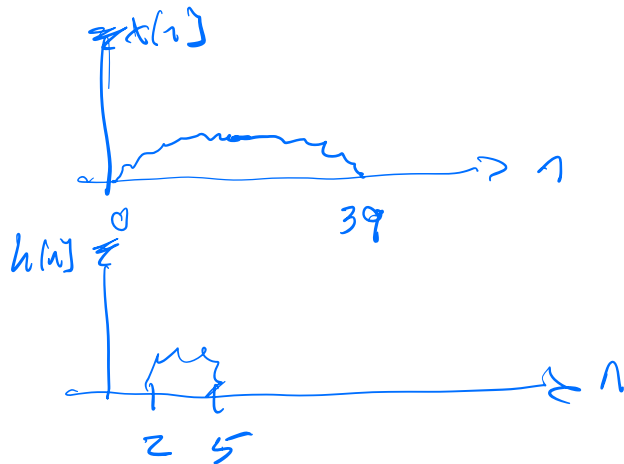


3/31/23

REVIEW FOR Q2 B

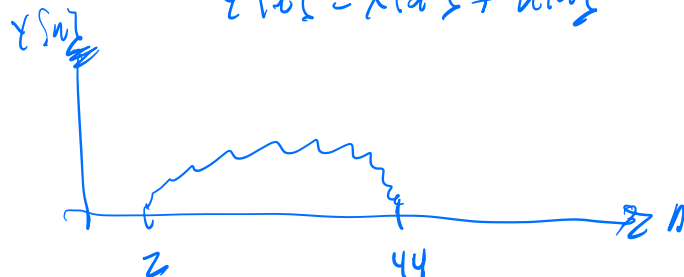
$$x[n] \neq 0, \quad 0 \leq n \leq 39$$

$$h[n] \neq 0, \quad 2 \leq n \leq 5$$



$$y[n] = x[n] * h[n]$$

(a)



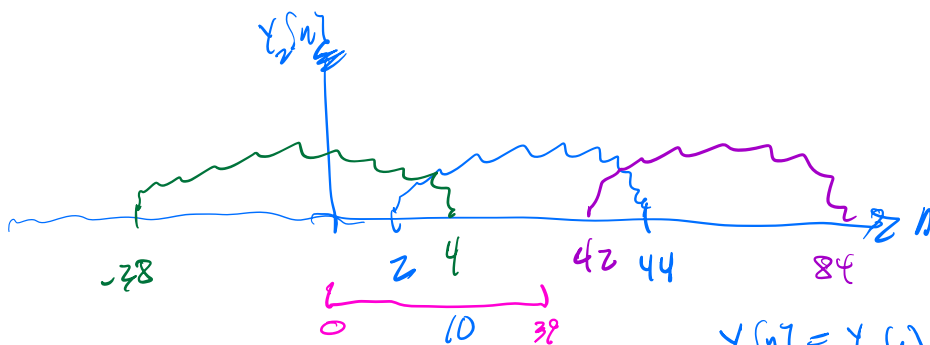
(b)

$$x[n] \xleftrightarrow{40} X[k]$$

$$h[n] \xleftrightarrow{40} H[k]$$

$$Y_2[k] = H[k] X[k]$$

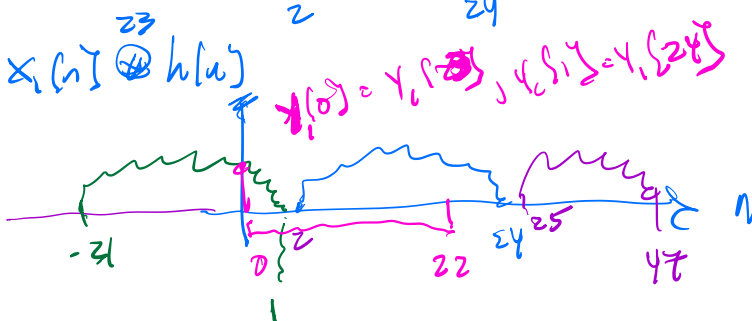
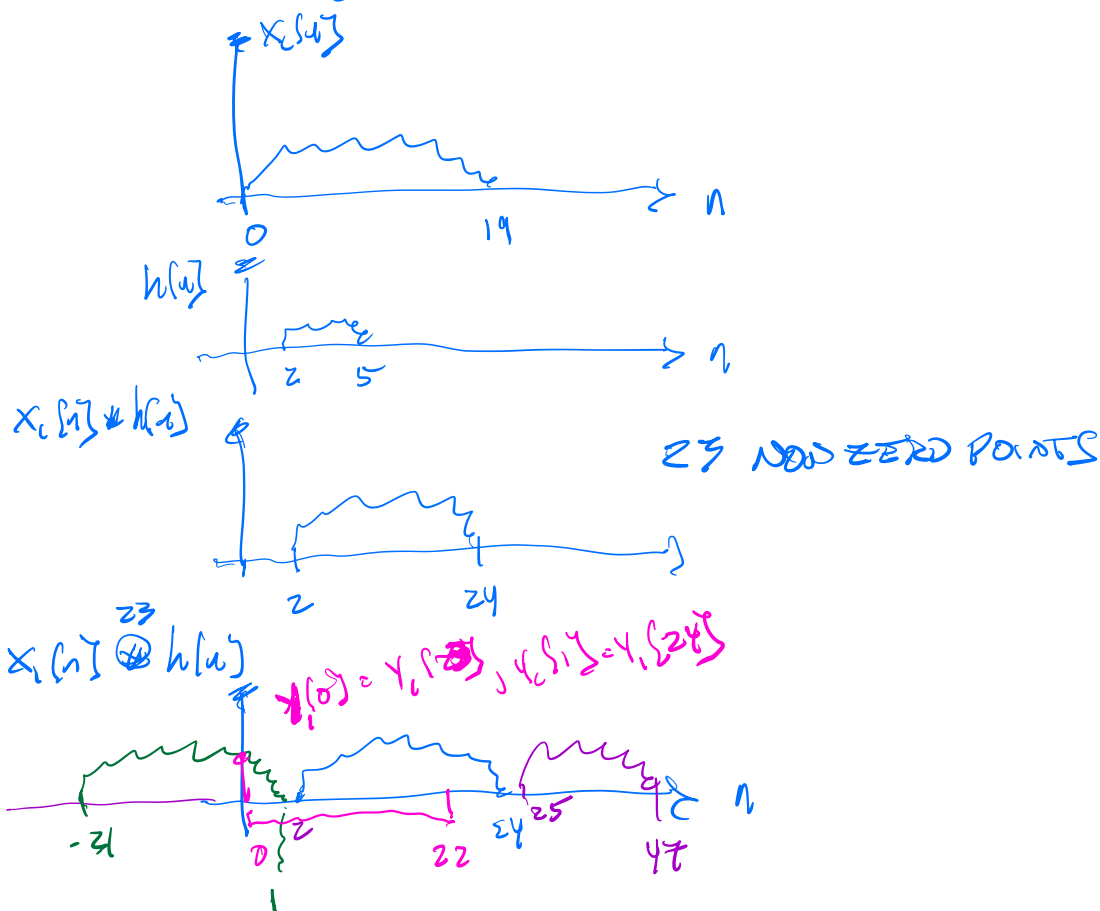
$$Y_2[n] \xleftrightarrow{40} Y_2[k] = x[n] \oplus h[n]$$



$$y[n] = y_2[n] \text{ for } 5 \leq n \leq 41$$

(c) $x[n]$ arbitrary sequence of length 20

take $h[n]$, $0 \leq n \leq 5$



2 sections used

$$\text{let } x_1[n] = x[n], \quad 0 \leq n \leq 19$$

$$y_1[n] = x_1[n] * h[n]$$

$$y_1[0] = y_1[24] = y_1[1], \quad y_1[n], \quad 2 \leq n \leq 24$$

$$x_2[n] = x[n+20], \quad 0 \leq n \leq 19$$

$$y_2[n] = x_2[n] * h[n], \quad y_2[20] = y_2[0], \quad y_2[24] = y_2[1]$$

$$y[n] = y_1[n] + y_2[n-20], \quad 2 \leq n \leq 24$$

Q3 ZEROS @ 0, 1, 2

POLES @ $-1, -1+j, -1-j$

$$y[n] = -3x[n-1] - 4x[n-2] - 2x[n-3] + x[n] - 3x[n-1] + 2x[n-2]$$

(a)

1. DFT II

2. TRANSPOSED DFT II

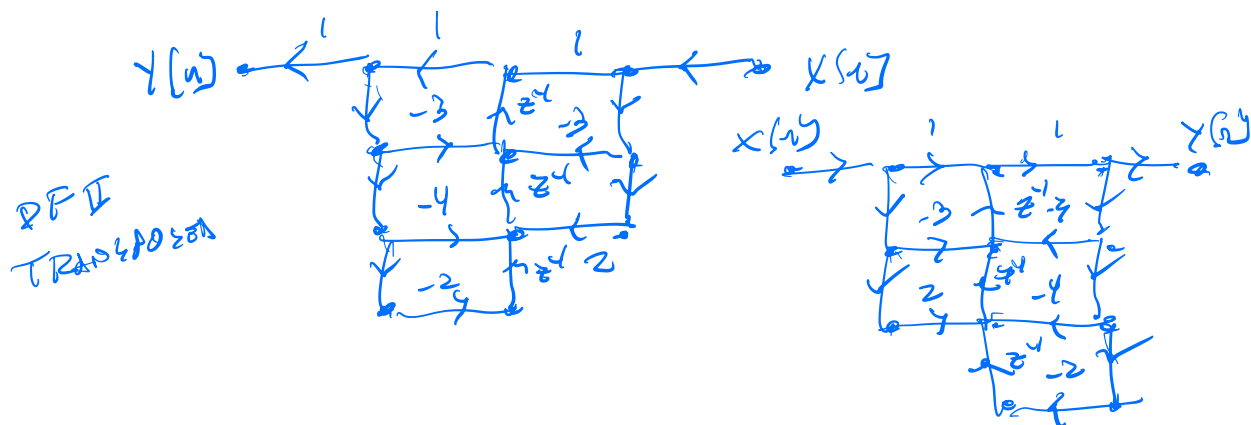
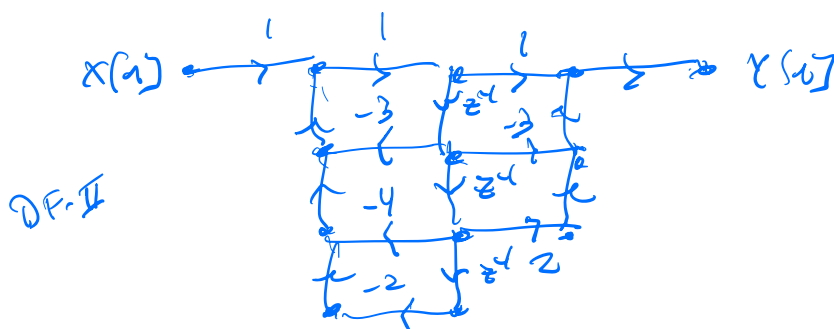
3. CASCADE FORM

DFT II

$$y[n] + 3y[n-1] + 4y[n-2] - 2y[n-3] = x[n] - 3x[n-1] + 2x[n-2]$$

$$Y(z)(1 + 3z^{-1} + 4z^{-2} + 2z^{-3}) = X(z)(1 - 3z^{-1} + 2z^{-2})$$

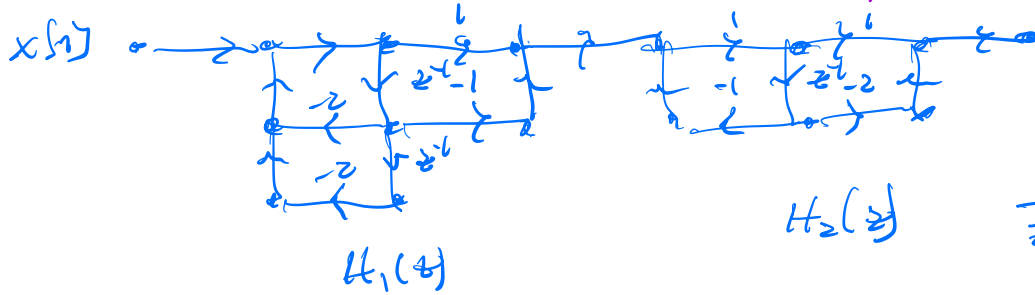
$$H(z) = \frac{Y(z)}{X(z)} = \frac{1 - 3z^{-1} + 2z^{-2}}{1 + 3z^{-1} + 4z^{-2} + 2z^{-3}} = \frac{\sum_{l=0}^M b_l z^{-l}}{1 - \sum_{k=1}^N a_k z^{-k}}$$



CASCAD~~ED~~ FORM

ZEROS @ $0, 1, 2$

POLES @ $-1, -1 \pm j$



$$H_2(z) = \frac{z-2}{z+1} = \frac{1-2z^{-1}}{1+z^{-1}}$$

$$H_1(z) = \frac{(1-0z^{-1})(1-z^{-1})}{1+2z^{-1}+2z^{-2}} = \frac{1-z^{-1}}{1+2z^{-1}+2z^{-2}}$$

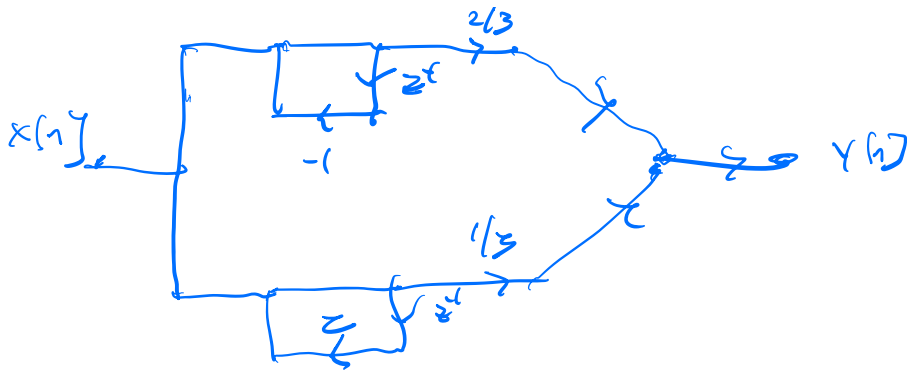
$$H_2(z) = \frac{1-2z^{-1}}{1+z^{-1}}$$

$$\begin{aligned} \text{(b)} \quad H(z) &= \frac{(z)(z-1)}{(z+1)(z-2)} = \frac{1(1-z^{-1})}{(1+z^{-1})(1-2z^{-1})} \\ &= \frac{A_1}{1+z^{-1}} + \frac{A_2}{1-2z^{-1}} \end{aligned}$$

$$A_1 = \left. \frac{1-z^{-1}}{1-2z^{-1}} \right|_{z=-1} = \frac{2}{3}$$

$$A_2 = \left. \frac{1-1z^{-1}}{1+z^{-1}} \right|_{z=2} = \frac{1-\frac{1}{2}}{1+\frac{1}{2}} = \frac{1/2}{3/2} = \frac{1}{3}$$

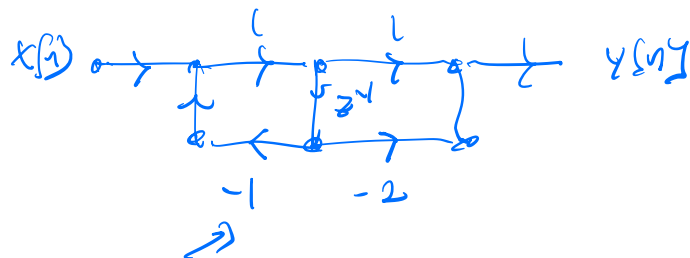
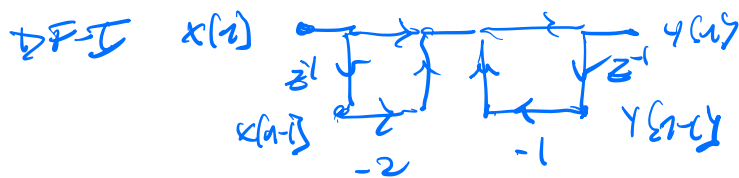
$$H(z) = \frac{2/3}{1+z^{-1}} + \frac{1/3}{1-2z^{-1}}$$



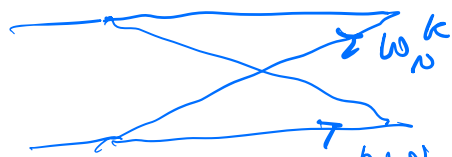
$$H(z) = \frac{1 - 2z^{-1}}{1 + z^{-1}} = \frac{Y(z)}{X(z)} = \frac{\sum_{l=0}^M b_l z^{-l}}{1 - \sum_{k=1}^p a_k z^{-k}}$$

$$y[n] + y[n-1] = x[n] - 2x[n-1]$$

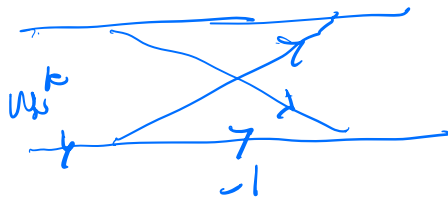
$$y[n] = y[n-1] + x[n] - 2x[n-1]$$



$$X[k] = \text{y-p. DFT of even} + \omega_N^k \text{ y-p. DFT of odds}$$



$$w_N^{k+N/2} = w_N^k \cdot w_N^{N/2} = w_N^k \cdot (-1)$$



$$w_8^0 = 1$$

$$w_8^1 = -j$$

$$w_8^2 = -1$$

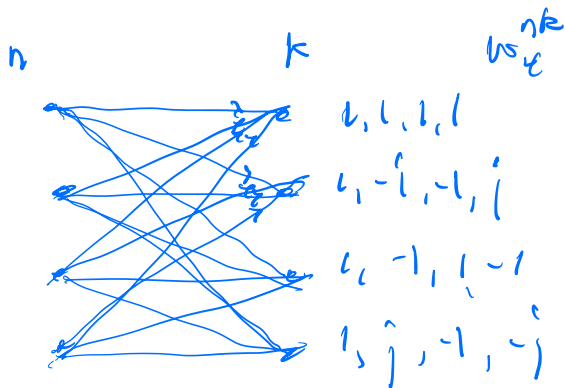
$$w_8^3 = j$$

$$w_8^4 = 1$$

$$w_8^5 = -j$$

$$w_8^6 = -1$$

$$w_8^7 = j$$



Q1

QW500 x/17, $\{k\}$

