EE3900: Linear Systems and Signal Processing Assignment-2

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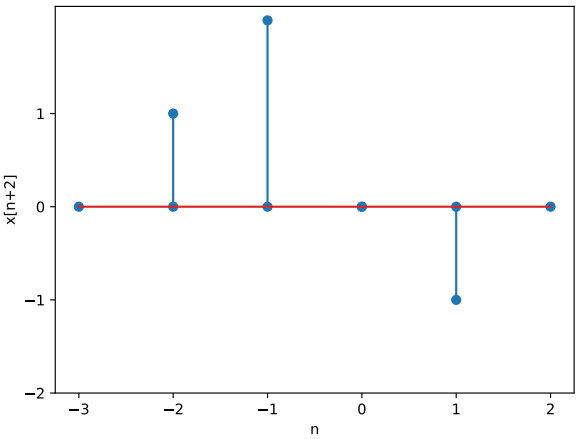
***Abstract*—This document contains solution to Assignment-2 [Question 2.1(b) from Discrete-Time Signal Processing by Alan V. Oppenheim and Ronald W. Schafer]**

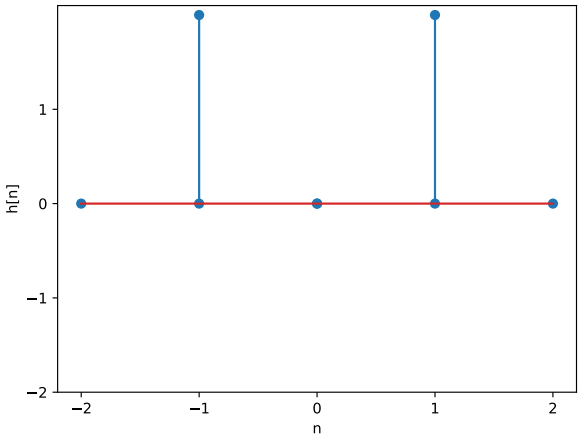
Linear Time Invariant System

1 Let $x[n] = \delta[n] + 2\delta[n-1] - \delta[n-3]$ and $h[n] = 2\delta[n+1] + 2\delta[n-1]$.
Compute and plot convolution of $y_2[n]$
$y_2[n] = x[n+2] * h[n]$
Solution:

$$\delta[n-a] = \begin{cases} 1 & n = a \\ 0 & otherwise \end{cases} \tag{0.1}$$

$x[n+2] = \{1, 2, 0, -1\}$
$h[n] = \{2, 0, 2\}$

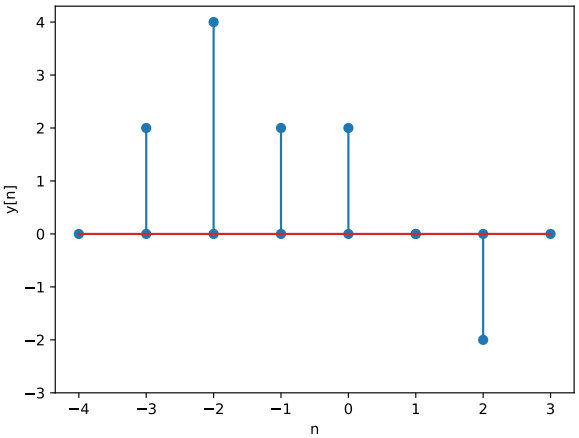




$$\mathbf{y} = \begin{pmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 0 & 2 & 1 \\ -1 & 0 & 2 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{pmatrix} \begin{pmatrix} 2 \\ 0 \\ 2 \end{pmatrix} = \begin{pmatrix} 2 \\ 4 \\ 2 \\ 2 \\ 0 \\ -2 \end{pmatrix} \tag{0.2}$$

(0.3)

So $y[n] = \{2, 4, 2, 2, 0, -2\}$
Plot of convolution is


y[n]
n
4
3
2
1
0
−1
−2
−3
−4
−3
−2
−1
0
1
2
3