PURDUE UNIVERSITY NORTHWEST   **DEPARTMENTS OF ENGINEERING**

ENGR15100: SOFTWARE TOOLS FOR ENGINEERS

Laboratory 1

Follow the instructions carefully solve each problem in MATLAB.
PURPOSE: Practice with MATLAB editor and basic operations.

Starting MATLAB and create MATLAB script
As discussed in the lecture that we can work with MATLAB in interactive mode or batch mode. In interactive mode, we enter a single command in the command window, execute it, and then enter the next command and so on. In batch mode, we are able to write several commands in a single MATLAB <u>script file</u> (.m) and then execute them by running the script**.** For lab assignments, we will use **batch mode**. So let's start:

- It is suggested that you first create a file organization to keep a personal record of the code written during the laboratories. It is suggested that you first create a course folder where you will save each lab and the associated files. For example, you could create a folder **ENGR15100 Fall 2021**, then separate subfolders such as **Lab 1** to contain the code for each lab. It is the best to create these folders in Windows rather than through Matlab interface.
- Next, start MATLAB and either type `the command edit` in the command window or open a new script via the pull downs. Either way the editor window opens with an untitled script. Click the **Save As** button to save the script file with a specified filename. You have to navigate and save it in the appropriate folder that you have created in the previous step. In general, for each problem create a MATLAB script file and name it with the following convention: **Firstname_Lastname_LAB1_ProblemX.m**.
- All MATLAB files should and will be stored as **M-files**, which end in extension with **.m** .
- Once you save the file, you can see it in the **current folder** window. You can execute the file either by typing the name of file without the extension in the command window or by clicking the **Run** arrow button.
- You can reopen a saved script file into the editor by clicking the Open button and browse until finding the folder where you have saved the file. Once open, Click the **Run** button to execute this editor file as before. You may at first see a prompt to make a selection. Click **Change the folder** button to allow matlab to change its present working directory from the current or default folder to that of the file you have opened.

As discussed above, for each lab, create a MATLAB script file and name it FIRSTNAME_LASTNAME_LAB1.m. Put ALL the commands for the required steps in your script file:
- Be sure to clear the display of the command window and the workspace memory.
- Display your name.
- Separate & label different steps using comments (%) and section command (%%).

A sample starter script file is being provided on Blackboard to assist you on this first lab. Please continue to use the initial header format in all future laboratories as appropriate. Also, continue naming future files with the convention: FIRSTNAME_LASTNAME_LAB1.m etc.

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 files using the Blackboard Assignment feature no later than the date specified.

PROBLEM 1 (30 points)

Use MATLAB to solve the following math questions, and put all the commands in your script file. Separate and label different steps using comments. Unless otherwise specified, do NOT suppress MATLAB's output. Also, verify the results manually by applying operator precedence and associativity and mention them as comments in the script file.

(1)   8+3/5+2
(2)   3^2/4
(3)   7*(5+8)/2

(4)   2^3^(1+2)/4

PROBLEM 2 (30 points)

Use the built-in functions in MATLAB as possible as to solve the following math equations, and put all the commands in your script file. Before using a function, learn the details of the function using `help` **or** `doc` command. Type `help function_name` to see the details. Separate and label different steps using comments. Unless otherwise specified, do NOT suppress MATLAB's output.

(1) $\sqrt[3]{64 + |-17|}$
(hint: Real nth root of real numbers: **nthroot(X,N)**, Absolute value and complex magnitude: **abs(X)**)

(2) $e^{\sqrt{60+3*\sqrt{49}}}$
(hint: Exponential: **exp(X)**, Square root: **sqrt(X)**)

(3)   2 + floor(20/9)/2+ceil(6/9+3)/2
(hint: Round toward negative infinity: **floor(X)**, Round toward positive infinity: **ceil(X)**)

(4) $\dfrac{\sin{(0.2\pi)}}{\cos{(\frac{\pi}{6})}}$ + tan 60°
(Hint: use **pi** for π, Sine of argument in radians: **sin(X),** Cosine of argument in radians: **cos(X),** Tangent of argument in radians: **tan(X)**)

(5) $\dfrac{23+\sqrt[3]{45}}{16\times0.7}$ + log₁₀589006

(Hint: Common logarithm (base 10): **log10(X)**)

PROBLEM 3 (40 points)

In this problem, you have to define variables and then you have to use them to evaluate the expressions. You can use built-in functions in MATLAB. Unless otherwise specified, do NOT suppress MATLAB's output.
(1) Define the variables x and y as x = 6.5 and y = 3.8, then evaluate:
   a. $(x^2 + y^2)^{\frac{2}{3}} + \dfrac{xy}{y-x}$
   b. $\dfrac{(x-y)^2}{\sqrt{x+y}} + 2x^2 - xy^2$
(2). Define the variables a, b, c, and d as: a= 12, b= 5.6, c=$\dfrac{3a}{b^2}$, d=$\dfrac{a-b}{a+b}$, then evaluate:
   a. $\dfrac{a}{b} + \dfrac{d-c}{d+c} - (d-b)^2$
   b. $e^{\frac{d-c}{a-2b}} + \ln{(|c - d + \dfrac{b}{a}|)}$