

EEL 3135 – Quiz 3

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20 minutes close book

By signing my name below, I declare that I have not given or received help from others during the quiz.

Name: ANSWER, ID #: _____

Please answer in the space provided (1 question)

1- Question 1: Using convolution compute the response $y(n]$ to the LTI system with impulse response

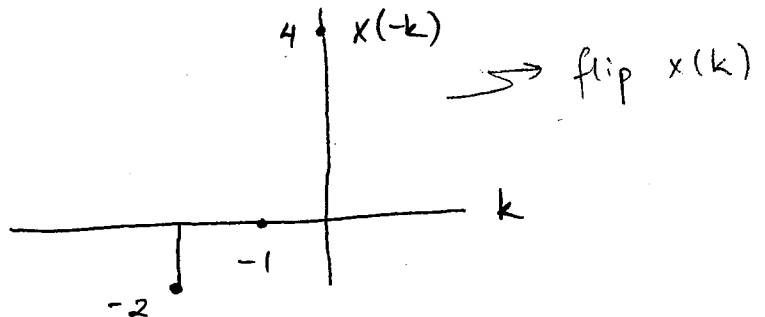
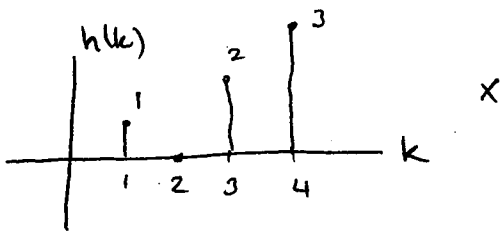
$$h(n) = \delta(n-1) + 2\delta(n-3) + 3\delta(n-4)$$

to the input $x(n) = 4\delta(n) - 2\delta(n-2)$

$$y(n) = \sum_{k=-\infty}^{\infty} h(k) x(n-k)$$

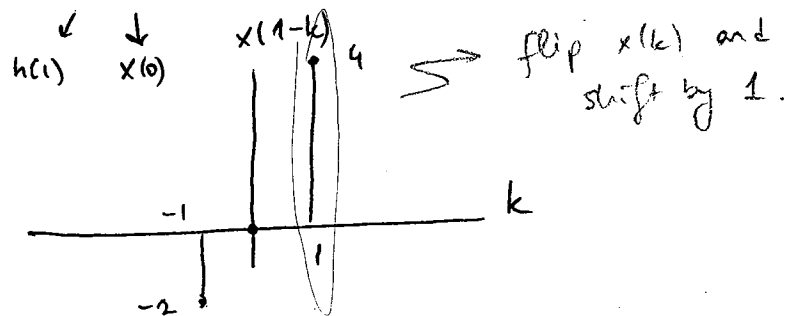
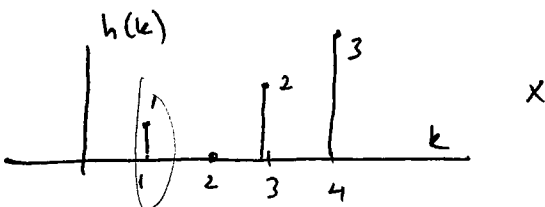
$n=0$

$$y(0) = \sum_{k=-\infty}^{\infty} h(k) x(-k) = 0$$



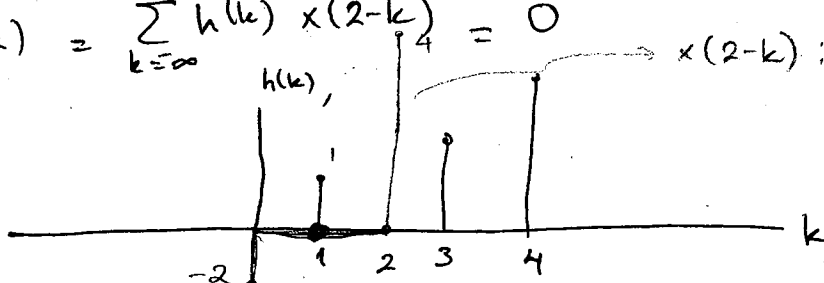
$n=1$

$$y(1) = \sum_{k=-\infty}^{\infty} h(k) x(1-k) = 1 \cdot 4 = 4$$



$n=2$

$$y(2) = \sum_{k=-\infty}^{\infty} h(k) x(2-k) = 0$$

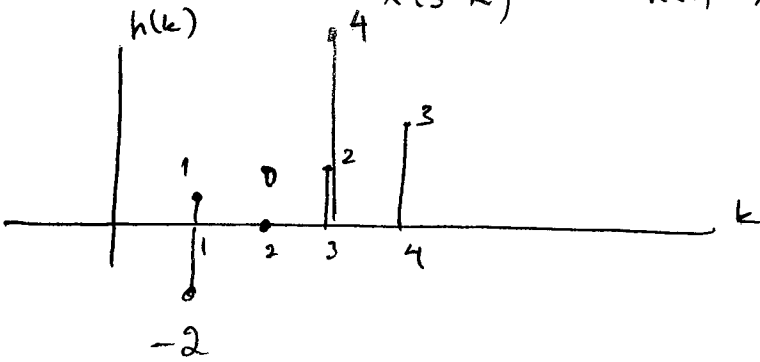


$x(2-k)$: flip $x(k)$ & shift by 2

$$n=3$$

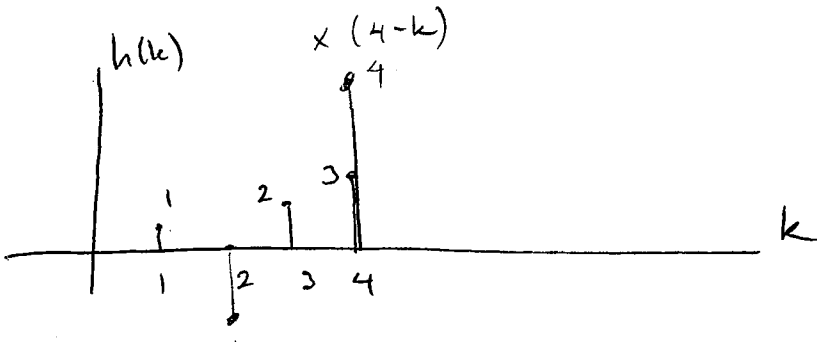
$$y(3) = \sum_{k=-\infty}^{\infty} h(k) \cdot x(3-k) = 1 \cdot -2 + 2 \cdot 4 = 6$$

$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$
 $h(1) \cdot x(2) \quad h(3) \cdot x(0)$



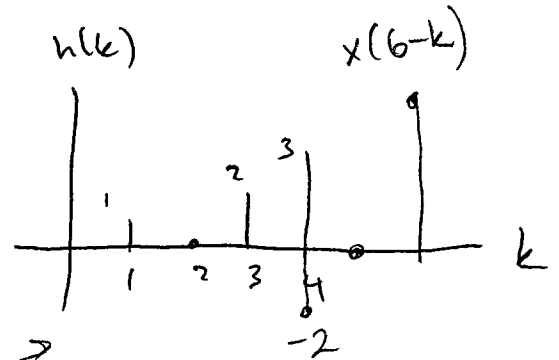
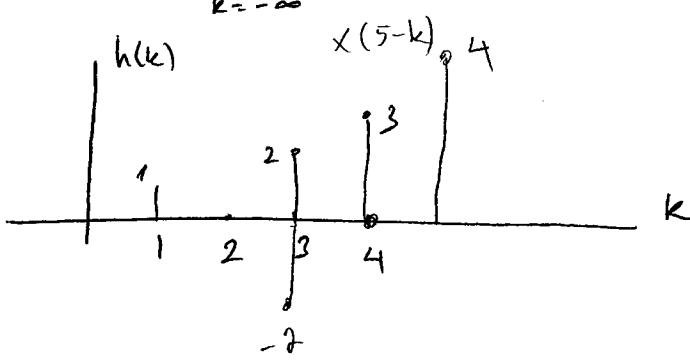
$$n=4$$

$$y(4) = \sum_{k=-\infty}^{\infty} h(k) x(4-k) = 0 \cdot -2 + 3 \cdot 4 = 12$$



$$n=5$$

$$y(5) = \sum_{k=-\infty}^{\infty} h(k) x(5-k) = 2 \cdot -2 = -4$$

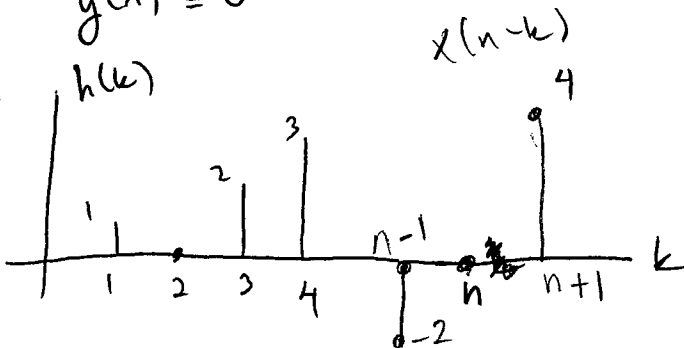


$$n=6$$

$$y(6) = \sum_{k=-\infty}^{\infty} h(k) x(6-k) = 3 \cdot -2 = -6$$

$$n \geq 6$$

$$y(n) = 0$$



$$y(n) = 4\delta(n-1) + 6\delta(n-3) + 12\delta(n-4) - 4\delta(n-5) - 6\delta(n-6)$$

Note that you don't have to explicitly plot each graph! ^{at each n.} Once you see the pattern, you can directly write the answer.

Solution using superposition:

$$\delta(n) \rightarrow \boxed{} \rightarrow \delta(n-1) + 2\delta(n-3) + 3\delta(n-4) = h(n)$$

$$4\delta(n) \rightarrow \boxed{} \rightarrow 4h(n)$$

$$-2\delta(n-2) \rightarrow \boxed{} \rightarrow -2h(n-2)$$

$$\Rightarrow y(n) = 4h(n) - 2h(n-2)$$

$$= 4(\delta(n-1) + 2\delta(n-3) + 3\delta(n-4)) - 2(\delta(n-3) + 2\delta(n-5) + 3\delta(n-6))$$

$$= 4\delta(n-1) + 6\delta(n-3) + 12\delta(n-4) - 4\delta(n-5) - 6\delta(n-6)$$