

**Duke University**  
Edmund T. Pratt, Jr. School of Engineering

EGR 53L Fall 2004

**Test I**

Lianne Cartee

Michael R. Gustafson II

---

Name (please print) \_\_\_\_\_

In keeping with the Community Standard, I have neither provided nor received any assistance on this test. I understand if it is later determined that I gave or received assistance, I will be brought before the Undergraduate Judicial Board and, if found responsible for academic dishonesty or academic contempt, fail the class. I also understand that I am not allowed to speak to anyone except the instructor about any aspect of this test until the instructor announces it is allowed. I understand if it is later determined that I did speak to another person about the test before the instructor said it was allowed, I will be brought before the Undergraduate Judicial Board and, if found responsible for academic dishonesty or academic contempt, fail the class.

Signature: \_\_\_\_\_

---

**Problem I: [15 pts.] Basic Programming**

Given the following equation:

$$x = \frac{\ln(a) + \cos(\theta) + (ab)^2}{2a}$$

where  $a$ ,  $b$ , and  $\theta$  are input variables with  $\theta$  in degrees, write a Matlab script to obtain values for  $a$ ,  $b$ , and  $\theta$  from the user then calculate and display  $x$ .

*Note:* The equation is undefined if  $a$  is equal to zero. Therefore, if the value of  $a$  falls within the range  $-\text{eps} < a < \text{eps}$ , where  $\text{eps}$  is the built-in Matlab variable, the program should not calculate the value of  $x$  and instead output the message, "x cannot be calculated"

---

```
a = input('a: ');
b = input('b: ');
theta = input('theta: ');
if -eps<a & a<eps
% OR if abs(a)<eps
    fprintf('x cannot be calculated');
else
    x = (log(a) + cos(theta*pi/180) + (a*b)^2)/(2*a)
    % OR x = (log(a) + cosd(theta) + (a*b)^2)/(2*a)
end
```

Name (please print):

Community Standard (print ACPUB ID):

## Problem II: [20 pts.] Matrix Creation and Manipulation

For each of the following sections, write the Matlab command required or answer the question:

- (a) Create a matrix named `mat` with the following elements:

$$\text{mat} = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$$

- (b) Starting from `mat`, create a new matrix named `doublerow2` which is identical to `mat` except that the elements of the 2nd row have been multiplied by 2. That is:

$$\text{doublerow2} = \begin{bmatrix} 1 & 2 & 3 \\ 8 & 10 & 12 \end{bmatrix}$$

You *must* generate this by manipulating the `mat` matrix.

- (c) What is the result of the following command?

```
answer = 2 + mat(3, 3)
```

- (d) Create `newmat` from `mat`. `newmat` is a 5x5 matrix identical to `mat` but with zeros in the extra elements.

$$\text{newmat} = \begin{bmatrix} 1 & 2 & 3 & 0 & 0 \\ 4 & 5 & 6 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Again, you *must* generate this by manipulating the `mat` matrix.

- (e) Starting from `newmat` above, write the command to create `nextmat`.

$$\text{nextmat} = \begin{bmatrix} 1 & 2 & 3 & 0 \\ 4 & 5 & 6 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

This time, you *must* generate this by manipulating the `newmat` matrix.

---

```
mat = [1 2 3; 4 5 6]
% OR mat = [1:3; 4:6]
% OR mat = reshape(1:6, 3, 2)

doublerow2 = mat;
doublerow2(2,:) = 2*mat(2,:);
% OR doublerow2 = [mat(1,:); 2*mat(2,:)]

??? Index exceeds matrix dimensions.

newmat = mat;
newmat(5,5) = 0;
% OR newmat = [ mat zeros(2,2); zeros(3,5)]

nextmat = newmat(1:3, 1:4)
% OR nextmat = newmat;
%   nextmat(4:5, :) = [];
%   nextmat(:, 5) = [];
```

Name (please print):

Community Standard (print ACPUB ID):

### Problem III: [15 pts.] UNIX

For the first task below, assume that you have just logged into a UNIX station and just started a terminal window. For each successive line, assume the lines above it have already been completed.

- (a) Create a directory called **MyStuff** in your home directory
- (b) Change into your **MyStuff** directory - the rest of the commands below assume you are in your **MyStuff** directory.
- (c) Create a directory called **labs** in your **MyStuff** directory
- (d) Create a directory called **backoops** in your **MyStuff** directory
- (e) Copy all files from Dr. G's `~mrg/public/Etest` directory into your **labs** directory
- (f) Delete all files ending in `.jnk` from your **labs** directory
- (g) Rename your **backoops** directory to **backups**
- (h) Move all files that end in `.back` from your **labs** directory to your **backups** directory

---

```
mkdir MyStuff
cd MyStuff
mkdir labs
mkdir backoops
cp ~mrg/public/Etest/* labs
rm labs/*.jnk
mv backoops backups
mv labs/*.back backups
```

Name (please print):

Community Standard (print ACPUB ID):

### Problem IV: [15 pts.] Relational Operators

Given the following Matlab commands:

```
A = [1 2 3 4 5]
B = [3 1 4 1 5]
```

Show what each variable below will become. For purposes of earning partial credit in the event of an incorrect response, you may also choose to write a brief description of what is happening in each command.

- (a)  $C = A > B$
- (b)  $D = (A - B) < -1 \mid (A - B) > 1$
- (c)  $E = 3 < A < 5$
- (d)  $F = (A \sim = B) \& (B > 2)$

---

```
C = [0 1 0 1 0]
% true wherever the element in A is greater than the element in B

D = [1 0 0 1 0]
% true wherever the elements are more than 1 number apart

E = [1 1 1 1 1]
% 3 < A is [0 0 0 1 1] and
% [0 0 0 1 1] < 5 returns [1 1 1 1 1]

F = [1 0 1 0 0]
% A ~ = B is [1 1 1 1 0] and
% B > 2 is [1 0 1 0 1] 'and'
% yields [1 0 1 0 0]
```

Name (please print):

Community Standard (print ACPUB ID):

### Problem V: [20 pts.] MATLAB Interpretation

The following Matlab script, `testit.m`, calls the function `dummy.m`. Please show the output when `testit` is executed.

The contents of the file `testit.m` are:

```
%%% start of testit.m
A=1;
B=2;
C=3;
D=4;
E=5;

[D, E] = dummy(A, B, C);

disp([A, B, C, D, E])
%%% end of testit.m
```

The contents of the file `dummy.m` are:

```
%%% start of dummy.m
function [a,b]=dummy(c, d, e)
c=c+e+1;
d=8.*d;
e=d./2;
a=c;
b=e;
disp([a, b, c, d, e])
%%% end of dummy.m
```

---

```
5 8 5 16 8
1 2 3 5 8
```

Name (please print):

Community Standard (print ACPUB ID):

### Problem VI: [15 pts.] L<sup>A</sup>T<sub>E</sub>X Processing

Assuming you have written a file named `Report5.tex`, give the proper UNIX commands needed to:

- (a) Process `Report5.tex` using L<sup>A</sup>T<sub>E</sub>X to produce a `.dvi` file
- (b) Preview the `Report5.dvi` file
- (c) Create a PostScript file named `Printable5.ps` from `Report5.dvi`
- (d) Preview the `Printable5.ps` file

---

```
latex Report5.tex
xdvi Report5.dvi
dvips Report5.dvi -o Printable5.ps
% OR dvips -o Printable5.ps Report5.dvi
gvv Printable5.ps
```