# ECE 2066: Science of Information
Fall 2018

Homework 4

Instructions: Put both your name and computing ID (e.g., ffh8x) on the homework. You must show your work to receive full credit for a problem. Please turn in legible and complete answers. While you are encouraged to discuss your approach with your classmates, all your answers must be your own.

1. (4 Pts) For each of the following systems, is it possible for an LTI system (or a filter) to have the following input and output signals. If it's not possible, explain why.
   a. $x(t) = \cos(2\pi 10 ft) \rightarrow y(t) = 1$
   b. $x(t) = \cos(2\pi 10 ft) \rightarrow y(t) = 0$
   c. $x(t) = \cos(2\pi 10 ft) \rightarrow y(t) = 5\cos(2\pi 10 ft)$
   d. $x(t) = \cos(2\pi 10 ft) \rightarrow y(t) = \cos(2\pi 20 ft)$

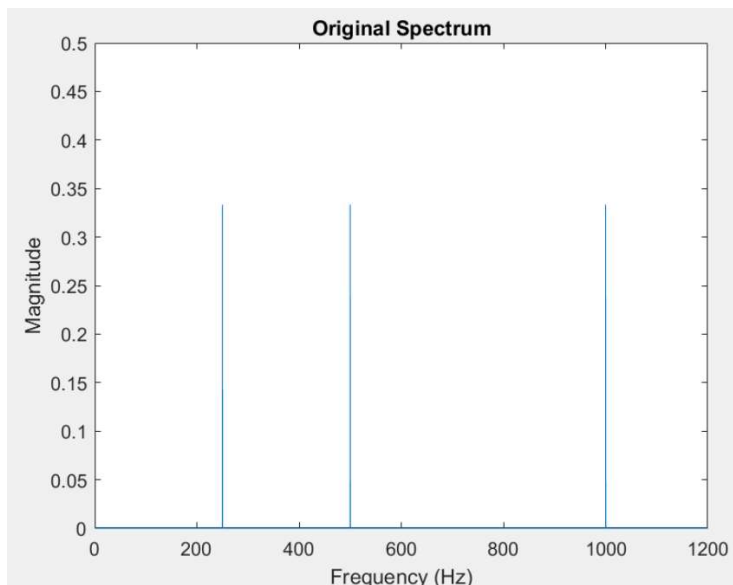2. (2 Pts) Consider the following spectrum:

5HZ   20HZ
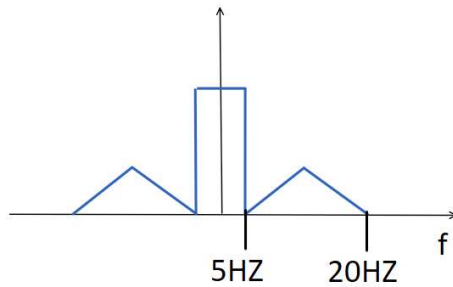
Draw what the full spectrum looks like after being multiplied by

   a. $\cos(2\pi 60 Hz)$.
   b. $\cos(2\pi 60 Hz) + \cos(2\pi 180 Hz)$

Make sure to include numeric values on the x axis.

3. (3 Pts) Given the following spectrum

a) Draw what the spectrum would look like if a high pass filter was applied with cutoff at 800Hz (passes all frequencies above 800Hz)

b) Draw what the spectrum would look like if a low pass filter was applied with cutoff at 800Hz (passes all frequencies below 800Hz)

c) Now draw what the spectrum would look like if a filter was applied as shown below
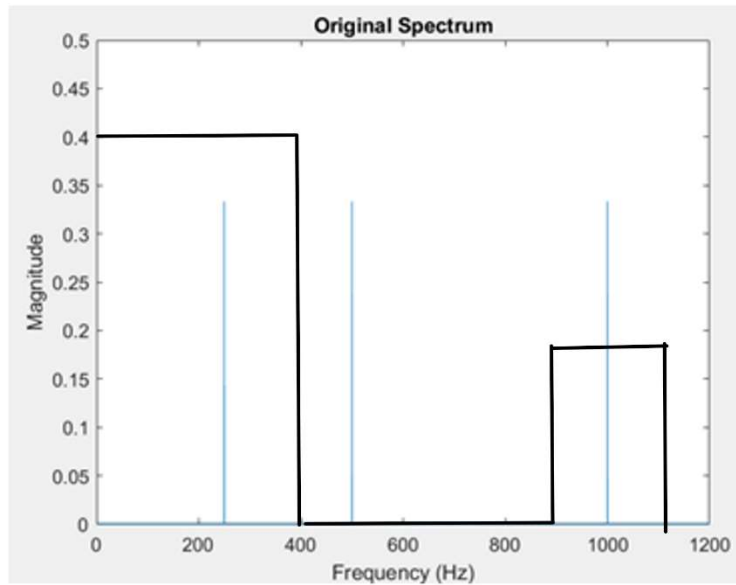
4. (1 Pt) Is perfect reconstruction possible for a signal that contains a bandwidth of 100Hz and is sampled at a rate of 50samples per second? Why or why not?