THE UNIVERSITY OF AKRON
Theoretical and Applied Mathematics

AcroTEX Bundle
Grouped Responses

D. P. Story

dpstory@uakron.edu
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1. The mathGrp Environment

The Exerquiz Package defines a `mathGrp` environment; enclosed math or text fill-in questions are treated as a single question. The environment takes two optional parameters, which we shall get into in the next section. Before we take a look at some of the subtleties of this environment, let's look at the example what appeared in webeqman.pdf, the manual of usage for the AcroTEX Bundle.

1.1. The quiz Environment

Consider the following quiz requiring a vector response. We could use the techniques of `jqzspec.tex`, where we show how to create a JavaScript function what will process a vector response. Using this technique, the user enters the vector response in a single text field using a special "vector" syntax. Here, the user enters each component of the response in a separate text box; together, the three boxes form the expected response to the one question.

Begin (3pts) Compute the following cross product:

$$(3\vec{i} - 2\vec{j}) \times (\vec{i} + 5\vec{k}) = \square\vec{i} + \square\vec{j} + \square\vec{k}$$

End Correct Ans:

ScoreField PointsField

Notes: If you miss any one of the three answers, the `ScoreField` reports back '`Score: 0 out of 1`'. There is only one question there, to get it correct, you must answer all three inputs correctly.

In many practical assessments, the instructor would want to assign more than one point to the question, and want to assign credit in some appropriately manner. The `ScoreField` gives one point if all parts of the grouped problem are correct, many times, however, the instructor is willing to assigning "partial credit"; perhaps one point for each correct answer for a total of 3 points, or no credit unless two of the three are correct, then a nonzero score is given.

Points can be assigned to the individual responses and a score is given based on the validity of the inputs and the corresponding points. There is a default JavaScript function that scores the results.

The default JavaScript function, called `groupEval`, returns the sum of the points associated with each correct answer in the group.

The document author can define a custom JavaScript function to obtain more "exotic" strategies of evaluating the group. See Section 2 for details.

Notice that after you take the quiz and click on "Correct" button, the "Ans" button appears (as usual). If you click repeatedly on this "Ans" button, you can cycle through all answers to this question; the response box is highlighted (or put in focus) and the answer appears in the answer field provided.

Assigning Points. Assign points using the `\PTs` command. When you say `\PTs{3}`, you assign 3 points to the *next* problem encountered: multiple choice, math fill-in, or text fill-in. The command `\PTs` is typeset according to the definition of `\PTsHook` command. For this document, the definition in the preamble is

```
\PTsHook{($\eqPTs^{\text{pts}}$)}
```

where `\eqPTs` is the macro that contains the point value assign by `\PTs`. `\PTs` also has a `*` version. When you say `\PTs*{1}`. the point assignment is made (`\eqPTs` is given a value of 1), but the text defined by `\` is not typeset. You can see in the above example how these are used: I used `\PTs{3}` in the statement of the problem, this is typeset for the student to read; just after the `\begin{mathGrp}`, I inserted `\PTs*{1}`. This last use of `\PTS*` is the one the are read when the

\RespBoxMath is read. We have three components to the math group, each worth 1 point for a total of 3 points. The value of \PTs{3} is actually read in by the mathGrp environment, and this value is saved as the total number of points assigned to this group.

CorrAnsButtonGrp. A grouped question uses a special button for displaying the grouped answers. \CorrAnsButtonGrp takes two arguments, the first one is optional, used to modify the appearance of the button (as described in the reference document on eForms Support); the second one takes a comma delimited list of answers.

In the above example, we had

```
\CorrAnsButtonGrp{-10,-15,2}
```

List the answers in the order in which TEX processes the vertical list and encounters the math and text fill-in questions. If an answer to a text fill-in has an embedded comma, enclose that answer in braces, e.g.,

```
\CorrAnsButtonGrp{1776,{Washington, George}, Thomas Jefferson}
```

1.2. The shortquiz Environment

Within a shortquiz, the mathGrp environment behaves in a way that is consistent with a shortquiz. Points are not supported in

the `shortquiz`. As the student responds to each question in a group of questions in a `mathGrp`, the student gets immediate feedback—right or wrong.

Here is the same question in a `shortquiz` environment.

Quiz Compute the following cross product:

$$(3\vec{i} - 2\vec{j}) \times (\vec{i} + 5\vec{k}) = \square\vec{i} + \square\vec{j} + \square\vec{k}$$

Ans

Clear

As in the case of the `quiz` environment, clicking on the "Ans" button toggles through the correct answers. You can provide an optional solution as well.

2. Group Evaluation Functions

The `mathGrp` has two optional parameters

```
\begin{mathGrp}[<totalweight>][<evalfunc>]
...
\end{mathGrp}
```

where `<totalweight>` and `<evalfunc>` are described below:

`#1` The `<totalweight>` is the total number of points for the group. This parameter needs to be specified if the sum of the points

assigned to each of the problems in the group is not equal to the total weight you want to give the problem as a whole. See the third problem in the quiz that follows.

`#2` The second optional parameter is `<evalfunc>`, the name of a JavaScript function that is to be used to process the group. The default is `groupEval`.

The way these two optional parameters are parsed, if you specify only one of the two parameters, the parsing will assume that parameter is the `<evalfunc>` parameter. To specify the `<totalweight>` parameter, you need to provide both parameters.

The AcroTEX Bundle provides two group evaluation functions, `groupEval` and `WeightedEval`. The former is the default, and simply returns the sum of the the points of each correct response.

The latter function, `WeightedEval`, is meant to handle the case where the sum of the parts in not equal to the value of the whole problem. For example, in problem #3, the total points assigned to the problem is 3 points, yet there are nine parts to the group! We cannot assign fractional points so we assign 1 point per part and compute a weighted average. `WeightedEval` uses the `Math.floor` JS function to return an integer value. (So the student needs to get three responses correct to get 1 point, six responses correct to get 2 points,

and all nine responses to get full credit.

Start Answer each of the following. Work the problems out first, then respond. Don't guess. Passing is 100%.

1. (4^{pts}) Compute the following matrix product:

$$\begin{pmatrix} 1 & 1 \\ 2 & 3 \end{pmatrix} \cdot \begin{pmatrix} -1 & 2 \\ 1 & 2 \end{pmatrix} = \begin{pmatrix} \square & \square \\ \square & \square \end{pmatrix}$$

2. (6^{pts}) Compute the following cross product:

$$(3\vec{i} - 2\vec{j}) \times (\vec{i} + 5\vec{k}) = \square\,\vec{i} + \square\,\vec{j} + \square\,\vec{k}$$

3. (3^{pts}) The derivative of a function f is given by

$$f'(x) = 2x^3 - x^2 - 5x - 2$$

Find and classify the critical numbers of f using the *Second Derivative Test* by filling out the following table below. Enter the value of the requested critical number under "x" column; enter $+$ or $-$ for the "sign of $f''(x)$"; finally, enter `max` or `min`, as appropriate, under the "Classify" column. Finally, enter the critical numbers from least to greatest, i.e., enter smallest critical number and its data in the first row, and so on.

x	sign of $f''(x)$	Classify

End Correct

Answers:

Comments:

- Problem 1 uses the default JS function `groupEval`. In this problem, the total points is the sum of the points assigned to the subparts. None of the optional arguments are needed.
- Problem 2 uses a custom JS evaluation function, which I called `mygrpEval`. The definition of this function is given in the preamble of this document. `mygrpEval` is not a general function (as `groupEval` and `WeightedEval` are). Problem 2 has three fill-in elements each worth 2 points. The grading strategy is as follow: If the student gets one or zero right, zero credit is awarded; otherwise, the student gets credit for each part correct (if two correct, 4 points are awarded, if three correct, 6 points).
- Problem 3 uses the other built-in function `WeightedEval`. In this problem, both optional parameters are passed. The problem declares a 3 point question, but there are nine elements to the group, each element is given 1 point. The formula for computing the score for this problem is

$$\texttt{Math.floor}\left(\frac{\sum_i \texttt{aKey[i]} * \texttt{Weights[i+1]}}{\texttt{<totalweight>}}\right)$$

  which is a weighted average.

Notice the use of the (new) convenience macros `\saveDest` and `\useDest`. Normally, the `solutions` environment immediately follows the question, in this problem, the questions are embedded in a `tabular` environment, which causes a problem when the `solutionsafter` option is taken. Since this problem is treated as a unit anyway, a single solution for all components is appropriate. I placed a single `\CorrAnsButtonGrp` and saved the current solution destination[1] with `\saveDest`—this is the destination that `\CorrAnsButtonGrp` will use—after the tabular, the save destination is then made the current one using `\useDest`.

[1] The destination for a solution is held in the internal macro `\@qzsolndest`.

Solutions to Quizzes

Solution to Quiz: We have

$$f'(x) = 2x^3 - x^2 - 5x - 2 = (x+1)(2x+1)(x-2)$$

Critical numbers are $x = -1, -1/2, 2$. Going to the second derivative, we have...

$$f''(x) = 6x^2 - 2x - 5$$

Putting this info into a table,...

x	sign of $f''(x)$	Classify
-1	$+$	min
$1/2$	$-$	max
2	$+$	min