

EECS 123 Spring 1996 Midterm #1

Problem #1

1. (15 points)

Assume M is an integer.

(a) (5 points)

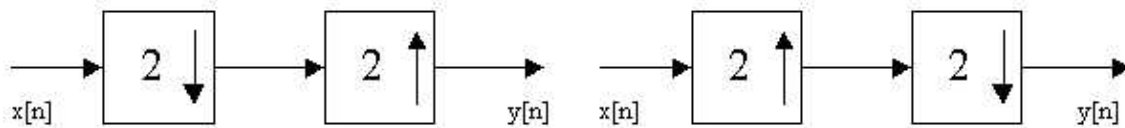
Is downsampling by M linear? Is it time invariant? Justify your answer.

(b) (5 points)

Is upsampling by M linear? Is it time invariant? Justify your answer.

(c) (5 points)

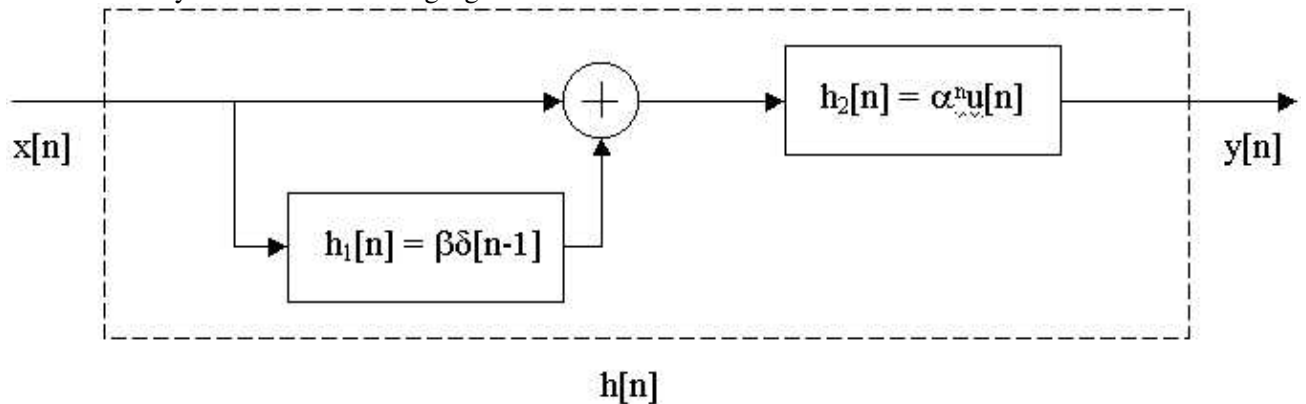
Are the following two systems equivalent? Why?



Problem #2

2. (25 points)

Consider the system in the following figure:



(a) (10 points)

Find the impulse response $h[n]$ of the overall system.

(b) (10 points)

Find the frequency response $H(e^{j\omega})$ of the overall system.

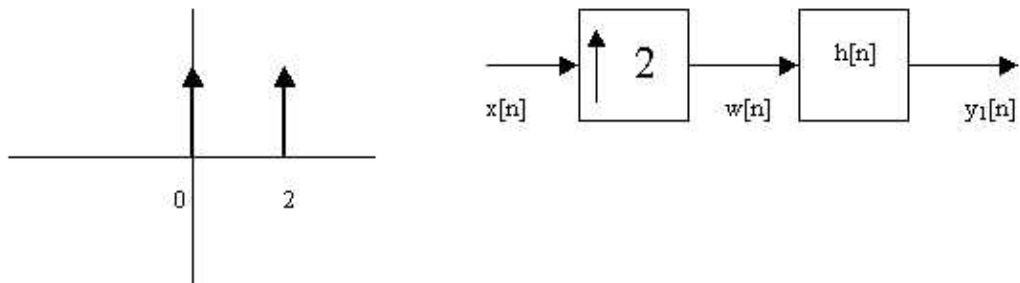
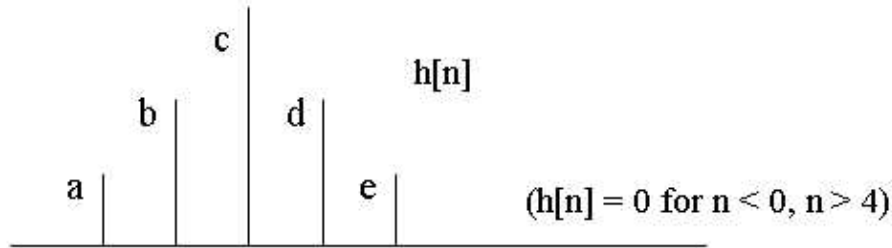
(c) (5 points)

Is this system causal? Is it stable?

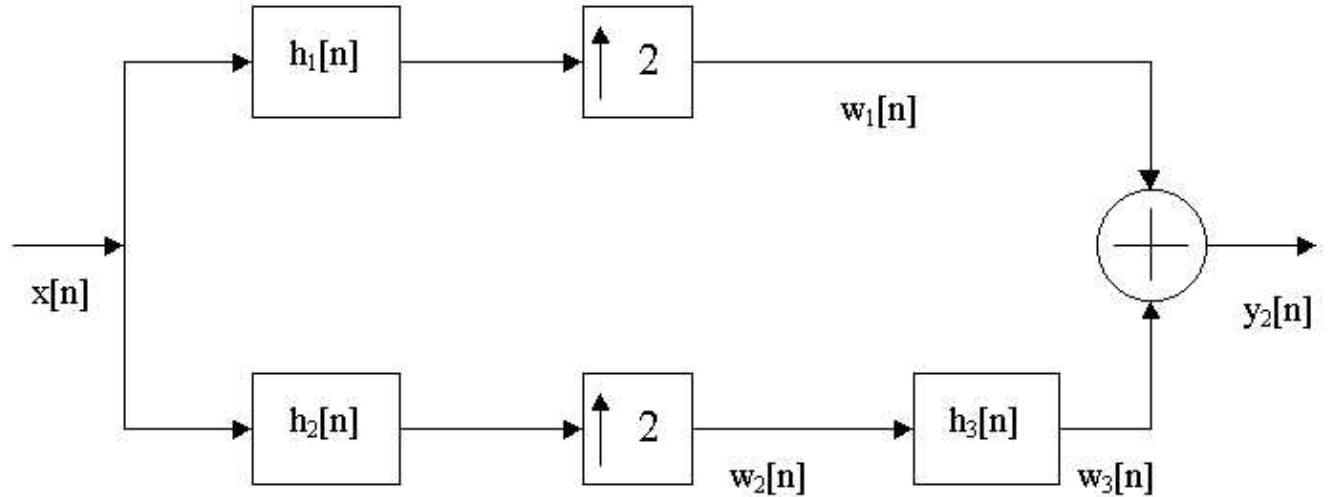
Problem #3

3. (30 points)

We would like to implement the following system:



Except we cannot use filters with more than three taps. So the following implementation is proposed:

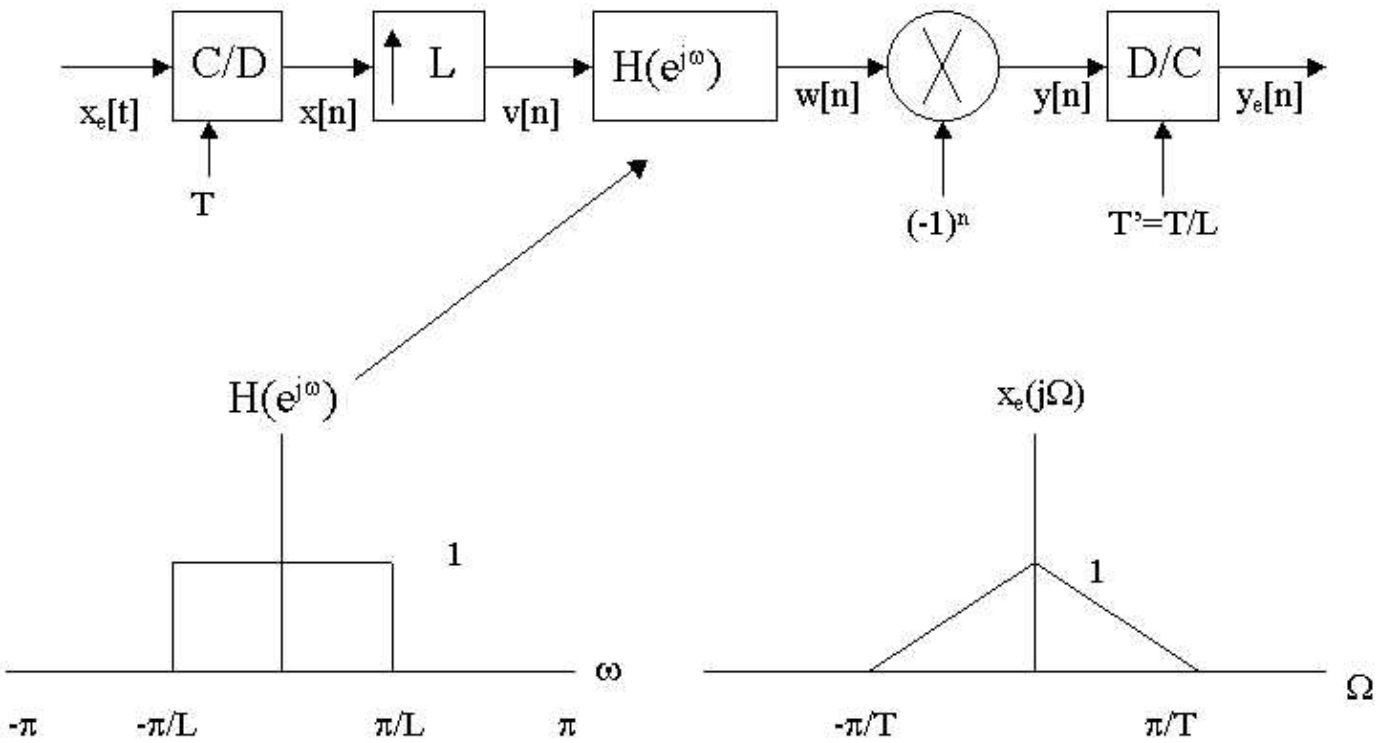


The three impulse responses $h_1[n]$, $h_2[n]$, and $h_3[n]$ are restricted to be zero outside the range $0 \leq n \leq 2$. Determine a choice for $h_1[n]$, $h_2[n]$, and $h_3[n]$ and so that $y_1[n] = y_2[n]$.

Problem #4

4. (30 Points)

Consider the following system:



$X_e(j\omega)$ is given the continuous time Fourier Transform of $X_e(t)$. Sketch and label $Y_e(j\omega)$, the continuous time Fourier Transform of $Y_e(t)$.

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