

TeX Macros for Producing Multiple-Choice Tests

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Since many members of the TeX community work in an academic environment, at least some of us teach. Sometimes we teach large classes. One facet of teaching is, unavoidably, testing. With a large class and no assistance in grading tests, the only reasonable way to give a test is with multiple-choice "computer-graded" examinations.

As a practical matter, when administering a multiple-choice test, steps must be taken to prevent students from copying answers from each other. Most students are inherently honest; however, in a crowded room where students are sitting close to each other it is unavoidable that one student can see his or her neighbor's choices of answers. Under these circumstances we have an obligation to keep this from becoming an advantage since, in a high-pressure situation, almost any normal person might be tempted to peek. We must prevent such temptations from occurring. The obvious solution is, of course, to use a number of different versions of the test in which questions and answers are scrambled. This insures that no useful information can be transferred by simply peeking while at the same time each student is given the same set of questions and the same choices for answers so that all students are treated equally.

TeX provides an ideal solution to this problem since TeX will let us easily produce different versions of a test from the same source. With TeX we can scramble the answers to an individual question; e.g., if the question is "How much is two minus two?" the answer "zero" can be choice A on one test and choice C on another. In addition, TeX allows us to re-arrange the questions; e.g., question number 1 on one test might be question number 7 on another. Further, TeX can put the correct answers to the test into a data file for later use provided we tell TeX what these answers are. (TeX is smart, but not quite smart enough to get the answers on his own.) TeX allows us to separate the mechanics of preparing a test from the effort of making good test questions. We can go as far as creating a different test for each student; however, there are good reasons to not get carried away. If it proves necessary to go back and re-grade a particular question (it happens—fortunately not very often) it is easier to correct a small number of different versions of a test. This, combined with the fact that four versions of a test are enough

so that in a normal rectangular room no student will have the same version as any nearest neighbor in any direction (and nine versions are enough to insure that no student will have the same version as any nearest or next nearest neighbor) means that four (or nine) versions of the test are adequate for most situations. Since a typical multiple-choice test has five possible answers, and these answers can be arranged 120 different ways, we have chosen to scramble only the answers and have a maximum of nine different versions of a test.

The set of macros given here has been used for some time to prepare tests for elementary Physics courses and it has worked well. Each student is assigned a particular seat (in our case the seats are labeled A-2, . . . , A-9, B-2, . . . , M-9). The tests are printed in this order with a version number and a seat designation on each test so there is a minimum of fuss when distributing them. Each student is asked to put his name, student identification number, and the test version number on the answer sheet for the test. Invariably a few students forget one of these, but this is not a serious problem, provided that the student at least sat in the correct seat, since there is some redundancy here.

At the University of Alabama the office of Test Services will take the individual answer sheets and provide a file on magnetic tape, disk, or by electronic mail that contains a record of each student's responses, including name, student identification number, test version number and answers to individual questions, known locally as a raw data file. After editing this file to get it into the correct format, we use a FORTRAN program that reads this file and the data file containing the test keys created by TeX. The program computes a grade for each student and also produces a table for statistical purposes that gives the number of students that chose a particular literal (unscrambled) answer for each question. We also produce a crude histogram, a set of grades by student identification number that can be posted, a file containing averages, etc.

We have written these macros so that they require two files for input. The first file, TESTOP.TEX, is the heading which includes instructions for all students taking the test. The other file, called ATEST.TEX contains the actual test questions and answers. Each of these ends with an `\endinput` statement. A sample of each file is included. The answer key (or keys) is put into a file TESTKEY.DAT. The names TESTOP.TEX, ATEST.TEX and TESTKEY.DAT can, of course, be changed.

In ATEST.TEX the macro `\qn` marks the beginning of each question. This is just an adaptation

of `\item` that automatically numbers the question. After this is a statement of the test question. This is followed by a macro `\picks` that takes five arguments, each enclosed between a `{ }` pair, representing the five choices for the answer to the question. The correct answer should be marked by `**`. This will be replaced by a `*` on the printed test if we are making a copy for proofreading purposes, but will be suppressed when we are actually printing tests. The macro `\endq` marks the end of the question and answers. Thus a typical question and its answers would read:

```
\qn How often have you been
late for class?
\picks{always}{usually}{sometimes\**}
{rarely}{never}
\endq
```

`TEX` will choose one of four formats for printing the answers to a question. If all five of the answers fit comfortably onto a single line, then `TEX` will do it this way. If not, `TEX` determines the widths of the individual answers. If the three longest answers fit on a line, then we let `TEX` put the first three answers on one line and the last two on a second line in tabular format. If not, but if the two longest answers do fit on a single line, the first two answers are placed on one line, the second two on a second line, and the last one on a third line. If the two longest answers are too long to fit together on a single line, `TEX` puts one answer per line. If an answer is more than one line long, any additional lines are suitably placed under the first one.

A question and its answers should be a unit; there should not be a page break between the start of a question and the end of the answers. I initially used `\nobreak`, `\goodbreak`, and `\medskip` to achieve this, but this did not always work. `\filbreak`, on the other hand, seems to solve this problem.

The macros given here have several modes. When `\makingprooftrue`, a single copy of the test is generated. This single copy, version 0, does not have the answers scrambled. All other versions will have scrambled answers that can be unscrambled to compare to version 0. In this mode, the printed copy does not have a seat number printed on the test and the correct answer to each question is marked with a `*`.

When `\makingprooffalse`, the correct answers are not marked and the number of copies generated depends on `\ifsmallset`. For `\smallsettrue` only one copy of each version of the test is generated with the version number printed on it (except when there

is only one version), but without a seat number. This is useful if we have limited disk space or a slow printer, since we can still have many versions of the test. In this case we can make additional copies with a copy machine and put seat numbers on the tests by hand. It is not as pretty (or as automatic) as `TEX`, but it is sometimes the most efficient way to do things. When `\smallsetfalse`, a test is printed for each seat number.

There is also a parameter `\alternationnumber` that should be set to either one, two, or three. This lets us select the number of different versions of the test. If `\alternationnumber=1` we get a single version of the test, which does not require a seat number or a version number, so these are suppressed. If `\alternationnumber=2` we get tests that alternate every second row and seat for a total of 4 versions of the test. If `\alternationnumber=3` we get 9 versions of the test. Thus `\alternationnumber=1` `\smallsettrue` gives one copy of the test without seat or version numbers, `\alternationnumber=1` `\smallsetfalse` gives a set of tests without seat or version numbers, `\alternationnumber=2` or `3` `\smallsettrue` gives one copy of each version of the test that includes a version number but no seat number, while `\alternationnumber=2` or `3` `\smallsetfalse` gives a complete set of tests with seat and version numbers. These parameters are set near the beginning of the macros. Also, several other parameters (e.g., the number of seats in a row) are given values here. Assuming that we call this set of macros `TESTMAKE.TEX`, `TEX` is run on `TESTMAKE`, and `TESTMAKE` reads the test heading and the test.

For one class in which we used these macros, we printed 90 copies of a test that was a little less than two pages long, thus the amount of time it took `TEX` to process this set of tests was about the same as it would be for a 180-page document. The size of the `.DVI` file and the time required to print the tests were also comparable to those for a 180-page document. With a large computer and a fast printer this is acceptable; with a small computer or a slow printer it might not be.

A few closing words: Answers such as “none of the above” and “both A and C are true” should be avoided, since the answer scrambler is going to move the answers around. An answer such as “none of these choices”, however, seems quite reasonable. It is not a good idea to put additional `\newcount`, `\newdimen`, etc. statements in `TESTOP` or `ATEST`; it is better to put these at the beginning of `TESTMAKE` along with your own favorite macros. As given here, `TESTMAKE` can put a maximum of 10 answers

into TESTKEY, but the extension to longer tests is straightforward. Simply look in the macros for `\ansx`; wherever it appears add `\ansxi`, `\ansxii`, etc. in the same context.

Although this set of macros has been used in its present form for more than a year, it has evolved from a few simple definitions and it will continue to evolve as new situations arise. There are probably better ways to do many of the things described here (a few of them were found by trial and error), but these macros have worked reasonably well for me. After using them a few times you get accustomed to the error messages generated when you make the usual typographical errors. Further, we can accumulate questions in \TeX format, so when one last question is needed to finish writing a test, we will have a selection to choose from.

Finally, students prefer \TeX made tests to typed tests. (Remember purple ditto masters?) In fact, on one occasion a student asked me how I prepared my tests, and when I told her I used \TeX , I received a knowing nod of approval and after that she began to sit in the front row during class. I think there is some psychology involved in this.

A spoon full of sugar helps the medicine go down.
—Mary Poppins

An ounce of prevention is worth a pound of cure.
—Old proverb

A sample of TESTOP.TEX

```
\rightline{NAME $\underline{
\phantom{a\hskip3in a}}$}
\vskip2mm
\line{\bf PHYSICS 102 \hfil
FIRST EXAMINATION \hfil SPRING 1990}
\vskip1.5mm
\ifprintcode\line{\bf\hfil TEST
CODE NUMBER \number\version \hfil}
\fi
\vskip 1.0ex
{\multiply\baselineskip by 5
\divide\baselineskip by 4
This test consists of 4 multiple-choice
questions. Answer each question in the
space provided on the answer sheet. There
is one 'best' answer to each question.
Also {\bf PLEASE FILL IN YOUR NAME}
(last name first) on this sheet.
Remember to darken the appropriate
circles for your name.
\ifprintcode
At the top of this test is a code number.
{\bf Fill in this number on your answer
```

sheet. It must be put in the first column of `{\sl SPECIAL CODES}`.

```
\fi
Do not consult with anyone
during the test.}
\def\ldrf1{\leaders\hrule\hfill\ }
\vskip1mm
\line{\ldrf1 {Good luck!} \ldrf1}
\vskip 1.2ex
\endinput
```

A sample of ATEST.TEX

```
\qn If a man and a half can dig a hole
and a half in a day and a half, how many
holes can three men dig in three days?
\picks{3}{6\**}{2.25}{4}{4.5}
\endq
\qn \TeX\ is
\picks{a very small mouse.}
{a great big dog.}{a lonesome cowboy.}
{a state of the union.}
{a state of mind.\**} \endq
\qn
A good way to recall the spectral classes
of main sequence stars is to remember the
phrase \picks{All Cows Eat Grass.}
{Spectroscopy Prevents Daddy From Going
Home.}
{Old MacDonald Had A Farm EIEIO.}
{Oh Be A Fine Girl, Kiss Me.\**}
{Twinkle Twinkle Little Star.}
\endq
\qn We need a question and some answers
that each fill up more than one line.
In order to accomplish this we will ask
the following question: 'What are the
basic food groups?'
\picks{Sugar, salt, caffeine and fat.}
{Burger, fries, coke and a candy bar.}
{Fruit, cereal, meat
or fish and dairy products.\**}
{Nuts (eeech!), berries (eeech!),
honey (mmmmm!) and anything we can beg,
borrow or steal from the picnic basket
of an unsuspecting camper.}
{A book of verses underneath the Bough,
a Jug of Wine, a Loaf of Bread---and
Thou Beside me, singing in the
Wilderness---Oh, Wilderness were
Paradise enow!}
\endq
\endinput
```

And Finally, TESTMAKE.TEX

```

% no guarantees---use at your own risk.
\font\twentytwentypointbf=cmbx10 scaled\magstep4 % use a large bold font
\newcount\firstseatnum \newcount\lastseatnum
\newcount\firstseatletter \newcount\lastseatletter
\newcount\alternationnumber \newwrite\keywrite
\newif\ifmakingproof \newif\ifsmallset

%%%%%%%%% PUT CHANGES BETWEEN HERE %%%%%%%%%%
\hsize=6.00in\hoffset=0.250in
\vsize=7.50in\voffset=0.250in
% size and offset adjusted for margins of both printer and driver
% page number should appear at the bottom of the test
\firstseatnum=2 % there is no first row in our room
\lastseatnum=2 %11 % row goes from 2 to 11, but 2 for testing
\firstseatletter=1 % starts with A
\lastseatletter=1 %12 % ends with M (but no I), but A for testing
% here is the name of the test heading
\def\getthetop{{\input testop \relax}}
% here is the name of the file containing the test
\def\getthetest{{\input atest \relax}}
%% define a file for the test keys %%%%%%%%%%
\immediate\openout\keywrite=testkey.dat
\makingprooffalse % set either true of false
\alternationnumber=2 % use either 1, 2 or 3 here
% \smallsettrue % set either true of false
\smallsetfalse
%%%%%%%%% AND HERE %%%%%%%%%%

\newif\ifprintversion \newif\ifprintseatnumber
\newif\ifprintstar \newif\ifprintcode \newcount\numberofcopies
\numberofcopies=1 \printcodetrue

\ifsmallset \printseatnumberfalse \else \printseatnumbertrue \fi
\ifmakingproof \printstartrue \printseatnumberfalse
\else \printstarfalse \fi
\ifnum\alternationnumber=1 \printversionfalse \else \printversiontrue \fi

\ifnum\alternationnumber=1
\ifsmallset \else \printseatnumberfalse \fi \fi

% numberofcopies is set to 1 for a single copy, 2 for a single copy of
% each version and 3 for a fullblown set of tests

\ifsmallset \else \ifmakingproof \else \numberofcopies=3 \fi \fi

\ifsmallset \ifnum\alternationnumber=1 \else
\ifmakingproof \else \numberofcopies=2 \fi \fi \fi
\ifprintversion \printcodetrue\else\printcodefalse\fi % redundant

\newdimen\itemsize \itemsize=1dd
\def\qn{\parindent=1dd\item{\number\questionno.}}
\def\endq{\vskip2.0ex\filbreak\medskip}

```

```

\newcount\qsizecounter\newcount\anct\newcount\anso\newcount\ansi
\newcount\ansii\newcount\ansiii\newcount\ansiv\newcount\ansv
\newcount\ansvi\newcount\ansvii\newcount\ansviii\newcount\ansix
\newcount\ansx \newcount\version \newdimen\widp \widp=\hsize
\newcount\anscor\newcount\seatcounter\newcount\testitone
\newcount\testittwo\newcount\versionend\newcount\letternum
\newcount\questionno\newcount\testpageno\newcount\oldpagenumber
\newdimen\aaazz\newdimen\bbbzz\newdimen\ccczz\newdimen\dddzz
\newdimen\eeezz\newdimen\sizeline\newdimen\temzz\newcount\bubblbb
\newtoks\aaay\newtoks\bbby\newtoks\ccyy\newtoks\ddyy\newtoks\eeey
\letternum=\firstseatletter \version=0 \oldpagenumber=0

\newbox\testbox\newbox\aaabox\newbox\bbbbox
\newbox\cccbox \newbox\dddbox\newbox\eeebox

% next necessary to get alignment right: 01...10 in output file
\def\qwy{0\number\seatcounter}\def\qwz{\number\seatcounter}

% this writes a line to the test key file
\def\writeitout{\def\qwa{\ifnum\seatcounter<10 \qwy\else\qwz\fi}
\immediate\write\keywrite{%
VERSION-\number\version..SEAT-\LETTERPUT-\qwa...
\number\ansi \number\ansii \number\ansiii \number\ansiv \number\ansv
\number\ansvi \number\ansvii \number\ansviii \number\ansix \number\ansx}}

\def\pickansform#1#2#3#4#5{% formats answer depending on \qsizecounter
\aaay={#1}\bbby={#2}\ccyy={#3}\ddyy={#4}\eeey={#5}
\global\anct=0 \global\anscor=0
% find the right answer for this version
\ctest\aaay\ifresult\global\anscor=1 \advance\anct by 1 \fi
\ctest\bbby\ifresult\global\anscor=2 \advance\anct by 1 \fi
\ctest\ccyy\ifresult\global\anscor=3 \advance\anct by 1 \fi
\ctest\ddyy\ifresult\global\anscor=4 \advance\anct by 1 \fi
\ctest\eeey\ifresult\global\anscor=5 \advance\anct by 1 \fi
\ifnum\anct<1 \message{no right answer for question \the\questionno} \fi
\ifnum\anct>1 \message{more than one correct answer given
for question number \the\questionno} \fi
\ifcase\qsizecounter % \qsizecounter=0: one line for all answers
{\line{\hskip1pt a) #1 \quad
\hfil b) #2 \quad\hfil c) #3 \quad\hfil d) #4 \quad\hfil e) #5}}
\or % \qsizecounter=1: one or more lines per answer
{\parindent=0.8em % 1.0em is too much
\ vbox{\parindent=0.8em % 0.9 is too much
\ vbox{\itemitem{a}} #1}\vskip0.5ex \vbox{\itemitem{b}} #2} \vskip0.5ex
\ vbox{\itemitem{c}} #3}\vskip0.5ex \vbox{\itemitem{d}} #4} \vskip0.5ex
\ vbox{\itemitem{e}} #5} }}
\or% \qsizecounter=2: need 3 lines; 2 on first, 2 on second, one on third
{\vbox{\halign to \hsize{\hskip1pt ##\hfil
\tabskip=5em plus5em minus5em&##\hfil\cr
a) #1 &b) #2 \cr
c) #3 &d) #4 \cr
e) #5 &\cr} }}
\else% \qsizecounter=3: three on first, two on second line

```

```

{\vbox{\halign to \hsize{\hskip1pt ##\hfil
\tabskip=5em plus5em minus5em&##\hfil& ##\cr
a) #1 &b) #2 &c) #3 \cr
d) #4 &e) #5 & \cr} }}
\fi}

\newif\ifresult % for the result of a test (taken from the TeXbook)
\def\ctest#1{\resultfalse\expandafter\c\the#1\ctest}
\def\c{\afterassignment\cc\let\next= }
\def\cc{\ifx\next\ctest \let\next\relax
\else\ifx\next*\resulttrue\fi\let\next\c\fi \next}

% here is the answer scrambler
% computes \qsizecounter depending on lengths of answers and
% scrambles answers depending on value of \version
\def\picks#1#2#3#4#5{\nobreak\vskipimm\nobreak
\ifnum \questionno > 10 \message{OOPS...this test has more than
10 questions. Time to fix things!!!} \fi

\setbox\testbox=\hbox{\hskip1pt a) #1 \hfil\quad b) #2 \hfil\quad
c) #3 \hfil\quad d) #4 \hfil\quad e) #5 \quad}
\sizeline=\wd\testbox
\ifdim\sizeline<\widp \global\qsizecounter=0 % answers fit on one line
\else% compute widths of individual answers--with a little extra space
\setbox\aaabox=\hbox{ia) #1\quad}\setbox\bbbbox=\hbox{ia) #2\quad}
\setbox\cccbox=\hbox{ia) #3\quad}\setbox\dddbox=\hbox{ia) #4\quad}
\setbox\eeebox=\hbox{ia) #5\quad}
%%p. 121 TeXbook
\aaazz=\wd\aaabox \bbbzz=\wd\bbbbox \ccczz=\wd\cccbox
\dddzz=\wd\dddbox \eeezz=\wd\eeebox
\global\bubblbb=1
\loop \ifnum\bubblbb>0 % bubble sort answers according to length
\global\bubblbb=0
\ifdim\aaazz<\bbbzz\temzz=\aaazz\aaazz=\bbbzz\bbbzz=\temzz
\global\advance\bubblbb by 1 \fi
\ifdim\bbbzz<\ccczz\temzz=\bbbzz\bbbzz=\ccczz\ccczz=\temzz
\global\advance\bubblbb by 1 \fi
\ifdim\ccczz<\dddzz\temzz=\ccczz\ccczz=\dddzz\dddzz=\temzz
\global\advance\bubblbb by 1 \fi
\ifdim\dddzz<\eeezz\temzz=\dddzz\dddzz=\eeezz\eeezz=\temzz
\global\advance\bubblbb by 1 \fi
\repeat % loop if not completely sorted
\global\qsizecounter=1 \temzz=\aaazz \advance\temzz by \bbbzz
% \temzz becomes width of widest and next widest answers
\ifdim\temzz<\widp \global\advance\qsizecounter by 1 \fi
\advance\temzz by \ccczz % \temzz is width of three widest answers
\ifdim\temzz<\widp \global\advance\qsizecounter by 1 \fi
\advance\temzz by \dddzz % \temzz is width of four widest answers
\ifdim\temzz<\widp \global\advance\qsizecounter by 1 \fi
\fi % close ifdim\sizeline
% scramble answers--move these around from time to time.
\ifcase\version \pickansform{#1}{#2}{#3}{#4}{#5}\or
\pickansform{#2}{#1}{#4}{#3}{#5}\or \pickansform{#4}{#3}{#2}{#1}{#5}\or
\pickansform{#3}{#5}{#1}{#2}{#4}\or \pickansform{#2}{#4}{#3}{#1}{#5}\or

```

```

\pickansform{#3}{#4}{#5}{#1}{#2}\or \pickansform{#4}{#5}{#1}{#2}{#3}\or
\pickansform{#5}{#4}{#3}{#2}{#1}\else
\pickansform{#1}{#3}{#4}{#2}{#5}
\fi
% put right answer into correct slot for this question
\ifcase\questionno\or \global\ansi=\anscor\or
\global\ansii=\anscor\or \global\ansiii=\anscor\or
\global\ansiv=\anscor\or \global\ansv=\anscor\or
\global\ansvi=\anscor\or \global\ansvii=\anscor\or
\global\ansviii=\anscor\or \global\ansix=\anscor\or
\global\ansx=\anscor\or
\fi
% we need the next few statements so that each test starts with page 1
\global\advance\questionno by 1 \ifnum\pageno>\oldpagenumber
\global\advance\oldpagenumber by 1
\global\advance\testpageno by 1
\fi} % end of the answer scrambler

% this zeros the answers
\def\settozero{\ansi=0 \ansii=0 \ansiii=0 \ansiv=0 \ansv=0
\ansvi=0 \ansvii=0 \ansviii=0 \ansix=0 \ansx=0}

\def\printst{*}\def\noprintst{}
\def**{\ifprintstar\printst\else\noprintst \fi}

\def\LETTERPUT{\ifcase\letternum A\or B\or
C\or D\or E\or F\or G\or H\or % I\or % don't have seats with 'I'
J\or K\or L\or M\or N\or O\or P\or Q\or
R\or S\or T\or U\or V\or W\or X\or Y\or Z\fi}

% it is useful to print 'more' at the bottom of all but the last page
\def\footlinea{\rm ---more---\hss ---more---\hss ---\number\testpageno
---\hss ---more--- \hss ---more---}
% and 'end' at the bottom of the last page
\def\footlineb{\rm ---end---\hss ---end---\hss ---\number\testpageno
---\hss ---end---\hss ---end---}

\newcount\outputlinecounter\outputlinecounter=0

% this formats a copy of the test
\def\doacopy{\settozero \questionno=1 \testpageno=0
\footline={\footlinea}
\phantom{.}
\ifprintseatnumber
\vskip-12mm
\line{\hfil{\twentypointbf \LETTERPUT-\number\seatcounter } }
\vskip+12mm
\else
\vskip-12mm
\line{\hfil{\phantom{\twentypointbf \LETTERPUT-\number\seatcounter }}}
\vskip+12mm
\fi
{\getthetop }\getthetest }
\footline={\footlineb}

```

```

\vfil\eject
\ifnum\outputlinecounter=0 \writeitout \fi
\ifnum\alternationnumber=1 \global\advance\outputlinecounter by 1 \fi}
% end of def of doacopy

% modular arithmetic is useful for computing the version number
\newcount\aaqqq\newcount\bbqqq\newcount\ccqqq\newcount\ddqqq
\newcount\modcounter
\def\modulo#1#2{\modcounter=0
\aaqqq=#1 \bbqqq=#2 \ccqqq=#1
\divide \ccqqq by \bbqqq \multiply \ccqqq by \bbqqq
\ddqqq=\aaqqq \advance \ddqqq by -\ccqqq
\global\modcounter=\ddqqq}

\advance\lastseatnum by 1 \advance\letternum by -1 % stop loops correctly
% Finally we actually DO something!
\versionend=\alternationnumber
\ifcase\numberofcopies\or
\doacopy      % numberofcopies=1
\or          % numberofcopies=2, single copy of each version
\multiply\versionend by \alternationnumber
\loop\ifnum\version<\versionend
\doacopy
\advance\version by 1
\repeat
\or          % a whole set of tests
% make many copies of the test with scrambled answers
\loop\seatcounter=\firstseatnum\ifnum\letternum<\lastseatletter
  {\loop
    \modulo{\seatcounter}{\alternationnumber}
    \testitone=\modcounter
    \modulo{\letternum}{\alternationnumber}
    \testittwo=\modcounter
    \multiply \testittwo by \alternationnumber
    \version=\testitone \advance \version by \testittwo
    \ifnum\seatcounter<\lastseatnum
      {\doacopy}
      \advance\seatcounter by 1
      \repeat} % close seatcounter loop
\advance\letternum by 1
\repeat % close letternumber loop
\fi % close \ifcase\numberofcopies
\end

```

A Sample of the Output

A-2

NAME _____

PHYSICS 102

FIRST EXAMINATION

SPRING 1990

TEST CODE NUMBER 0

This test consists of 4 multiple-choice questions. Answer each question in the space provided on the answer sheet. There is one 'best' answer to each question. Also **PLEASE FILL IN YOUR NAME** (last name first) on this sheet. Remember to darken the appropriate circles for your name. At the top of this test is a code number. **Fill in this number on your answer sheet. It must be put in the first column of SPECIAL CODES.** Do not consult with anyone during the test.

_____ Good luck! _____

1. If a man and a half can dig a hole and a half in a day and a half, how many holes can three men dig in three days?
 - a) 3
 - b) 6
 - c) 2.25
 - d) 4
 - e) 4.5

2. T_EX is
 - a) a very small mouse.
 - b) a great big dog.
 - c) a lonesome cowboy.
 - d) a state of the union.
 - e) a state of mind.

3. A good way to recall the spectral classes of main sequence stars is to remember the phrase
 - a) All Cows Eat Grass.
 - b) Spectroscopy Prevents Daddy From Going Home.
 - c) Old MacDonald Had A Farm EIEIO.
 - d) Oh Be A Fine Girl, Kiss Me.
 - e) Twinkle Twinkle Little Star.

4. We need a question and some answers that each fill up more than one line. In order to accomplish this we will ask the following question: "What are the basic food groups?"
 - a) Sugar, salt, caffeine and fat.
 - b) Burger, fries, coke and a candy bar.
 - c) Fruit, cereal, meat or fish and dairy products.
 - d) Nuts (eeech!), berries (eeech!), honey (mmmmm!) and anything we can beg, borrow or steal from the picnic basket of an unsuspecting camper.
 - e) A book of verses underneath the Bough, a Jug of Wine, a Loaf of Bread—and Thou Beside me, singing in the Wilderness—Oh, Wilderness were Paradise enow!

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