M. Masyim Abdillah P. 1101191095 TT-43-11

1. $\left(\frac{1}{7}\right)^n u[n] : |z| > \frac{1}{7}$ $\left(-\frac{1}{2}\right)^n u[n] : |z| > \frac{1}{2}$

$R = R_1 \cap R_2 = |z| > \frac{1}{2}$ (b)

2. b. Merupakan deretan unit sample

Seharusnya deretan unit impuls

3. $x[n] = \delta[n] + \delta[n-5] \rightarrow X(z) = 1 + z^{-5}$

$Y[n] = \delta[n-2] \rightarrow Y(z) = z^{-2}$

$x[n] * y[n] = X(z) \cdot Y(z)$

$= (1 + z^{-5})(z^{-2}) = z^{-2} + z^{-7}$

$= \delta[n-2] + \delta[n-7]$ (a)

4. c. $\delta[n+5] + \delta[n]$

5. $x[n] = \delta[n-2] + \delta[n-4] = z^{-2} + z^{-4}$ (a)

6. $x[n] = \left(\frac{1}{2}\right)^n u[n] + \left(-\frac{1}{3}\right)^n u[n]$

$= \frac{1}{1 - \frac{1}{2}z^{-1}} + \frac{1}{1 - \left(-\frac{1}{3}\right)z^{-1}} = \frac{1}{1 - \frac{1}{2}z^{-1}} + \frac{1}{1 + \frac{1}{3}z^{-1}}$ (b)

7. d. Sistem non-rekursif orde

8. a. Merupakan sinyal ganjil

9 $Y[n] + 0,6\,Y[n-1] + 0,08\,Y[n-2] = X[n] - X[n-1]$

a. $Y[n] + 0,6\,Y[n-1] + 0,08\,Y[n-2] = X[n] - X[n-1]$

$Y(z) + 0,6\,z^{-1}Y(z) + 0,08\,z^{-2}Y(z) = X(z) - z^{-1}X(z)$

$Y(z)\left[1 + 0,6\,z^{-1} + 0,08\,z^{-2}\right] = X(z)\left[1 - z^{-1}\right]$

$$\frac{Y(z)}{X(z)} = H(z) = \frac{1 - z^{-1}}{1 + 0,6\,z^{-1} + 0,08\,z^{-2}}$$

$$H(z) = \frac{z^2 - z}{z^2 + 0,6z + 0,08}$$

b. Zero : $z^2 - z = z(z-1)$

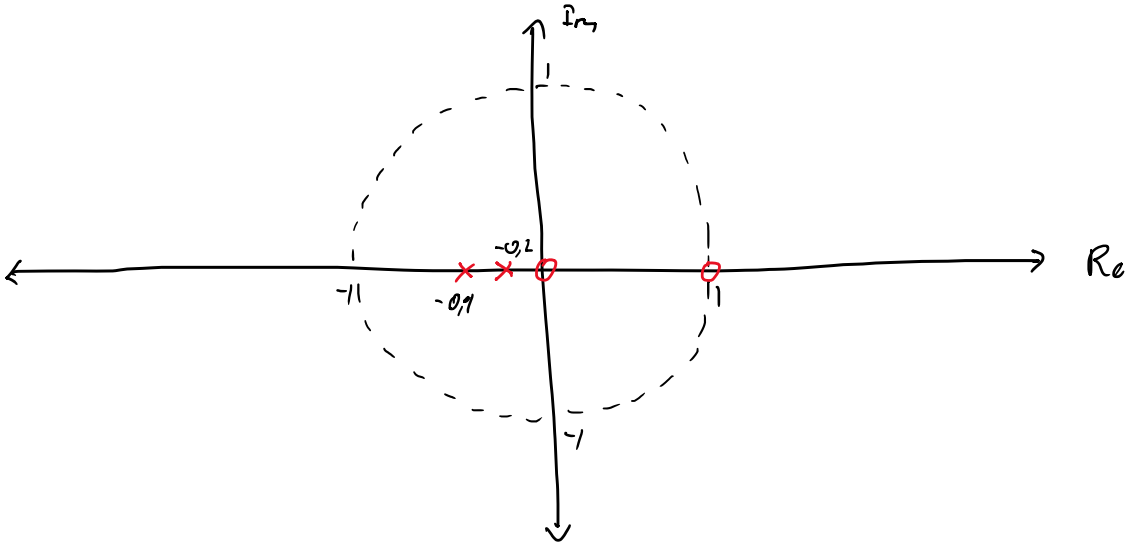
$z_1 = 0$

$z_2 = 1$

Pole : $z^2 + 0,6z + 0,08 = (z + 0,2)(z + 0,4)$

$p_1 = -0,2$

$p_2 = -0,4$



c. ROC $X(z)$: $|z| > 1$

ROC $Y(z)$: $|z| > 0,4$

ROC $X(z) \cap Y(z) = |z| > 1$

d. Karena pole dan zero berada di dalam lingkaran satuan maka sistem stabil.

e. karena $h[n] = 0$ untuk $n < 0$

maka sistem kausal

f. $H(z) = \dfrac{z^2 - z}{z^2 + 0{,}6z + 0{,}08} = \dfrac{z^2 - z}{(z + 0{,}2)(z + 0{,}4)}$

$A + B = 1$

$0{,}4A + 0{,}2B = -1$

$A = -6$

$B = 7$

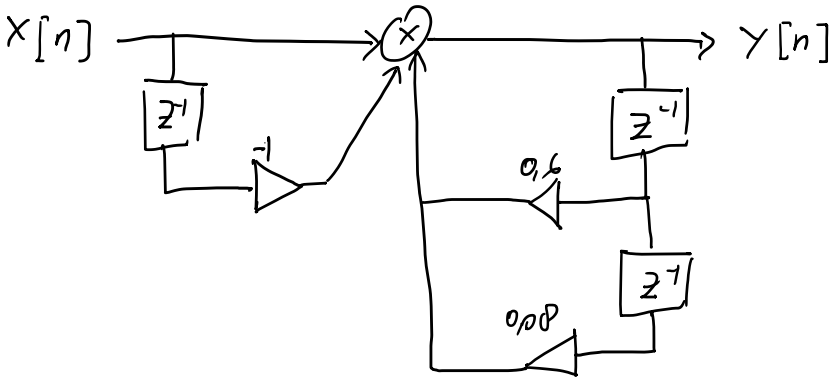
$= \dfrac{Az}{z + 0{,}2} + \dfrac{Bz}{z + 0{,}4}$

$= \dfrac{Az^2 + 0{,}4Az}{z + 0{,}2} + \dfrac{Bz^2 + 0{,}2Bz}{z + 0{,}4}$

$= -\dfrac{6z}{z + 0{,}2} + \dfrac{7z}{z + 0{,}4}$

$H(n) = -6(-0{,}2)^n u[n] + 7(-0{,}4)^n u[n]$

g.



h. $H(e^{j\omega}) = -6 \cdot \dfrac{1}{1 - (-0{,}2)e^{-j\omega}} + 7\dfrac{1}{1 - (-0{,}4)e^{-j\omega}}$

$= -6\left(1 + 0{,}2e^{-j\omega}\right)^{-1} + 7\left(1 + 0{,}4e^{-j\omega}\right)^{-1}$

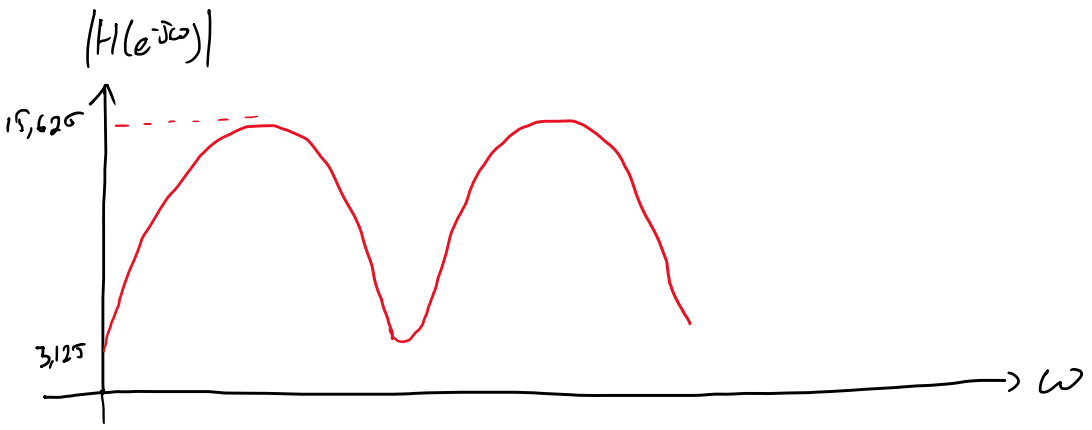
$= -6\dfrac{1}{1 + 0{,}2e^{-j\omega}} \cdot \dfrac{1 - 0{,}2e^{-j\omega}}{1 - 0{,}2e^{-j\omega}} + 7\dfrac{1}{1 + 0{,}4e^{-j\omega}} \cdot \dfrac{1 - 0{,}4e^{-j\omega}}{1 - 0{,}4e^{-j\omega}}$

$= -\dfrac{6}{0{,}96}\left(1 - 0{,}2(\cos\omega - j\sin\omega)\right) + \dfrac{7}{0{,}64}\left(1 - 0{,}4(\cos\omega - j\sin\omega)\right)$

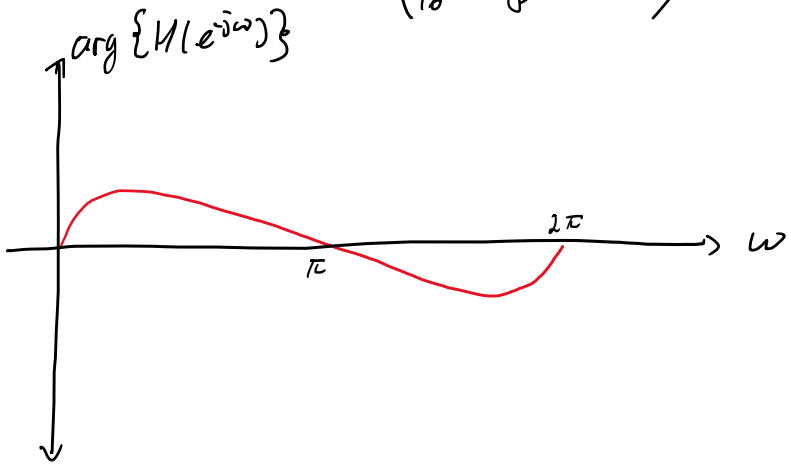
$= \dfrac{75}{16} - \dfrac{25}{8}\cos\omega + j\dfrac{25}{8}\sin\omega$

i. $|H(e^{-j\omega})| = \sqrt{\left(\frac{75}{16} - \frac{25}{8}\cos\omega\right)^2 + \left(\frac{25}{8}\sin\omega\right)^2}$

$|H(e^{-j\omega})| = \frac{25}{16}\sqrt{13 - 12\cos\omega}$



j. $\arg\{H(e^{-j\omega})\} = \tan^{-1}\left(\frac{\frac{25}{8}\sin\omega}{\frac{75}{16} - \frac{25}{8}\cos\omega}\right) = \tan^{-1}\left(\frac{2\sin\omega}{3 - 2\cos\omega}\right)$



10. $Y[n] = 0{,}36\,Y[n-2] + X[n] + X[n-1]$

a. $Y[n] - 0{,}36\,Y[n-2] = X[n] + X[n-1]$

$Y(z) - 0{,}36\,z^{-2}Y(z) = X(z) + z^{-1}X(z)$

$\frac{Y(z)}{X(z)} = H(z) = \frac{1 + z^{-1}}{1 - 0{,}36z^{-2}} = \frac{z^2 + z}{z^2 - 0{,}36} = \frac{z(z+1)}{(z+0{,}6)(z-0{,}6)}$

$H(z) = \frac{Az}{z+0{,}6} + \frac{Bz}{z-0{,}6} = -\frac{1}{3}\frac{z}{z+0{,}6} + \frac{4}{3}\frac{z}{z-0{,}6}$

$$h[n] = -\frac{1}{3}(-0,6)^n u[n] + \frac{4}{3}(0,6)^n u[n]$$

$$= \left[\frac{4}{3}(0,6)^n - \frac{1}{3}(-0,6)^n\right] u[n]$$

b. $$\sum_{n=-\infty}^{\infty} |h[n]| = \left[\frac{4}{3}(0,6)^n - \frac{1}{3}(-0,6)^n\right]_{n=-\infty}^{\infty} = \left(\frac{4}{3} - \frac{1}{3}\right)(0,6)^{\infty} = 1$$

c. Sistem stabil karena $\sum_{n=-\infty}^{\infty} |h[n]| < \infty$

d. $$H(e^{-j\omega}) = -\frac{1}{3}\frac{1}{1+0,6e^{-j\omega}} + \frac{4}{3}\frac{1}{1-0,6e^{-j\omega}}$$

$$= -\frac{1}{3}\frac{1}{1+0,6e^{-j\omega}} \times \frac{1-0,6e^{-j\omega}}{1-0,6e^{-j\omega}} + \frac{4}{3}\cdot\frac{1}{1-0,6e^{-j\omega}} \times \frac{1+0,6e^{-j\omega}}{1+0,6e^{-j\omega}}$$

$$= -\frac{1}{3}\cdot\frac{1}{1,36}\cdot(1-0,6e^{-j\omega}) + \frac{4}{3}\cdot\frac{1}{0,64}(1+0,6e^{-j\omega})$$

$$= -\frac{1}{4,08}(1-0,6e^{-j\omega}) + \frac{25}{12}(1+0,6e^{-j\omega})$$

$$H(e^{-j\omega}) = \frac{125}{68} + \frac{95}{68}e^{-j\omega}$$

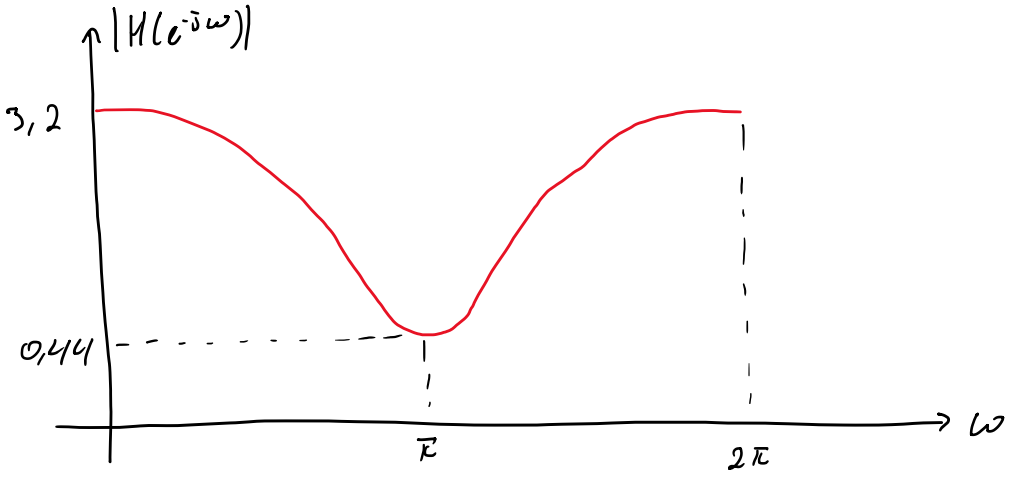
e. $$H(e^{-j\omega}) = \frac{125}{68} + \frac{95}{68}(\cos\omega - j\sin\omega)$$

$$H(e^{-j\omega}) = \frac{125}{68} + \frac{95}{68}\cos\omega - j\frac{95}{68}\sin\omega$$

$$|H(e^{-j\omega})| = \sqrt{\left(\frac{125}{68} + \frac{95}{68}\cos\omega\right)^2 + \left(\frac{95}{68}\sin\omega\right)^2}$$

$$|H(e^{-j\omega})| = \sqrt{\left[\frac{5}{68}(25 + 19\cos\omega)\right]^2 + \left[\frac{5}{68}(19\sin\omega)\right]^2}$$

$$= \frac{5}{68}\sqrt{986 + 950\cos\omega}$$



5. $\arg\{H(e^{-j\omega})\} = \tan^{-1}\left(\frac{\frac{95}{60}\sin\omega}{\frac{120}{60}+\frac{95}{60}\cos\omega}\right) = \tan^{-1}\left(\frac{19\sin\omega}{25+19\cos\omega}\right)$