

MATHQUIZ: WEB QUIZZES USING L^AT_EX

Introduction

MathQuiz is a L^AT_EX based system to create *interactive* web quizzes. The idea is that you write the quiz using L^AT_EX and that MathQuiz creates the web page from this file. Anything which you can write using L^AT_EX will be converted to HTML by MathQuiz. This includes, for example, mathematics and graphics written using PSTricks. **MathQuiz** supports three different types of quiz questions:

1. Multiple choice questions with a *unique* correct answer. (See Question 1)
2. Multiple choice questions with *several* (or no) correct answers. (See Question 2)
3. Questions which require a *numerical* answer. (See Question 3)

The use of **MathQuiz** is described in the next section. Later sections describe how each of the **MathQuiz** environments are used.

The `discussion` environment in **MathQuiz** can also be used to write Web Pages like this one (The pages you are reading here were written using **MathQuiz**.)

Basic Usage

Once you have a **MathQuiz** file, you can run it through L^AT_EX, in the usual way, to produce a readable version of your quiz. When you are happy with the quiz, use `mathquiz` to create the HTML version. Note that the printable version of the quiz does *not* look like the web page; rather, it contains all of the information in an easily readable layout.

If, for example, your quiz file is called *quiz1.tex* then you can use the following commands:

```
> latex quiz1           % latex a quiz file
> xdvi quiz1            % view the quiz using xdvi
> dvips quiz1           % print the quiz
> mathquiz quiz1        % converts the quiz to html
```

Converting the quiz to html can take quite a long time, particularly if a large number of images need to be created.

MathQuiz files

The basic structure of a **MathQuiz** file is as follows:

```

\documentclass{mathquiz}

\title{Quiz 1: Complex numbers}

\UnitCode{MATH1001}
\UnitName{Differential Calculus}
\UnitURL{/u/UG/JM/MATH1001/}
\QuizzesURL{/u/UG/JM/MATH1001/Quizzes/}

\begin{document}

% optional "discussion"
\begin{discussion}[optional title]
. . .
\end{discussion}

% question 1
\begin{question}
. . .
\end{question}

% question 2
\begin{question}
. . .
\end{question}
.
.
\end{document}

```

The preamble of the L^AT_EX file specifies the course code, the name of the unit of study, the location of the homepage for the unit and the index file for the quizzes for this unit; this is done using the commands `\UnitCode`, `\UnitName`, `\UnitURL` and `\QuizzesURL` respectively. If the command `\QuizzesURL` is omitted then the URL for the quiz index file is set to `\UnitURL/Quizzes`. (Within the the School of Mathematics and Statistics, there is also a package `smsquiz.sty` which sets the default parameters from the course code.)

The title of the quiz should also be set in the preamble using the `\title` command. Note that the `\title` command *must* appear before the `\begin{document}` command. In the preamble you can also define macros and load any packages that you want in the usual way .

The `discussion` environment can be used to add comments or remarks to a quiz. For example, it can be used to summarize the material being tested in the quiz or to give references to the course notes. The syntax for the `discussion`

environment is as follows:

```
\begin{discussion}[optional title]
. . .
\end{discussion}
```

Anything you like (text, mathematics, ...) can go inside discussion environments. The *optional title* is used both as the section heading on the web page and as the heading in the navigation bar which runs down the left hand side of the page. The headings should not be too long as they have to fit in the left hand margin. By default, the title is **discussion**. There can be several **discussion** environment, but they go all in front of the questions.

Questions are set inside a **question** environment. The text is followed by the answers.

MathQuiz supports three types of questions:

- Multiple choice questions with *precisely one* correct answer;
- Multiple choice questions with *several or no* correct answers;
- Questions taking a *numerical* answer.

With each of these types of questions you can (and should) provide feedback to the students depending on whether their answer is correct or incorrect. Below we describe how to produce these different types of questions.

Question 1

The syntax for a multiple choice question having *precisely one* correct answer is as follows:

```
\begin{question}
. . .question text
\begin{choice}
  \correct . . . text for correct option
  \response . . . feedback on response

  \correct . . . text for correct option
  \response . . . feedback on response
.
.
.
\end{choice}
\end{question}
```

The multiple choice responses for each question go inside a choice environment. The correct answer goes after `\correct`, incorrect answers after `\incorrect`.

Either can be followed by a `\response`, providing comments on the students choice when checking their answers. The `\reponse` commands are optional; however, it is recommended that you use them as good feedback is very useful for the students.

For example, Question 1 below was typed into **MathQuiz** using the following commands:

```
\begin{question}
  The shaded region in the graph
  \begin{center}
    \begin{pspicture}(-3,-1.5)(3,4)
      \pscircle[linewidth=2pt,linestyle=dashed,%
        fillcolor=blue,fillstyle=solid](1,1){2}
      \psaxes[linecolor=red,linewidth=1pt,labels=none]%
        {->}(0,0)(-1.5,-1.5)(3.5,3.5)
      \rput(3.75,0){$x$}
      \rput(0,3.85){$y$}
      \rput(3,-0.4){3}
      \rput(-0.4,3){3i}
      \psdots(1,1)
    \end{pspicture}
  \end{center}
  is equal to which of the following sets of complex numbers?
  \begin{choice}
    \incorrect $\{z \in \mathbb{C} : (z-1)^2+(z-(i+1))^2 < 2\}$
    \response The equation of a circle in the complex plane with
    centre $a+ib$ and radius $r$ is
    \begin{displaymath}
      \{z \in \mathbb{C} : |z-(a+ib)| < r\}.
    \end{displaymath}
    \end{choice}

    \incorrect $\{z \in \mathbb{C} : z+(i+1) < 2\}$
    \response You want the set of points whose \textit{distance}
    from $1+i$ is less than $2$.

    \correct $\{z \in \mathbb{C} : |z-(i+1)| < 2\}$
    \response The graph shows the set of complex numbers whose
    distance from $1+i$ is less than $2$.

    \incorrect $\{z \in \mathbb{C} : |z-2| < |i+1-2|\}$
    \response As $|i+1-2|=\sqrt{2}$, this is the set of complex
    numbers whose distance from $2$ is less than
    $\sqrt{2}$.

    \incorrect None of the above.
    \response The graph shows the set of complex numbers whose
    distance from the centre of the circle is less than $2$.
  \end{choice}
\end{question}
```

Question 2

To allow multiple (or no) correct answer we add `multiple` as an optional argument to the `choice` environment:

```
\begin{question}
. . .question text. . .
\begin{choice}[multiple]
  \((in)correct . . . text for (in)correct option
  \response . . . feedback on response

  \((in)correct . . . text for (in)correct option
  \response . . . feedback on response
.
.
.
\end{choice}
\end{question}
```

The only difference to the previous case is that multiple (or no) `\correct` commands may be used.

For example, Question 2 below was typed into MathQuiz using the following commands:

```
\begin{question}
Which of the following numbers are prime?
\begin{choice}[multiple]
  \incorrect 1
  \response By definition, a prime is a number greater than 1
  whose only factors are 1 and itself.

  \correct 19
  \response The only factors of 19 are 1 and itself.

  \incorrect 6
  \response 2 is a factor of 6

  \correct 23
  \response The only factors of 23 are 1 and itself.

  \correct 191
  \response The only factors of 191 are 1 and itself.
\end{choice}
\end{question}
```

Question 3

By default, the `choice` environments puts the multiple choice options into two column format. Sometimes, however, the options look better when listed in a single column and, sometimes, three or more columns are better. There is a more general `Choice` environment which lets you specify the number of columns in the HTML version of the quiz. Its syntax is similar to that of the `choice` environment.

```
\begin{question}
. . .question text. . .
\begin{Choice}[multiple]{n} . . . n columns
  \correct . . . text for correct option
  \response . . . feedback on response

  \correct . . . text for correct option
  \response . . . feedback on response
.
.
.
\end{Choice}
\end{question}
```

If the optional argument `[multiple]` is not present, then the question admits precisely one correct answer.

For example, Question 3 below was typed into **MathQuiz** using the following commands:

```
\begin{question}
What are suitable parametric equations for this plane curve?
\begin{center}
\psset{unit=.6cm}
\begin{pspicture}(-2.5,-0.5)(5,5.5)
  \psaxes[linecolor=red,linewidth=1pt,labels=none]%
  {->}(0,0)(-2.5,-1.5)(5,5)
  \psellipse[linecolor=blue,linewidth=2pt](1,2)(3,2)
\end{pspicture}
\end{center}

\begin{Choice}{1}
\incorrect  $x=2\cos t + 1$ ,  $y=3\sin t + 2$ 
\response This is an ellipse with centre  $(1,2)$  and with axes of
length  $4$  in the  $x$ -direction and  $6$  in the  $y$ -direction.
\begin{center}
\psset{unit=.6cm}
\begin{pspicture}(-2.5,-0.5)(5,5.5)
  \psaxes[linecolor=red,linewidth=1pt,labels=none]%
  {->}(0,0)(-2.5,-1.5)(5,5)
  \parametricplot[linecolor=blue,linewidth=2pt]{0}{360}%
  {t cos 2 mul 1 add t sin 3 mul 2 add}
```

```

\end{pspicture}
\end{center}

\correct $x=3\cos t + 1$, $y=2\sin t + 2$
\response The curve is an ellipse centre (1,2) with axes length 6
in the $x$ direction and 4 in the $y$ direction.

\incorrect $x=3\cos t - 1$, $y=2\sin t - 2$
\response This is an ellipse with centre  $(-1,-2)$  and with axes
of length 6 in the $x$-direction and 4 in the $y$-direction.
\begin{center}
\psset{unit=.6cm}
\begin{pspicture}(-5,-4)(1,2)
\psaxes[linecolor=red,linewidth=1pt,labels=none]%
{<-}(0,0)(-4.5,-5.5)(1,2)
\parametricplot[linecolor=blue,linewidth=2pt]{0}{360}%
{t cos 3 mul 1 sub t sin 2 mul 2 sub}
\end{pspicture}
\end{center}

\incorrect $x=2\cos t - 1$, $y=3\sin t - 2$
\response This is an ellipse with centre  $(-1,-2)$  and with axes
of length 4 in the $x$-direction and 6 in the $y$-direction.
\begin{center}
\psset{unit=.6cm}
\begin{pspicture}(-4,-5)(1,2)
\psaxes[linecolor=red,linewidth=1pt,labels=none]%
{<-}(0,0)(-4.5,-5.5)(1,2)
\parametricplot[linecolor=blue,linewidth=2pt]{0}{360}%
{t cos 2 mul 1 sub t sin 3 mul 2 sub}
\end{pspicture}
\end{center}
\end{Choice}
\end{question}

```

Question 4

The final type of question that **MathQuiz** supports is a question which requires a *numerical* as an answer. The numerical answer must be given in decimal form. The answer is typeset using the `\answer` macro. That macro takes two arguments, some text appearing in an answer box after the question and the actual numerical answer. The text is optional. The syntax is `\answer[text after answer box]{numerical answer}`. Then there is a mechanism for providing feedback for correct and incorrect answers. This is done using `\whenRight` and `\whenWrong`. Unlike the `\response` commands, the two responses `\whenRight` and `\whenWrong` are both mandatory for questions of this type. The syntax is for such questions is as follows:

```
\begin{question}
```

```

. . .question text. . .
\answer[text after the answer box]{actual answer}
\whenRight . . . feedback when right
\whenWrong . . . feedback when wrong
\end{question}

```

For example, Question 4 below was typed into **MathQuiz** using the following commands:

```

\begin{question}
  If the vectors  $\vec{a}$  (of magnitude 8 units) and  $\vec{b}$ 
  (of magnitude 3 units) are perpendicular, what is the value
  of
  \begin{displaymath}
    |\vec{a} - 2\vec{b}|^2?
  \end{displaymath}
  (Hint: Draw a diagram!)

  \answer[units]{10}
  \whenRight The vectors  $\vec{a}$ ,  $-\vec{b}$ , and
   $\vec{a} - 2\vec{b}$  form the sides of a right-angled
  triangle, with sides of length 8 and 6 and
  hypotenuse of length  $|\vec{a} - 2\vec{b}|$ . Therefore
  by Pythagoras' Theorem,
   $(|\vec{a} - 2\vec{b}|)^2 = 8^2 + 6^2 = 100$ .

  \whenWrong Draw a diagram and then use Pythagoras' theorem.
\end{question}

```

Index Files

MathQuiz also provides a mechanism for creating a web page containing an index of all quizzes for a given Unit of Study. This is done with a **MathQuiz** file which contains a `—quizlist—` environment. The syntax for this environment is as follows:

```

\begin{quizlist}
  \quiz[url1]{title for quiz 1}
  \quiz[url2]{title for quiz 2}
  . . .
\end{quizlist}

```

If no *url* is given as an optional argument to `—`

Quiz 1. —.

URL: `./quiz1.html` then **MathQuiz** sets the url(s) to `quiz1.html`, `quiz2.html` and so on.