SOLUTIONS

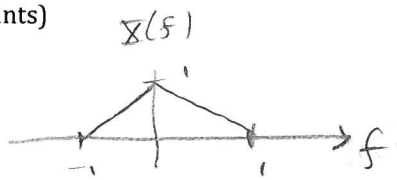
Quiz #4
ECEn 380 – Fall 2013

You have 12 minutes to complete the following quiz. Closed book, closed note, and closed neighbor.

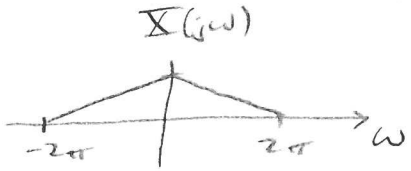
Consider a signal $x(t)$ with the following spectrum (where f is in Hertz, or cycles/s):

$$X(f) = \begin{cases} f+1, & -1 < f < 0 \\ 1-f, & 0 < f < 1 \\ 0 \text{ else} & \end{cases}$$

(a) Sketch the spectrum $X(f)$ (3 points)



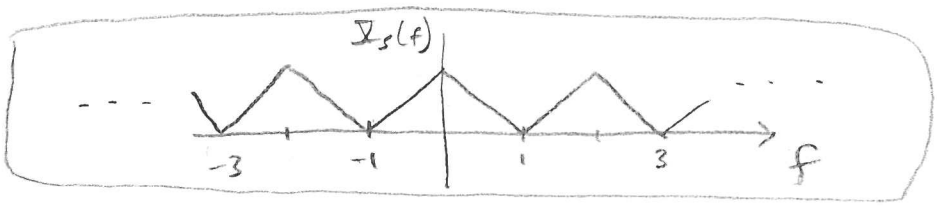
(b) Sketch the spectrum $X(j\omega)$, where the frequency axis is now in terms of ω (radians/s instead of Hertz) (3 points)



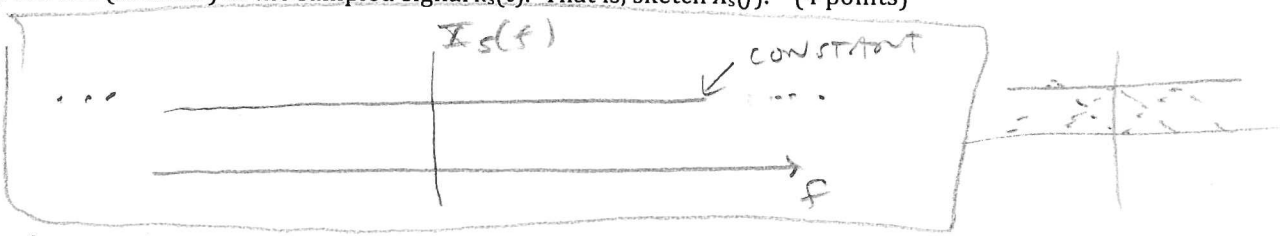
(c) What is the Nyquist rate (in **samples/s**) of the signal $x(t)$? (3 points) 2 samples/s

Don't worry about the exact amplitude scaling in your spectrum sketches of the next 2 parts.

(d) Suppose that you delta-train (or impulse) sample $x(t)$ at a rate of **2 samples/s**. Sketch the **spectrum** (in Hertz) of the sampled signal $x_s(t)$. That is, sketch $X_s(f)$. (4 points)



(e) Suppose instead that you delta-train (or impulse) sample $x(t)$ at a rate of **1 sample/s**. Sketch the **spectrum** (in Hertz) of the sampled signal $x_s(t)$. That is, sketch $X_s(f)$. (4 points)



(f) You low-pass filter the sampled signal from **part (e)** with an ideal low-pass filter with cut-off frequency 1 Hz. What kind of a signal do you get out (in the **time** domain)? (3 points)

a. The output is a rect in the time domain
b. The output is a sinc in the time domain
c. The output is a constant in the time domain