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

EGR 53L Fall 2007

Test I

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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: [8 pts.] The Wheels on the Bus

Fill out the following table with the results of the MATLAB commands given:

x	ceil(x)	floor(x)	fix(x)	round(x)
-2.8				
-1.2				
3.7				
4.2				

Problem II: [7 pts.] Basic Matrices

(a) Write a one-line MATLAB command to produce a 4 by 6 array of random integers evenly distributed between -5 and 15 and call it `MyNumbers`.

(b) Write out the matrix created with the MATLAB command:

```
A = [1:3:8; ones(2), [-2 -4]']
```

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Problem III: [22 pts.] Rocket!

This problem comes from Chapra, Problem 3.14, p. 78. The problem gives a possible equation for the velocity of a rocket as:

$$v(t) = \begin{cases} 11t^2 - 5t & 0 \leq t \leq 10 \\ 1100 - 5t & 10 < t \leq 20 \\ 50t + 2(t-20)^2 & 20 < t \leq 30 \\ 1520e^{-0.2(t-30)} & t > 30 \\ 0 & \text{otherwise} \end{cases}$$

(a) Write a *function* that takes a vector of t values as an input and **uses a logical mask** to calculate and output a vector of v values. The function **must** use logical masks. If *any* of the times passed to the function are less than zero, your function should issue a warning:

```
Warning: Rocket is not launched until time 0!
```

(b) Write a *script* that generates a vector of 200 evenly-spaced times from -5 to 50, uses the function you wrote above to calculate the corresponding velocities, and then makes a plot of the velocity as a function of time using a black sold line. You do *not* need to label or title the plot.

Then ask the user whether the program should save the plot. If the user answers with the word 'yes' the plot should be saved into an encapsulated PostScript file called `MyPlot.eps` otherwise the plot should not be saved.

Function:

Script:

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Problem IV: [18 pts.] Matrix Creation and Manipulation

For each of the following sections, show what the matrices `A`, `B`, and `C` will look like at the end of the snippet of code.

(a)

```
>>A=[0:5]
>>B=A.^3
>>C=B(1,3)
```

(b)

```
>>A=6.5
>>B=eye(2,3)
>>C=A*B
```

(c)

```
>>A=[1.4,2.6;-4.2,0.8]
>>B=ceil(A)
>>C=A.*B
```

(d)

```
>>A=linspace(-pi,pi,5) % you can write this using the pi symbol
>>B=A(1:3:end)
>>C=cos(B)
```

(e)

```
>>A=-4:2:1;
>>B=[A' A' A']
>>C=A+B(2,:)
```

(f)

```
A=[1 2; -3 4];
B=[-4 6]
C=abs(A.*[B;B])
```

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Problem V: [20 pts.] I/O Functions

Write the MATLAB script that will perform the following tasks to produce a variable-size multiplication table. First, to get the number of rows in the table, ask the user to input an integer between 1 and 10, inclusively, and validate the number (i.e. keep asking until you are sure the user has entered an integer *and* that integer is in the domain of 1 to 10). Second, to get the number of columns in the table, ask the user to input an integer between 1 and 6, inclusively, and validate the number (i.e. keep asking until you are sure the user has entered an integer *and* that integer is in the domain of 1 to 6). Then use those numbers in conjunction with a double `for` loop to print out a multiplication table. You will want to reserve enough space such that the numbers all line up properly and you will want to make sure the numbers are printed without any decimal points. You do *not* need to label the rows or columns, just print the "meat" of the table. As examples, the output below represents what might happen if the user entered 3 for the rows and 5 for the columns after messing up each a couple times. Note that a '␣' represents a space:

```
# of Rows (between 1 and 10): 0
No! # of Rows (BETEEN 1 and 10): 11
No! # of Rows (BETEEN 1 and 10): 3
# of Columns (between 1 and 6): 0
No! # of Columns (BETEEN 1 and 6): 7
No! # of Columns (BETEEN 1 and 6): 5
__1__2__3__4__5
__2__4__6__8_10
__3__6__9_12_15
```

while a user immediately entering 6 for the number of rows and 3 for the number of columns would get:

```
# of Rows (between 1 and 10): 6
# of Columns (between 1 and 6): 3
__1__2__3
__2__4__6
__3__6__9
__4__8_12
__5_10_15
__6_12_18
```

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Problem VI: [15 pts.] Matrix Functions

Assuming the following MATLAB commands have already run:

```
TheNumbers = [42    25     3    45    47;...
              38    22     6    11    28;...
              14    20    16    42    33;...
              43    22    45    41    48];
MoreNumbers = rand(6,8)
```

(a) Show the result of: `max(TheNumbers)`

(b) Show the result of: `min(TheNumbers')`

(c) Show the result of: `min(max(TheNumbers))`

(d) Write the one-line command in MATLAB to give you the overall average of `MoreNumbers`

(e) Write the one-line command in MATLAB to give you the sum of the squares of all of the elements in `MoreNumbers`

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Problem VII: [10 pts.] UNIX and LaTeX Processing

Assuming you have just logged in and opened a terminal window, give the proper UNIX commands needed to:

(a) Change into your EGR53 directory

(b) Create and then change into a `recT` directory

(c) Copy all files ending in `.tex` from user `wns`'s, `public/EGR53/recT/` directory into your current directory

(d) Assuming there is now a file called `Example.tex` in your `recT` directory, rename it `QuizFile.tex`

(e) Assuming you have renamed the file properly, process `QuizFile.tex` to produce a `.dvi` file

(f) Preview the `.dvi` file which results

(g) Create a PostScript file named `Printable.ps` from the `.dvi` file

(h) Preview the `.ps` file