Lab 9: Convolution TIMS Wk 2 - Answer Sheet

Follow the procedures in the document "Lab 9 – Convolution TIMS Wk 2 - Procedure" and prepare a report on your ePortfolio. The report should include the following sections (Note: all figures must be labelled correctly):

Introduction:
The main goal of this lab is to build understanding of convolution through examples using the TIMS hardware. This lab continues to build on the content from the previous week also studying convolution.

Procedures:
This section should be written to describe the steps taken for each part of the lab. The report should include answers to the following questions:

1) Explain in detail the output of the system in Figures 1 and 2.

- The output of the system appears as three sequential unit step pulses of different amplitudes. The first is about 0.25V, the second about 0.42V, and the third about -0.2V. These amplitudes are proportional the the b adder gains. The Z-transforms acts as the unit delays in the system. The b triple adder corresponds to b0, b1, and b2 gains placed on the various delayed forms of the input.

2) What electrical circuit component creates the presence of 'delayed energy'?

- An inductor would create presence of delay energy.

3) Explain the superposition sum in your lab notebook in your own words.

- The superposition sum form of convolution can be thought of adding up impulse responses across an entire collection of values, x(k). Each impulse responses is multiplied by some value in x(k) effectively weighting that impulse response compared to other impulse responses.

4) Based on your findings from Week 1, explain what you would expect the system output to be if the input was four pulses back to back instead of one or two?

- The output would have 5 different amplitudes, each corresponding to different combinations of the four pulses.

5) How could you adjust the current TIMS setup to simulate this?

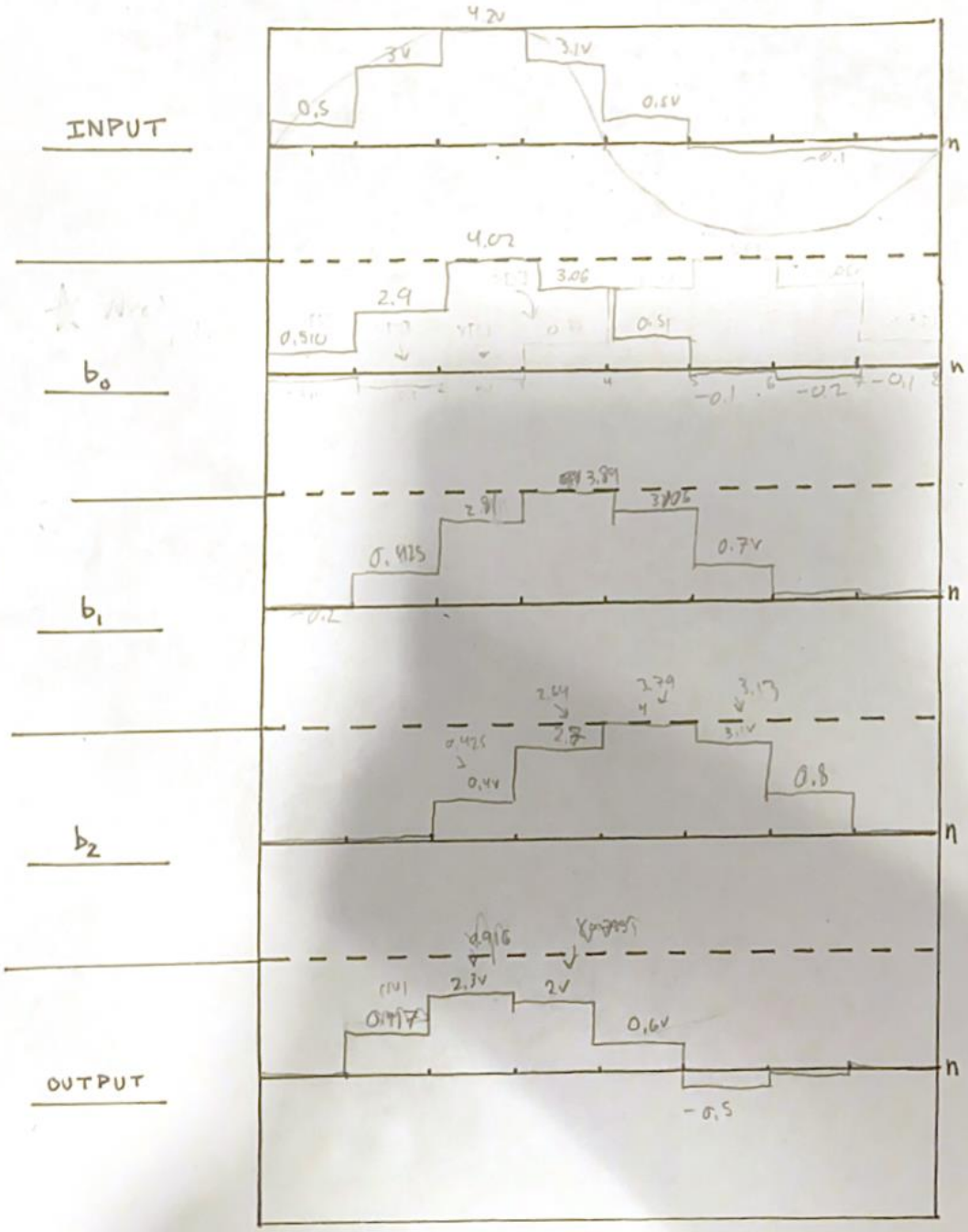
- Change how dividers work. Put the CLK through divide by 4 twice

6) Follow the instructions in the lab to complete the handout.
    a. Label where x[0], x[1], …, x[7] show up on each of the plots. Set x[0] as the first pulse of the positive sin wave on the input.
    b. Record the voltages of the first 3 time steps in each plot and compare to the output voltage in that time step
    c. Record any error found in the previous step

- Error y[0] = 0.021
- Error y[1] = 0.015
- Error y[2] = 0.028

    d. Include all of this in your submission

Handout for Convolution Lab



7) Write equations for y[1], y[2], and y[6].

- y[1] = h[0]*x[1] + h[1]*x[6] + h[2]*x[5]
- y[2] = h[0]*x[2] + h[1]*x[1] + h[2]*x[6]
- y[6] = h[0]*x[6] + h[1]*x[5] + h[2]*x[4]

Conclusions:

This section should include the conclusions to the lab and should answer the following questions.

In conclusion, this lab built understanding of what the action of convolution is doing by using real examples in the lab. I enjoyed seeing the connection between the separate signals combining to form the overall output. No major improvements.