COE 301 Introduction to Computer Programming Fall, 2019

Homework 9 – Due: 11/15/2019 9:00 am

Problem 1. (25 points) Short answers.

(1) [4 points] Please write MATLAB command(s) to create a row vector with integers from 1 to 1000 as [1 2 3 …. 999 1000] **without loops**.

(2) [9 points] Let x be a 1x2 row vector, and v is a 2x1 column vector.

```
x = [1  4]
y = [2; 1]
```

What is the result of the following expression? Please first compute the results by hand (show your derivations) and verify them using MATLAB (**please be careful on which one use element-wise multiplication**).

```
a) x * y
b) y' .* x
c) y * x
```

(3) [4 points] write a code snippet to create a row vector of the powers of 2 2^0 through 2^9. **Do not use loops and you are not allowed to type in all the elements as:**

```
x= [1  2  4  8  16  32  64  128  256  512];
```

(4) [4 points] Write a snippet of MATLAB code **without loops** to make a vector with integers from 1 to 1000 and then make every other value in it negative as [1 -2 3 -4 … 999 -1000].

(5) [4 points] Make a row vector 1000 uniformly distributed random numbers in the interval (0,1).

Problem 2. (25 points) Short problems to practice syntax. Create one MATLAB script, which will have several parts. Note: If you separate parts of a script with "%%", it will create a "section", which you can run separately with Ctrl-enter or clicking "Run section". We will be giving most of the answers here simply as a way for you to practice using these new commands. Please **DO NOT** use loops.

Part A.
Create a row vector a that contains the following elements: 1, 2, 3, 4.
Create a column vector b that contains the following elements: 5, 6, 7.
Display the answer to the question "what is the MATLAB default data type for all numeric variables?" using the 'disp' function.
Check what is in your workspace. Note that you may use the "clear" command, which removes all variables from the workplaces:

Part B.
Use the 'zeros' function to make a row vector of 5 zeros
Use the 'ones' function to make a column vector of 8 ones
Use the 'rand' function to make a row vector of 7 uniformly distributed random numbers in the interval (0,5).

Part C.
Make a row vector x of 101 points evenly spaced between -1 and 1.
Make a variable y, which equals the square of each element of x.
Make a variable z, which equals the cube of each element of x.
Make a plot of x vs. x, y vs. x and z vs. x on the same figure.
Please submit your .m file as "yourLastName_hw9_prob2.m". No write-up is required.

Problem 3. (25 points) Create a vector x with n equally spaced values starting at 0 and ending at 2pi using linspace, plot sin(x) vs. x for the case n = 3. Now plot sin(x) vs. x for two additional cases n = 7 and n = 21 on the same plot. Label the x-axis and y-axis and add a legend to describe the three lines you have plotted. Use your intuition to explain why the result is a straight line when n equals 3.

Now define a vector t with n=21 equally spaced values starting at 0 and ending at 2pi, create a new plot

y = sin(t)+cos(5t)+0.5sin(10t)+1.5cos(20t)

Next plot y vs. t for the case n = 201 on the same plot and explain what you see.

Note: When describing plots, the convention is "response" vs "input" (i.e. y goes on the vertical axis, t goes on the x axis). The MATLAB function plot takes the arguments plot(input, response,...).

Report your figures and explanations in the write-up.
Please submit your .m file as “yourLastName_hw9_prob3.m”.

Problem 4. [25 points] We have learned in the class that the inner product of a vector with itself gives the square of its magnitude:

$$|x| = \sqrt{x^T x}$$

We can define a similarity measure of two column vectors x and y as

$$\text{similarity}(x, y) = \frac{(x - \overline{x})^T (y - \overline{y})}{\sqrt{(x - \overline{x})^T (x - \overline{x})} \cdot \sqrt{(y - \overline{y})^T (y - \overline{y})}}$$

,where $\bar{x}$ and $\bar{y}$ are the mean of vector x and y. The similarity number ranges from -1 to 1. 1 means the vectors x and y are 100% correlated, 0 means the vectors x and y are not correlated at all and -1 means the vector are anti-correlated (when one goes up, the other goes down and vice-versa).

Use the similarity measure to discover which stock has very similar price movement with AAPL. The historical daily stock price for AAPL, MSFT, QCOM and WFC can be downloaded under the folder ‘Lab9_data’. You may load the text file that contains the daily stock prices into a vector using the MATLAB command:

```
aapl = load('prob3_aapl.txt');
```

Please plot the price time series of all four stocks on the same figure and comment on whether you can observe the similarity from the plot easily.

Report your figure and your comment in the write-up.
Please submit your .m file as “yourLastName_hw9_prob4.m”.

Submission Instructions:

There should be 3 files in your submission:

1. A write up (any type- .txt, .docx, .pdf are all fine) that contains your answers to all questions in problem 1-3.
2. The .m file for problem 2.
3. The .m file for problem 3.
4. The .m file for problem 4.

Please make sure your last name is included in the filename.