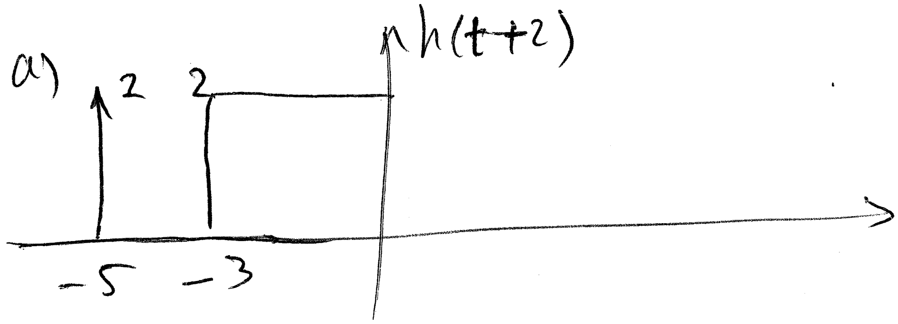
Midterm Solution (B)

1)

a)



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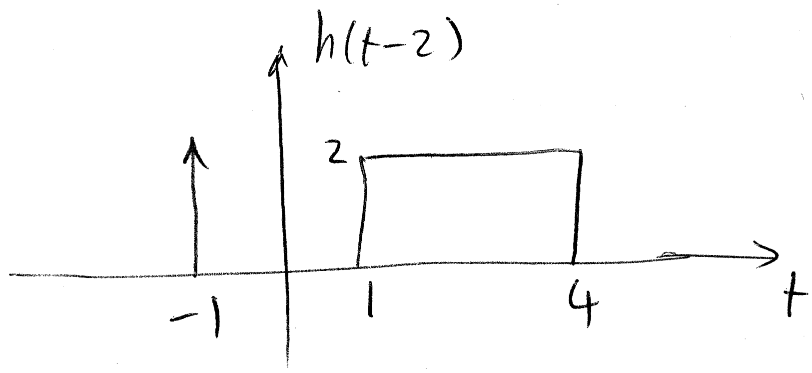
b)



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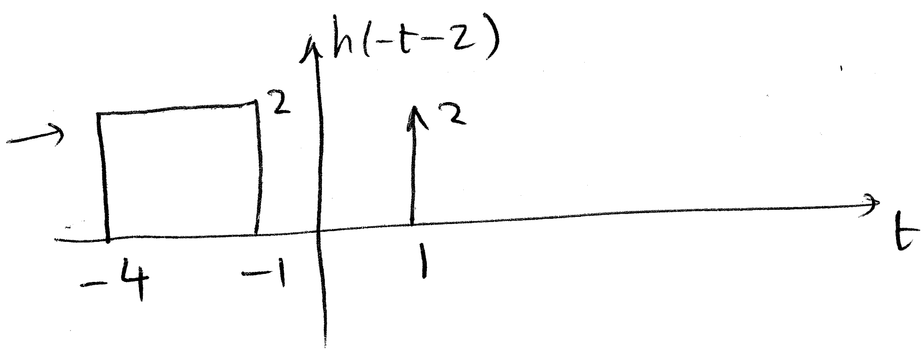

c) No, Since $h(t) \neq 0$ for $t < 0$, example, $h(-0.5) \neq 0$

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d) No, Since $h(t) \neq k\,\delta(t)$

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e) yes, $\int_{-\infty}^{+\infty} |h(t)| = 2 + 2 \times 3 = 8 < \infty$

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#2) $y = Im\{x[n]\}$

a) $x_1(n) = a\,x[n]$, $a \in \mathbb{C}$ Complex numbers

$\rightarrow y_1(n) = Im\{x_1(n)\} = Im\{a\,x[n]\} \neq a\,x[n]$ in general

$\Rightarrow$ non-linear

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or, Counterexample: $x[n] = \delta[n]$, $a = 1+j$

$Im\{a\,x[n]\} = \delta[n] \neq a\,Im\{x[n]\} = 0$

b) $x_1[n] = x[n-n_0]$, $y[n] = Im\{x[n]\}$

$\rightarrow y_1[n] = Im\{x_1[n]\} = Im\{x[n-n_0]\}$

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$= y[n-n_0] \longrightarrow$ Time invariant

c) no, Since the <u>real part</u> of $x[n]$ Can not be

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recovered from the real part

d) Assume: $|x[n]| < B$ (bounded input)

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$|y(n)| = |Im\{x[n]\}| = \frac{1}{2}|x[n] - x^*[n]|$

$\leq \frac{1}{2}\left[|x[n]| + |x^*[n]|\right] = |x[n]| < B$

$\rightarrow$ Stable (bounded output)

e) $x[n] = \delta[n] \Rightarrow y(n) = h(n) = \delta(n) + \delta(n-1)$

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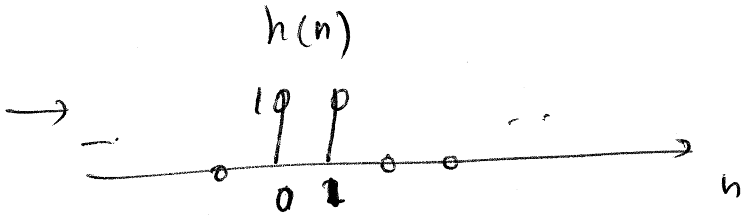

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f)

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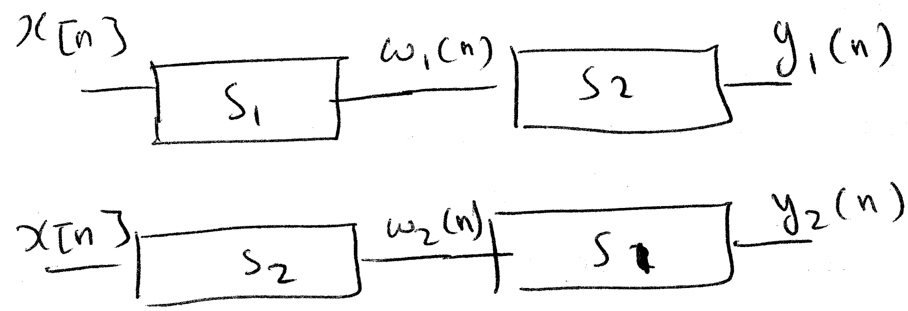


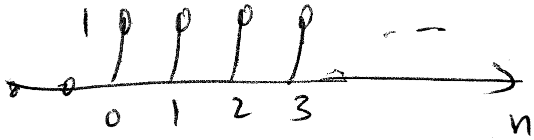
$w_1(n) = Im\{x[n]\} \Rightarrow y_1(n) = Im\{x[n]\} + Im\{x(n-1)\}$

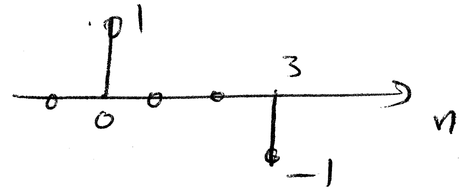
$w_2(n) = x[n] + x[n-1] \Rightarrow y_2(n) = Im\{x[n]\} + Im\{x(n-1)\}$

$\Rightarrow y_1(n) = y_2(n)$

#3)

a) $x[n]$ $h(n)$





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b) $Od\{h(n)\} = \dfrac{h(n) - h(-n)}{2}$

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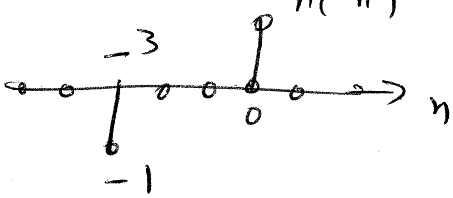
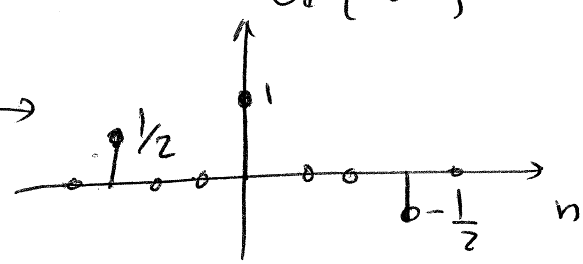
$h(-n)$



$\longrightarrow$ $Od\{h(n)\}$



c) $y(n) = u(n) * (\delta(n) - \delta(n-3))$

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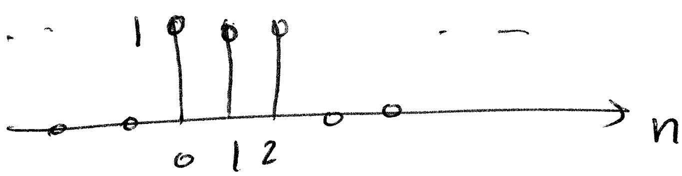
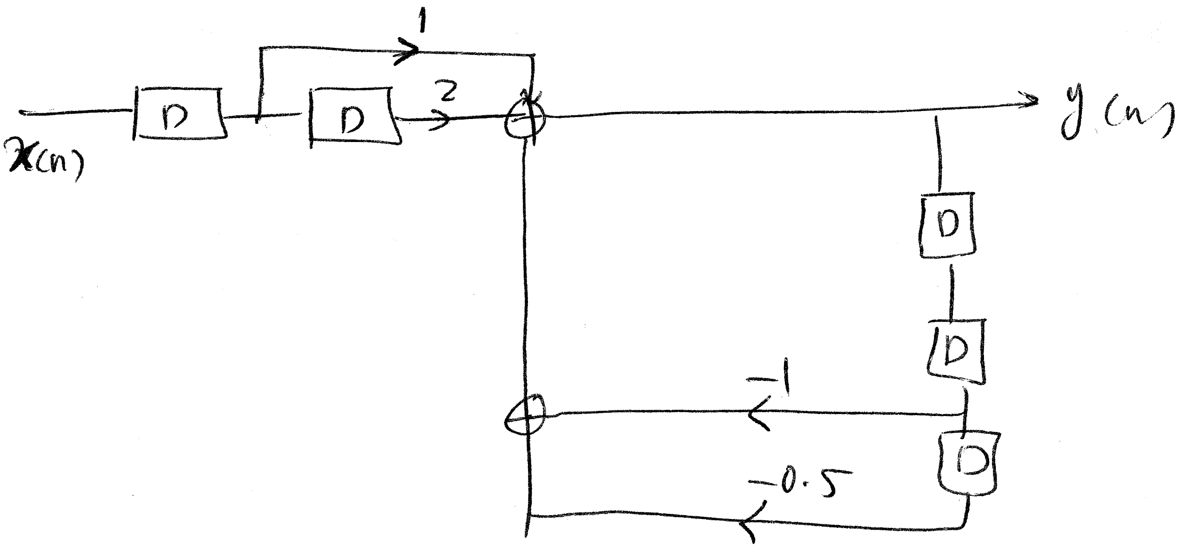
$= u(n) - u(n-3)$ 2/7

$y(n)$



#4) $y(n) = -y(n-2) - 0.5\,y(n-3) + x(n-1) + 2x(n-2)$

a)



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b) $x(n) = \delta(n)$

Initial rest condition: $h(n) = 0$ for $n \leq 0$

$\rightarrow$ $h(2) = -\overset{0}{h(0)} - 0.5\,\overset{0}{h(-1)} + \overset{0}{\delta(1)} + 2\,\overset{1}{\delta(0)}$

$= 2$