ECE 2200 **HOMEWORK ASSIGNMENT IV** **Fall 2019**

1. Let

$$x[n] == 3\cos(0.7\pi n - \pi/3) \text{ for all } n \,.$$

Someone tells you they got $x[n]$ by sampling a continuous-time signal

$$x(t) = A\cos(2\pi f_o t + \phi) \text{ for all } t$$

at frequency $f_s = 8000$ samples per second. Thing is, they forgot what f_o and ϕ were except for the facts that $f_o > 0$ and $-\pi < \phi \leq \pi$. Determine three different possibilities, all less than 11 kHz, for f_o along with accompanying ϕ-values.

2. Consider the continuous-time amplitude-modulated signal

$$x(t) = (10 + \cos(2\pi(2000)t))\cos\left(2\pi\left(10^4\right)t\right) \text{ for all } t \,.$$

(a) Sketch $x(t)$'s spectrum.
(b) Is $x(t)$ periodic? If so, what is its fundamental period?
(c) What inequality must f_s satisfy so that $x(t)$ emerges when we put the discrete-time signal

$$x[n] = x(nT_s) \text{ for all } n \,,$$

where $T_s = 1/f_s$, through an ideal D-to-C converter (I referred to it in lecture as a magic box) with interpolation interval T_s?

3. Suppose $x(t)$ has spectrum depicted in the accompanying graph. Suppose we form $x[n]$ by sampling $x(t)$ at 700 samples per second, i.e.

$$x[n] = x(nT_s) \text{ for all } n \,,$$

where $T_s = 1/700$. What signal $y(t)$ emerges when we use $x[n]$ as input to an ideal D-to-C converter with interpolation interval $T_s = 1/700$?

4. From the book, Problem P-4.22.

5. From the book, Problem P-4.17.

6. Suppose

$$x[n] = 10\cos(.2\pi n - \pi/7) \text{ for all } n \,.$$

(a) Find two different continuous-time sinusoids of the form

$$x(t) = A\cos(2\pi f_o t + \phi) \text{ for all } t$$

where $f_o < 1000$ Hz such that

$$x[n] = x(nT_s) \text{ for all } n \,,$$

where $T_s = .001$ sec.
(b) Suppose we use $x[n]$ as input to an ideal D-to-C converter with interpolation interval $1/2000$ sec. What continuous-time signal emerges?