

## Quiz #1

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1. Compute and plot the convolution  $y[n] = x[n] * h[n]$ , where

$$x[n] = \begin{cases} 1, & -2 \leq n \leq 2 \\ 0, & \text{otherwise} \end{cases} \quad \text{and} \quad h[n] = \begin{cases} (-1)^n, & 0 \leq n \leq 5 \\ 0, & \text{otherwise} \end{cases}.$$

Answer:

(1)

$$y[n] = x[n] * h[n] = \sum_{k=-\infty}^{\infty} x[k]h[n-k] = \sum_{k=-2}^2 x[k]h[n-k] = \sum_{k=-2}^2 h[n-k]$$

$$h[n-k] = \begin{cases} (-1)^{n-k}, & 0 \leq n-k \leq 5 \\ 0, & \text{otherwise} \end{cases}$$

$$0 \leq n-k \leq 5, -2 \leq k \leq 2 \Rightarrow -2 \leq n \leq 7$$

$$n \leq -3, n \geq 8 \Rightarrow y[n] = 0$$

$$y[-2] = h[0] = 1$$

$$y[-1] = h[1] + h[0] = 0$$

$$y[0] = h[2] + h[1] + h[0] = 1$$

$$y[1] = h[3] + h[2] + h[1] + h[0] = 0$$

$$y[2] = h[4] + h[3] + h[2] + h[1] + h[0] = 1$$

$$y[3] = h[5] + h[4] + h[3] + h[2] + h[1] = -1$$

$$y[4] = h[5] + h[4] + h[3] + h[2] = 0$$

$$y[5] = h[5] + h[4] + h[3] = -1$$

$$y[6] = h[5] + h[4] = 0$$

$$y[7] = h[5] = -1$$

(2)

$$h[n] = \delta[n] - \delta[n-1] + \delta[n-2] - \delta[n-3] + \delta[n-4] - \delta[n-5]$$

$$y[n] = x[n] * h[n]$$

$$= x[n] - x[n-1] + x[n-2] - x[n-3] + x[n-4] - x[n-5]$$

