PLAYING WITH MATLAB

LAB # 02

Fall 2023

CSE-402L

Digital Signal Processing Lab

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Class Section: **A**

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

Student Signature: ______________

Submitted to:

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Wednesday, October 11, 2023

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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%**

Dr. Yasir Saleem Afridi

Playing With MATLAB

Objectives:

- Revise matlab
- Assignment, variables, lopes, plot, sound, colon operators etc

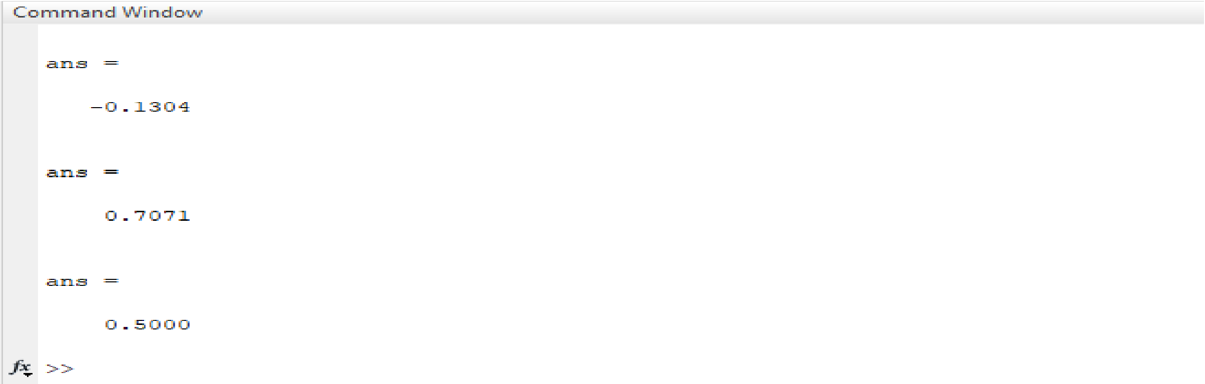
Tasks:

Task 1.1 (d): Use MATLAB as a calculator

Code:

```
clear all;
clc;
close all;
pi*pi - 10
sin(pi/4)
ans ^ 2
```

Output:



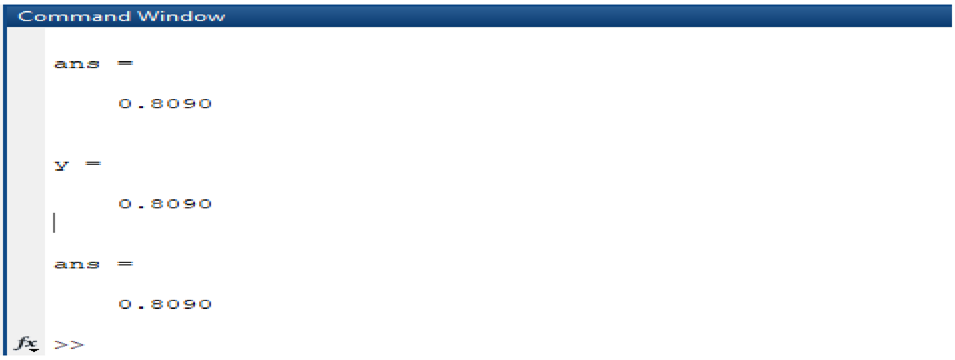
```
ans =

   -0.1304


ans =

    0.7071


ans =

    0.5000

>>
```

Task 1.1 (e): Do variable name assignment in MATLAB.

Code:

```
clear all;
clc;
close all;
x = sin( pi/5 );
cos( pi/5 ) %<--- assigned to what?
y = sqrt( 1 - x*x )
ans
```

Output:



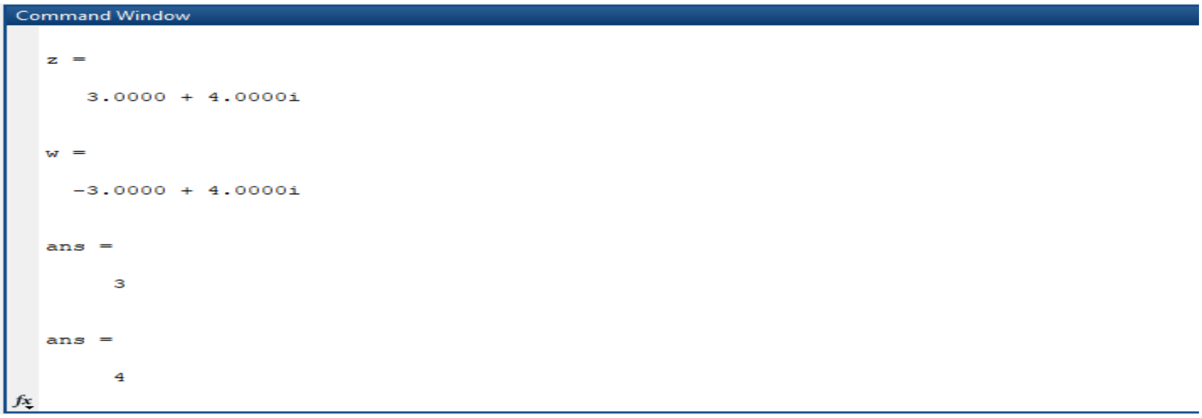
```
ans =

      0.8090

y =

      0.8090

ans =

      0.8090

>>
```

Task 1.1(f): Complex numbers are natural in MATLAB.

Code:

```
clear all;
clc;
close all;
z = 3 + 4i, w = -3 + 4j
real(z), imag(z)
abs([z,w]) %<-- Vector constructor
conj(z+w)
angle(z)
exp( j*pi )
exp(j*[ pi/4, 0, -pi/4 ])
```

Output:



```
z =

   3.0000 + 4.0000i

w =

  -3.0000 + 4.0000i

ans =

      3

ans =

      4
```

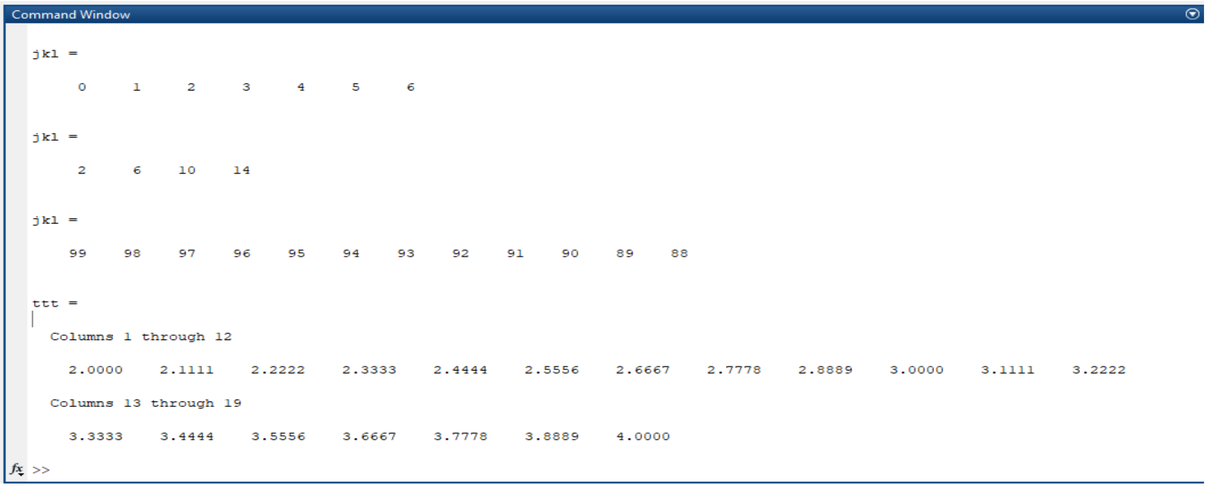
Task 2.1: MATLAB Array Indexing

Code:

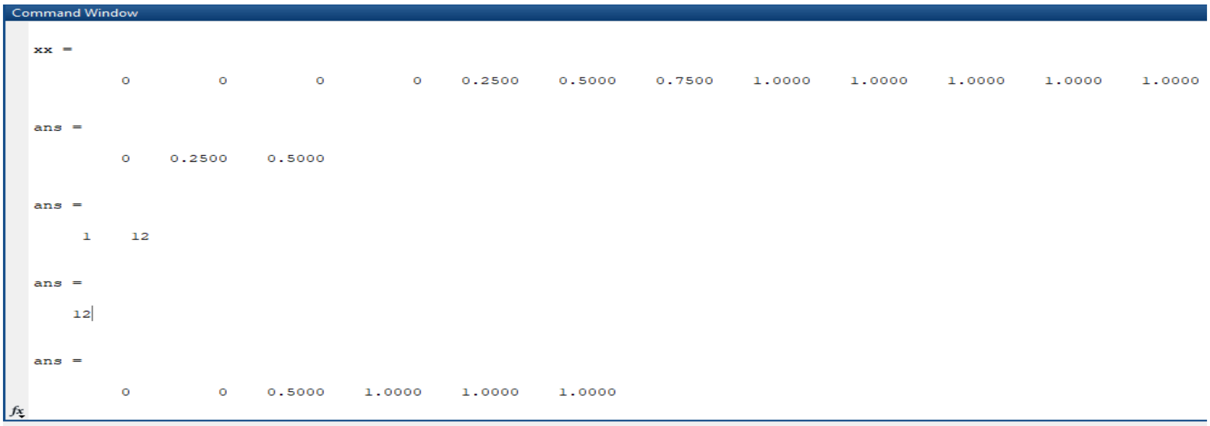
```
clc;
clear all;
close all;
```

```
%% (a)  Make sure that you understand the colon notation. In
particular, explain in words what the following MATLAB code will
produce
jkl = 0 : 6
jkl = 2 : 4 : 17
jkl = 99 : -1 : 88
ttt = 2 : (1/9) : 4
tpi = pi * [ 0:0.1:2 ];

%% (b)  Extracting and/or inserting numbers into a vector is very
easy to do.
xx = [ zeros(1,3), linspace(0,1,5), ones(1,4) ]
xx(4:6)
size(xx)
length(xx)
xx(2:2:length(xx))
xx(2:2:end)

%% (c)  Observe the result of the following assignments
yy = xx;
yy(4:6) = pi*(1:3)
```

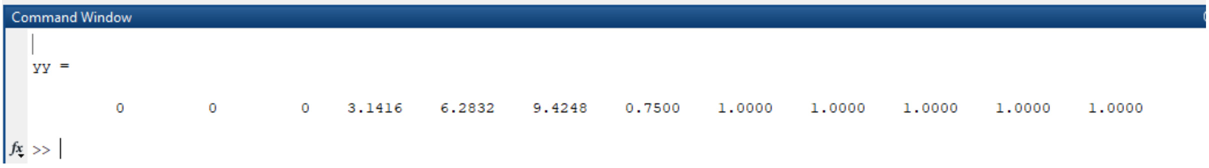
Output:



```
jkl =

     0     1     2     3     4     5     6


jkl =

     2     6    10    14


jkl =

    99    98    97    96    95    94    93    92    91    90    89    88


ttt =

  Columns 1 through 12

    2.0000    2.1111    2.2222    2.3333    2.4444    2.5556    2.6667    2.7778    2.8889    3.0000    3.1111    3.2222

  Columns 13 through 19

    3.3333    3.4444    3.5556    3.6667    3.7778    3.8889    4.0000

>>
```



```
xx =

         0         0         0         0    0.2500    0.5000    0.7500    1.0000    1.0000    1.0000    1.0000    1.0000


ans =

         0    0.2500    0.5000


ans =

     1    12


ans =

    12


ans =

         0         0    0.5000    1.0000    1.0000    1.0000
```



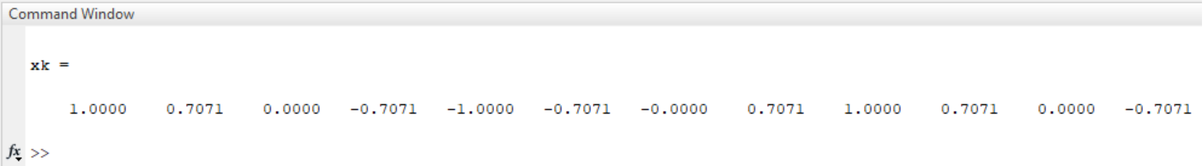
```
yy =

         0         0         0    3.1416    6.2832    9.4248    0.7500    1.0000    1.0000    1.0000    1.0000    1.0000

>>
```

Task 2.2: MATLAB Script Files

Code:

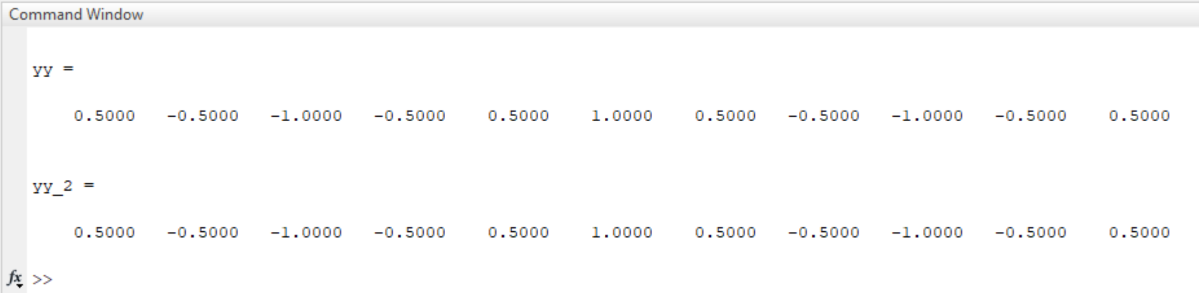
```
clc;
clear all;
close all;

%% (a)  Experiment with vectors in MATLAB. Think of the vector as a
set of numbers.
xk = cos( pi*(0:11)/4 ) %<---comment: compute cosines

%% (b) Rewrite this computation without using the loop (follow the
style in the previous part).
yy = [ ]; %<--- initialize the yy vector to be empty
for k=-5:5
yy(k+6) = cos( k*pi/3 )
end
yy_2 = cos(pi*(-5:5)/3)

%% (c)  Plotting is easy in MATLAB for both real and complex
numbers. The basic plot command will plot a vector y versus a vector
x connecting successive points by straight lines.
x = [-3 -1 0 1 3];
y = x.*x - 3*x;
plot( x, y )
z = x + y*sqrt(-1)
plot( z ) %<---- complex values: plot imag vs. real

%% (d)  Use the built-in MATLAB editor to create a script file
called mylab1.m containing the following lines
tt = -1 : 0.01 : 1;
xx = cos(5*pi*tt);
zz = 1.4*exp(j*pi/2)*exp(j*5*pi*tt);
plot(tt, xx, 'b-', tt, real(zz), 'r--') %<--- plot a sinusoid
grid on
title('TEST PLOT of a S')

%% (e)  Run your script from MATLAB. To run the file mylab1 that you
created previously, try
mylab1 %<---will run the commands in the file
type mylab1 %<---will type out the contents of
% mylab1.m to the screen
```

Output:



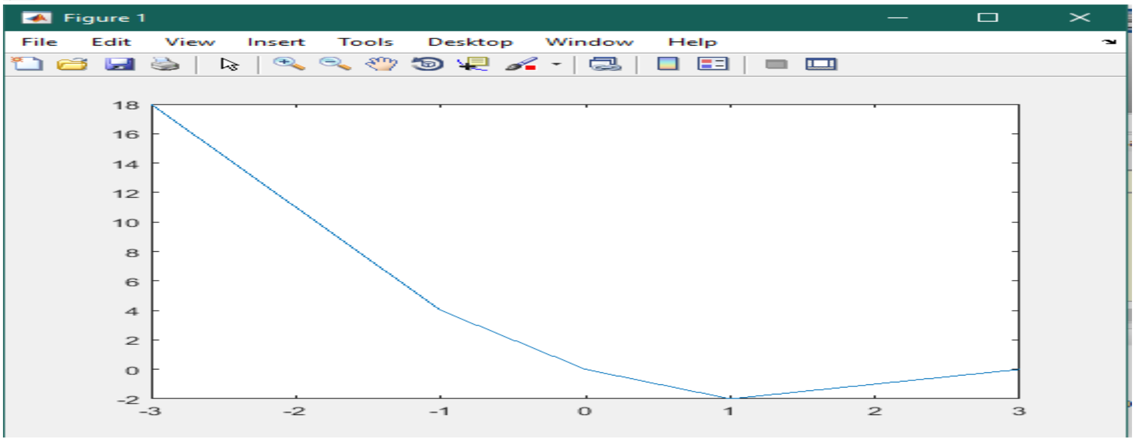
Command Window

```
xk =

   1.0000    0.7071    0.0000   -0.7071   -1.0000   -0.7071   -0.0000    0.7071    1.0000    0.7071    0.0000   -0.7071

fx >>
```



Command Window

```
yy =

   0.5000   -0.5000   -1.0000   -0.5000    0.5000    1.0000    0.5000   -0.5000   -1.0000   -0.5000    0.5000


yy_2 =

   0.5000   -0.5000   -1.0000   -0.5000    0.5000    1.0000    0.5000   -0.5000   -1.0000   -0.5000    0.5000

fx >>
```

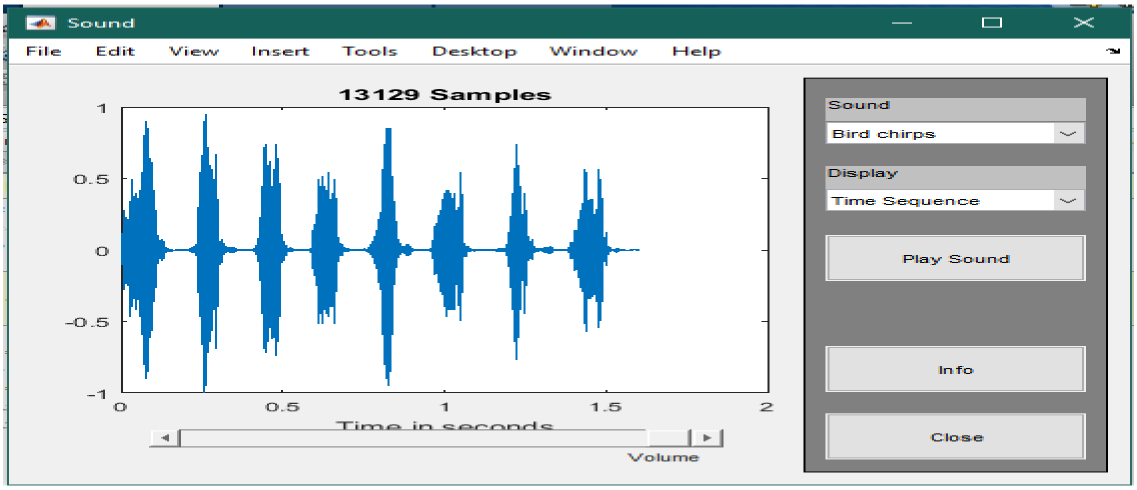


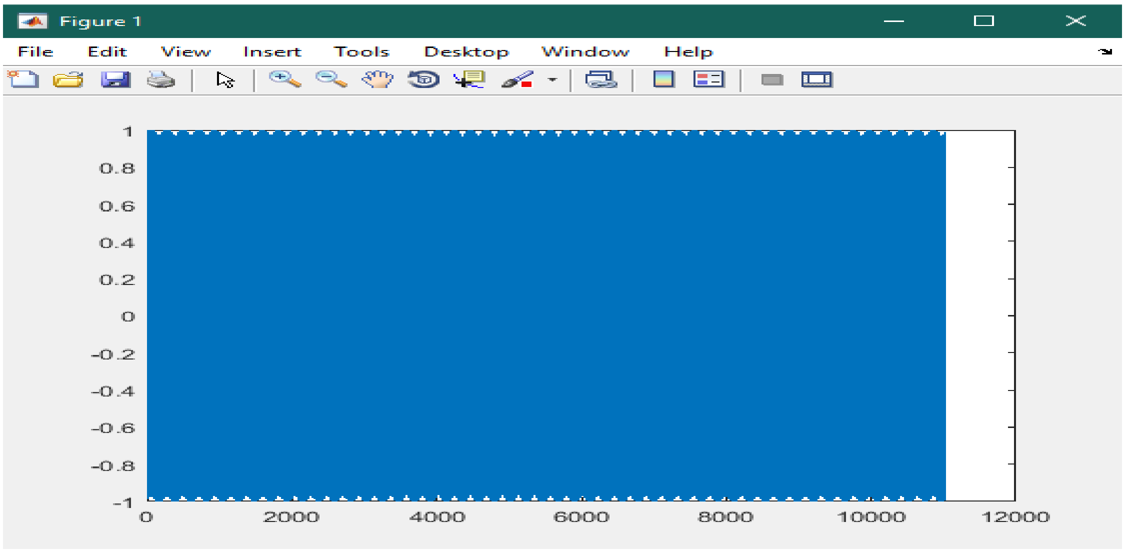
Task 2.3: MATLAB Sound

Code:

```
clc;
clear all;
close all;

%% (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
xpsound

%% (b)  Now generate a tone (i.e., a sinusoid) in MATLAB and listen
to it with the soundsc() command.
fs = 11025;
dur = 1;
tt = 0:(1/fs):dur;
sound = sin(2*pi*2000*tt);
plot(sound);
soundsc(sound, fs);
```

Output:





Conclusion:

In this lab we have revised the matlab concepts and syntax. We also learnt how can we replace a loop by colon operator, accessing via ans variable, and most significantly is how can we generate, play, pause and plot a sound using matlab.

The End.