EXAM 2 – WRITTEN PORTION

NAME _____

SECTION NUMBER _____

CAMPUS MAILBOX NUMBER _____

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Written Portion	/ 40
Computer Portion	/ 60
Total	/ 100

USE MATLAB SYNTAX FOR ALL PROGRAMS AND COMMANDS YOU WRITE

Problem 1:
(4 points) Given the following code, what will be printed at the end of the code?

```
i = 4;
j = 7;
k = 8;
if (i*j < k) | (2 * i > k)
    i = i*j - k;
elseif (i == 8) & (j==7)
    i = i*j;
end
fprintf('i = %3i \n', i);
```

a) i = 28
b) i = 20
c) i = 4
d) i = 8
e) none of the above: i = _____

Problem 2:
(4 points) Given the following piece of code, what will the value of `product` be at the end of the code?

```
x_vec = [2 4 8];
product = 1;
for i = 1:2
    if x_vec(i) <= 2
        product = product * x_vec(i);
    elseif x_vec(i) == 8
       product = i * x_vec(i) ;
    else
        product = product * 4 * x_vec(i);
    end
end
```

a) product = 1
b) product = 2
c) product = 16
d) product = 24
e) none of the above: product = _____

Problem 3:
(4 points) A main code and a simple function have been written below:

```
begin = 10;
end = 20;
incr = 4;
answer = fun_function(good, better, step)
```

```
function [fun] = fun_function(good, better, step)
fun = 0;
for N = good:step:better
    fun = fun + good + N;
end
```

After we run the main code, what is the value of 'fun' in Matlab's workspace?

a) fun = 20
b) fun = 44
c) fun = 72
d) none of the above: fun = _____
e) none of the above: explain_____

Problem 4:
(4 points) The following code is supposed to add up the numbers from 0 to 10 and save the running total into a vector. It produces an error. Do not alter the existing code. Write out the additional line(s) necessary to make it work correctly.

```
for n = 1:1:10

     i = i + 1;

     total(i) = total(i-1) + n;

end
```

Problem 5:
(4 points) What will the value of `add` be at the end of the following code?

```
x = 1;
add = 1.0;
while (add < 10) | (x < 12)
   x = 2 * x;
   add = add + x;
end
```

a) 1
b) 3
c) 7
d) 15
e) none of the above: add = _____

Problem 6:
(4 points) Write down the final result of V at the end of the following code.

```
i = 1;
V(1,1) = 1.0;
while V(i,1) > 0.2
   V(i+1,1) = V(i,1) * 0.5;
   i = i + 1;
end
```

a) [1 0.5 0.25]

b) [1 0.5 0.25 0.125]

c) $\begin{bmatrix} 1 \\ 0.5 \\ 0.25 \end{bmatrix}$

d) $\begin{bmatrix} 1 \\ 0.5 \\ 0.25 \\ 0.125 \end{bmatrix}$

e) none of the above

Problem 7:
(4 points) The following line creates a 3 x 3 matrix in MATLAB.

```
A = [1 4 10; 7 2 9; 3 6 8];
```

The following loop will change the matrix A.

```
for i = 2:3
   for j = 1:2
      A(i-1,j) = A(i,j) + A(i-1,j)
   end
end
```

Fill in the blank 3 x 3 matrix below with its contents after the process is complete.

1	4	10
7	2	9
3	6	8

Before

After

Problem 8
(4 points) The following very simple MATLAB program is executed:

```
for i = 1:3
    A(i+1,2) = 1;
end %for
```

MATLAB would have which of the following values for A?

a) 1

b) $\begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 \end{bmatrix}$

c) $\begin{bmatrix} 0 \\ 1 \\ 1 \\ 1 \end{bmatrix}$

d) $\begin{bmatrix} 0 & 0 \\ 0 & 1 \\ 0 & 1 \\ 0 & 1 \end{bmatrix}$

e) [0 1 1 1]

f) none of the above

Problem 9:
Two triangles are *similar* if they have the same shape. Recall that if you are given the sides a_1 and b_1 of one triangle and the sides a_2 and b_2 of another triangle, then

$$\frac{a_1}{b_1} = \frac{a_2}{b_2}$$

if the triangles are similar. Suppose you are given the side lengths of a reference triangle: a_2 = 1 and b_2 = 2. Your task is to write a function that will calculate and output the side length a_1 of another similar triangle given its other length b_1 as an input. The side length b_1 needs to be positive and non-zero, so have your function print the error message

Error: The side length b1 needs to be greater than zero. The output will be set to 0.

and return the appropriate output for a_1 if an unacceptable value for b_1 is an input to your function. If the function header and first few lines of code look like

```
function [a1] = sim_tri(b1)

a2 = 1;
b2 = 2;
```

(6 points) Write the rest of the function.

(2 points) This function would be saved in a file called

a) sim_tri.m
b) function_a1.m
c) a1.m
d) function.m
e) Any name you choose will be fine.

EXAM 2 – Computer PORTION

Name: _____ Campus Mail: _____

For this problem, you should turn in three codes. The main program should be called `lastname_firstname.m` (all lower case). The function to be written for part b) should be called `lastname_firstname_mean.m`. The function to be written for part c) should be called `lastname_firstname_cost.m`. Include your name, section number, and CM number in the header section of all your code files. You do not need to add any other comments but these. Remember, there should be no output other than what is asked for.

NOTE: Your code should be general enough to process any data file with the given specifications. Do not hard code any specific number (*e.g.* row number) in your code.

Problem (60 pts)

Download the Excel spreadsheet named "`powerdata.xls`" from the course web page at `http://www.rose-hulman.edu/ME123/courseware.shtml`

It contains two columns of data. The first column contains a list of dates in the month of July, and the second column contains energy demand for each date (in units of kW-hrs) for a small town in Indiana.

You must do the following tasks:

a) [10 pts] Have your main program read in the data stored in the Excel spreadsheet. Split the columns into separate vectors, and plot energy demand versus date. Be sure to put appropriate axis labels and a title on your plot.

b) [25 pts] Create a function that will compute the mean daily energy demand over the dates given. The function call should look like this:

```
[mean_energy] = lastname_firstname_mean(powerdata);
```

where `mean_energy` is the mean daily energy demand and `powerdata` is the matrix that you obtained by reading the Excel file.

NOTE: **YOUR FUNCTION SHOULD NOT USE THE MATLAB `mean` FUNCTION**. You should program your own mean function here.

Your main program should call this function and then print to the screen the mean energy demand. This output should look like this:

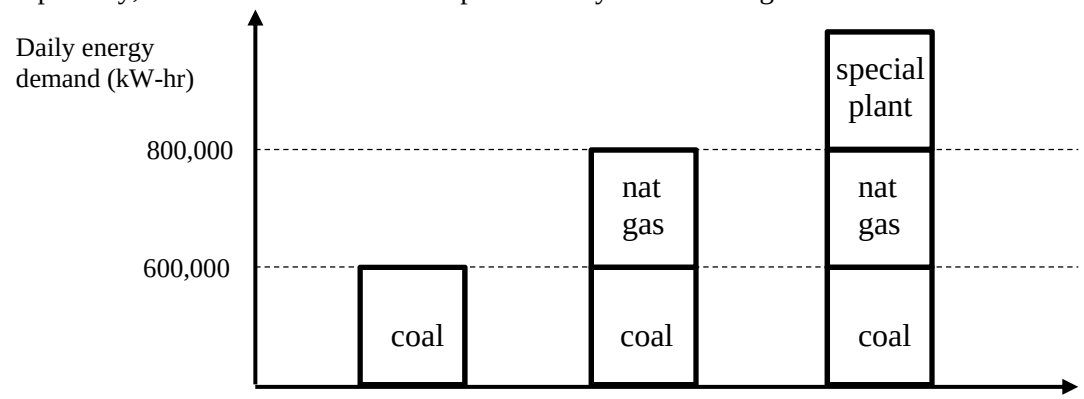
```
The mean energy demand was: #######.# kW-hr.
```

TURN THE PAGE

c) [25 pts] The cost of energy generation depends on how much energy must be generated. The cost can be computed as follows:

1. The first 600,000 kW-hr in a day can be generated by a coal-fired power plant and will cost $0.0432 per kW-hr.
2. The next 200,000 kW-hr for that day must be generated by a natural gas-fired plant for $0.0556 per kW-hr.
3. If more than 800,000 kW-hr are required for a given day, demand in excess of 800,000 kW-hr must be generated by a special peak power plant at a cost of $0.0866 per kW-hr.

Graphically, the cost structure can be represented by the following chart.



Create a function that will generate a single vector filled with the cost of generating the energy for each date. The function call should look like this:

```
[daily_cost] = lastname_firstname_cost(powerdata);
```

where `daily_cost` is a vector of the cost for each date for generating the energy specified in the `powerdata` matrix that you obtained by reading the Excel file.

Your function should use "for" loops to accomplish this task.

Your main program should call this function and then print the cost of generating the energy for Day 18 to the screen. This output should look like this:

```
The cost of generating energy on Day 18 is $######.##.
```

When you are done, post your m-file to the correct DFS folder:

1. Launch a Windows Explorer window by clicking on the folder icon menu bar at the bottom of your screen.
2. Click on the "DFS Root" folder in the upper left corner of the Explorer window
3. Double-click on Academic Affairs.
4. Double-click on ME.
5. Double-click on ME123.
6. Double-click on Exams.
7. Double-click on the folder with your section number.
8. Copy and paste your m-file to this folder.