**FALL 24 EC516 Problem Set 07**

*Due: Sunday October 27 (Before 11:59pm)*

*You must submit your homework attempt on Blackboard Learn. For this purpose, you must convert your homework attempt to a pdf file and upload it at the corresponding homework assignment on Blackboard Learn.*

Problem 7.1

(a) Draw the envelope of the signal $x[n] = \delta[n-3]$.

(b) Draw the discrete-time signal whose envelope is $\frac{\sin(\pi(t-0.5))}{\pi(t-0.5)}$ for $-3 \leq n \leq 3$.

Problem 7.2

Consider the following ideal impulse response of a filter:

$$h_{id}[n] = \frac{\sin(0.5\pi n)}{\pi n}$$

a) Draw $H_{id}(e^{j\omega})$

b) Let $h[n] = h_{id}[n-3]w[n]$, where $w[n] = u[n] - u[n-7]$. Given that $H(e^{j\omega}) = \frac{1}{2\pi}\int_{-\pi}^{\pi} H_{id}(e^{j\theta})\, W(e^{j(\omega-\theta)})d\theta$, show that $H(e^{j\omega}) = R(\omega)e^{-j3\omega}$ where $R(\omega)$ is a real function of $\omega$. Sketch $R(\omega)$.

Problem 7.3

Repeat Problem 7.2 but this time use

$$h_{id}[n] = \frac{(-1)^n \sin(0.5\pi n)}{\pi n}$$

Problem 7.4

Repeat Problem 7.2 but this time use

$$w[n] = \sum_{k=-\infty}^{\infty} \{u[k] - u[k-4]\}\{u[n-k] - u[n-k-4]\}$$