Title: The randexam class for LaTeX

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Code: https://github.com/lvjr/randexam

Contents

1 Introduction

Document class randexam is an exam class for LaTeX. With this class you could easily make an exam paper and its randomized variants.

The class mainly focuses on making math exam papers, but you could use it to make other exam papers.

The latest release of this package can be downloaded from here: https://ctan.org/pkg/randexam.

2 Basic Structure

2.1 A randexam document

The following is the basic structure of a randexam document:

```
\documentclass{randexam}
% document preamble
\begin{document}
% document body
\end{document}
```

In document preamble you could set some options for the exam. In document body you write the contents of the exam.

2.2 Document preamble

In document preamble you normally set some class options with \SetExamOption command. For example, you could change the random seed with seed key. The seed is used only when you add class option random (see Subsection 7.2):

```
\SetExamOption{
  seed = 19061116, % random seed
}
```

2.3 Document body

In document body you normally write an `\examtitle`, multiple `\exampart`, and an optional `\examdata` commands:

```
\examtitle{name=Math Final Exam,date=2018-06-28,version=A}
......
\exampart{Fill in the blanks.}[3 points for each.]
......
\exampart{Select one answer.}[3 points for each.]
......
\exampart{Work out math calculations.}[8 points for each.]
......
\examdata{Some data may be used in the exam}
......
```

2.4 Exam title

In calling `\examtitle` command, you need to provide some basic informations of the exam:

```
\examtitle{name=Math Final Exam,date=2018-06-28,version=A}
```

If the `date` key is missing, it has the default value `\today`. When class option random is passed, the value of `version` key will be modified from `A` to `B`.

2.5 Exam parts

The questions in an exam could be separated into several parts:

```
\exampart{Fill in the blanks.}[3 points for each.]
......
\exampart{Select one answer.}[3 points for each.]
......
\exampart{Work out math calculations.}[8 points for each.]
......
```

2.6 Exam data

At the end of the exam, you could add some appendix data with `\examdata` command:

```
\examdata{Some data may be used in the exam}
......
```

You must put appendix data after `\examdata` command, or the exam variants will be incorrect.

3 Types of questions

3.1 True-or-false questions

```
\exampart{True-or-false questions}[3 points for each.]

\begin{question}
The first true-or-false question. \tickout{T}
\end{question}

\begin{question}
The second true-or-false question. \tickout{F}
\end{question}
```

1. The first true-or-false question. . . . . [T]

2. The second true-or-false question. . . . . [F]

With `\tickout{T}` and `\tickout{F}`, you get T and F; with `\tickout{t}` and `\tickout{f}`, you get ✓ and ×.

You must put answers inside `\tickout` command, so as to make randexam hide them in generating blank exam papers.

3.2 Fill-in-the-blank questions

```
\exampart{Fill in the blanks.}[3 points for each.]

\begin{question}
The first fill-in-the-blank question \fillout{answer}.
\end{question}

\begin{question}
The second fill-in-the-blank question \fillout{answer}.
\end{question}
```

3. The first fill-in-the-blank question _____answer_____.

4. The second fill-in-the-blank question _____answer_____.

With `\fillout` command, the underline will fill the whole line; with `\fillin` command, the underline will be minimal.

You must put answers inside `\fillout` or `\fillin` command, so as to make randexam hide them in generating blank exam papers.

3.3 Multiple-choice questions

```
\exampart{Select one answer.}[3 points for each.]

\begin{question}
The first multiple-choice questions \pickout{A}.
\begin{abcd}
  \item First
  \item Second
  \item Third
  \item Fourth
\end{abcd}
\end{question}

\begin{question}
The second multiple-choice questions \pickout{C}.
\begin{abcd}
  \item First choice
```

```
  \item Second choice
  \item Third choice
  \item Fourth choice
\end{abcd}
\end{question}
```

5. The first multiple-choice questions · (A).
(A) First (B) Second (C) Third (D) Fourth

6. The second multiple-choice questions · · · · · · · · · · · · · · · · · (C).
(A) First choice (B) Second choice
(C) Third choice (D) Fourth choice

With `\pickout` command, the answer will be printed on the right edge of the line; with `\pickin` command, the answer will be printed on current position.

You must put answers inside `\pickout` or `\pickin` command, so as to make randexam hide them in generating blank exam papers.

The four choices of multiple-choice questions could be typeset with `abcd` environment. And `abcd` environment will put them in one, two, or four rows according to the lengths of the choices.

3.4 Subjective questions

For subjective questions, you could put answers inside `solution` environment.

```
\exampart{Work out math calculations.}[8 points for each.]

\begin{question}
The first math calculation question.
\end{question}

\begin{solution}
Answer to the first question.
\end{solution}

\begin{question}
```

```
The second math calculation question.
\end{question}

\begin{solution}
Answer to the second question.
\end{solution}
```

7. The first math calculation question.

Solution. Answer to the first question.

8. The second math calculation question.

Solution. Answer to the second question.

3.5 Other questions

You can write other types of questions. For example:

```
\exampart{Some question type}[4 points for each.]

\begin{question}
First question text. \answer{Answer text.}
\end{question}

\begin{question}
Second question text. \answer{Answer text.}
\end{question}
```

9. First question text. Answer text.

10. Second question text. Answer text.

You must put answer text inside `\answer` command, so as to make randexam hide them in generating blank exam papers.

4 Other components

4.1 Grade tables

Normally you need a grade table after exam title. You can get it by using `\gradetable` command.

```
\gradetable[total=6,strut=2em]
```

Part	I	II	III	IV	V	VI	Total
Score							

The meanings of keys in the `\gradetable` command are:

total total number of parts in this exam.

strut strut height of the score row; its default value is `2.5em`.

4.2 Answer tables

Before true-or-false, fill-in-the-blank, or multiple-choice questions, you may use `\answertable` to generate a blank answer table:

```
\answertable[total=6,column=3,strut=3em]
```

Notice: you MUST write the answers in the following tables.

Number	1	2	3
Answer			
Number	4	5	6
Answer			

The meanings of keys in the `\answertable` command are:

total total number of questions in this exam part.

column number of questions in each row.

strut strut height of the answer rows; its default value is `1em`.

notice notice text before the answer table.

4.3 Vertical space

You could leave some vertical space after a `question` or `solution` environment. At this time randexam class supports the following commands for adding vertical space:

`\smallskip`	Add small vertical space
`\medskip`	Add medium vertical space
`\bigskip`	Add big vertical space
`\vfill`	Fill vertical space available

Of course, you could use multiple commands in the above tables.

In the exam body, you could use `\newpage` to make a page break, but you should NOT use other page breaking commands, such as `\clearpage`, or the exam variants may be wrong.

5 Writing questions

5.1 points key

The `question` environment accepts a `points` key:

```
\begin{question}[points=4]
This is a question.
\end{question}
```

11. (4 points) This is a question.

6 Writing solutions

6.1 Solution name

If you would like to change the name of `solution` environment, you could modify the translation of `solution-Solution` keyword (see Subsection 8.1). The following example changes it from "Solution" to "Proof":

```
\SetExamTranslation{solution-Solution=Proof}
\begin{solution}
  This is the proof.
\end{solution}
```

Proof. This is the proof.

6.2 Points command

Inside `solution` environment, you could use `\points` to give points for each step. For example:

```
\begin{solution}
$1+1=2$ \points{4}
$2+2=4$ \points{8}
\end{solution}
```

Solution. $1+1=2$ ·····4 points
$2+2=4$ ·····8 points

You can also use `\points` command inside displayed formulas or `align*` environment. And the point text will be printed at the right edge of the line.

6.3 Alignment commands

With class option freealign, randexam loads freealign package, and freealign package provides several commands for aligning math formulas in different lines.

Here is the first example:

```
We have $(a+b)^2 \? = (a+b)(a+b)$ \\
                \+$= a^2+2ab+b^2$ \points{2}
```

We have $(a+b)^2 = (a+b)(a+b)$
$= a^2+2ab+b^2$ ……2 points

The \? command inside the first formula saves current horizontal position, and the \+ command before the second formula jumps to previously saved position.

Here is another example:

```
We have \? $(a+b)^2 = (a+b)(a+b)$ \\
        \< $= a^2+2ab+b^2$ \points{2}
```

We have $(a+b)^2 = (a+b)(a+b)$
$= a^2+2ab+b^2$ ……2 points

The \? command before the first formula saves current horizontal position, and the \< command before the second formula jumps to the left of previously saved position by the width of =.

Because freealign package uses zref package to save positions, you need two compilations to get correct results.

7 Class options

All options provided by randexam class are listed in the following table:

noanswer	hide all answers in the exam paper
random	shuffle questions in each part
seed	the random seed used by random option
plain	set page style `plain`
a3paper	typeset a two-column paper of A3 size
a3input	input a paper of A4 size and change it to A3 size
mathdesign	use mathdesign utopia font
freealign	load freealign package
medmath	load medmath package
moremath	define more math commands
math=many	⇔ mathdesign,freealign
math=most	⇔ mathdesign,freealign,medmath
math=all	⇔ mathdesign,freealign,medmath,moremath
language	set language and use corresponding translations

Some of the options could also be modified with `\SetExamOption`: noanswer, random, and seed.

7.1 Blank exam papers

Assume exam-a-answer.tex is an exam paper with answers. You can easily get a blank exam paper with answers removed, by creating an exam-a-blank.tex file with the following lines:

```
\PassOptionsToClass{noanswer}{randexam}
\input{exam-a-answer}
```

That is to say, when adding noanswer option to randexam class, The answers will be hidden in the compiled exam paper.

7.2 Randomized variants

Assume exam-a-answer.tex is an exam paper. You could get a randomized variant with all questions in the same part shuffled, by creating an exam-b-answer.tex file with the following lines:

```
\PassOptionsToClass{random}{randexam}
\input{exam-a-answer}
```

That is to say, when adding random option to randexam class, The questions in the same part will be shuffled in the compiled exam paper. Furthermore, four choices in an `abcd` environment will be shuffled too.

7.3 Two column exam papers

Assume exam-a-blank.tex is the TeX file of an exam paper of A4 size. You could get an exam paper of A3 size, by creating a new TeX file with the following lines:

```
\PassOptionsToClass{a3paper}{randexam}
\input{exam-a-blank}
```

That is to say, when adding a3paper option to randexam class, The result paper will be a two column document in A3 size.

Assume exam-a-blank.pdf is the PDF file of an exam paper of A4 size. You could get an exam paper of A3 size, by creating a new TeX file with the following lines:

```
\documentclass[a3input]{randexam}
\begin{document}
\includepdf[pages=-,nup=2x1]{exam-a-blank}
\end{document}
```

That is to say, you can make an exam of A3 size from an exam of A4 size, even if you have only the PDF file.

8 Customizations

8.1 Translations of keywords

With `\DeclareExamTranslation` you can define the translaitons of the keywords in a randexam paper.

```
\DeclareExamTranslation{english}{
   answertable-Answer   = Answer
  ,answertable-Number   = Number
  ,examdata-Appendix    = Appendix
  ,exampart-Part        = Part
  ,examtitle-Name       = Name
  ,examtitle-Solutions  = Solutions
  ,gradetable-Evaluator = Evaluator
  ,gradetable-Part      = Part
  ,gradetable-Score     = Score
  ,gradetable-Total     = Total
  ,headfoot-Name        = Name
  ,headfoot-of          = of
  ,headfoot-Page        = Page
  ,headfoot-Solutions   = Solutions
  ,headfoot-Version     = Version
  ,points-point         = point
  ,points-points        = points
  ,question-Question    = Question
  ,solution-Solution    = Solution
}
```

At this time only English and Chinese keywords are defined. You could translate them for another language and enable them with `\SelectExamTranslation` command:

```
\DeclareExamTranslation{somelang}{
   question-Question    = Questiooooooon
  ,solution-Solution    = Sooooooolution
}
\SelectExamTranslation{somelang}
```

After this, you could load current translation of some keywords with `\UseExamTranslation` command:

```
\UseExamTranslation{question-Question}
\UseExamTranslation{solution-Solution}
```

Questiooooooon Soooooolution

This command is useful in defining new templates for the exam (see Subsection 8.5).

8.2 Checking current language

There are commands `\IfExamLanguageEqT`, `\IfExamLanguageEqF`, and `\IfExamLanguageEqTF`, with which you can execute code based on current language.

8.3 Checking boolean flags

There are several commands for creating, setting, or checking boolean flags:

`\NewExamBool`	create a new boolean flag
`\SetExamBoolTrue`	set the boolean flag to true
`\SetExamBoolFalse`	set the boolean flag to false
`\IfExamBoolT`	run code if the boolean flag is true
`\IfExamBoolF`	run code if the boolean flag is false
`\IfExamBoolTF`	run true-state code or false-state code

8.4 Saving and reading key values

With `\SetExamValue` and `\UseExamValue` you could save and read the value of a key, respectively.

```
\SetExamValue{somemodule}{somekey=SomeValue}
\UseExamValue{somemodule}{somekey}
```

SomeValue

The class also provides commands for conditional typesetting.

`\IfExamValueExistT`	`\IfExamValueExistF`	`\IfExamValueExistTF`
`\IfExamValueEmptyT`	`\IfExamValueEmptyF`	`\IfExamValueEmptyTF`

```
\IfExamValueExistTF{somemodule}{somekey}{True}{False}
```

True

Furthermore, you may change typeset command of some counter with `\SetExamValue` and the counter is typeset with `\TheExamCounter` command when needed.

```
\SetExamValue{exampart}{number=\Roman}
\SetExamValue{question}{number=\arabic}
Part \TheExamCounter{exampart},
Question \TheExamCounter{question}
```

Part IV, Question 11

These commands are useful in defining new templates for the exam (see Subsection 8.5).

8.5 Templates of elements

With `\DeclareExamTemplate` you could define a new template for some exam element, which could be set as default template with `\SelectExamTemplate`. And with `\UseExamTemplate` you could use the default template of the element.

To customize examtitle element for your school, you can write the following code in document preamble:

```
\DeclareExamTemplate{examtitle}{myschool}{%
  \fbox{%
    \UseExamValue{examtitle}{name}\quad%
    \UseExamValue{examtitle}{date}%
  }%
}%
\SelectExamTemplate{examtitle}{myschool}
```

Then the `\examtitle` command in document body will produce different result:

```
\examtitle{name=Final Exam in My School,date=\today}
```

Final Exam in My School July 9, 2024

Normally `\examtitle` will call `\UseExamTemplate{examtitle}{default}`.

All elements that could be customized with templates in an exam paper are listed in the following table:

examtitle	for customizing `\examtitle` command
exampart	for customizing `\exampart` command
examdata	for customizing `\examdata` command
gradetable	for customizing `\gradetable` command
answertable	for customizing `\answertable` command
questionbegin	for customizing `question` environment
questionend	for customizing `question` environment
solutionbegin	for customizing `solution` environment
solutionend	for customizing `solution` environment

8.6 Filling space with contents

In defining exam templates, we may need the following filling commands.

`\ExamFillCdot`	fill space with centered dots
`\ExamFillUline`	fill space with an underline
`\ExamFillUlineText`	fill space with underlined text
`\ExamFillUlinePhantom`	fill space with underlined phantom text

```
Hello\ExamFillCdot World\par
Hello\ExamFillUline World\par
Hello\ExamFillUlineText{Text}World\par
Hello\ExamFillUlinePhantom{\Huge Text}World\par
```

Hello····· World

Hello_____ World

Hello_____ Text _____ World

Hello_____ World

8.7 Headers and Footers

To customize headers and footers of the exam paper, we could modify the following `fancy` templates.

```
\DeclareExamTemplate{headleft}{fancy}{
  \UseExamValue{examtitle}{name}
}
\DeclareExamTemplate{headcenter}{fancy}{}
\DeclareExamTemplate{headright}{fancy}{
  \IfExamBoolTF{answer}{
    \UseExamTranslation{headfoot-Solutions}
  }{
    \UseExamTranslation{headfoot-Name}:\hspace{12em}
  }
}
\DeclareExamTemplate{footleft}{fancy}{
  \UseExamValue{examtitle}{date}
}
\DeclareExamTemplate{footcenter}{fancy}{
```

```
  \UseExamTranslation{headfoot-Page} \thepage\space
  \UseExamTranslation{headfoot-of} \zpageref{LastPage}
}
\DeclareExamTemplate{footright}{fancy}{
  \UseExamTranslation{headfoot-Version}
  \UseExamValue{examtitle}{version}
}
```

Actually, randexam class uses fancyhdr package to customize headers and footers.

8.8 Themes of exam papers

With `\DeclareExamTheme` command you can collect some templates into a theme, which could be activated later with `\SelectExamTheme` command.

```
\DeclareExamTheme{mytheme}{
  \SelectExamTemplate{examtitle}{mytheme}
  \SelectExamTemplate{exampart}{mytheme}
  \SelectExamTemplate{examdata}{mytheme}
}
......
\SelectExamTheme{mytheme}
```