Name __Answers__

EE-3220-11 – Dr. Durant – Quiz 2
Winter 2014-'15, 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.

	$y_1(n) = x(n-2)$	$y_2(n) = 2x(n+1)-x(n-1)$	$y_3(n) = n\, x^2(n)$
Linear?	+	+	—
Time-invariant?	+	+	—
Causal?	+	—	+

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(-1) h(0)] = [2 3]. Explain why this system is not 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 $-\left(\frac{1}{2}\right)^n \left[\,1\ \ 1\ \ \underset{\uparrow}{1}\ \ 1\,\right] = \left[\,-4\ \ -2\ \ \underset{\uparrow}{-1}\ \ -\frac{1}{2}\,\right]$

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

④ $h(-1) \neq 0 \Rightarrow$ system output anticipate/carries before input

⑤ ok $x(k)$

$$
\begin{array}{c|cccc}
 & -3 & -2 & \overset{n}{-1} & 0 \quad 1 \\
\hline
-2 \quad -4 & -8 & -12 & & \\
-1 \quad -2 & & -4 & -6 & \\
0 \quad -1 & & & -2 & -3 \\
1 \quad -\frac{1}{2} & & & -1 & -\frac{3}{2} \\
\hline
& \left[-8 \quad -16\right. & & -8 & -4 \quad \left.-\frac{3}{2}\right]
\end{array}
$$

$\uparrow$

EE-3220-21 – Dr. Durant – Quiz 2
Winter 2014-'15, 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.

	$y_1(n) = x(n-3)$	$y_2(n) = x(n)+2$	$y_3(n) = x^2(n-1)$
Linear?	+	—	—
Time-invariant?	+	+	+
Causal?	+	+	+

2. (2 points) Write the non-0 portion of the sequence resulting from $x(n) = \left(\frac{-1}{2}\right)^n (u(n+1)-u(n-3))$. 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 are not required to show the formula for the convolution sum). Indicate where $n=0$.

② $\left(\frac{-1}{2}\right)^n [1\ \ 1\ \ 1\ 1] = [-2\ \underset{\uparrow}{1}\ -\frac{1}{2}\ \frac{1}{4}]$

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

④ $h(k)=0$ if $k<0$ ⟹ the output does __not__ arrive before the input

⑤

k	$x(k)$	-1	0	1	2	3
-1	-2	-10	6			
0	1		5	-3		
1	$-\frac{1}{2}$			$-\frac{5}{2}$	$\frac{3}{2}$	
2	$+\frac{1}{4}$				$\frac{5}{4}$	$\frac{-3}{4}$

$[-10\quad 11\quad -5\frac{1}{2}\quad 2\frac{3}{4}\quad \frac{-3}{4}]$