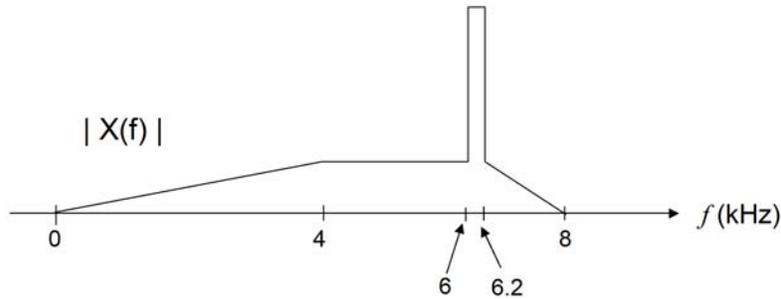


EE432 Fall 08 Homework Problem Set 7 (PS07) Due: 10/21/08

1. Suppose you are given a signal $x(t)$ with frequency spectrum (magnitude of Fourier transform) shown below. Given this plot, answer the following questions.



- a. What is the minimum sample frequency to prevent aliasing? _____
- b. Sample this signal at 1.25 times the minimum sample frequency. What is the actual sample frequency? Use this sample frequency for the remainder of this problem. _____
- c. What is the Nyquist frequency? _____
- d. Suppose you collect 20 samples of $x(t)$ that you are going to use for frequency analysis. How long did it take to collect those samples (how many seconds)? _____
- e. What will be the frequency resolution of your FFT? _____
- f. Sketch the FFT result on a plot below, from 0 Hz to $f_s/2$ Hz. Label it well.
- g. Looking at your plot, are there any significant problems with your frequency analysis? If so, what problem(s) exist? If there are problems, how could you fix them?

- h. If instead of collecting 20 samples, you collected 2000 samples, in what ways would your answer to problem 1.f (your frequency plot) change? Be specific; or give a rough sketch.
2. Given a signal consisting of a 25 Hz sinusoid and a 57 Hz sinusoid that is sampled at 125 samples/sec. Suppose you collect 116 samples and compute/plot the FFT. Will there be any leakage on the frequency plot? If so, be specific.
3. An A/D system has a Nyquist frequency of 11025 Hz. What is the maximum frequency content of an input signal such that no aliasing will occur?
4. What is the minimum sample rate for a system that must decode DTMF tones?