more short answers). It provides commands for inclusion of space for calculations, as well as commands for automatic creation of "answer spaces". In addition, the package will automatically create page headers and footers, and will let you include instructions and space for students to put their name.

Contents

*This document describes the version number v1.00, last revised 2007/07/30.

1 Introduction

There are several classes and packages for typesetting exams in LaTeX available. However, I found out that none of them satisfy my needs. Some of the classes and packages are very sophisticated, providing commands and environments for things like fill in the blank, true/false and multiple choice questions. In contrast, nearly all exams in my lower level undergraduate math classes (including exams I took myself as an undergraduate) have basically the same format: a list of questions, each followed by a vertical space for students to do their calculations, each optionally followed by one or more reserved spaces for students to write their final answers.

Some of my colleagues use various word-processing softwares to type their exams. Because of limitations of these programs, they usually end up typing each questions, followed by bunch of blank lines, followed by something like "Answer underscore underscore underscore ...", carefully inserting just the right number of blank lines so that the each question will be on the same page as its corresponding "Answer:...", and the last "Answer:..." on each page will be somewhat close to the bottom of the page. This works fine as long as you don't change the questions, the font, margins, and as long as you always use the same printer to print the exam. Every time you do anything that results in a change in pagination, you have to go back and insert or delete blank lines in order to have everything align correctly again.

TeX with its stretchable vertical glue, can easily solve this problem. This package provides a way for easy inclusion of vertical space after questions, as well as single or multiple "answer spaces". It does not take care of things like numbering of questions (I prefer to use standard LaTeX list making environments), tracking the number of points, etc.

2 Installation

To install this package, simply run LaTeX with the input file `mathexam.ins` like this:

```
$ latex mathexam.ins
```

That will create the file `mathexam.sty`. You need to move this file to a place where LaTeX can find it.

To generate documentation for this package, run LaTeX with the input file `mathexam.dtx` instead, like

```
$ latex mathexam.dtx
```

to generate the documentation in the `.dvi` format, or

```
$ pdflatex mathexam.dtx
```

to create a `pdf` file.

3 Usage

To use the package, all you have to do is include `\usepackage{mathexam}` in the preamble of your document:

```
\documentclass[11pt]{article}
\usepackage{mathexam}
```

`nohdr` Normally, the `mathexam` package automatically generates headers and footers for each page, containing information about the exam. In order to do that, the package uses several other packages, namely `fancyhdr`, `lastpage` and `ifthen`. These packages have to be installed on your computer if you want the `mathexam` package generate headers. If you don't have all of these packages, or if for some reason you don't want the `mathexam` package to generate headers (you have your own way to include headers, for example), you can call the `mathexam` package with `nohdr` option:

```
\documentclass[11pt]{article}
\usepackage[nohdr]{mathexam}
```

3.1 Main Commands

`\answer` The command `\answer` inserts a stretchable vertical space followed by a generic "answer space":

```
What is $1+1$? \answer
```

produces:

What is $1 + 1$?

Answer:_____

`\addanswer` The command `\addanswer` works just like `\answer` except that it does not insert any extra vertical space. It can be used for example in situation where we need two "answer spaces" immediately following each other:

```
Product of two numbers equals 24, while their sum is 10.  What are the
numbers? \answer\addanswer
```

produces:

Product of two numbers equals 24, while their sum is 10. What are the numbers?

Answer:_____

Answer:_____

3.2 Optional Arguments

In the examples above, there is a stretchable vertical glue between the text of each problem and the "answer space". You cannot really see it in this document, since the problems are surrounded by other text and we let LaTeX decide where to break the page. Normally, you would insert `\newpage` after several problems, which would make the problems nicely distributed on the page.

Sometimes you want to make sure that certain problem has enough space for students to write down their work. You can specify an exact amount of space between the text of the problem and the "answer space" using an optional argument with the `\answer` or `\addanswer` commands:

```
What is $1+1$? \answer[1in]
```

produces:

What is $1 + 1$?

Answer:_____

Here, the space between the text of the problem and the "answer space" will be 1 inch. In this aspect, `\addanswer[1in]` will work the exact same way. The argument can be any glue, for example if you want to include at least one inch, which can possibly stretch further, you can do `\answer[1in plus 1fill]`

3.3 Changing Labels for "Answer Spaces"

Often you want to use different text instead of the default "Answer:" label for an "answer space". This can easily be done with the "stared" version of the commands. The commands `\answer*` and `\addanswer*` take one mandatory argument (in addition to the optional argument described above) with the text you want to use for the label. For example

```
Find the first two derivatives of the function $f(x) = x^2\cos(x)$.  Simplify
your answers as much as possible.  Show all your work.
\answer*[1in]{$f'(x)=$}\answer*[1in]{$f''(x)=$}
```

produces

Find the first two derivatives of the function $f(x) = x^2 \cos(x)$. Simplify your answers as much as possible. Show all your work.

$f'(x) =$_____

$f''(x) =$_____

Notice that here, vertical spaces before both of the "answer spaces" will be 1 inch long. In the following example, the answer spaces for x and y will be right above each other:

```
If $x + y = 10$ and $2x - y = 8$, find $x$ and $y$.
\answer*[1in]{$x=$}\addanswer*{$y=$}
```

produces

If $x + y = 10$ and $2x - y = 8$, find x and y.

$x =$_____

$y =$_____

3.4 No "Answer Space"

Sometimes you will have problems where the work is the answer, or the answer is too long to fit into a short "answer space". For that purpose, the package defines the `\noanswer` command.

`\noanswer` This command will simply include a stretchable vertical space after the prob-

lem. Again, as with `\answer` and `\addanswer`, the command takes one optional argument, which is an optional length of the vertical space.

3.5 Other Commands

The package provides several other commands for things like identifying the exam, giving instructions to students, including space for student's name etc.

`\ExamName` `\ExamClass` `\ExamHead`

The commands `\ExamName`, `\ExamClass` and `\ExamHead` are used for identifying the exam. They will determine how will the headers of the exam pages look like. For example, in the preamble of your document you could specify

```
\ExamName{Final Exam}
\ExamClass{Calculus III}
\ExamHead{\today}
```

The `mathexam` package will use the `fancyhdr` package to include this information in the page headers.

`\ExamNameLine`

The `\ExamNameLine` command can be used to include a line on which students can write their name:

```
\ExamNameLine
```

produces

Name:_____

`\ExamInstrBox`

The command `\ExamInstrBox` lets you include some basic instructions to students taking the exam. Example:

```
\ExamInstrBox{Please show all your work! Answers without supporting work will
not be given credit. Write answers in spaces provided.  You have 1 hour and 50
minutes to complete this exam.}
```

produces

> Please show all your work! Answers without supporting work will not be given credit. Write answers in spaces provided. You have 1 hour and 50 minutes to complete this exam.

4 Notes

4.1 TODO

There are several things I plan to improve in the future:

- Some basic internationalization (right now everything is in English)

- Add some code for printing point value of problems.

If you have any other suggestions, please contact me.

4.2 Bugs, Suggestions, Comments...

If you find any bugs, or have any suggestions, comments, patches etc. please let me know at `jhlavace@svsu.edu`.

5 Implementation

First we will process options:

```
\newif\ifExamHdr
\ExamHdrtrue
\DeclareOption{nohdr}{\ExamHdrfalse}
\ProcessOptions
```

If ExamHdr is true, we load some packages we need

```
\ifExamHdr
\RequirePackage{fancyhdr}
\RequirePackage{lastpage}
\RequirePackage{ifthen}
\fi
```

\ExamName
\ExamClass
\ExamHead

Here we will set up macros that handle exam headers and footers. First we will define the three commands that provide a user interface:

```
\newcommand{\ExamName}[1]{\def\@xamname{#1}}
\newcommand{\ExamClass}[1]{\def\@xamclass{#1}}
\newcommand{\ExamHead}[1]{\def\@xamrighthdr{#1}}
```

Then we will initialize the internal macros to some default values:

```
\def\@xamname{\relax}
\def\@xamclass{\relax}
\def\@xamrighthdr{\relax}
```

If ExamHdr is true, set up the fancy headers:

```
\ifExamHdr
\pagestyle{fancy}

\lhead{\@xamclass}
\chead{\@xamname}
\rhead{Page \thepage\ of \pageref{LastPage}}

\rfoot{\ifthenelse{\value{page}=\pageref{LastPage}}{The End.}{Cont.}}
\cfoot{}
```

Handle the first page differently:

```
\AtBeginDocument{
\begin{center}
   \large\scshape \@xamclass \hfill \@xamname \hfill \@xamrighthdr
```

```
\end{center}}

\thispagestyle{empty}
\fi
```

`\answer` `\addanswer` Prepare auxiliary commands for `\answer` and `\addanswer`. First the regular (non-stared) version:

```
\newcommand{\answ@r}[1][\fill]{%
   \nopagebreak\vspace{#1}\par\nopagebreak\hfill\hbox to
   .5\columnwidth{Answer:\hrulefill}\vspace{\baselineskip}}

\newcommand{\addansw@r}[1][\baselineskip]{%
   \nopagebreak\vspace{#1}\par\nopagebreak\hfill\hbox to
   .5\columnwidth{Answer:\hrulefill}\vspace{\baselineskip}}
```

Then the stared version:

```
\newcommand{\answ@rstar}[2][\fill]{%
   \nopagebreak\vspace{#1}\par\nopagebreak\hfill\hbox to
   .5\columnwidth{#2\hrulefill}\vspace{\baselineskip}}

\newcommand{\addansw@rstar}[2][\baselineskip]{%
   \nopagebreak\vspace{#1}\par\nopagebreak\hfill\hbox to
   .5\columnwidth{#2\hrulefill}\vspace{\baselineskip}}
```

Now we will pot them together. Look ahead to see if there is a star. If there is, use the stared version:

```
\def\answer{%
   \def\e@t*{}%
   \def\n@xt{\if\noexpand\myn@@xt*%
      \expandafter\expandafter\expandafter\answ@rstar\expandafter\e@t\else%
      \expandafter\answ@r\fi}%
   \futurelet\myn@@xt\n@xt}

\def\addanswer{%
   \def\e@t*{}%
   \def\n@xt{\if\noexpand\myn@@xt*%
      \expandafter\expandafter\expandafter\addansw@rstar\expandafter\e@t\else%
      \expandafter\addansw@r\fi}%
   \futurelet\myn@@xt\n@xt}
```

`\noanswer`

```
\newcommand{\noanswer}[1][\fill]{\nopagebreak\vspace{#1}\par}
```

Finally, couple of very simple macros. They could probably be made more interesting and flexible.

`\ExamNameLine`

```
\newcommand{\ExamNameLine}{%
\par
\vspace{\baselineskip}
```

```
63 Name:\hrulefill\relax
64 \par}
```

\ExamInstrBox

```
65 \newcommand{\ExamInstrBox}[1]{\begin{center}\vspace{\baselineskip}%
66    \fbox{\fbox{\parbox{.8\hsize}{#1}}}\end{center}}
```

Change History

1.00 distribution 1
General: Rewrote as a .dtx file for

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.