

Midterm #1 Solutions

Question 1

The exam number is: 1

Question 2

$$y(t) = 0.1x(t-20) + 0.03x(t-35) + 0.2x(t-50)$$

Question 3

$$y[n] = 0.1x[n-200] + 0.03x[n-350] + 0.2x[n-500]$$

$$\begin{array}{ccccccc} x[n] \rightarrow & \text{---} & \text{D1} & \text{-----} & \text{D2} & \text{-----} & \text{D3} & \text{----} \\ & & | & & | & & | & \\ & & | & & | & & | & \\ & & \text{M1} & & \text{M2} & & \text{M3} & \\ & & | & & | & & | & \\ & & | & & | & & | & \\ & & \text{---} \rightarrow & \text{-----} & + & \text{--} \rightarrow & \text{----} & + & \text{---} \rightarrow & y[n] \end{array}$$

$$D1 = 200$$

$$D2 = 150$$

$$D3 = 150$$

$$M1 = 0.1$$

$$M2 = 0.03$$

$$M3 = 0.2$$

Question 4

Linear: Yes

Memoryless: No

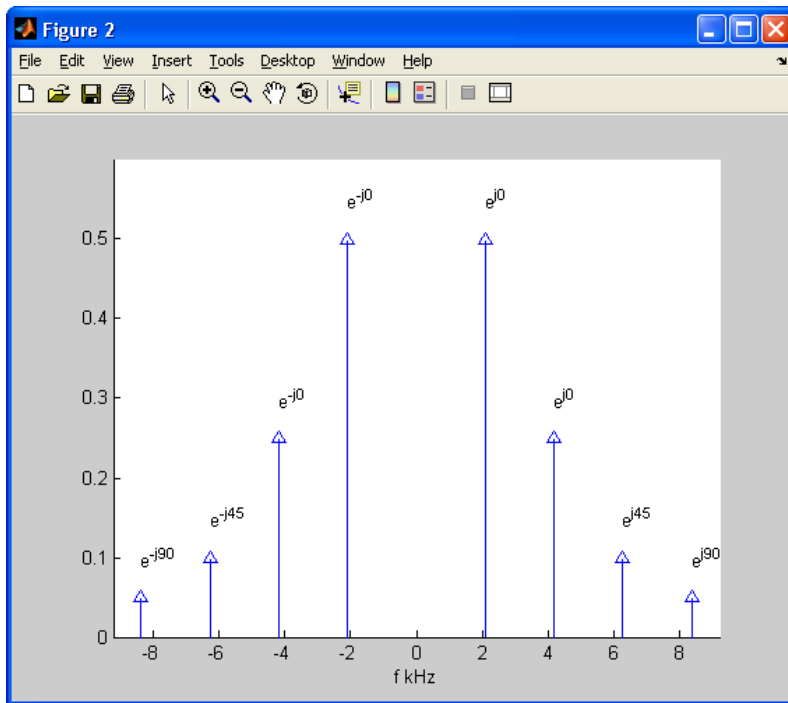
Shift-Invariant: Yes

LSI: Yes

Stable: Yes

Causal: Yes

Question 5



Fmax= 5 kHz

Question 6

$$x(t) = 1\cos(2\pi 2.093t + 0) + 0.5\cos(2\pi 4.186t + 0) + 0.2\cos(2\pi 6.279t + 45) + 0.1\cos(2\pi 8.372t + 90)$$

$$x[n] = 1\cos[2\pi 0.2093n + 0] + 0.5\cos[2\pi 0.4186n + 0] + 0.2\cos[2\pi 0.6279n + 45] + 0.1\cos[2\pi 0.8372n + 90]$$

0.6279 is aliased and it is folding

0.8372 is aliased and it is folding

$x[n]$ after accounting for aliasing

$$x[n] = 1\cos[2\pi 0.2093n + 0] + 0.5\cos[2\pi 0.4186n + 0] + 0.2\cos[2\pi 0.3721n + -45] + 0.1\cos[2\pi 0.1628n + -90]$$

Question 7

Signal Power: 0.75 V^2

Noise Power: $7.9512\text{e-}008 \text{ V}^2$

SNR Linear: 9432576.5625

SNR: 69.7463 dB

Question 8

(M)The length of the filter is: 501

(L)The block length is: 1548