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

ECE 498MH Signal and Image Analysis

Homework 8

Fall 2013

Assigned: Friday, November 8, 2013 Due: Friday, November 15, 2013

Reading: SPF 12-3

Problem 8.1

Consider a pure tone at 9000Hz, $x(t) = \cos(2\pi 9000t)$.

(a) $y[n] = \cos(2\pi 9000n/10,000) = \cos(-2\pi 0.1n) = \cos(2\pi 0.1n)$, so $\omega_a = 0.2\pi$ or $\omega_a = -0.2\pi$ are both correct.

(b) It has energy at

$$\Omega_a = \omega_a F_s = (\pm 0.2\pi \pm 2\pi k)F_s = 2\pi(\pm 1000 \pm 10,000k)$$

for every integer value of k.

(c) We want $H(\Omega) = T$ for $-\frac{\pi}{T} \leq \Omega \leq \frac{\pi}{T}$, so

$$h(t) = \text{sinc}\left(\frac{\pi t}{T}\right)$$