LAB 1

Introduction to MATLAB

ECEn 380 Section 001

LAB 1

Objective First objective is to learn the basics of MATLAB. The second objective is to get familiar with data acquisition in MATLAB.

Task 1 When executing the following code:

index 3 = 0 : 2*pi/10 : 2*pi

this is the output:

0 0.6283 1.2566 1.8850 2.5133 3.1416 3.7699 4.3982
5.0265 5.6549 6.2832

when executing length(index3), it returns 11. This is due to the fact that 0 is included.

After executing the following code:

array2 = array1
array2(2:3, 2:3) = [0.5 0.5 ; 0.7 0.7]

It changed the contents of array2. It replaced the 2X2 block in ~~position~~ row 2 & 3 and column 2 & 3 with
0.5 0.5
0.7 0.7

Here are some more examples of working with arrays:

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```
>> array4 = randn(4:4)

array4 =

    0.5377    0.3188    3.5784    0.7254
    1.8339   -1.3077    2.7694   -0.0631
   -2.2588   -0.4336   -1.3499    0.7147
    0.8622    0.3426    3.0349   -0.2050

>> array4(2:3,1:2) = [1 2; 3 4]

array4 =

    0.5377    0.3188    3.5784    0.7254
    1.0000    2.0000    2.7694   -0.0631
    3.0000    4.0000   -1.3499    0.7147
    0.8622    0.3426    3.0349   -0.2050
```

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```
>> array5(3, 3) = [0]

array5 =

   -0.1241   -1.2075    0.7269   -1.1471    0.3252
    1.4897    0.7172   -0.3034   -1.0689   -0.7549
    1.4090    1.6302         0   -0.8095    1.3703
    1.4172    0.4889   -0.7873   -2.9443   -1.7115
```

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When the following input is entered $m1=[1\,4\,3;\ 2\,3\,1;\ 5\,4\,3]$
$m2=[1\,1\,1;\ 0\,0\,1;\ 0\,2\,0]$
$m1 * m2$

the output is: $\begin{bmatrix} 1 & 7 & 5 \\ 2 & 4 & 5 \\ 5 & 11 & 9 \end{bmatrix}$

Here is the hand calculation to verify: $\begin{bmatrix} 1 & 4 & 3 \\ 2 & 3 & 1 \\ 5 & 4 & 3 \end{bmatrix} \cdot \begin{bmatrix} 1 & 1 & 1 \\ 0 & 0 & 1 \\ 0 & 2 & 0 \end{bmatrix}$

$$= \begin{bmatrix} 1\cdot1+4\cdot0+3\cdot0 & 1\cdot1+4\cdot0+3\cdot2 & 1\cdot1+4\cdot1+3\cdot0 \\ 2\cdot1+3\cdot0+1\cdot0 & 2\cdot1+3\cdot0+1\cdot2 & 2\cdot1+3\cdot1+1\cdot0 \\ 5\cdot1+4\cdot0+3\cdot0 & 5\cdot1+4\cdot0+3\cdot2 & 5\cdot1+4\cdot1+3\cdot0 \end{bmatrix} = \begin{bmatrix} 1 & 7 & 5 \\ 2 & 4 & 5 \\ 5 & 11 & 9 \end{bmatrix}$$

The difference between the operations m1^2 and m1.^2 is that the first command times the m1 matrix by itself. and the second command squares each element in the m1 matrix.
The results for m1^2 is: $\begin{bmatrix} 24 & 28 & 16 \\ 13 & 21 & 12 \\ 28 & 44 & 28 \end{bmatrix}$ Results for m1.^2: $\begin{bmatrix} 1 & 16 & 9 \\ 4 & 9 & 1 \\ 25 & 16 & 9 \end{bmatrix}$

We created a 400 Hz tone s1 by evaluating sin(2·pi·400·t) over a 10 second period. The difference between sampling at a rate of 1/16000 seconds and 1/48000 seconds is that the tone became higher pitched.

We plot and played: s2 = s1.*(t>3).*(t<5); (see Graph1)
In this command, the (t>3) and (t<5) is acting like a filter. So any number above 5 and under three would make s1 multiply by 0.

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~~Signoff~~

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~~Task 2 Data Acquisition~~

Plot index 3

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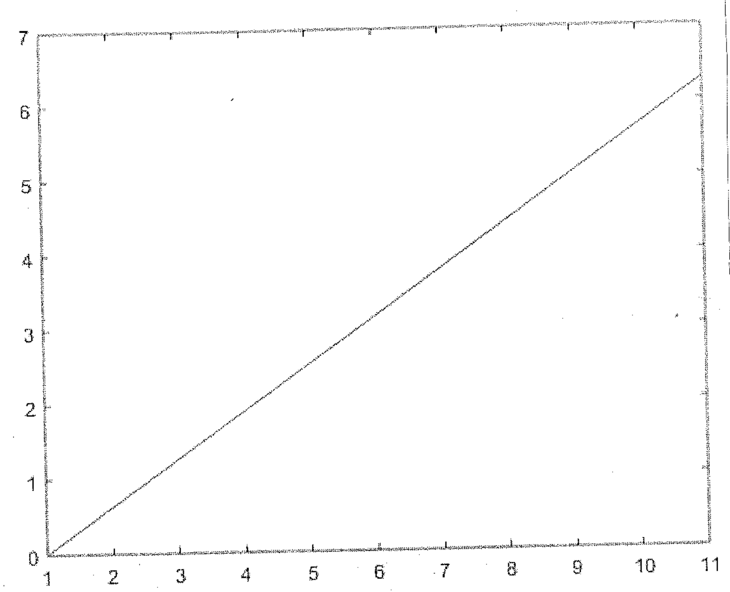

Plot sin index 3

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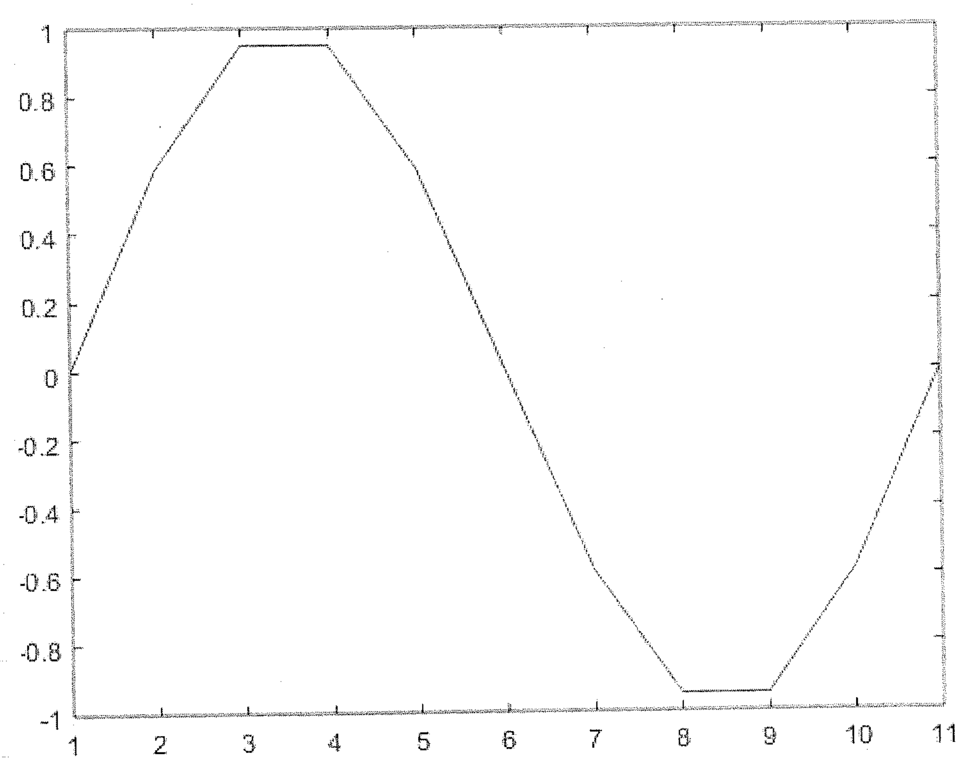

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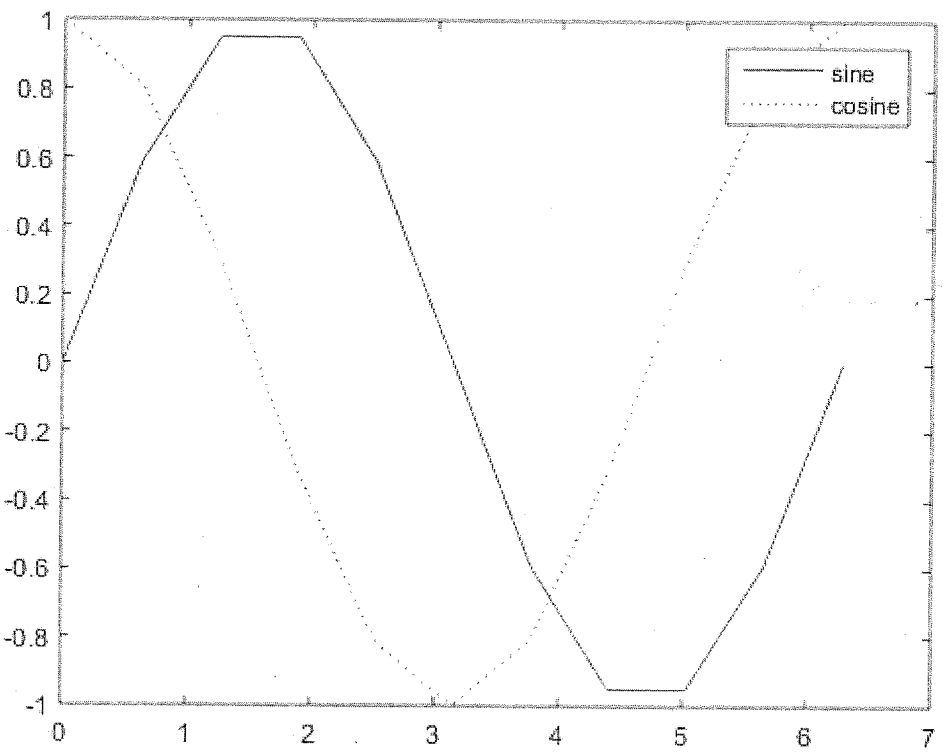
Sin(index3) cos(index3)



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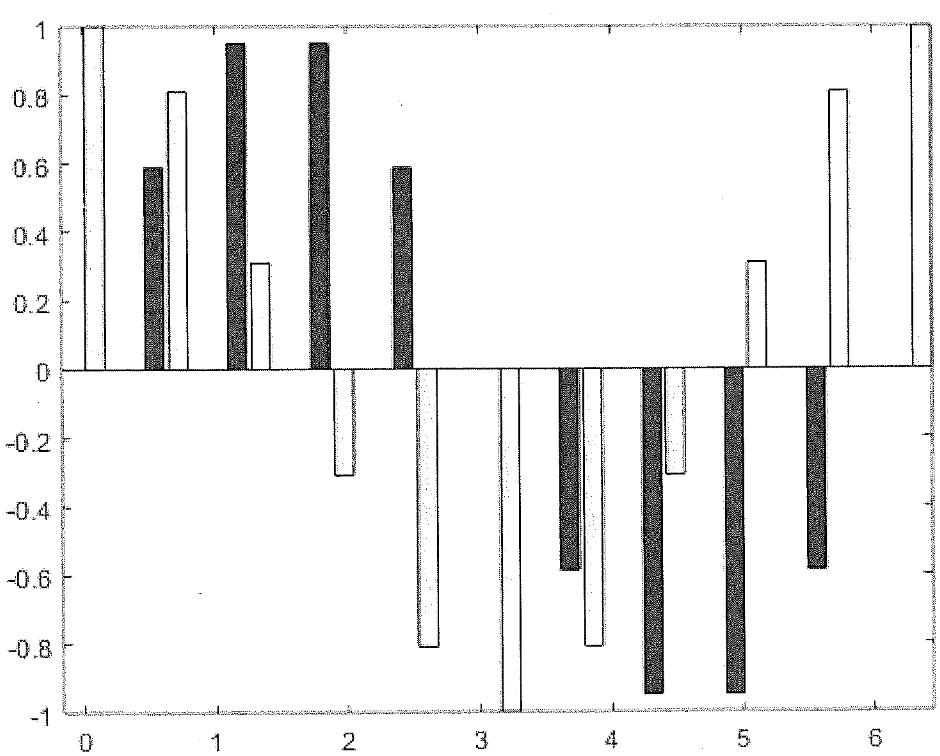
Bar Plot



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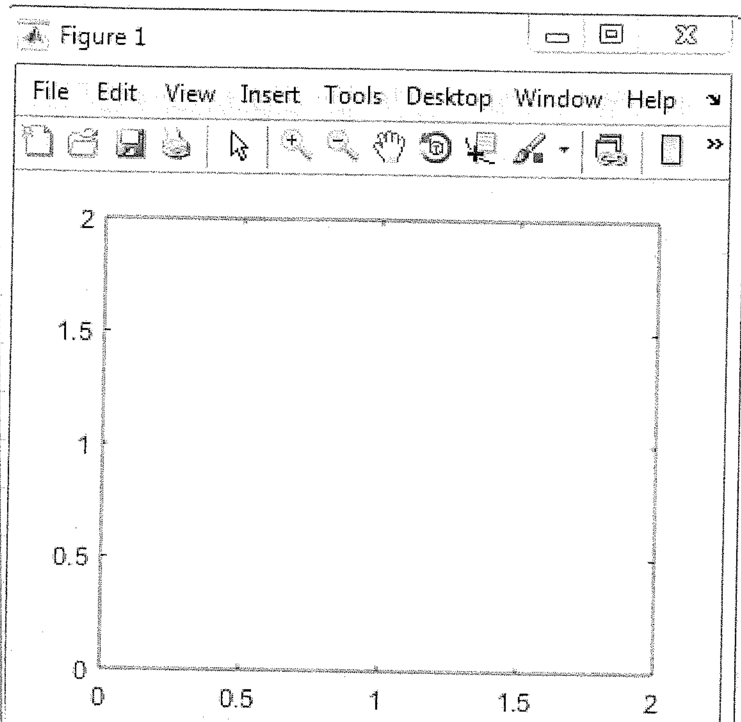
```
figure(1);
y = 1;
plot(1, 1, 'g');
```



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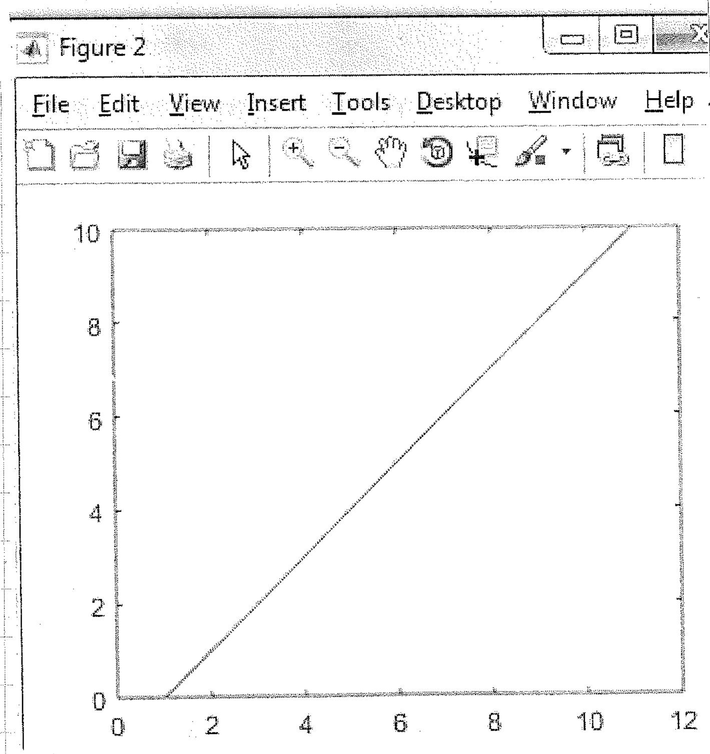
```
figure(2);
x = 0:1:10;
plot(x);
```



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```
figure(3);
plot(x.^2);
```

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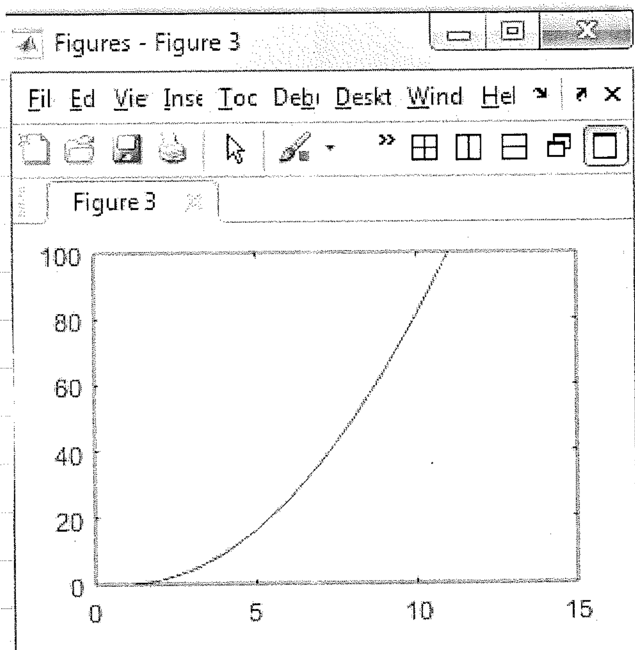
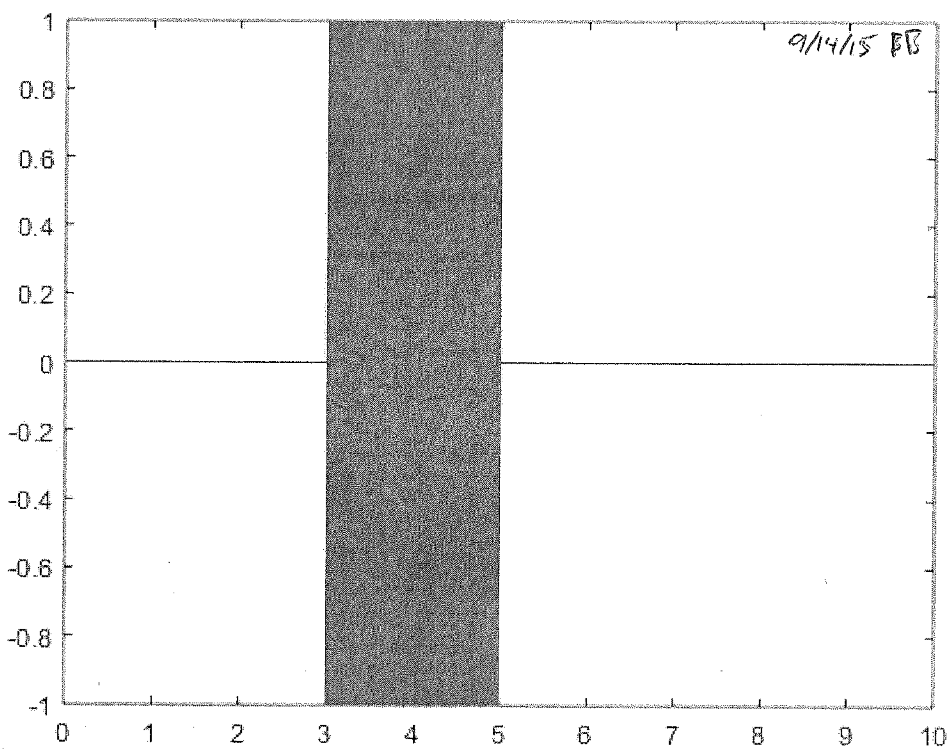


Graph 1



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sign off

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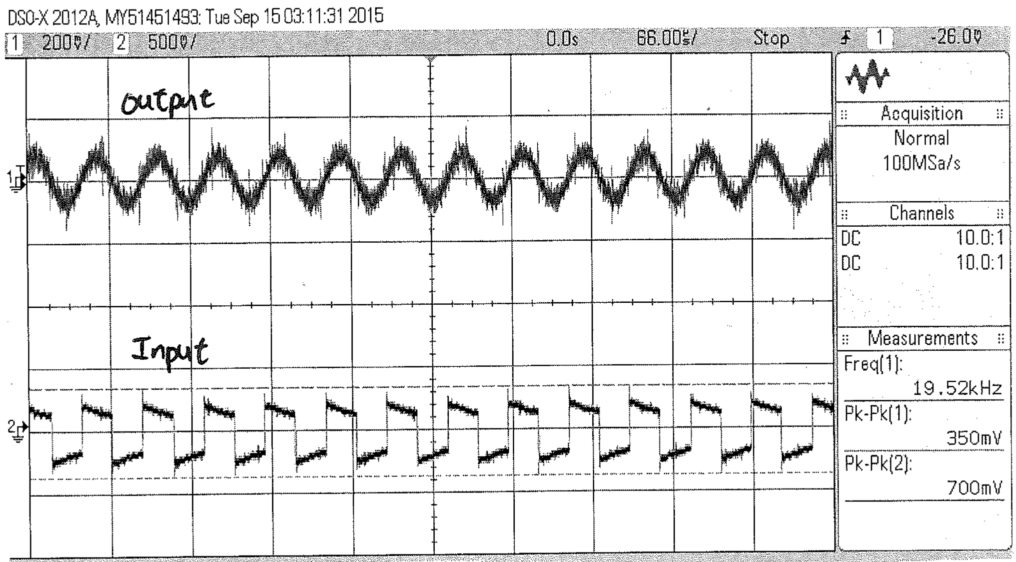
Task 2

The output from the computer to oscilloscope based on an input from the function generator. The Square and sine functions had larger amplitudes than the ramp function. The outputs are all very close to sin waves.

Square wave at 20 KHz from function generator. 9/14/15 BB



Even with the volume on our input and on the computer turned all the way ~~to~~ up we still can't get distortion. However, we were able to do so by changing parameters in loopback.m.

There was some degradation in quality, but it wasn't very noticeable. ~~There~~ quality was still pretty good because of the high sampling rate.

After changing the sampling rate to 8ksamps/s the quality of the music changed slightly. It sounds like the music is coming from a fish bowl. The volume also seemed to have decreased.

Task 2 Sign off [illegible] 9/14/2015

Conclusion We learned the basics on how to do matrix math and plotting on MATLAB. We also learned data acquisition in MATLAB using a soundwave input and output. We noticed a slight decrease in sampling rate caused a slight decrease in sound quality.