COE 301 Introduction to Computer Programming Fall, 2019

Homework 11 – Due: 12/2/2019 9:00 am

Problem 1. [30 points]

(1) [4 points] what is the output of the following block of code?

```
x = [-4:9];
y = [-10:3];
a = x(x>0 & y>0);
disp(a)
```

(2) [8 points] you are given a vector:

```
x = [0.1  0.4  0.5  0.05  0.9  0.8  0.5];
```

a) Write a snippet of code to count the number of elements in x greater than 0.25 but less than 0.75. **Do not use any loops.**
For the given vector x, this would produce 3

b) Now, write a snippet to compute the sum of all elements in x that are greater than 0.7. **Do not use any loops.**
For the given x, this would produce 1.7.

(3) [6 points] You are given

```
A = 1:5; % row of 5 numbers, 1 through 5
B = (10:15)'; % column of 6 numbers, 10 through 15
c = 3; % a single scalar 3
```

How would you produce the following vectors **without loops**:

a) a column vector (dimensions 3x1) containing [10; 12;14] using just B
b) a row vector [1.0, 0.50, 0.333, 0.25, 0.2] using just A
c) a row vector [1, 8, 27, 64, 125] using A and c

(4) [6 points] what is the output of the following block of code?

```
nrows = 5;
ncols = 5;
% IMPORTANT initialize A before the loop
A = zeros(nrows,ncols);
for c = 1:ncols
    for r = 1:nrows

        if r == c
            A(r,c) = 2;
        elseif abs(r-c) == 1
            A(r,c) = -1;
        end

    end
end
```

Now, use the MATLAB function diag to generate the same matrix A without using loops.

(5) [3 points] If A is a 100-by-4 matrix and b is a 100-by-1 vector, what is the dimension of A\b?

(6) [3 points] Please explain what this MATLAB snippet computes.

```
n = 1;
nFactorial = 1;
while nFactorial < 10^4
    n = n + 1;
    nFactorial = nFactorial * n;
end
```

Problem 2. [35 points] *Remove invalid data.* Write a MATLAB function called `rmInvalid` that takes an input vector `x` of homework grades with values ranges between 0 and 100. However, there are some invalid data samples with values >100 or <0. The function should return one output vector `xout` with all invalid data samples removed. **Note that you are not allowed to use loops to solve this problem.** Please test your function in the command line using a vector v = [200 56.5 -7 93 85 75.5].

Please submit your .m function and report the test results in the write up.

Problem 3. [35 points] *Vector norms*. In linear algebra, the L1-norm of a vector is calculated as the sum of the absolute values of its elements. The L2-norm of a vector is defined as the square root of the sum of the squares of its elements. The infinity-norm of a vector is defined as the absolute value of its largest element. Write a MATLAB function called `vectorNorms` that takes an input vector `x` and returns its L1-norm, L2-norm and the infinity-norm as three scalars. **Note that you are not allowed to use loops or MATLAB built-in function** `norm` **to solve this problem.** Please test your function in the command line using a vector v= 1:3:16.

Please submit your .m function and report the test results in the write up.

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.

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