UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Department of Electrical and Computer Engineering

ECE 498MH SIGNAL AND IMAGE ANALYSIS

Homework 3
Fall 2014

Assigned: Thursday, 2/2/2017   Due: Thursday, 2/9/2017

Reading: 1–40

Do **one** of the following two problems, and submit by 11:59pm 2/9/2017 (by e-mail, if you don't hand it in during class). Homework will be handed back on 2/14/2017. If you don't like your grade, then you can hand in the **other** problem for a grade, no later than 2/21/2017.

Problem 3.1

The following signal is sampled at $F_{s,1} = 2000$ samples/second, creating the signal $x[n] = x(n/F_s)$. (a) Sketch a stem-plot of the power spectrum, $|X(\omega)|^2$ where ω is measured in radians/sample, for the domain $0 \leq \omega \leq 2\pi$. (b) The signal $x[n]$ is then played back through an ideal D/A, but at the wrong sampling rate, $F_{s,2} = 1000$ samples/second, creating the output signal $y(t)$. Find $y(t)$.

$$x(t) = 2 + 3\cos(1760\pi t) + \sin(2640\pi t)$$

Problem 3.2

The following signal is sampled at $F_s = 1000$ samples/second, creating the signal $x[n] = x(n/F_s)$. (a) Plot the power spectrum, $|X(\omega)|^2$ where ω is measured in radians/sample, for the domain $0 \leq \omega \leq 2\pi$. (b) The signal $x[n]$ is then played back through an ideal D/A, but at the wrong sampling rate, $F_{s,2} = 2000$ samples/second, creating the output signal $y(t)$. Find $y(t)$.

$$x(t) = 2 + 3\cos(510\pi t) + \sin(1530\pi t)$$