

a) $y(n) = x(n-3) + x(n-2) + x(n-1) + x(n)$
 $Y(z) = X(z) \cdot z^{-3} + X(z) \cdot z^{-2} + X(z) \cdot z^{-1} + X(z)$
 $Y(z) = X(z) \cdot (z^{-3} + z^{-2} + z^{-1} + 1)$

$$T(z) = \frac{Y(z)}{X(z)} = z^{-3} + z^{-2} + z^{-1} + 1$$

$$T(z) = \frac{z^3}{z^3} \cdot (z^{-3} + z^{-2} + z^{-1} + 1) = \frac{1 + z^1 + z^2 + z^3}{z^3}$$

Módulo y Fase

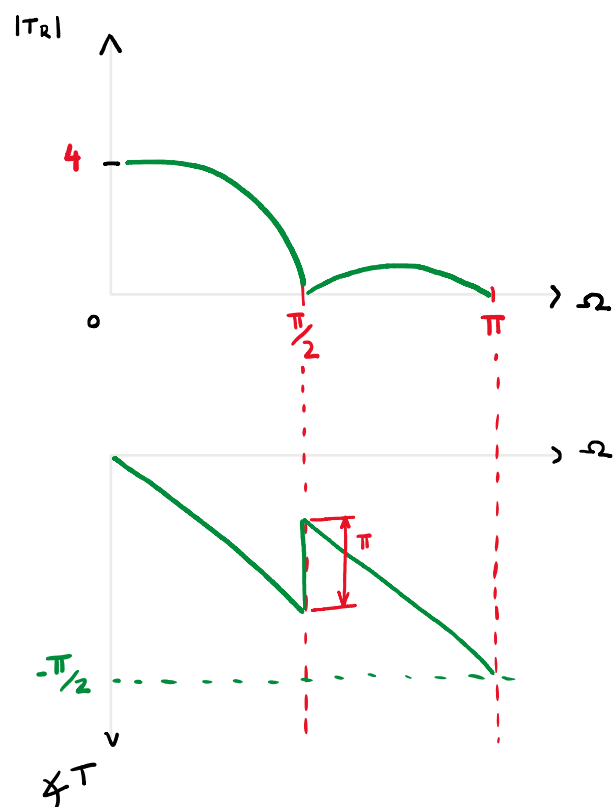
$$T(j\Omega) = \frac{e^{j0} + e^{j\Omega} + e^{2j\Omega} + e^{3j\Omega}}{e^{3j\Omega}}$$

$$= \frac{e^{\frac{3}{2}j\Omega} (e^{-\frac{3}{2}j\Omega} + e^{-\frac{1}{2}j\Omega} + e^{\frac{1}{2}j\Omega} + e^{\frac{3}{2}j\Omega})}{e^{3j\Omega}}$$

$$= e^{-\frac{3}{2}j\Omega} (2 \cos(\frac{3}{2}\Omega) + 2 \cos(\frac{1}{2}\Omega))$$

$$|T(z)| = |T_R(\Omega)| = |2 \cos(\frac{3}{2}\Omega) + 2 \cos(\frac{1}{2}\Omega)|$$

$$\angle T(z) = -\frac{3}{2}\Omega$$



$$2 \cos(\frac{3}{2}\Omega) + 2 \cos(\frac{1}{2}\Omega) = 0$$

$$2 (\cos(\frac{3}{2}\Omega) + \cos(\frac{1}{2}\Omega)) = 0$$

$$2 \left[2 \cos\left(\frac{\frac{3}{2}\Omega + \frac{1}{2}\Omega}{2}\right) \cos\left(\frac{\frac{3}{2}\Omega - \frac{1}{2}\Omega}{2}\right) \right] = 0$$

$$4 \cdot \cos\left(\frac{\cancel{2}\Omega}{2}\right) \cdot \cos\left(\frac{\Omega}{2}\right) = 0$$

$$\cancel{4} \cdot \cos(\Omega) \cos(\Omega/2) = 0$$

$$\cos(\Omega) = 0$$

$$\Omega = \frac{\pi}{2} + k\pi, \quad k \in \mathbb{N}$$

$$\cos(\Omega/2) = 0$$

$$\frac{\Omega}{2} = \frac{\pi}{2} + k\pi$$

$$\Omega = \pi + 2k\pi, \quad k \in \mathbb{N}$$

z

