Name *Answers*

EE-3220-21 – Dr. Durant – Quiz 2
Winter 2013-'14, Week 2

1. (3 points) Indicate whether each of the following systems is linear, time-invariant, and causal. You ***do not*** need to show your work for this problem.

	$y_1(n) = x(n-2)$	$y_2(n) = 2\ n\ x(n)$	$y_3(n) = x^2(n+1)$
Linear?	yes	yes	no
Time-invariant?	yes	no	yes
Causal?	yes	yes	no

2. (2 points) Write the non-0 portion of the sequence resulting from $x(n) = -\left(\frac{1}{2}\right)^n (u(n+2)-u(n-2))$. Recall that *u(n)* is the unit step that becomes 1 when the argument reaches 0. Clearly indicate the *n=0* position in your sequence.

3. (2 points) Express your sequence above as a weighted sum of shifted unit samples or deltas $(\delta(\cdot))$.

4. (1 point) Let the impulse response of a system be h(n) = [h(0) h(1)] = [3 -5]. Explain why this system is causal.

5. (2 points) Calculate the convolution $y(n) = x(n)*h(n)$. Show your work (intermediate products; you are not required to show the formula for the convolution sum). Indicate where *n=0*.

(2) $u(n+2)-u(n-2) = \begin{cases} 1, & -2 \le n \le 1 \\ 0, & \text{otherwise} \end{cases}$

$x(n): [-4\ \ -2\ \ \underset{\uparrow\, n=0}{-1}\ \ -\tfrac{1}{2}]$

(3) $x(n) = -4\,\delta(n+2) - 2\,\delta(n+1) + -\delta(n) + -\tfrac{1}{2}\,\delta(n-1)$

(4) $h(n) = 0$ when $n<0$. That is, there is no response before an input arrives.

(5)

$x(n)\times h(0)$	-12	-6	-3	$-1\frac{1}{2}$	
$+\ x(n)\times h(1)$		$+20$	$+10$	$+5$	$+2\frac{1}{2}$
$y(n)$	-12	$+14$	$+7$	$+3\frac{1}{2}$	$+2\frac{1}{2}$
n	-2	-1	0	1	2

Whoops, these are all negative of what they should be

Name *Answers*

EE-3220-41 – Dr. Durant – Quiz 2
Winter 2013-'14, Week 2

1. (3 points) Indicate whether each of the following systems is linear, time-invariant, and causal. You ***do not*** need to show your work for this problem.

	$y_1(n) = x(n+2)$	$y_2(n) = x(n)+2$	$y_3(n) = x^2(n)$
Linear?	yes	no	no
Time-invariant?	yes	yes	yes
Causal?	no	yes	yes

2. (2 points) Write the non-0 portion of the sequence resulting from $x(n) = \left(\frac{-1}{2}\right)^n (\underset{\text{starts @ -1}}{u(n+1)} - \underset{\text{starts @ 3}}{u(n-3)})$. Recall that *u(n)* is the unit step that becomes 1 when the argument reaches 0. Clearly indicate the *n=0* position in your sequence

3. (2 points) Express your sequence above as a weighted sum of shifted unit samples or deltas $(\delta(\cdot))$.

4. (1 point) Let the impulse response of a system be h(n) = [h(0) h(1)] = [5 -3]. Explain why this system is causal.

5. (2 points) Calculate the convolution $y(n) = x(n)*h(n)$. Show your work (intermediate products; you may but are not required to show the formula for the convolution sum).

(2) $u(n+1) - u(n-3)$ is 1 between -1 and 2, inclusive

$x(n) = [-2 \;\; \underset{\uparrow\, n=0}{1} \;\; -\frac{1}{2} \;\; \frac{1}{4}]$

(3) $x(n) = -2\delta(n+1) + \delta(n) - \frac{1}{2}\delta(n-1) + \frac{1}{4}\delta(n-2)$

(4) Because $h(n) = 0$ for $n < 0$. (There is no response before the input arrives.)

(5)

$x(n) \times h(0)$	-10	5	$-2\frac{1}{2}$	$1\frac{1}{4}$	
$+\; x(n) \times h(1)$		6	-3	$1\frac{1}{2}$	$-\frac{3}{4}$
y	-10	11	$-5\frac{1}{2}$	$2\frac{3}{4}$	$-\frac{3}{4}$
n	-1	0	1	2	3