Convolution Example

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CPE381 Signals & Systems

for Computer Engineers

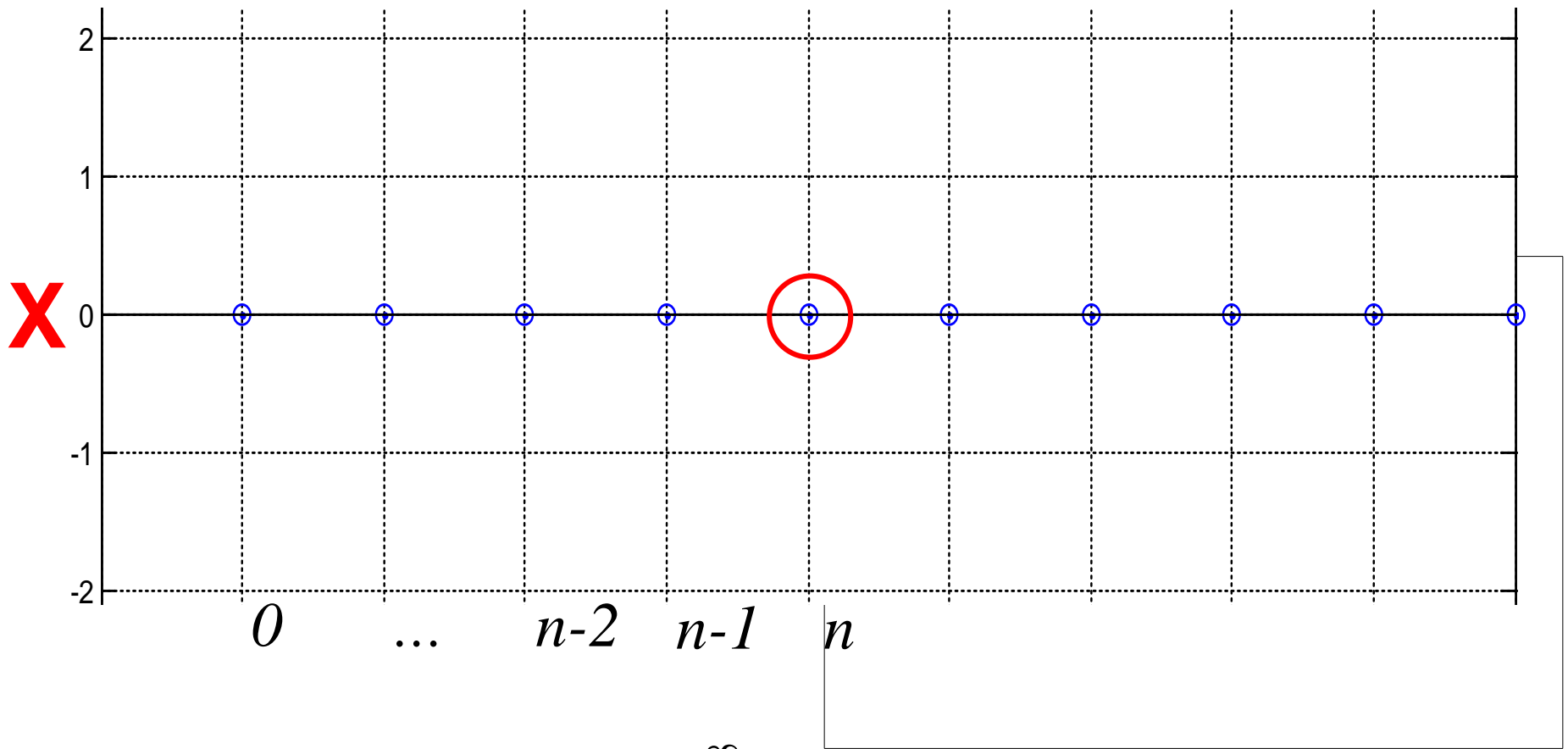- Recursive/infinite impulse response (IIR) system

$$y[n] = -\sum_{k=1}^{N-1} a_k y[n-k] + \sum_{m=0}^{M-1} b_m x[n-m] \qquad n \geq 0 \;\; \text{initial conditions} \;\; y[-k], \; k = 1, \cdots, N-1$$

- Non-recursive/finite impulse response (FIR) system

$$y[n] = \sum_{m=0}^{M-1} b_m x[n-m]$$

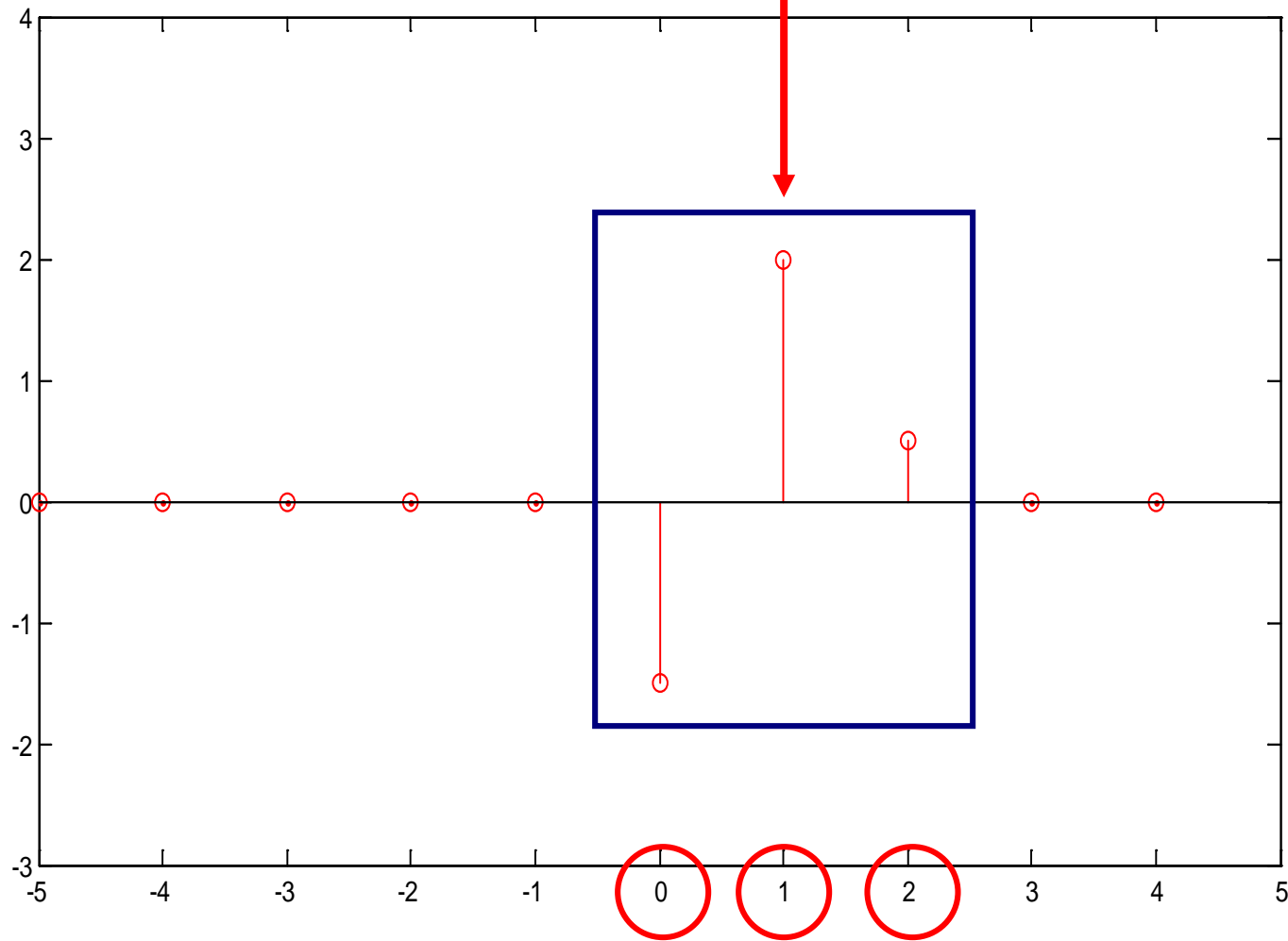# Convolution

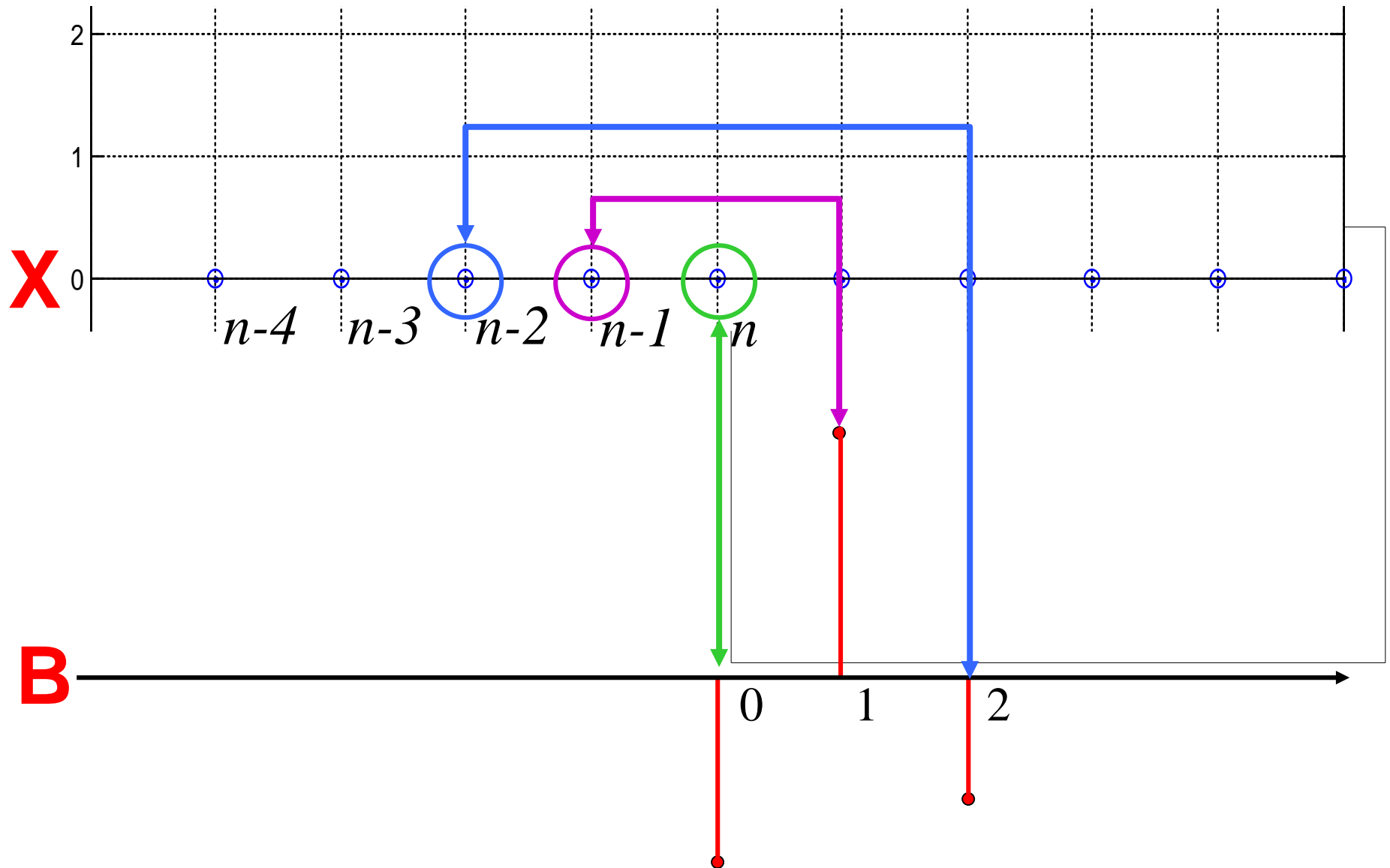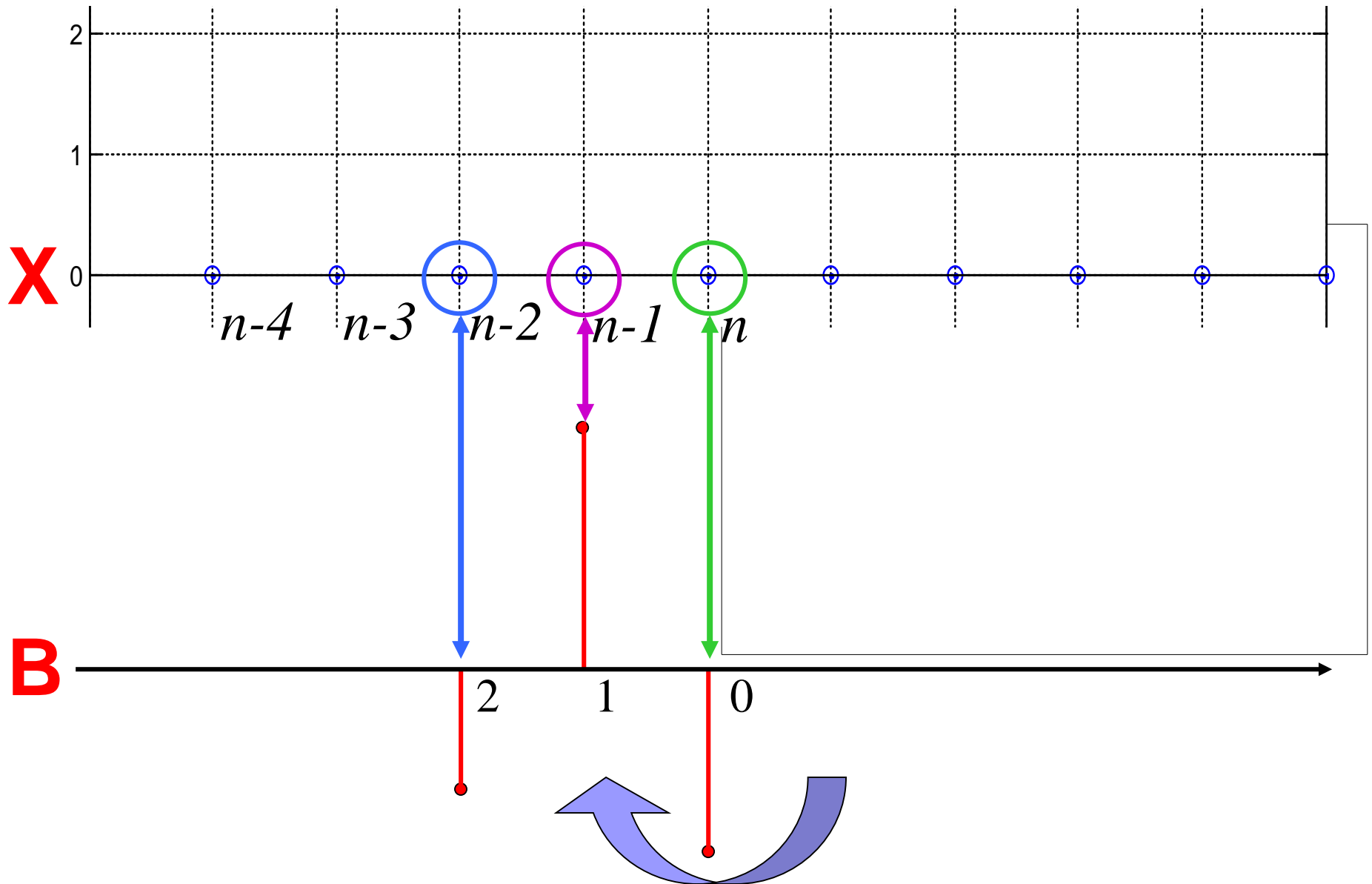$$y[n] = \sum_{k=-\infty}^{\infty} B[k] \cdot x[n-k]$$

B=[-1.5 2 0.5]

$$y[n] = \sum_{k=-\infty}^{\infty} B[k] \cdot x[n-k] \qquad y[n] = B[0] \cdot x[n-0] + B[1] \cdot x[n-1] + B[2] \cdot x[n-2]$$

Conv:

$$y[n] = B[0] \cdot x[n-0] + B[1] \cdot x[n-1] + B[2] \cdot x[n-2]$$

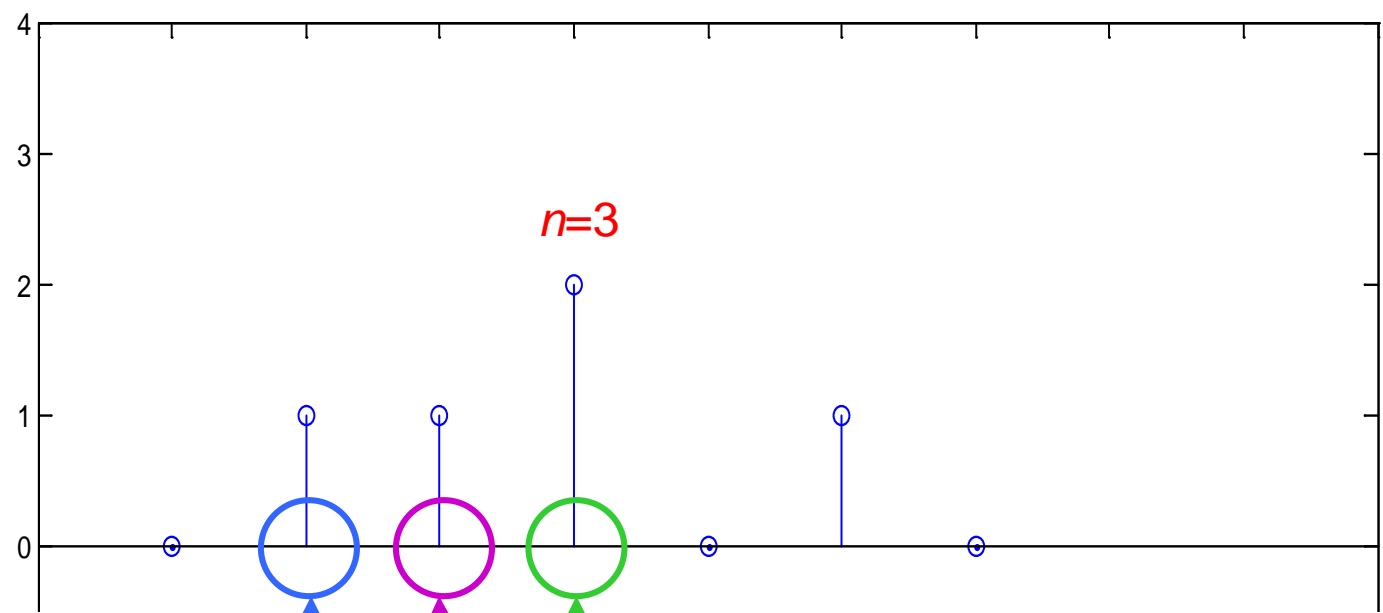Conv: $y[n] = B[0] \cdot x[n-0] + B[1] \cdot x[n-1] + B[2] \cdot x[n-2]$

X

B

n-4 n-3 n-2 n-1 n

2   1   0

x=[0 1 1 2 0 1 0]
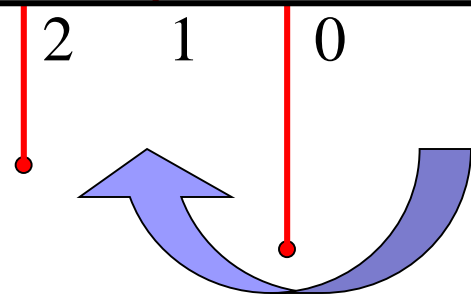
B=[-1.5 2 -0.5]

n=3

X

B

y[3] = B[0]*x[3]+B[1]*x[2] +B[2]*x[1]

y[3] = 2*(-1.5)+1*2+1*(-0.5) = -1.5

2   1   0

conv([-1.5 2 -0.5],[0 1 1 2 0 1 0])

$y[3] = 2*(-1.5)+1*2+1*(-0.5) = -1.5$