ENGR15100: SOFTWARE TOOLS FOR ENGINEERS

Laboratory 9

PURPOSE: Practice User-defined function in MATLAB.

For each problem, create a MATLAB script file and name it FIRSTNAME_LASTNAME_LAB9_ problemX.m.

You can use following template for each of the Problem.

```
%{
Class       : ENGR15100: Software Tools for Engineers
Instructor  : Xiaoli Yang
Author      : [Student's Name]
Assignment  : Lab [No.]
File Name   : Firstname_Lastname_LAB[No.]_Problem[No.].m
              (eg: Xiaoli_Yang_LAB1_Problem1.m)
Date        : [MM]/[DD]/[YY]
%}

%clear screen
clc

%clear workspace
clear

%display your name
disp('Your Full Name Here');
disp('Starting code: ');

%Start your source code here%

%End your code
disp('Completed');
```

SUBMITTING YOUR LAB:
Submit your lab by uploading .m file using the Brightspace Assignment feature no later than the date specified.

PROBLEM 1: (30 POINTS)

Convert the following MATLAB code into a user-defined function named *myFunction* where the inputs are x, y, z and the outputs are $out1$ and $out2$. Then use this function to calculate and display the results for $x = 5, y = 6, z = 10$ and $x = 1, y = 2, z = 3$, respectively.

```
k=1;
i = 1;
while (k <= 10)
    fprintf('k = %d\n ', k);
    if (x>y) && (k==5)
       out1(i) = k*sqrt(sum((x-y)/z));
       out2(i) = k*fact(z)*fact(x-y);
    else
       out1(i) = k*sqrt(sum((x+y)/z));
       out2(i) = k*factorial(z)*factorial(x+y);
    end
    k = k + 1;
    i = i + 1;
end
```

PROBLEM 2: (30 POINTS)

Write a user-defined MATLAB function for the following math function:

$$f(x) = 0.8x^2e^{-0.5x} + 2.5x^3e^{-0.5x}$$

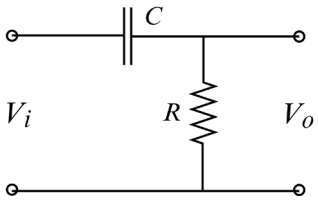
The input to the function is x and the output is y. Use the created function to perform the following calculation and MATLAB plotting.

1) Use the function to calculate $y(-5)$ and $y(10)$.
2) Use the function to make a plot of $y(x)$ for $-10 \le x \le 10$ with a step of 0.2. (Note that x is a vector in this case.)

PROBLEM 3: (40 POINTS)

The simple RC high-pass filter shown in the figure passes signals with frequencies higher than a certain cutoff frequency. The ratio of the magnitudes of the voltages is given by:

$$RV = \left|\frac{V_o}{V_i}\right| = \frac{\omega RC}{\sqrt{1 + \omega^2 R^2 C^2}}$$



where $\omega = 2\pi f$, and f is the frequency of the input signal.

1) Write a user-defined MATLAB function that calculates the ratio of magnitudes for given values of R, C, and f. For the function name and arguments, use $RV = RCFilt(R, C, f)$. The input arguments are R, the size of the resistor in Ω (ohms); C, the size of the capacitor in F (farad); and f, the frequency of the input signal in Hz (Hertz). Write the function such that f can be a vector.
2) Write a program in a script file that uses the *RCFilt* function to generate a plot of RV as a function of f for $10 \le f \le 10000$ Hz. The plot has a logarithmic scale on the horizontal axis. When executed, the script file asks the user to enter the values of R and C. Label the axes of the plot.
3) Run the script file with $R = 80\ \Omega$, and $C = 5\ \mu F$.