



PROBLEM:

Pick the correct frequency response and enter the number in the answer box:

Difference Equation or Impulse Response

Frequency Response

(a) $y[n] = \frac{1}{2}y[n-1] + x[n]$

ANS =

(b) $h[n] = (-\frac{1}{2})^n u[n]$

ANS =

(c) $y[n] = x[n] + x[n-1] + x[n-2]$

ANS =

(d) $h[n] = \sum_{k=0}^3 x[n-k]$

ANS =

1. $H(e^{j\hat{\omega}}) = e^{-j\hat{\omega}}(1 + 2\cos(\hat{\omega}))$

2. $H(e^{j\hat{\omega}}) = \frac{\sin \hat{\omega}}{\sin(\frac{1}{2}\hat{\omega})}$

3. $H(e^{j\hat{\omega}}) = e^{-j1.5\hat{\omega}} \frac{\sin 2\hat{\omega}}{\sin(\frac{1}{2}\hat{\omega})}$

4. $H(e^{j\hat{\omega}}) = 1 + \frac{1}{2}e^{-j\hat{\omega}}$

5. $H(e^{j\hat{\omega}}) = \frac{1}{1 - \frac{1}{2}e^{-j\hat{\omega}}}$

6. $H(e^{j\hat{\omega}}) = \frac{1}{1 + \frac{1}{2}e^{-j\hat{\omega}}}$



Pick the correct frequency response and enter the number in the answer box:

Difference Equation or Impulse Response

Frequency Response

(a) $y[n] = \frac{1}{2}y[n-1] + x[n]$

ANS = 5

(b) $h[n] = (-\frac{1}{2})^n u[n]$

ANS = 6

(c) $y[n] = x[n] + x[n-1] + x[n-2]$

ANS = 1

(d) $y[n] = \sum_{k=0}^3 x[n-k]$

ANS = 3

1. $H(e^{j\hat{\omega}}) = e^{-j\hat{\omega}}(1 + 2\cos(\hat{\omega}))$

2. $H(e^{j\hat{\omega}}) = \frac{\sin \hat{\omega}}{\sin(\frac{1}{2}\hat{\omega})}$

3. $H(e^{j\hat{\omega}}) = e^{-j1.5\hat{\omega}} \frac{\sin 2\hat{\omega}}{\sin(\frac{1}{2}\hat{\omega})}$

4. $H(e^{j\hat{\omega}}) = 1 + \frac{1}{2}e^{-j\hat{\omega}}$

5. $H(e^{j\hat{\omega}}) = \frac{1}{1 - \frac{1}{2}e^{-j\hat{\omega}}}$

6. $H(e^{j\hat{\omega}}) = \frac{1}{1 + \frac{1}{2}e^{-j\hat{\omega}}}$

$$(a) H(z) = \frac{1}{1 - \frac{1}{2}z^{-1}} \Rightarrow H(e^{j\hat{\omega}}) = \frac{1}{1 - \frac{1}{2}e^{-j\hat{\omega}}}$$

$$(b) (-\frac{1}{2})^n u[n] \rightarrow \frac{1}{1 - az^{-1}} \text{ with } a = -\frac{1}{2}$$

$$H(z) = \frac{1}{1 + \frac{1}{2}z^{-1}} \Rightarrow H(e^{j\hat{\omega}}) = \frac{1}{1 + \frac{1}{2}e^{-j\hat{\omega}}}$$

$$(c) H(e^{j\hat{\omega}}) = 1 + e^{-j\hat{\omega}} + e^{-j2\hat{\omega}}$$

$$= e^{-j\hat{\omega}}(e^{j\hat{\omega}} + 1 + e^{-j\hat{\omega}}) = e^{-j\hat{\omega}}(1 + 2\cos \hat{\omega})$$

$$(d) H(e^{j\hat{\omega}}) = 1 + e^{-j\hat{\omega}} + e^{-j2\hat{\omega}} + e^{-j3\hat{\omega}} \leftarrow 4\text{-pt summing}$$

$$L\text{-pt summing has } H(e^{j\hat{\omega}}) = e^{-j\hat{\omega}(L-1)/2} \frac{\sin L\hat{\omega}/2}{\sin \frac{1}{2}\hat{\omega}}$$

$$\therefore H(e^{j\hat{\omega}}) = e^{-j3\hat{\omega}/2} \frac{\sin 2\hat{\omega}}{\sin \frac{1}{2}\hat{\omega}}$$