Introduction To MATLAB

IMPORTANT NOTES :

• Name your file (and your function) as mentioned.

• Be aware of input/output format. Your code will be graded via an automated MATLAB judge according to the number of the tests you have passed.

• Do not display your answers by removing the semicolon at the end of your line. Using the functions disp or fprintf is recommended instead.

• Do not print any additional comments or variables in your output. You are only expected to display what you have been asked to.

Generating Variables, Common Functions and Indexing

Write a MATLAB script which generates the following variables and displays them as outputs:

• Define $X = 0.6$ and $X = 2.5416$ Generate $Z$ a vector containing $\sin(X)$ and $\cos(Y)$. calculate $A$ the sum of all square values of $Z$.

• Generate a vector $B$ with the first 20 fibonacci numbers. ($[0 \ 1 \ 1 \ 2 \ 3 \ 5 \ldots ]$). (B is a vector with 20 elements.)

• Generate vector $C = [4 \ 3.9 \ldots 0 \ldots 3.9 \ 4]$. (All the numbers from 4 to -4 decreased by 0.1).

• Make a 5 5 matrix $D$ with the form below:

\[
\begin{bmatrix}
2 & 4 & \ldots & 32 \\
& 4 & 8 & \ldots & 64 \\
& & \ddots & \ddots & \\
32 & 64 & \ldots & 512 \\
\end{bmatrix}
\]

• Use the values which are in both odd rows and columns of the matrix above to form a new matrix $E$ which should be a 3 3 matrix.

• Make a 9 9 matrix of all 1s and add it to another 9 9 matrix of all zeros but with the values of $[1 \ 2 \ 3 \ 5 \ 7 \ 11 \ 13 \ 17 \ 19]$ on the main diagonal. the final answer is the matrix $F$
which you should display (Use zeros, diag)

\[
\begin{array}{ccccccccc}
2 & 1 & \cdots & 1 & 1 \\
1 & \ddots & 1 & \ddots & \vdots \\
\vdots & 1 & \ddots & 1 \\
\ddots & 1 & \ddots & 1 \\
1 & \cdots & 1 & 20
\end{array}
\]

- Generate a random 4 \times 7 matrix G which is formed by the numbers between 0 and 1.

- A square matrix is called upper triangular if all the entries below the main diagonal are zero, generate a 5\times 5 upper triangular matrix H with the main diagonal \([1 \ 2 \ 3 \ 4 \ 5]\) and 2s for the rest of none zero values.

\[
\begin{array}{cccccc}
1 & 2 & \cdots & 0 \\
0 & 2 & \ddots & 2 \\
\vdots & \vdots & \ddots & \vdots \\
0 & 0 & \cdots & 5
\end{array}
\]

- Make hSum the column-wise sum of H. The answer should be a row vector. (Use sum)

- Make I a random 6 \times 6 matrix with values between 0 and 1 using rand. Find the elements that have values \(|0.5\) and set those values to 0, and set the elements with values \(|=0.5\) to 1. (Use find)

Sample input: Q1_92123456
Sample output: values of A, B, C, D, E, F, G, H hSum and I in separate lines.

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**Plot**

- Write a MATLAB script that plots \(f(x) = 4\sin(x) + \cos(x)\) which is displayed using “-” and \(g(x) = \sin(x) - 2\cos(x)\) which is displayed using “*” in a single figure. Do not forget to label the axises, a legend to describe the function you have plotted and a title for your plot. Plot these two functions using the vector x from 2 to 2. Use hold on to turn on the hold property of the figure and xlim to set the x axis to be from 2 to 2 and use ylim to set the y axis ranging from 4.5 to 4.5. You should get an output, like Figure 1:

- Plot the function below in a separate figure. Do not forget to label the axises and a legend to describe your function. Use xlim and ylim to set the axises ranging from -4 to 4 and -6 to 6, respectively.

\[
f = \begin{cases} 
x + 0.5\pi & x < -0.5\pi \\
\cos(x) & -0.5\pi < x < 0.5\pi \\
-x + 0.5\pi & x > 0.5\pi
\end{cases}
\]

(1)

Name of your file: Q2_92123456
Output: two figures
Figure 1: plotting $g \ f$