Prob. 2.24

$$h_2[n] = u[n] - u[n-2]$$

$$= \left\{ \underset{\uparrow}{1}, 1 \right\}$$
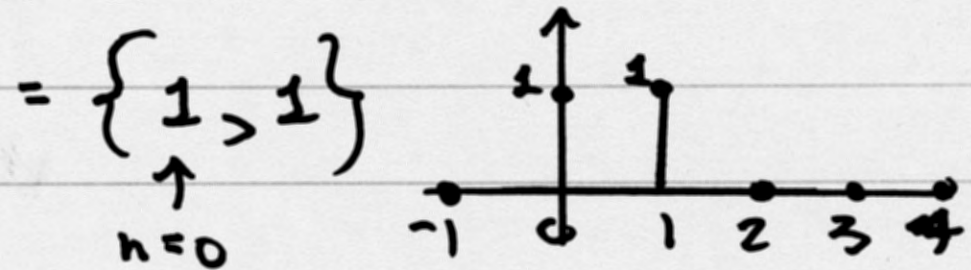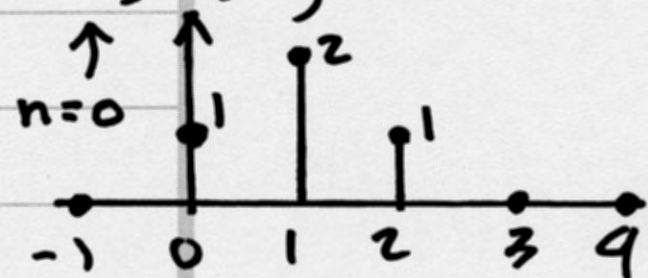$$n=0$$

Three LTI systems in series:

$$h_0[n] = h_1[n] * h_2[n] * h_2[n]$$

$$= h_1[n] * \left\{ (u[n]-u[n-2]) * (u[n]-u[n-2]) \right\}$$

$$\underbrace{}$$

$$h_3[n] = \left\{ 1, 2, 1 \right\}$$
$$\uparrow$$
$$n=0$$

Recall DT Convolution
method discussed in
class notes

$$h_0[n] = h_1[n] * \underbrace{\left\{ 1, 2, 1 \right\}}_{h_3(n)}$$

$$= \sum_{k=0} h_1[k] \, h_3[n-k]$$

First: how "long" is $h_1[n]$? call it N

Given: $h_0[n]$ is ot "length" 7

$$= \left\{ 1, 5, 10, 11, 8, 4, 1 \right\}$$

$\uparrow$ $n=0$　　　　　　　　$\uparrow$ $n=6$

Thus:

$$N + 3 - 1 = 7 \implies N = 5$$

which means it's only nonzero over $0 \le n \le 4$

n:	0	1	2	3	4	5	6	
$h_1[0]$ ×	1	2	1	0	0	0	0	
$h_1[1]$ ×	0	1	2	1	0	0	0	
$h_1[2]$ ×	0	0	1	2	1	0	0	
$h_1[3]$ ×	0	0	0	1	2	1	0	
$h_1[4]$ ×	0	0	0	0	1	2	1	
$h_0[n]$	1	5	10	11	8	4	1	

$n=0$:

$h_1[0] \cdot 1 = 1 \quad \Rightarrow \quad \boxed{h_1[0] = 1}$

$b=1$:

$2\,h_1[0] + 1 \cdot h_1[1] = 5 \quad h_1[1] = 5 - 2\,h_1[0] = 3$

$\boxed{h_1[1] = 3}$

$n=2$:

$1 \cdot h_1[0] + 2 \cdot h_1[1] + h_1[2] = 10$

$\Rightarrow \quad h_1[2] = 10 - 1 - 2(3) = 3 \qquad \boxed{h_1[2] = 3}$

$n=3$:

$1 \cdot h_1[1] + 2 \cdot h_1[2] + 1 \cdot h_1[3] = 11$

$\Rightarrow \quad h_1[3] = 11 - 3 - 2(3) = 2 \qquad \boxed{h_1[3] = 2}$

$n=4$:

$h_1[2] + 2\,h_1[3] + h_1[4] = 8 \qquad \boxed{h_1[4] = 1}$

$h_1[4] = 8 - 3 - 2(2) = 1$

$h_1[n] = \{\underset{\underset{n=0}{\uparrow}}{1}, 3, 3, 2, \underset{\underset{n=4}{\uparrow}}{1}\}$