ENGR 15100: Software Tools for Engineers
Spring 2015

Computer Assignment #3

Due Date: Tuesday, February 10, 2015, 9am CST

Departments of Engineering
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1. OBJECTIVE

Become familiar with performing mathematical operations with arrays in MATLAB.

2. PROCEDURE

Task I: Math Operations with Arrays

Create a MATLAB script file having the name `LASTNAME_LAB3.m` and perform the following sequence of steps in the file. ***Unless otherwise specified, do not suppress the output to the MATLAB Command Window.***

(a) **[1 points]** Clear the MATLAB Workspace and clear the contents of the MATLAB Command Window.

(b) **[0.5 points]** Activate a *diary* in a file named `LASTNAME_LAB3_DIARY.txt`.

(c) **[1 point]** Create a *variable* named `full_name` and assign to it a string indicating your full first and last name separated by a blank space. Suppress the output to the MATLAB Command Window. Then, using variable `full_name` in combination with the **`disp()`** function, display your full name in the MATLAB Command Window.

(d) **[1 point]** Create a variable named `lab_part` and assign to it the string `'Lab #3: Part #1'`. Suppress the output to the MATLAB Command Window. Then, display the contents stored in variable `lab_part` to the MATLAB Command Window using built-in function **`disp()`**.

(e) **[3 points]** Create a *variable* named `a` and assign to it a row vector whose elements have equally spaced values starting from 1 to 30 in increments of 2. Use the MATLAB colon (`:`) operator.

(f) **[3 points]** Create a *variable* named `c` and assign to it a 15 element row vector whose first and last elements have values -10 and $+10$, respectively. Use the built-in **`linspace()`** function.

(g) **[20 points]** Create a *variable* named `h` and assign to it a row vector whose elements have values obtained by evaluating the mathematical expression shown below for corresponding elements of row vectors `a` and `c`. Utilize the built-in function **`nthroot()`** when evaluating $\sqrt[3]{c/a}$.

$$h = 20\,sin^2(2a + (\pi/4))\,cos(5c - (\pi/3)) + 6\left(\sqrt[3]{c/a}\right)/(a - c)$$

(h) **[1 point]** Assign the variable `lab_part` to the string `'Lab #3: Part #2'`. Suppress the output to the MATLAB Command Window. Then, display the contents stored in variable `lab_part` to the MATLAB Command Window using built-in function **`disp()`**.

(i) **[15 points]** Create a *variable* named `A` and assign to it a 5×5 *square matrix* whose elements are the coefficients of the linear system of equations of 5 unknown variables x_1 through x_5 as shown below.

$$\begin{aligned}
3x_1 + 1.5x_2 + 1x_3 + 0.5x_4 + 4x_5 &= -11.75 \\
-2x_1 + 1x_2 + 4x_3 - 3.5x_4 + 2x_5 &= 19 \\
6x_1 - 3x_2 + 2x_3 + 2.5x_4 + 1x_5 &= -23 \\
1x_1 + 4x_2 - 3x_3 + 0.5x_4 - 2x_5 &= -1.5 \\
3x_1 + 2x_2 - 1x_3 + 1.5x_4 - 3x_5 &= -3.5
\end{aligned}$$

(j) **[6 points]** Create a *variable* named b and assign to it a *column vector whose elements are values* obtained by *transposing* a *row vector* whose elements are the right-hand-side constants of the linear system of equations shown above.

(k) **[5 points]** Create a *variable* named `x` and assign to it a *column vector whose* elements are the values of the solution to the linear system of equations shown above. Utilize the left division operator `\`.

(l) **[1 point]** Assign the variable `lab_part` to the string `'Lab #3: Part #3'`. Suppress the output to the MATLAB Command Window. Then, display the contents stored in variable `lab_part` to the MATLAB Command Window using built-in function **`disp()`**.

(m) **[5 points]** Create a *variable* named `h_average1` and assign to it a scalar value indicating the mean (average) of the elements of row vector `h`. Utilize the built-in **`mean()`** function.

(n) **[8 points]** Repeat step (m), but this time, create a variable named `h_average2` and assign to it the mean (average) using a combination of the built-in functions **`sum()`** and **`length()`**.

(o) **[5 points]** Create *a variable* named `h_sorted` and assign to it a row vector whose elements are those from row vector `h` sorted in *descending* (largest to smallest) order. Utilize the built-in **`sort()`** function.

(p) **[5 points]** Create a *variable* named `h_median1` and assign to it the median (middle) value of the elements contained in row vector `h`. Utilize built-in function **`median()`**.

(q) **[8 points]** Repeat step (p), but this time, create a variable named `h_median2` and assign to it the median value by indexing the middle element of row vector `h_sorted`. Compute the index of the middle element using a combination of built-in functions **`length()`** and **`round()`**.

(r) **[5 points]** Use the built-in **`max()`** function for this step. Create *variables* named `h_max` and `h_max_index`. Assign to variable `h_max` the element of row vector `h` whose value is maximum. Assign to `h_max_index` the index/address/position of the element of row vector `h` whose value is maximum. Perform this step using one MATLAB statement.

(s) **[3 points]** Display the value of that element of row vector `a` which caused the occurrence of the maximum element of row vector `h`. A sample of the Command Window output after completing this step is shown below. Utilize built-in function **`disp()`** multiple times.

```
The element of vector a causing the max element of vector h is:
   #######
```

(t) **[3 points]** Display the value of that element of row vector `c` which caused the occurrence of the maximum element of row vector `h`. A sample of the Command Window output after completing this step is shown below. Utilize built-in function **`disp()`** multiple times.

```
The element of vector c causing the max element of vector h is:
   ######
```

(u) **[0.5 points]** Deactivate the *diary* in the file named `LASTNAME_LAB3_DIARY.txt`.

Task II: Computer Assignment Submission

Upload the following files onto Blackboard Learn.

(a) MATLAB script file `LASTNAME_LAB3.m`

(b) MATLAB diary file `LASTNAME_LAB3_DIARY.txt`