Lab #5
ECE-2026 Fall-2023
LAB COMPLETION REPORT

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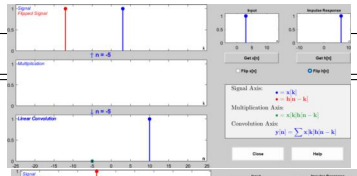
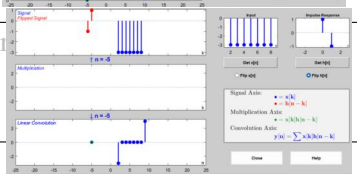
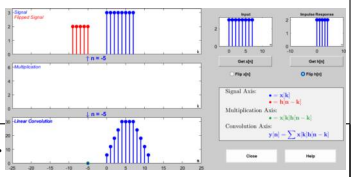
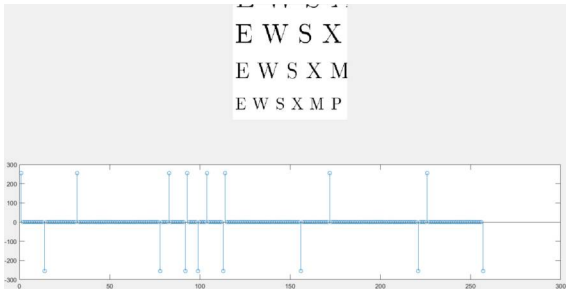
Part 1a: Did you attend the lab in week 1? Yes

Part 1b: Did you attend the lab in week 2? Yes

Part 2: Did you get full check-offs for in-lab demo? Yes

Part	Observations (Write down answers for each part)
3.1(a)	Convolve impulses: $\delta[n-3] * \delta[n-7] =$ δ [n - 10] 
3.1(b)	Rectangular Pulse through a First-Difference filter: $y[n] =$ wr -3δ[n-2] + 3 δ[n-8] 
3.1(c)	Explain why $y[n]$ is zero for most values of n. It is almost all 0 because there is no difference between most of the values, because they are all of the same sign and magnitude.
3.1(d)	Convolve two rectangles, sketch result; make sure you have the correct beginning and end! 
3.1(e)	Maximum Amplitude and Length of the convolved-rectangles output. Amplitude: 30 Length: 12
3.1(f)	List the locations of the transitions in the output signal, $y[n]$. n = 7, 13, 20, 25, 32, 38, 45, 50. y[n] has non-zero values when the magnitude of the input switches between zero and one.
3.1(f)	Explain polarity (positive/negative) of the transitions in the output signal, $y[n]$. The transition is positive if the input is switching to one and negative if the input is switching to zero.

Part 3.2(a) Process one row of the input image `echart` with a 1-D first-difference filter. Explain how the output from the filter makes it easy to measure the width of black regions. Use MATLAB's `find` function to help in determining the width of the black "E" from the impulses in the first-difference output.



White to black forms a peak of -1 and black to white forms another peak of 1, and you can utilize these clusters to find the width of the black and white areas.

32 - 14 = 18 is the width of E

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3.1

```
dconvdemo
```

```
Error using evalin
Undefined function 'Lab5' for input arguments of type 'char'.
```

Answer questions and attach screenshots in the Lab Report

3.2

```
clc;clear;close all
load echart.mat

bdiffh = [1, -1];

imshow(echart)
m = 65; % 147, 221
yy1 = conv( echart(m,:), bdiffh );
```

Plot the input and output in the same figure using subplot

```
subplot(2,1,1);
imshow(echart);
nn = 1: length(echart(m,:));

% subplot(2,1,2);
% stem(nn - 1, echart(m,:));
```

```
% mm = 1: length(yy1);

subplot(2,1,2)
stem(yy1)
```

Find the width of "E"

Find the length of a dense cluster of rises and drops in the filtered response.

```
find(yy1)
```

3.3.2

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

Part a

```
xx = 255*(rem(1:159,30)>19);
bb = [1, -1];
yy = firfilt(bb, xx);

% Plot x and y using subplot
subplot(2, 1 ,1 );
plot(xx);
subplot(2, 1, 2);
plot(yy);
```

Part b

Explain the effect of the first-difference operator on this input signal.% The operator finds the rises and drops and uses a 1 to indicate a rise and a -1 to indicate a drop.

Part c

Find length of xx and yy xx is 159 long and yy is 160 long

```
% How are they related?
%Y signal is longer because it is convolved with a signla of length 2 and
%have boundary cases making it slightly longer.
```

Part d: find the edges

```
threshold = 100;
d = abs(yy) > threshold;
```

Part e: find edges indices

```
edge_index = find(d);
num_edges = length(edge_index);
```

3.4

```
dltidemo
```

Answer questions and attach GUI screenshots for the lab report

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Part	Observations
3.4(b)	Magnitude and phase of the frequency response of the length-7 averager, at the input frequency. Phase: -0.6pi Magnitude: 0.374
3.4(c)	Give an equation that explains how the filter's *delay* is related to the phase of $H(e^{j\hat{\omega}})$ at $\hat{\omega} = 0.2\pi$. For w^ = 0.2pi then phase of H(e^jw) is td = phase * e^-j3w = 0.374e^-j3w
3.4(d)	Formula for output from a length-7 averager written in the form $y[n] = A\cos(\hat{\omega}_0(n - n_7))$ y[n] = 0.6cos(0.2pi[n-5])