EECS 361
Homework #12

1. Section 6.1 Participation Activities
- 6.1.1: Transformations for Digital Signal Processing (DSP)
- 6.1.2: Discrete-time signal transformations.
- 6.1.3: Discrete-time signal durations and transformations

2. Section 6.2 Participation Activities
- 6.2.1: Sampling rate and discrete-time period and frequency
- 6.2.2: Discrete-time periodic parameters.
- 6.2.3: Periodic parameter values.
- 6.2.4: Periodic continuous-time vs. discrete-time functions.
- 6.2.5: Discrete sinusoids.

3. (Concept: Discrete time step and delta functions)
Convert each of these signals into the finite sequence form {$\underline{a}$,b,c,...}

a. $2u[n-2]+2\delta[n-3]-2u[n-6]$
b. $(n-1)u[n]-(n-1)u[n-3]$
c. $4\delta[n+3]+10\delta[n]+4\delta[n-3]$

4. Section 6.3 Participation Activities
- 6.3.1: Discrete-time system terminology

5. Section 6.4 Participation Activities
- 6.4.1: Properties of discrete-time systems, part one.
- 6.4.2: Properties of discrete-time systems, part two.
- 6.4.3: Impulse response of MA (moving average) system.
- 6.4.4: Step response of moving average system.
- 6.4.5: ARMA system, impulse and step responses.
- 6.4.6: ARMA system, $|p|<1$ impulse and step responses.
- 6.4.7: Discrete-time system stability.

6. (Concepts: stability and causality of discrete time LTI systems)
Classify the following systems as causal and/or stable.

a. $h[n] = 3\delta[n]-2\delta[n-2]+1\delta[n-1]$
b. $h[n] =(n+2)u[n]$

7. (Concepts: Properties of discrete time LTI systems)
Classify the following systems as linear and/or time-invariant.

a. $y[n] = 2x[n] + 1$
b. $y[n] = 2x[n] + 3x[n-1]$
c. $y[n]=(n-1)x[n]$

8. Section 6.5 Participation Activities
- 6.5.1: Example: delayed-impulses convolution method.
- 6.5.2: Delayed-impulses convolution, input
- 6.5.3: Discrete-time convolution via delayed impulses.
- 6.5.4: Graphical or textual sliding convolution.
- 6.5.5: Graphical convolution process.
- 6.5.6: Graphical convolution values.

9. (Concept: Discrete time convolution)
Compute the following linear convolutions

a. $x_a[n] =\{\underline{1}, 2\}$ and $h_a[n]=\{\underline{5}, 6, 7\}$ $y_a[n] =x_a[n]*h_a[n]$
b. $x_b[n] =\{\underline{4}, 0, -4\}$ and $h_b[n]=\{\underline{2}, 2, 2\}$ $y_b[n] =x_b[n]*h_b[n]$
c. $x_c[n] =\{\underline{0}, 1, 0\}$ and $h_c[n]=\{\underline{1}, 0, 3, 0, 5\}$ $y_c[n] =x_c[n]*h_c[n]$
d. $x_d[n] =\{\underline{1}, 1, 1,\}$ and $h_d[n]=\{\underline{1}, 1, 1, 1, 1, 1\}$ $y_d[n] =x_d[n]*h_d[n]$
e. $x_e[n] =\{\underline{4}, 4, 4, 4, 4, 4\}$ and $h_e[n]=\{\underline{4}, 4, 4, 4, 4, 4\}$ $y_e[n] =x_e[n]*h_e[n]$

10. (Concept: The length of the linear convolution of discrete time signals)
Given the signals in problem 9. Let N_{x_k} be the length of $x_k[n]$ for $k = \{a .. e\}$ and N_{h_k} be the length of $h_k[n]$ for $k = \{a .. e\}$. Find the length of N_{y_k} for k={a..e}

11. (Concept: Causality and stability given the impulse response of discrete time LTI system)
Find the system impulse response for a system defined by the following input, x[n] output, y[n] relationship y[n] = 10x[n+1]-5x[n]+x[n-1].

a. Is this system causal?

b.Is this system stable?