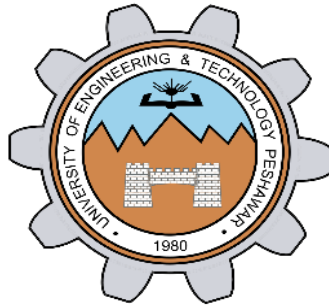


DIGITAL SIGNAL PROCESSING LAB

Fall 2024, 5th Semester

Lab Report 2




Submitted by: Hassan Zaib Jadoon

Registration Number: 22PWCSE2144

Section: A

"On my honor, as a student at the University of Engineering and Technology Peshawar, I have neither given nor received unauthorized assistance on this academic work."

Signature: 

Submitted To: Dr. Yasir Saleem Afridi

Department of Computer Systems Engineering

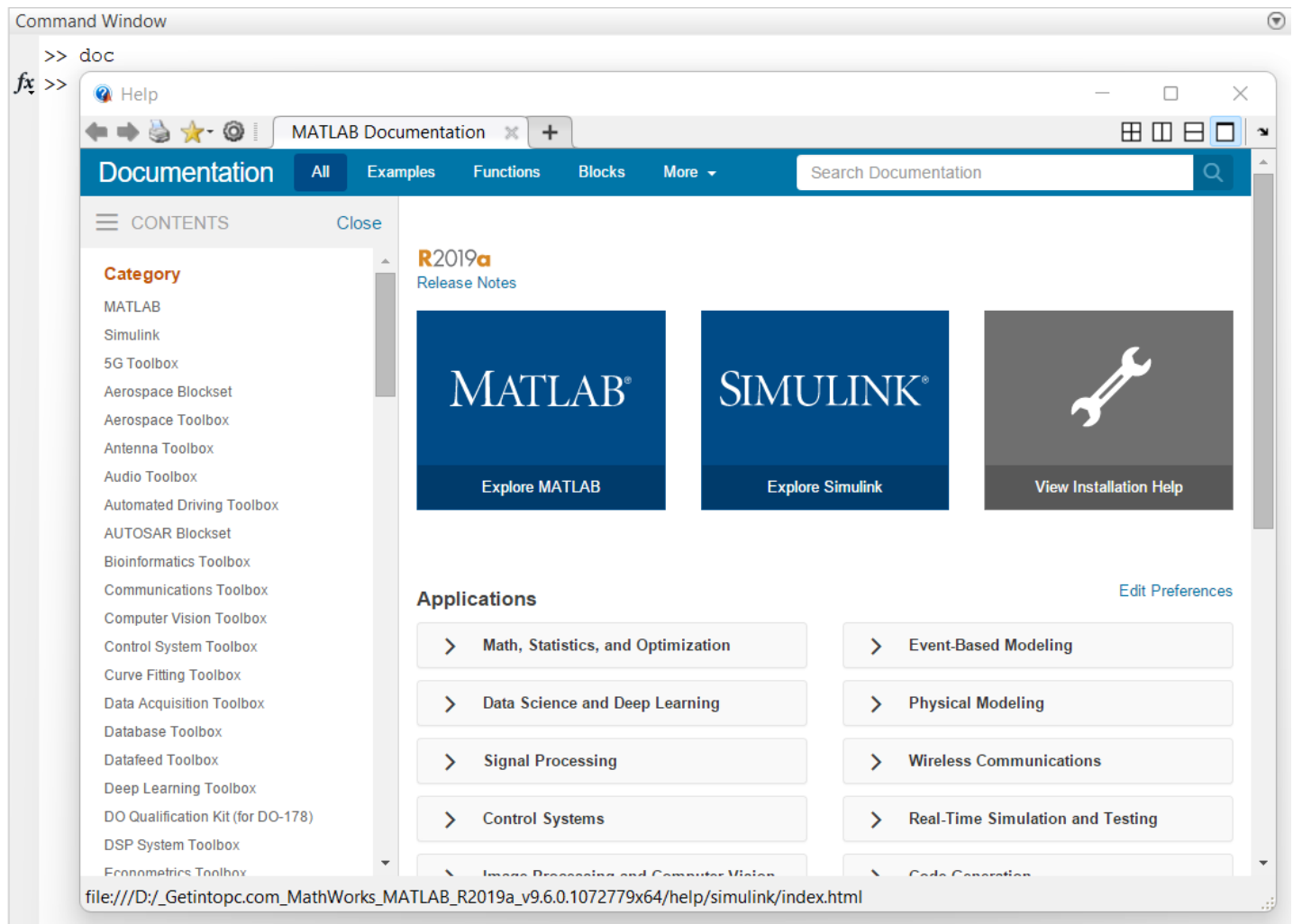
University of Engineering and Technology Peshawar

Lab Report 2

Playing with MATLAB

(a) Run the MATLAB help desk by typing `doc`. The help desk provides a hypertext interface to the MATLAB documentation. Two links of interest are Getting Started and Getting Help in MATLAB. Both are under the Documentation Set.

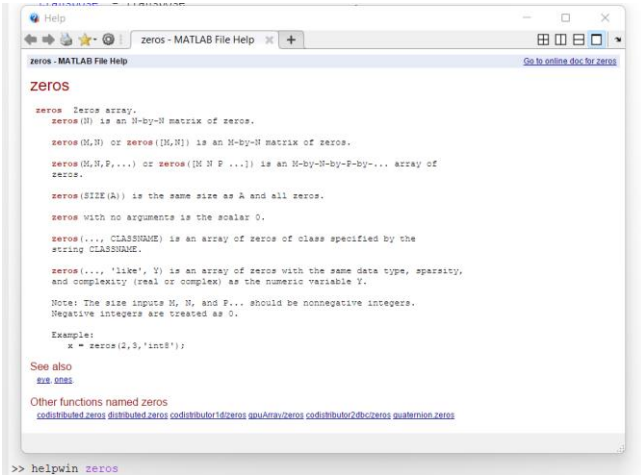
Screenshot:



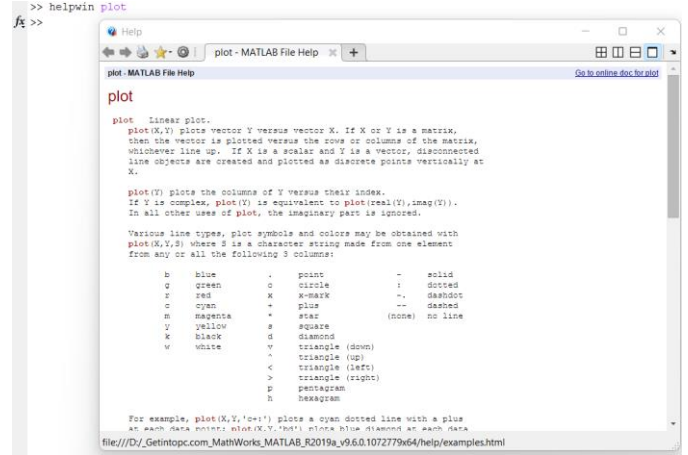
Remarks: This will open documentation of MATLAB, which will show us the complete documentation including all the functions.

(a) Explore the MATLAB `helpwin` capability available at the command line. Try the following:

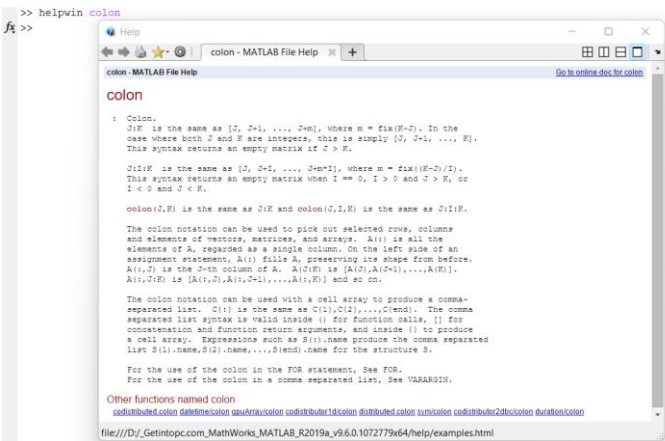
```
helpwin
helpwin plot
helpwin colon    %<--- a VERY IMPORTANT notation
helpwin ops
helpwin zeros
helpwin ones
lookfor filter    %<--- keyword search
```



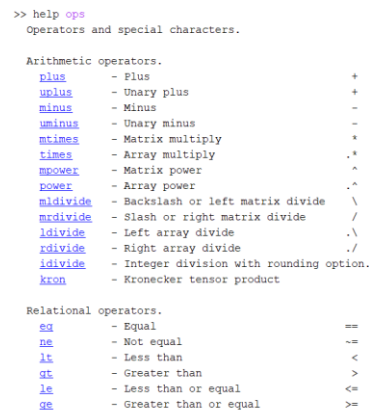
Remarks: This command brings up information about the zeros function, which creates an array filled with zeros.



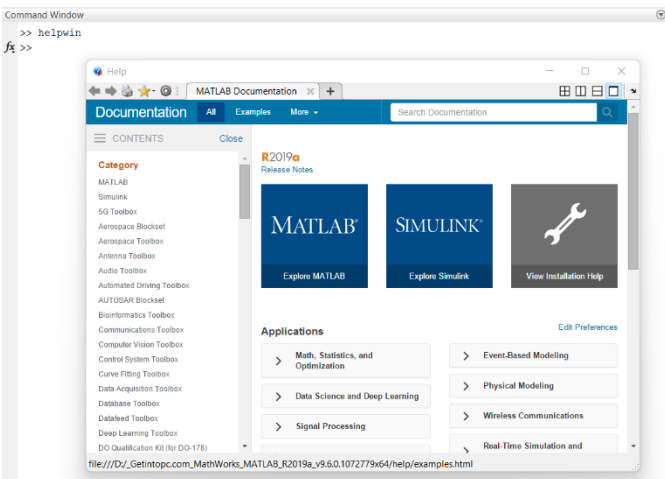
Remarks: This opens help specifically for the plot function, showing us how to make different types of plots.



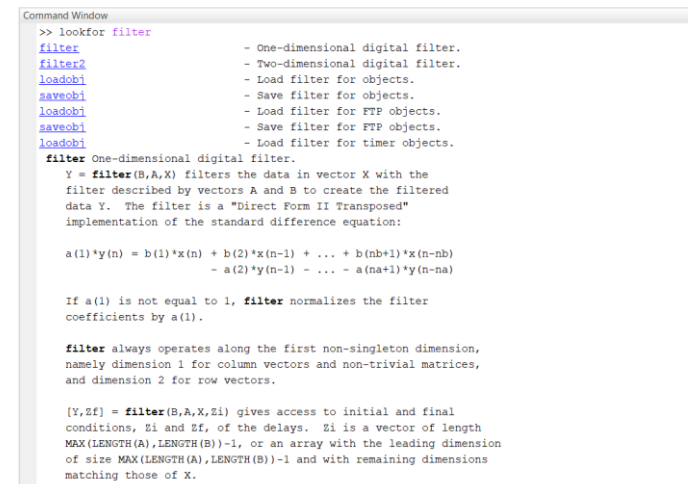
Remarks: This opens help for the colon (:) notation



Remarks: This shows help for basic operators like +, -, *, and /, telling how to do calculations in MATLAB.

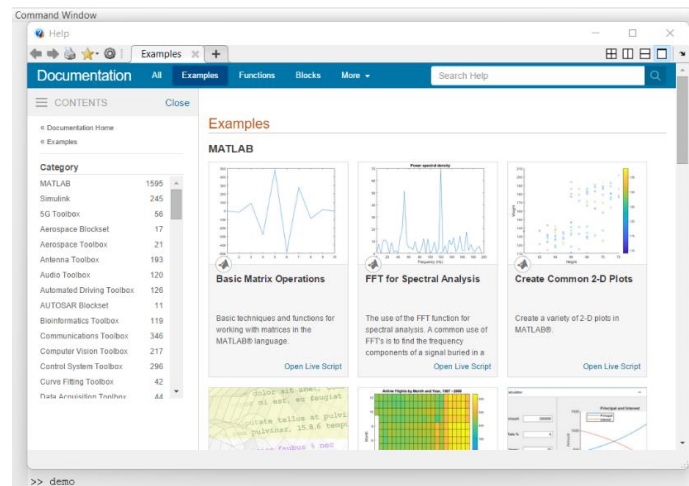


Remarks: This command shows detailed information about different functions, helping us understand what each one does.



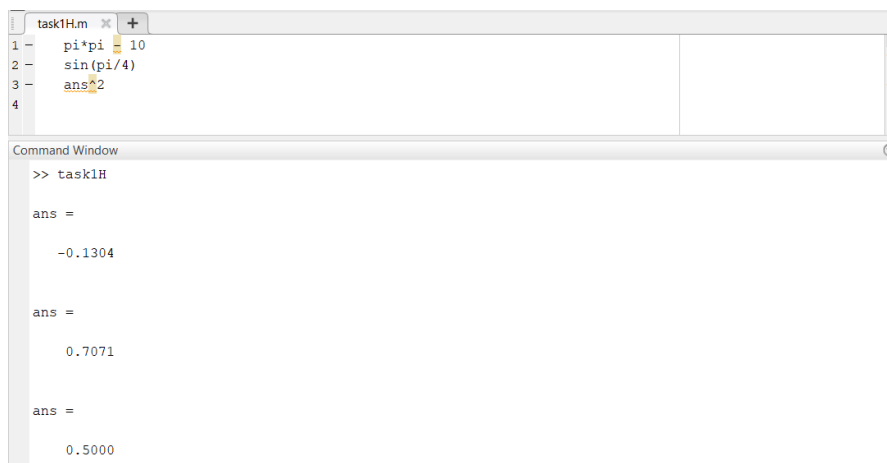
Remarks: This searches for all functions related to "filter"

c) Run the MATLAB demos: type demo and explore a variety of basic MATLAB commands and plots.



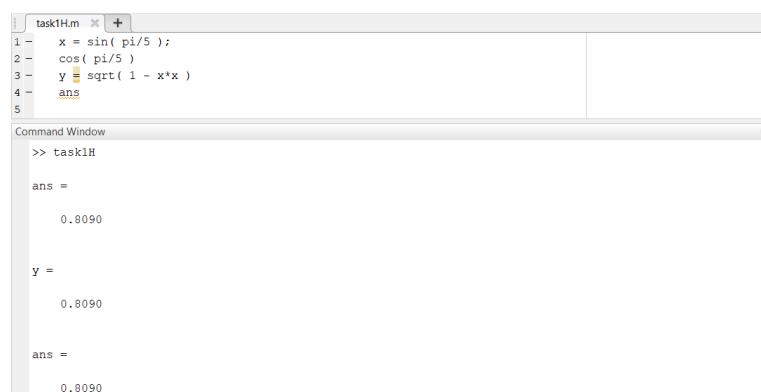
Remarks: We can check the MATLAB documentation using the demo command. It will show us the complete documentation including all the functions.

d) Use MATLAB as a calculator. Try the following:



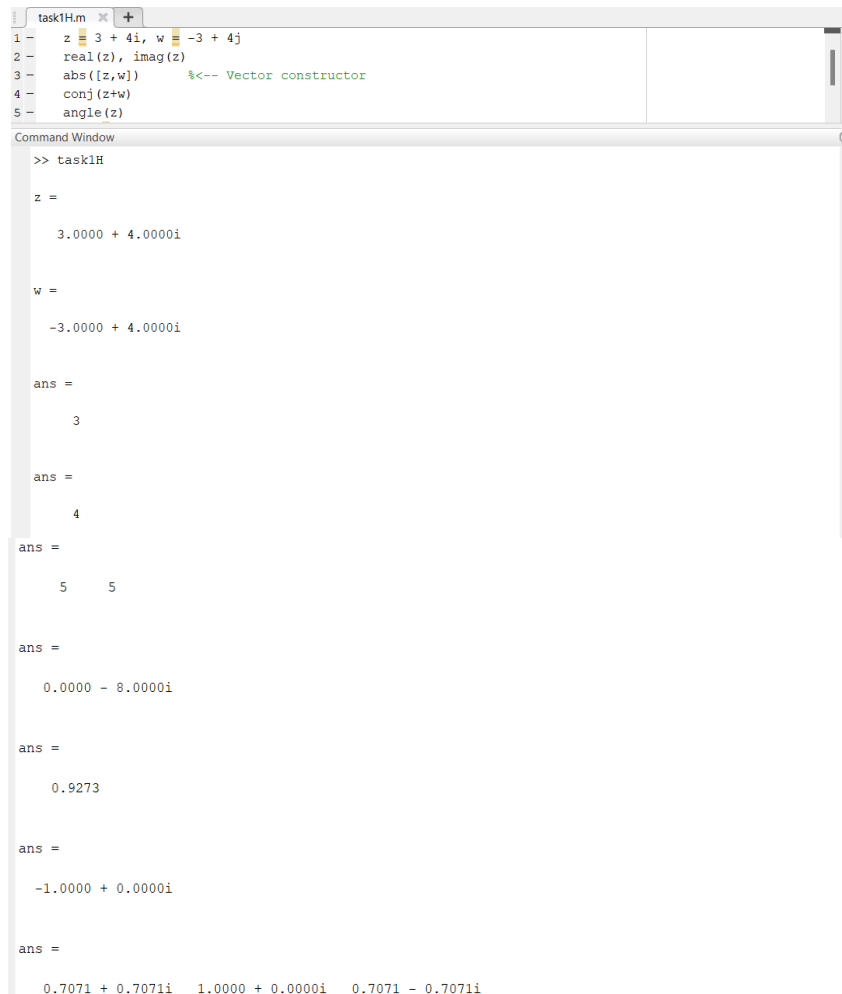
Remarks: We can multiply the variables in the command window using our MATLAB as a calculator

e) Do variable name assignment in MATLAB. Try the following:



Remarks: This allows us to save numbers or text with a name, so we can use them easily later on.

f) Complex numbers are natural in MATLAB. The basic operations are supported. Try the following:



```

1 - z = 3 + 4i, w = -3 + 4j
2 - real(z), imag(z)
3 - abs([z,w]) %<-- Vector constructor
4 - conj(z+w)
5 - angle(z)

```

Command Window

```

>> task1H

z =

    3.0000 + 4.0000i

w =

   -3.0000 + 4.0000i

ans =

     3

ans =

     4

ans =

     5     5

ans =

    0.0000 - 8.0000i

ans =

    0.9273

ans =

   -1.0000 + 0.0000i

ans =

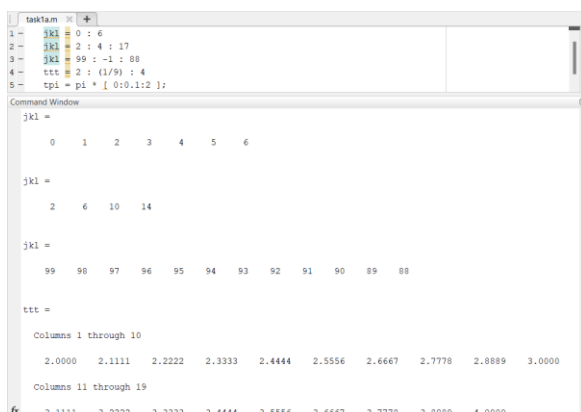
    0.7071 + 0.7071i    1.0000 + 0.0000i    0.7071 - 0.7071i

```

Remarks: MATLAB supports calculations with complex numbers (having both real and imaginary parts), which is helpful.

MATLAB Array Indexing

(a) Make sure that you understand the colon notation. Explain in words what the following MATLAB code will produce.



```

1 - jkl = 0 : 6
2 - jkl = 2 : 4 : 17
3 - jkl = 99 : -1 : 88
4 - ttt = 2 : (1/9) : 4
5 - tpi = pi * [ 0:0.1:2 ];

```

Command Window

```

jkl =

     0     1     2     3     4     5     6

jkl =

     2     6    10    14

jkl =

    99    90    97    96    95    94    93    92    91    90    89    88

ttt =

Columns 1 through 10
    2.0000    2.1111    2.2222    2.3333    2.4444    2.5556    2.6667    2.7778    2.8889    3.0000

Columns 11 through 19
    3.1111    3.2222    3.3333    3.4444    3.5556    3.6667    3.7778    3.8889    4.0000

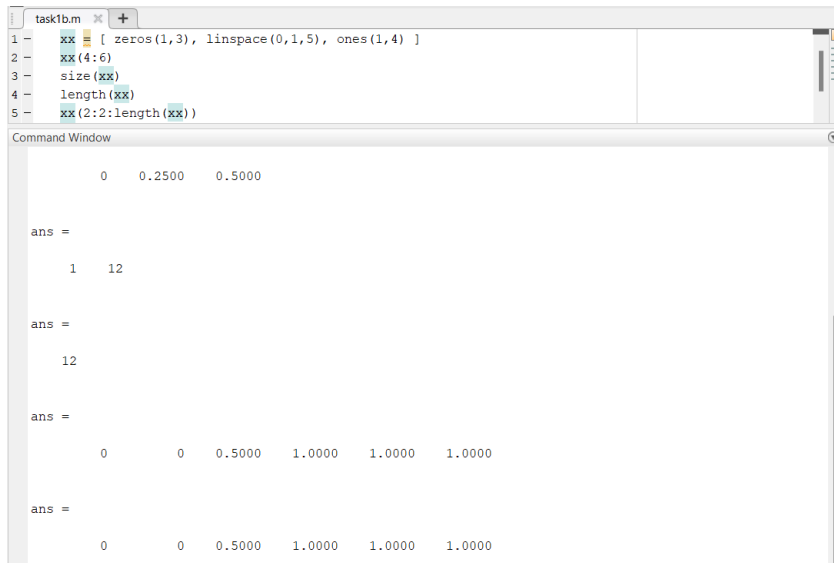
tpi =

    0.0000    0.3142    0.6283    0.9425    1.2566    1.5708    1.8849    2.1991    2.5133    2.8274    3.1416    3.4558    3.7699    4.0841    4.3982    4.7124    5.0265    5.3407    5.6549    5.9690    6.2832

```

Remarks: This will let us select specific parts of an array using colons, making it easy to pull out the data which is needed.

- b) Extracting and/or inserting numbers into a vector is very easy to do. Consider the following definition of `xx`:



```

1 - xx = [ zeros(1,3), linspace(0,1,5), ones(1,4) ]
2 -
3 - size(xx)
4 - length(xx)
5 - xx(2:2:length(xx))

```

Command Window

```

0    0.2500    0.5000

ans =

     1     12

ans =

    12

ans =

     0         0    0.5000    1.0000    1.0000    1.0000

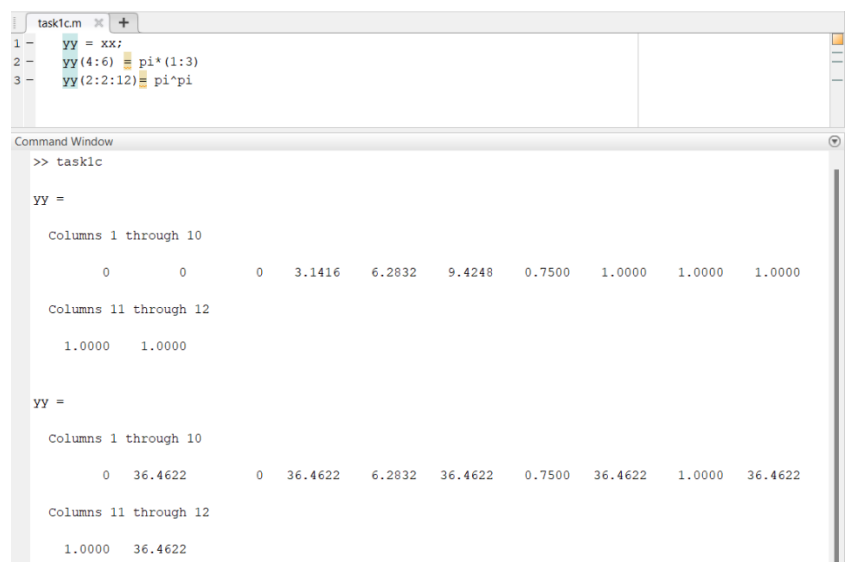
ans =

     0         0    0.5000    1.0000    1.0000    1.0000

```

Remarks: This will be inserting numbers into vector.

- (c) Observe the result of the following assignments:



```

1 - yy = xx;
2 - yy(4:6) = pi*(1:3)
3 - yy(2:2:12) = pi*pi

```

Command Window

```

>> task1c

yy =

Columns 1 through 10

     0         0         0    3.1416    6.2832    9.4248    0.7500    1.0000    1.0000    1.0000

Columns 11 through 12

    1.0000    1.0000

yy =

Columns 1 through 10

     0   36.4622         0   36.4622    6.2832   36.4622    0.7500   36.4622    1.0000   36.4622

Columns 11 through 12

    1.0000   36.4622

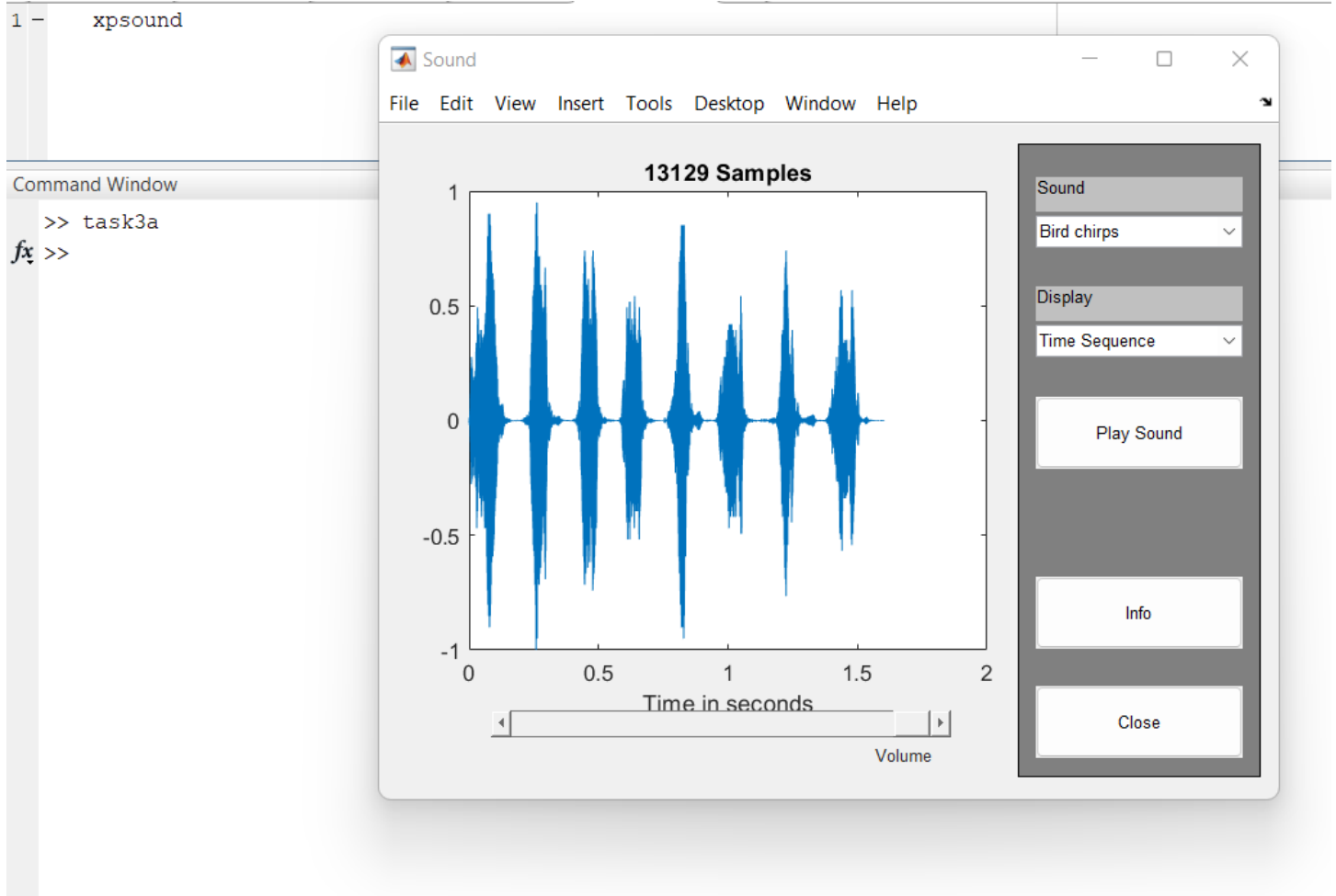
```

Remarks:

This will replace values of vector `xx` at specific index.

MATLAB Script Files

- (a) Run the MATLAB sound demo by typing `xpsound` at the MATLAB prompt. If you are unable to hear the sounds in the MATLAB demo then ask for help.



Remarks: The `xpsound` command plays sound

b)

```
task3b.m
1 - fs = 11025;
2 - f = 2000;
3 - dur = 0.9;
4 - tt = 0:(1/fs):dur;
5 - xx = cos(2*pi*f*tt);
```

Remarks: This will create a time signal and then by using time signal values, we are creating cosine signal values.

- c) The frequency of your sinusoidal tone should be 2000 Hz and its duration should be 0.9 sec. Use a sampling rate (f_s) equal to 11025 samples/sec. The sampling rate dictates the time interval between time points, so the time-vector should be defined as follows:

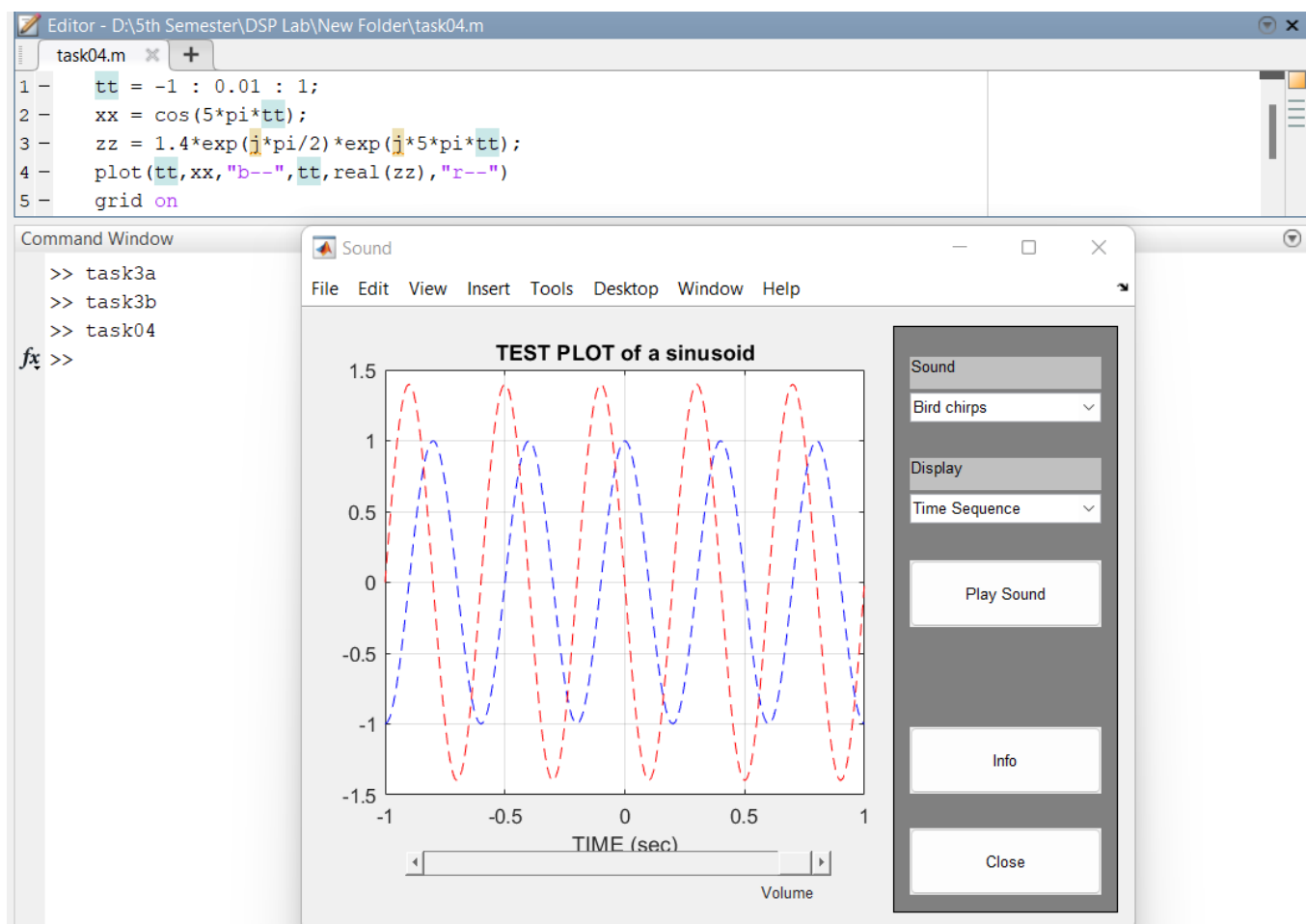
```

Editor - D:\5th Semester\DSP Lab\New Folder\task3b.m
task3b.m
1 - fs =11025;
2 - f=2000;
3 - dur=0.9;
4 - tt= 0:(1/fs):dur;
5 - xx= cos(2*pi*f*tt);
6 - sound(xx, fs)

```

Remarks: This helps us set the frequency and duration of a tone

- d) Use the built-in MATLAB editor to create a script file called mylab1.m containing the following lines:



Remarks: This will be plotting signal.

CSE 402L: Digital Signal Processing

| Demonstration of Concepts | Poor (Does not meet expectation (1)) The student failed to demonstrate a clear understanding of the assignment concepts | Fair (Meet Expectation (2-3)) The student demonstrated a clear understanding of some of the assignment concepts | Good (Exceeds Expectation (4-5)) The student demonstrated a clear understanding of the assignment concepts | Score 30% |
|----------------------------------|---|---|---|--------------------------------|
| Accuracy | The student completed (<50%) tasks and provided MATLAB code and/or Simulink models with errors. Outputs shown are not correct in form of graphs (no labels) and/or tables along with incorrect analysis or remarks. | The student completed partial tasks (50% - <90%) with accurate MATLAB code and/or Simulink models. Correct outputs are shown in form of graphs (without labels) and/or tables along with correct analysis or remarks. | The student completed all required tasks (90%-100%) with accurate MATLAB code and/or Simulink models. Correct outputs are shown in form of labeled graphs and/or tables along with correct analysis or remarks. | 30% |
| Following Directions | The student clearly failed to follow the verbal and written instructions to successfully complete the lab | The student failed to follow the some of the verbal and written instructions to successfully complete all requirements of the lab | The student followed the verbal and written instructions to successfully complete requirements of the lab | 20% |
| Time Utilization | The student failed to complete even part of the lab in the allotted amount of time | The student failed to complete the entire lab in the allotted amount of time | The student completed the lab in its entirety in the allotted amount of time | 20% |