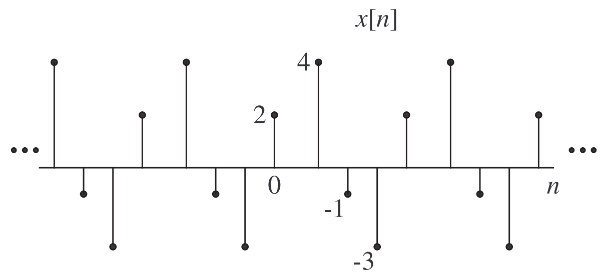
ENEE 222: 5/07 Class

Material: Lecture videos *22.3*, **23.1**, **23.2**

1. The sequence $x[\cdot]$ shown below is periodic with period $L = 4$ samples.



If $x[\cdot]$ is the input to a FIR filter with input-output relationship

$$y[n] \;=\; x[n] \;-\; 3x[n-1] \;+\; 4x[n-2] \;-\; 3x[n-3] \;+\; x[n-4] \;,$$

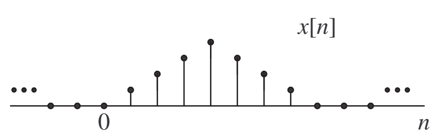
then the output sample at time $n = 26$ equals

A. -3 B. -7 C. 3 D. 7

2. The FIR filter described by

$$y[n] \;=\; b_0x[n] \;+\; b_1x[n-1] + \; b_2x[n-2] + \; b_3x[n-3] + \; b_4x[n-4] + \; b_5x[n-5]$$

(where b_0 and b_5 are both nonzero) accepts the finite-duration input $x[\cdot]$ depicted below.



If n_1 and n_2 are, respectively, the time indices of the first and last nontrivial (nonzero) samples in the output sequence, then (n_1, n_2) equals

A. $(0, 12)$ B. $(0, 13)$ C. $(1, 12)$ D. $(1, 13)$

3. The convolution table shown below computes the response of a FIR filter to an input sequence of finite duration.

		-1	4	0	-4	1			
3	5	1							y_0
	3	5	1						y_1
		3	5	1					y_2
			3	5	1				y_3
				3	5	1			y_4
					3	5	1		y_5
						3	5	1	y_6

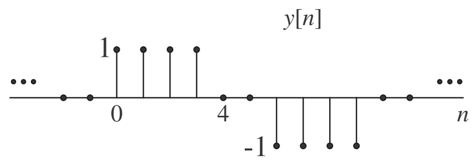
The output value y_3 equals

A. 8 B. -2 C. 4 D. -3

4. When the input

$$x[0:4] \;=\; [1 \;\; 0 \;\; 0 \;\; 0 \;\; -1]^T; \qquad x[n] \;=\; 0 \text{ for all other } n$$

is applied to a FIR filter, the output $y[\,\cdot\,]$ is as shown below.



Which of the following is the filter coefficient vector $\mathbf{b}$?

A. $[1 \;\; 1 \;\; 1 \;\; 1 \;\; 1 \;\; 1]^T$

B. $[1 \;\; 1 \;\; 1 \;\; 1]^T$

C. $[1 \;\; 1 \;\; 1 \;\; 1 \;\; 1]^T$

D. $[1 \;\; 1 \;\; 1 \;\; 1 \; -1 \; -1]^T$

5. (HW 27 $\subset$ ii v) Consider the FIR filter with coefficient vector $\mathbf{b} = \begin{bmatrix} 1 & 3 & 0 & -3 & -1 \end{bmatrix}^T$.

Interpret the following two computations as operations performed by this filter on suitable input sequences.

```
% Computation #1:
    b  = [1 3 0 -3 -1].' ;
    H  = fft(b,6) ;
    x1 = [1 2 4 -1 -2 -4].' ;
    X1 = fft(x1) ;
    Y1 = H.*X1 ;
    y1 = ifft(Y1)

% Computation #2:
    b  = [1 3 0 -3 -1].' ;
    H  = fft(b,6) ;
    H  = H(1:2:6) ;
    x2 = [2 -1 5].' ;
    X2 = fft(x2) ;
    Y2 = H.*X2 ;
    y2 = ifft(Y2)
```