Experiment 1: Familiarization with MATLAB

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Objective: To learn about MATLAB and familiarize oneself with its usage and applicability to Signals and Systems

Software Required: MATLAB software R2015a

MatLab (**MATrix** Laboratory) is matrix based software package for computation engineering. Science and applied mathematics. It offers a powerful programming language, excellent graphics, and wide range of expert Knowledge. A numerical analyst called Cleve Moler wrote the first version of MATLAB in the year 1970.

NOTE :

(1) Open the Matlab : Double click on the Matlab **Icon** available on your computer desktop

(2) Use HELP / SEARCH DOCUMENTATION options of MATLAB

Run #01 :

Q1**.** Mention **ALL** Matlab windows.

Answer : Command Window, Editor Window, Workspace Window, Command History Window, Current Folder, File Details Window

Q2. (i) What is the purpose of command window in MATLAB?

Hint : use the option **SEARCH DOCUMENTATION** in your matlab window (Right side top corner)

(ii) Type a = 7 b = 8 in command window and calculate c = a + b what is c? Can you save this command and value?

Answer :
(i)It is used to enter matlab commands in the command line

(ii) c = 15. The command can not be saved using the command window. The workspace can be saved

Q3. What is the purpose of command history in MATLAB?

Answer : It is very useful when using the same commands multiple times in the command window.You can very easily access your previous commands (using the arrow keys).

Q4. (i) What is the purpose of Workspace in MATLAB?
(ii) Can you save this workspace file?
(iii) What is the extension of this workspace file?

Answer :
(i) The workspace contains all the data that is being used by the user. You can easily check the variable contents.

(ii) Yes, the workspace can be saved
(iii) '.mat' extension is used for workspace files

Q5. (i) What is the current directory that MATLAB is in?
(ii) How can you change the path of the current directory?

Answer :
(i) C:\Users\abhis\Documents\MATLAB

(ii) You can directly change it using the current directory window, or you can use 'cd [path]'in the command window.

Q6. (i) What is Editor Window?
(ii) What is the extension of the file that is saved in Editor Window?
(iii) What is m-file ?
(iv) Type “edit” command in command window and write your observations?

Answer :
(i) The Editor Window is a text editor where you can work with your MATLAB files

(ii)'.m'

(iii) These are script files which contain a series of commands.

(iv) The Editor Window pops up

Q7. Write comments on the following keywords related to different MATLAB windows (Command window, editor window, workspace window etc)

i. clc
ii. clear all
iii. clf
iv. help
v. lookfor
vi. pwd
vii. path

Answer :
1) clears the command window
2) clears the workspace
3)clear current figure window, deletes from the current figure all graphics objects whose handles are not hidden
4) To refer to documentation
5)Searches for a keyword in all help entries
6) Shows the current working directory.
7)displays the MATLAB search path

Run #02: Perform the following Simple Calculations using only **Command Window**

Q8. Arithmetic Operations:

i. Calculate the value of $\frac{10^5}{25^2-15}$ using power operator (or "power" command) of matlab.

ii. Calculate the area of a circle of radius 10 cm using multiplication and power operators of matlab. Hint: Keyword **for Π is pi).**

Answer :
1)(10^5)/((25^2)-15)
163.9344
2)10*10*pi
314.1593

Q9.Trigonometry Operations: Find the values of the following trigonometric functions in both radians and degrees

i. $\sin\frac{\pi}{6}$, $\cos\frac{\pi}{4}$ and $\tan\frac{\pi}{2}$

ii. $\sin^{-1}(-0.3)$ and $\cot^{-1}(3)$

Answer :

i. Radians: sin(pi/6) = 0.5000, cos(pi/4) = 0.7071, tan(pi/2) = 1.6331e+16
Degrees: sind(30) = 0.5000, cosd(45) = 0.7071, tand(90) = inf

ii. Radians: asin(-0.3)= -0.3047, acot(3)= 0.3218
Degrees: asind(-0.3) = -17.4576, acosd(3) = 18.4349

Q10. Complex Number Operations:

i. $\frac{1+5i}{1-5i}$ .Compare the result with matlab code and manual calculations.

ii. Calculate the angle and magnitude of the complex function $\frac{10-3i}{4+3i}$ using **abs** and **angle** functions of matlab

iii. Execute the commands exp(pi/2*i) and exp(pi/2i) using matlab code. Explain the differences between the two.

Answer :
i. a = 1+5*i, b = 1-5*i, ans = a/b : -0.9231 + 0.3846i
ii. a = 10-3*i, b = 4+3*i, c = a/b, abs(c) = 2.0881, angle(c) = -0.9350
iii. exp(pi/2*i) = 0.0000 + 1.0000i, 0.0000 - 1.0000i = 0.0000 - 1.0000i
First command's arg is (pi/2)*i and second command's arg is pi/(2*i)

Run #03: Vectors

Q11. What are the different ways to create a vector? (use help command)

Answer : [1,2,3,4], [1 2 3 4], 1:4, 1:1:4, linspace(1,4,4)

Q12. Create a row vector of your choice having 10 elements using matlab code

Answer : A = 1:10

Q13. Create a column vector of your choice having 5 elements/rows using matlab code

Answer : A = [1;2;3;4;5]

Q14.Given a vector V= [1 2 3 4 5 6 7 8 9 10 11 12]. Find the **size** of the vector.

Answer :
Ans = 1 12 (1x12)

Q15. Calculate the values of y for the equation y = mx+c for m = -5 and intercept value c = 10 for various value of x = 0, 1.6,5,9,15 and store the result in the vector y.

Answer :

```
x = [0 1.6 5 9 15]
m=-5
c=10
y=m*x + c
```

Q16. Create a vector t of 15 elements 1,2,3,…..15. Using this 't' vector compute y = t sin(t)

Answer :

```
t = 1:15
y = t.*sin(t)

y = Columns 1 through 10

    0.8415 1.8186 0.4234 -3.0272 -4.7946 -1.6765 4.5989 7.9149 3.7091 -5.4402

   Columns 11 through 15

    -10.9999 -6.4389 5.4622 13.8685 9.7543
```

Q17. Create two vectors, V1 and V2 of same size using **linspace** command and perform the following operations.

i. V_add = V1+V2
ii. V_sub = V1-V2
iii. V_mult = V1.*V2
iv. V_div = V1./V2

Answer :

```
V1=linspace(1,5,3);
V2=linspace(2,10,3);
1)3 9 15
2) -1 -3 -5
3) 2 18 50
4) 0.5000 0.5000 0.5000
```

(19) (i) Now create V1 and V2 of different sizes. Perform the above operations for this new V1 and V2. What happens when V1 and V2 are of different sizes?

(ii) Compute V_multi=V1*V2.Compare the answers with (iii) and write down your

conclusions.

Answer :

i. Error: matrix dimensions must agree.

ii. Error : Not valid because the matrix dimensions are not correct for matrix multiplication.

Conclusion: ".*" is for element wise multiplication of vectors and "*" is for matrix multiplication.

Link for uploading the completed observation:

https://forms.gle/f6ZAENbt8KMMTBiQ6

Due on 31/01/2021 Sunday 5 PM

Run #04: Try yourself

Note: WHEN YOU ARE WRITING A MATLAB PROGRAM AND SAVING IT AS .m file NAME OF THE FILE SHOULD NOT BE THE SAME AS EXISTING MATLAB FUNCTIONS. For e.g. if you are writing a MATLAB program to generate sine wave YOU SHOULD NOT give the file name as sin because MATLAB already has a built in function named 'sin'

Q20. Create a two vectors V1 and V2 such that V1 goes from 1 to 20 in steps/increments of 2, V2 goes from 1 to 50 in steps of 5.Find the size of each vector.Now create a new vector V3 by appending V1 to V2. What is the size of this appended array V3?

Q21. Find the values of the following trigonometric functions in both radians and degrees

i. $Y=\sin^2\frac{\pi}{6}+\cos^2\frac{\pi}{6}$

ii. $Y=\cosh^2 x+\cos^2 x$ at $x=32\pi$

Q22. Create a vector t of 15 elements 1,2,3,…..15. Using this 't' vector compute the following

i. $Y=\frac{t-1}{t+1}$

ii. $Y=\frac{\sin(t^2)}{t^2}$

Q23. If R = 10 Ohms and the current is increased from 0 to 10 A with increments of 2A, write a MATLAB.mfile program (use only editor window. Note : You can't use command window, why ?) that calculates voltage and power dissipation for the given current values using MATLAB vector multiplication approach. . Display voltage and power values in the command window.

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