Full Name: _____ **Lab Section:** _____

EEL 4750 / EEE 5502 (Fall 2018) – HW #02 **Due Date: Sept. 6, 2018**

Homework learning objectives: By the end of this homework, you should be able to:

- Determine if a system is linear, time-invariant, memoryless, and causal
- Compute the output of a system from a known input

Question #1: *(2 pts)* How many hours did you spend on this homework?

Question #2: *(12 pts)* Consider the system $y[n] = \mathcal{H}\{x[n]\} = x[n+1] - 2x[n] + x[n-1]$

(a) Sketch the output of the system $y_1[n] = \mathcal{H}\{x_1[n]\}$ for input $x_1[n] = u[n] - u[n-5]$.

(b) Sketch the output of the system $y_2[n] = \mathcal{H}\{x_2[n]\}$ for input $x_2[n] = 3\delta[n-2]$.

(c) Sketch the output of the system $y_3[n] = \mathcal{H}\{x_1[n] + x_2[n]\}$

(d) Sketch the output of the system $y_4[n] = \mathcal{H}\{x_1[n]\} + \mathcal{H}\{x_2[n]\}$

(e) Is this system linear? Why?

(f) Based on the previous results, what to you think is an application of this system?

Question #3: *(12 pts)* Consider the system $y[n] = \mathcal{H}\{x[n]\} = x[n+1]x[n]x[n-1]$

(a) Sketch the output of the system $y_1[n] = \mathcal{H}\{x_1[n]\}$ for input $x_1[n] = u[n] - u[n-5]$.

(b) Sketch the output of the system $y_2[n] = \mathcal{H}\{x_2[n]\}$ for input $x_2[n] = 3\delta[n-2]$.

(c) Sketch the output of the system $y_3[n] = \mathcal{H}\{x_1[n] + x_2[n]\}$

(d) Sketch the output of the system $y_4[n] = \mathcal{H}\{x_1[n]\} + \mathcal{H}\{x_2[n]\}$

(e) Is this system linear? Why?

(f) Based on the previous results, what to you think is an application of this system?

Question #4: *(8 pts)* Consider the system $y[n] = \mathcal{H}\{x[n]\} = x[n]\cos(\pi n)$

(a) Sketch the output of the system $y_1[n] = \mathcal{H}\{x_1[n]\}$ for input $x_1[n] = u[n] - u[n-5]$.

(b) Sketch the output of the system $y_2[n] = \mathcal{H}\{x_2[n]\}$ for input $x_2[n] = u[n-1] - u[n-6]$.

(c) Is this system time-invariant? Why?

(d) Is this system memoryless? Why?

(e) Based on the previous results, what to you think is an application of this system?

Question #5: *(10 pts)* Consider the system $y[n] = \mathcal{H}\{x[n]\} = \max(x[n], 1)$

(a) Sketch the output of the system $y_1[n] = \mathcal{H}\{x_1[n]\}$ for input $x_1[n] = n(u[n+2] - u[n-2])$.

(b) Sketch the output of the system $y_2[n] = \mathcal{H}\{x_2[n]\}$ for input n $x_2[n] = (n-1)(u[n+1]-u[n-3])$.

(c) Is this system time-invariant? Why?

(d) Is this system causal? Why?

(e) Based on the previous results, what to you think is an application of this system?