**Purdue University NORTHWEST DEPARTMENTS OF ENGINEERING**

**ENGR15100: Software Tools for Engineers**

**Laboratory 6**

**PURPOSE:** Learn about Conditional and Iterative Statements (if-end, for-end)

For each problem, create a MATLAB script file and name it FIRSTNAME\_LASTNAME\_LAB6\_ problemX.m. Put ALL the commands for the required steps in your script file:

* Be sure to clear the display and the memory.
* Display your name.
* Separate and label different steps using comments.

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%{

Class: ENGR15100: Software Tools for Engineers

Instructor: Xiaoli Yang

Author: [Student’s Name]

Assignment: Lab [No.]

File Name: LASTNAME\_LAB[No.]\_problem[No.].m

Date: [MM]/[DD]/[YY]

%}

%clear screen

clc

%clear workspace

clear

disp('Your Name Here');

disp('');

disp('starting code: ');

%Completing lab x

%your source code here%

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**problem 1: Analyzing an Array (30 points)**

Write a program that performs the following steps. **Unless otherwise specified, suppress output to the Command Window.**

1. Create a variable named ***V*** and assign to it a 250-element row vector whose elements are each randomly generated real numbers chosen uniformly from the open interval (-4.5, 5.5).
2. Create variables ***numNegative***, ***numPositive***, ***sumPositive***, ***meanPositive***, and ***prodRange***. Initialize each variable to an appropriate scalar value.

* ***numNegative***, ***numPositive***: number of negative and positive elements in ***V***, respectively
* ***sumPositive***, ***meanPositive***: sum of all the positive elements in ***V***, respectively.
* ***prodRange***: the product of all real numbers in vector ***V*** in the range [2.3, 2.6]

1. Declare a for-end statement using a loop variable named ***k*** that will be assigned to every element of a row vector whose elements represent the indices/positions of row vector ***V***.
2. The body of the for-end statement should update, when applicable, the values of ***numNegative, numPositive, sumPositive***, and ***prodRange***. The use of built in functions sum, mean, and prod is NOT allowed.
3. After the for-end statement, compute the mean of the positive real numbers in vector ***V*** and assign the mean to a variable named ***meanPositive***.
4. Using multiple instances of fprintf, display the values contained in variables ***numNegative, numPositive, sumPositive, meanPositive***, and ***prodRange***, respectively.

* Format variables ***numNegative*** and ***numPositive*** as integers.
* Format variables ***sumPositive, meanPositive*** and ***prodRange*** as fixed-point real numbers, each showing a maximum of 3 digits after the decimal point.

The result of executing your program should look similar to the sample output shown below.

>> FIRSTNAME\_LASTNAME\_LAB6\_ problem1

Vector V has 119 negative elements.

Vector V has 131 positive elements.

The sum of vector V's positive elements is 363.659.

The mean of vector V's positive elements is 2.776.

The product of the elements in the range [2.3, 2.6] is 229.376.

**problem 2: Maximum of a Function in an Interval (30 points)**

Write a MATLAB program that finds the maximum value of function (𝑥) = (𝑥 + 1)3(𝑥 − 1)(𝑥 − 2) in the interval 𝑥 = [−2, +2]. The program also finds the value of 𝑥 in the interval that caused the maximum (𝑥) to occur. **Unless otherwise specified, suppress output to the Command Window.**

1. Create variables ***xMax*** and ***yMax***. Initialize each variable to an appropriate scalar value.
2. Declare a for-end statement with a loop variable named ***x*** that will be assigned to every element of a row vector whose elements are equally spaced values starting with -2.0, ending with +2.0, with a step size of 0.01.
3. The body of the for-end statement should perform the following:

* Compute the current scalar value of a variable ***y*** in terms of the current scalar value of loop variable ***x*** according to the function (𝑥) = (𝑥 + 1)3(𝑥 − 1)(𝑥 − 2).
* When appropriate, update the scalar values of ***xMax*** and ***yMax***. You may not use any built in functions, including built-in function max.

1. Using multiple instances of the built-in fprintf function, display the values of ***yMax*** and ***xMax*** according to the following formatting specifications:

* Format the value of ***yMax*** as a fixed-point real number.
* Format the value of ***xMax*** as a fixed-point real number.

After completing the above steps, the result of executing the script should look like the output below.

>> FIRSTNAME\_LASTNAME\_LAB6\_ problem2

The maximum value of y is 2.640522.

The value of x causing the maximum value of y is 0.370000.

**problem 3: Modifying and Formatted Vector Output (40 points)**

Write a program according to the following specifications. **Unless specified, suppress all MATLAB Command Window output.** After completing the program, the result of executing your program should look similar to the output shown below.

>> FIRSTNAME\_LASTNAME\_LAB6\_ problem3

Enter the number of elements for a vector v: 10

The elements of vector v are:

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12 60 23 40

12 45 19 49

52 56

V contains 2 prime numbers.

V contains 1 multiples of 3 in the range (25, 55).

After updating the multiples of 3, V now contains: --------------------------------------------------

-2 -4 23 40

-10 -12 19 49

52 56

1. Create a variable named ***N*** and assign to it an integer obtained by prompting the user to enter the size of a row vector ***V***. Assume the user always enters a positive integer.
2. Create a variable named ***V*** and assign to it an N-element row vector whose elements are randomly generated integers uniformly chosen from the closed interval [0, 75].
3. Declare another for-end statement with a loop-variable named ***k*** that will be assigned to every element of a row vector whose elements represent the indices/positions of row vector ***V***. In the body of this for-end statement, perform the following:

* Count the number of prime numbers contained in row vector ***V***. Use the built-in function isprime.
* Count the number of elements of row vector ***V*** that are multiples of 3 (i.e. evenly divisible by 3), greater than 25, but less than 55.
* Multiply (and update) each of the elements in vector ***V*** that are only multiples of 3 by two times the negative of their index/position within row vector ***V***.

1. Using multiple instances of the built-in fprintf function, display the following:

* Number of prime numbers contained in ***V***. Format the number as an integer.
* Number of multiples of 3 contained in ***V*** in the range (25, 55). Format the number as an integer.
* Repeat step (d) to display all the elements contained in row vector ***V***. Re-use as much of the code as possible that was as part of completing step (d).

Test your program with at least the following scalar values for ***N***: +1, +10, and +24.

**SUBMITTING YOUR LAB:**

Submit your lab by uploading .m file using the Blackboard Assignment feature no later than the date specified.