ENGINEERING 1221 – Autumn 2012 Fundamentals of Engineering

HOMEWORK ASSIGNMENTS

Do ALL (Unless otherwise instructed) assignment in one Script File.

The first six lines should be:

```
clc
clear
format compact
disp ('Last Name, First Name')
```

Then for each problem:

```
disp ('Problem:#')
prob# = <Problem Solution>
```

Run the script file as you work on each problem, then go back and edit the script file to add the next problem, etc.

EXAMPLE

Script File

```
clc
clear
format compact
disp ('Buckeye,Brutus)
disp ('EG167, Seat 99')
disp ('Assignment 1')


disp ('Problem 4')
prob4a = cos(5*pi…,
```

Command Window

Buckeye, Brutus

EG 167, Seat 99

Assignment 1

Problem 4

MAT #1

Before starting this assignment type in the following commands into your command window

format short
clc
clear

1. Do the following calculations first in the command window and then in a script file.

   a. $$\frac{(24+4.5^3)}{e^{4.4}-\log_{10}(12560)}$$

   b. $$\frac{2}{0.036} * \frac{(\sqrt{250}-10.5)^2}{e^{-0.2}}$$

2. Create a script file that will verify the following identities. To do this, create 4 variables. LHSa and RHSa for the left hand and right hand sides of equation "a" and LHSb and RHSb for the left and right hand sides of equation "b". To prove that the identities are true, subtract the corresponding LHS and RHS from each other. If the identity is true, you should get 0.

   a. $(\sin x)^2 + (\cos x)^2 = 1$ for x = (3/4) π

   b. $(z^2 - y^2) = (z - y)(z + y)$ for z=12.3 and y= -21

3. Create a script file that uses the display command to make the following output on the command window.

Countdown commencing

Ignition in…

3

2

1

BLAST OFF!!!

4. Eggs are packed in containers such that 12 are place in each container. Write one line in the command window that will show how many cartons you would have to use to pack 634 eggs. *(Hint: use the built in Matlab function "ceil")*

5. The following equation is called the change of base equation

$$\log_a N = \frac{\log_b N}{\log_b a}$$

The variable "b" is the original base that you want to change and "a" is the new base that you are changing to. Use this information to calculate the following in command window. *(Hint: The command log(x) in Matlab actually will calculate the natural log of x or ln(x), not $log_{10}(x)$.)*

   a. $\log_8 20$
   b. $\log_{10} 4$

6. Now, using the same ideas as in question 5 write a script file that will calculate $\log_x y$ for any given x and y. Shows its output for the following two selections of x and y
   a. x=3 y=5
   b. x=4 y=1

MAT #2

Before starting this assignment type in the following commands into your command window

clc
clear
format shortg
format compact

1. Create the following vectors in the command window.
   a. A = [4 9 -23 7.77 8000 3.141]
   b. B = [$\sqrt{44}$, ln(51), 2^3, 5*tan(25°)]
2. Create a row vector with 8 equally spaced elements in which the first element is –π and last element is 2π.
3. Given the vectors A = [1 2 3], B=[4 5 6], C=[7,8,9] create the following using only these vectors

   a. $[1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9]$ b. $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ c. $\begin{bmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{bmatrix}$

4. Since it always seems to rain during finals week, a student decided to record rainfall during his final week instead of studying. He attained the following data

   Day 1 - 0.4 inches of rain
   Day 2 - 0.1 inches of rain
   Day 3 - 0.1 inches of rain
   Day 4 - 0.8 inches of rain
   Day 5 - 0.7 inches of rain
   Day 6 - 0.9 inches of rain
   Day 7 - 0.3 inches of rain

   Make a matrix that has two rows, the first row shows the day of the week and the second row shows the corresponding amount of rainfall during that day.

   Now, in one command, turn this matrix into a two column matrix where the first column is the day of the week and the second column is the corresponding amount of rain.

5. Create the matrix shown below by using the vector notation for creating vectors with constant spacing and/or the "linspace" command when entering the rows.

$$B = \begin{bmatrix} 0 & 4 & 8 & 12 & 16 & 20 & 24 & 28 \\ 69 & 68 & 67 & 66 & 65 & 64 & 63 & 62 \\ 1.4 & 1.1 & 0.8 & 0.5 & 0.2 & -0.1 & -0.4 & -0.7 \end{bmatrix}$$

MAT #3

Before starting this assignment type in the following commands into your command window

clc
clear
format shortg
format compact

1. Create three vectors, A B and C and one matrix D
    a. A should be a 10 element row vector whose first element is 0 and increments by 2 to the last element 10.
    b. B should be a 10 element row vector that starts at -3.3 and has even increments up to its final element which is 15
    c. C should be a ten element row vector whose first 4 elements are the first four elements of A, its 5th element is 0 and its last 5 elements are the last 5 elements of B.
    d. D should be a 3x10 matrix comprised of A,B and C in which A is the first column, B is the second column and C is the third column.

2. Given the following matrix

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 \\ 6 & 7 & 8 & 9 & 10 \\ 11 & 12 & 13 & 14 & 15 \end{bmatrix}$$

    a. Create a five element row vector the contains the first row of A
    b. Create a five element column vector that contains the third row of A
    c. Create an eight element row vector that contains the second row and fourth column of A
    d. Create a six element row vector that contains the first and fifth column of A

3. Create the following matrix A

$$\begin{bmatrix} 0.1 & 0.2 & 0.3 & 0.4 & 0.5 & 0.6 & 0.7 \\ 14 & 12 & 10 & 8 & 6 & 4 & 2 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 3 & 6 & 9 & 12 & 15 & 18 & 21 \end{bmatrix}$$

    a. Create a 3x4 matrix B from the 1st, 2nd and 3rd rows, and the 1st through 4th columns of the matrix A.
    b. Create a 2x7 matrix C from the 2nd, and 4th rows, and all the columns of the matrix A.

4. Create the following string

Letters = ‘ABCDEFGHIJK’

   a. Create the following words in matlab using only the elements of Letters
      i. BAD
      ii. CAB
      iii. KICK
      iv. CAKE
   b. Change the 5th element of Letters to the letter X and the last element of Letters to the letter Z

MAT #4

Include the following lines of code in your script file. Starting next assignment, you will no longer be reminded of this and should format your script files as you see fit.

```
clc
clear
format shortg
format compact
```

NOTE: In this assignment, be sure to only use dot operators when doing vector operations. Even though it may not affect your program, using dot operators for scalar math is not a good habit to get into as it will cause problems and confusion in larger programs.

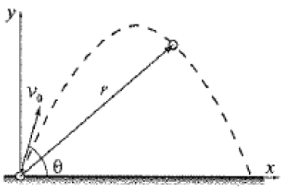
1. For the function

$$y = 5\sqrt{t} - \frac{(t+2)^2}{0.5*(t+1)}$$

   calculate the value of y for the following values of t: 0,1,2,3,4,5,6,7,8 using element-by-element operations. **You should only use a maximum of 2 dot operators in this problem.**

2. The position as a function of time (x(t),y(t)) of a projectile fired with a speed of v_0 at an angle θ is given by:

$$x(t) = v_0 \cos(\theta) * t \quad y(t) = v_0 \sin(\theta) * t - \frac{1}{2} g t^2$$



   where g = 9.81 m/s^2 is the gravitation of the Earth. The distance to the projectile at the time *t* can be calculated by $r(t) = \sqrt{x(t)^2 + y(t)^2}$. Consider the case where v_0 = 100 m/s and θ = 79°. Determine the distance *r* to the projectile for t = 0, 2, 4…, 20 s.

3. Create the following scalars and variables: x=4, y=2, a=[1,2,3,4,5] and b=[-3,4,2,0,1] and perform the following operations using only the minimum

number of dot operators. (Remember: dot operators are only needed for vector operations so don't over use them)

a. $\frac{b^2}{x}$ – y(a+b) (1 dot)

b. $\sqrt{a * b} - b^y + x$ (2 dots)

c. $\frac{a^2 * x^2}{y - ab}$ (3 dots)

4. Use MATLAB to show that the sum of the infinite series

$$4* \sum_{u=0}^{\infty} \frac{(-1)^n}{2n+1}$$

Converges to π. Do it by computing the sum for:

a. n=100
b. n=10,000
c. n=1,000,000

For each part create a vector in which the first element is 0, the increment is 1 and the last term is either100, 10,000, or 1,000,000.(Don't forget to use semicolons to suppress these huge vectors.) Then, use element-by-element calculation to create a new vector in which the elements are $\frac{(-1)^n}{2n+1}$. Finally use the MATLAB built-in function "sum" to add the terms of the series (and don't forget to multiply the sum by 4). Compare the values obtained in parts a,b, and c with the value of π.

MAT #5

In this assignment and for now on, unless otherwise specified make sure that anything displayed to the command window is displayed using the disp() or fprintf() command. This means that you can no longer display something by simply leaving off a semicolon. This will make the command window look nicer while also ensuring that the things displayed are displayed deliberately.

1. Create a script file that will multiply three variables, A, B and C. "A" is hardcoded into the scrip file, "B" is defined in the command window and "C" is input by the user using the input command. Find what their product is for the following values of A, B and C. (Note: make sure everything but the output of their product is suppressed.)
    a. A=3, B=4, C=6
    b. A=−3.33, B=4.68, C=.03
    c. A=212, B=13, C=79

2. Create a script file that asks a user for their first name, last name, age and favorite color. Then use this information to return a display that says the following.

    "Hello (first name) (last name). You are (age) years old and your favorite color is (favorite color)!"

3. A class consists of four tests and one final. Jim scored a 70 on his first test, 84 on his second test, 98 on his third test, a 100 on his last test and a 90 on his final.
    a. Using this information create a 5x2 matrix in which the first column is the test number (count the final as test number 5), and the second column is the corresponding grade.
    b. Now display this matrix as a table (using disp) with a header saying "Jims Test Scores" and for each row of the matrix display the test# and test score.
    c. Recreate this table using the fprintf command. (Hint: In part (a) you created a matrix with 2 columns and 5 rows, in order to display it as a table in part (b). Now you are going to have to alter it to become 5 columns and 2 rows. For a sample table refer to slides 13 and 19 of MATLAB 5 Input Output.)