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1、

(a) 已知 $S_1: y_1[n] = x_1[n] + x_1[n-1]$

$S_2: y_2[n] = x_2[n] + 2x_2[n-1] - x_2[n-2]$

$S_3: y_3[n] = x_3[n-1] + x_3[n-2]$

By backward-difference system, impulse response of $S_1: h_1[n] = \delta[n] + \delta[n-1]$

$S_2: h_2[n] = \delta[n] + 2\delta[n-1] - \delta[n-2]$

$S_3: h_3[n] = \delta[n-1] + \delta[n-2]$

$\therefore h[n] = (h_1[n] * h_2[n]) * h_3[n] = (\delta[n] + 3\delta[n-1] + \delta[n-2] - \delta[n-3]) * h_3[n]$

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

1	2	-1	
1	1		
1	2	-1	
	1	2	-1
1	3	1	-1

0	1	1			
1	3	1	-1		
0	1	1			
	0	3	3		
		0	1	1	
			0	-1	-1
0	1	4	4	0	-1

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

(b) System is FIR because y[n] is not depend on previous outputs. #

2.

(c)

Frequency response : $H(e^{jw}) = e^{-jw} + 4e^{-j2w} + 4e^{-j3w} - e^{-j5w}$ #

(d)

已知 causal system's property : An LTI system is causal if and only if

$h[n] = 0$ for all $n < 0$.

$h[n] = \delta[n-1] + 4\delta[n-3] + 4\delta[n-4] - \delta[n-5]$ when $n < 0$ e.g $n = -1 \Rightarrow h[-1] = 0$

$\Rightarrow$ $h[n] = 0$ when $n < 0$ meets the causal system's property.

$\therefore$ It is causal system. #