Prob. 1 Soln for Final Exam F 2017

- $L = 3$ so remove/discard 3 pts at the beginning and $L-1$ pts at the end:

$$y_4[n] = \{5-j,\ 7+3j,\ -1+5j,\ 3+7j\}$$

- Next: need 4-pt. DFT of $h[n]$ or $h[n] = \{\underset{\uparrow}{8}, 4, 2\}$

$h[n] \overset{DTFT}{\Longrightarrow} H(\omega)$ at $\omega = 0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}$

$= \quad = H(z)$ at $z = 1, j, -1, -j$

$$H(z) = 8 + 4z^{-1} + 2z^{-2}$$

$$H(0) = H_{zT}(1) = 14$$

$$H\left(\frac{\pi}{2}\right) = H_{zT}(j) = 8 - 4j - 2 = 6 - 4j$$

$$H(\pi) = H_{zT}(-1) = 8 - 4 + 2 = 6$$

$$H\left(\frac{3\pi}{2}\right) = H_{zT}(-j) = 6 + 4j$$

Similarly, we need 4-pt DFT of $y_4[n]$:

$$\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -j & -1 & +j \\ 1 & -1 & 1 & -1 \\ 1 & +j & -1 & -j \end{bmatrix} \begin{bmatrix} 5-j \\ 7+3j \\ -1+5j \\ 3+7j \end{bmatrix} = \begin{bmatrix} 14+14j \\ 2-10j \\ -6-6j \\ 10-2j \end{bmatrix}$$

Now, pointwise divide:

$b_0 = 14+14j \,/\, 14 = 1+j$

$b_1 = 2-10j \,/\, 6-j4 = 1-j$

$b_2 = -6-6j \,/\, 6 = -1-j$

$b_3 = 10-2j \,/\, 6+4j = 1-j$

Soln to Prob. 4 Final Exam F 2017

$y[n] = x[n] * h[n]$ is of length $L+M-1 = 4+5-1 = 8$

region of support: $n = 0, 1, \ldots, 7$

Time-Domain Aliasing:

$y_6[n] = y[n] + y[n+6]$

(A) $y_6[0] = y[0] + y[6]$

(B) $y_6[1] = y[1] + y[7]$

} 2 pts. at end aliased into 2 pts. at beginning

$y_6[n] = y[n]$ for $n = 2, 3, 4, 5$

$y[2] = 3$

$y[3] = 4$

$y[4] = 4$

$y[5] = 3$

} 4 good points

Soln to Prob 4 (cont.)

$$y_5[n] = y[n] + y[n+5]$$

(C) $y_5[0] = y[0] + y[5]$
(D) $y_5[1] = y[1] + y[6]$
(E) $y_5[2] = y[2] + y[7]$

} 3 pts. at end aliased into 3 pts. at beginning

$y_5[3] = y[3] = 4$
$y_5[4] = y[4] = 4$

} good points

4 Unknowns: $y[0], y[1], y[6], y[7]$

(C) $y_5[0] = 4 = y[0] + y[5] = y[0] + 3$ } $y[0] = 1$

(A) $y_6[0] = y[0] + y[6] = 1 + y[6] = 3$ } $y[6] = 2$

(D) $y_5[1] = y[1] + y[6] = y[1] + 2 = 4$ } $y[1] = 2$

(B) $y_6[1] = y[1] + y[7] = 2 + y[7] = 3$ } $y[7] = 1$

$y[n] = \{1, 2, 3, 4, 4, 3, 2, 1\}$