Exam 1

Monday, November 15, 2021 4:00 PM

1. (a) 1000 Hz

(b) $x[n]$ is not periodic since $\frac{1000}{3000\sqrt{n}}$ is not an integer.

(c) $F_s = \frac{1000}{12}$

2. (a) This system has magnitude distortion because the magnitude response is not constant.

(b) This system has phase distortion. Ideally the phase response should be linear but in this case it seems to be a sinusoid.

(c) $|Y(e^{j\omega})| = |X(e^{j\omega})|(1)$

$\angle Y(e^{j\omega}) = \angle X(e^{j\omega}) - 0.2932\pi$

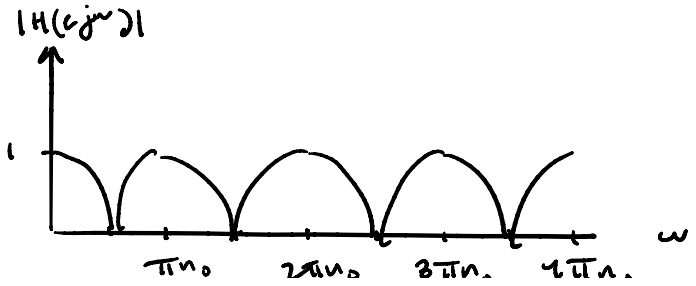
(d) $H(e^{j\omega}) = \frac{Y(e^{j\omega})}{X(e^{j\omega})} \rightarrow \begin{matrix} Y(e^{j\omega}) = 1 + 0.5e^{-j\omega} \\ X(e^{j\omega}) = 1 - 0.5e^{-j\omega} \end{matrix}$

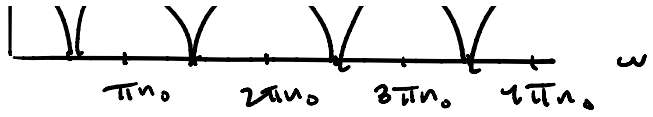
$y[n] = \delta[n] + 0.5\delta[n-1]$

(e) $H(z) = \frac{1+0.5z^{-1}}{1-0.5z^{-1}}$

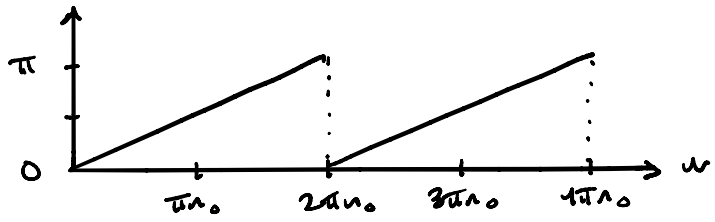
(f) $Y(e^{j\omega}) = e^{-j\omega} H(e^{j\omega}) = \frac{e^{-j\omega} + 0.5e^{-2j\omega}}{1 - 0.5e^{-j\omega}}$

3. (a)





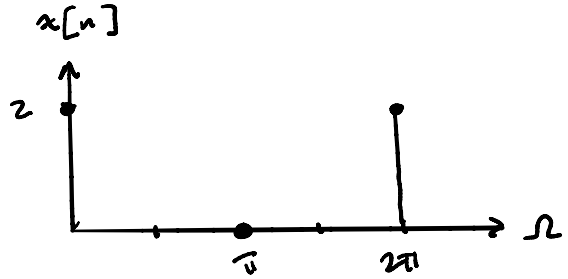
(b) $\angle H(e^{j\omega})$



(c) $h[n] = \delta[n - n_0]$

4. (a) $x(t) = \cos(2\pi\, 3000\, t) + \cos(2\pi\, 4000\, t)$

$T = 0.0001$



(b)