

# Making and Using a Database of Exam Questions

Joel A. Shapiro, Feb. 15, 2002

One of the advantages of Grtex is that the want file can pull the desired questions out of a large database, so one way of handling Grtex exams is to have a large database of questions, which can accumulate questions for a course. New questions can be added, but old ones can also be reused after an extended period. For example, at present, the database for Physics 228 has 784 questions, some dating back over 20 years.

To help people judge whether using a question is appropriate, some information about the previous use should be incorporated into the question. This is done by including an `\attrib` command inside (generally at the end of) the question statement. This command takes latex text as an argument. This text should include the author, possibly an indication of what material is covered, the exam and question number where it appeared, followed by the percentages of students giving each answer, as reported by GRAD<sup>1</sup>. Here is an example:

```
\setup{19}{3}{Total internal reflection takes place in the glass
prism shown. The index of refraction of this glass is:
\attrib{Harold Zapolsky, on Serway 35.7.
228e89:5;
228s97h1:3 (5,3,40*,28,24),
228s00h1:3 (3,3,53*,19,21)}}%
{at least 1.50}%
{at most 1.50}%
{at least 1.41}%
{at most 1.41}%
{impossible, total reflection cannot occur as shown}%
\pixquest{1.5in}{../eps/228e89h1:5.eps}
```

It is also useful to have the reasons for answers provided spelled out, so those considering reusing a question understand the choices of distractors. This is done with the `\explain` command, which also takes L<sup>A</sup>T<sub>E</sub>X text. For example:

```
\setup{23}{3}{A concave mirror is to project an image onto a
screen 48 cm away from the mirror
```

---

<sup>1</sup>A program to read the output of the “item analysis” and write out the right thing to place in the `attrib` field is available, called `harddigest`.

such that the image is three times bigger than the object.  
 What must be the focal length of the mirror?

\attrib{Mohan Kalelkar, (some changes) on Serway 36.2.

228s91h1:16 (12,9,43\*,6,30),

228s00h1:7 (15,1,38\*,5,41) }}%

{None of the other answers}%

{0.083 cm\explain{\$1/f\$}}%

{12 cm\explain{Correct: \$p=16,q=48\$}}%

{16 cm\explain{just \$p\$}}%

{24 cm\explain{\$1/16 - 1/48\$}}%

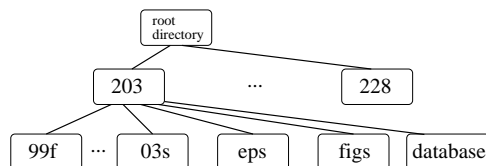
\stdquest

Of course we don't want that information to appear on a real exam, so by default the `attrib` and `explain` commands produce nothing in the output. But we have provided a command, `\realexamfalse` which will enable them.

If you find an old question which you would like to use, but you would like to change it slightly, what you should do depends on what kind of change is being made. If there is previous performance information and the changes might reasonably affect the answers, you should not make changes in the old question, but instead copy it, give it a new number, add `cf`'s to the old and new question (inside the `attrib` command) referring to each other. On the other hand, if you are just correcting spelling or something else which was clear anyway, you can just make the change in the old question.

## Planning the Directory Structure

Most instructors will want to keep the information for a given semester in a subdirectory for that semester. However, if questions will be used, references to inclusions, such as figures, ought to be to a



subdirectory which is constant in time. For this reason I recommend a directory structure like that shown<sup>2</sup>. References to figures should then be relative, for example

<sup>2</sup>One could go one step further and put the `figs` and `eps` directories under the `grtex` root, rather than the course number. Thus far there has been no sharing of figures across different courses, but I am now keeping all my figures together, in a `eps` directory under the `grtex` root directory. Then one can either have the `203/eps` directory a symbolic link to `../eps`, or make the `pixquest` references start with `../..eps`.

```
\pixmap{2.5in}{../eps/123f99h1f.eps}
```

Each figure should have a name which is unique among all figures that might ever be combined, as is my name for the sixth figure on the first hour exam in 123 in fall 99.

If you are going to keep the questions in a cumulative database, the question file could either move from semester to semester to the current directory, or could be in a separate subdirectory on the same hierarchical level as the current semester.

## Structuring the database file

If you are going to use the database file directly to produce the exams using `grtex`, it needs to be in the form required by `grtex`. So you should read “`GRTEX— To Make Multiple Exam Versions from LATEX`”, `/physics/doc/physics/grading/grtex/grtex.dvi` with `xdvi` or `dvips`. In addition, the following considerations apply if you are using a database.

Usually your exam will have some cover page material which will change from exam to exam, and may have some post-question material as well. While this material could be in the database file, it is a bit cleaner to have the database file `\input cover.tex` in the place where that cover material would be, (after the line that says

```
% enter your cover page material here, if you want one.
```

and `\input tail.tex` after the line `% end of exam questions.` . You might have individual files (*e.g.* `228f02f.c` for the cover page for the final exam in fall 2002, and `228f02f.tail` if you have last page material), and then make symbolic links

```
ln -s 228f02f.c cover.tex
```

which you will change for each new exam. This way you can keep your old material.

The questions themselves have to appear in the file that gets `grtex`'d, because the `grtex` program does not obey the input commands.

If you are keeping the database in a separate subdirectory from the semester files, you need to either

- run the latex from the semester directory with `latex ../db/124db.q`
- make the links in the database directory  

```
ln -s ../02s/228f02f.c cover.tex
```