ECE 201 In-Class Problems, Lecture 17, 3/30/2016

George Mason University
ECE 201: Introduction to Signal Analysis
In-class Problems
Lecture 17, 3/30/2016

Name: ____________________________

ECE 201 In-Class Problem 1
What is the required sampling rate for the signal \( x(t) \) defined below? (The required sampling rate is the rate that obeys the Shannon theorem.)

\[
x(t) = 3 \cos(2\pi(10)t) + 2 \sin(2\pi(25)t) + 8 \cos(2\pi(50)t)
\]

ECE 201 In-Class Problem 2
The motion of the clock hands in the video can be represented by two rotating phasors, i.e., signals of the form \( e^{j2\pi ft} \) where \( t \) indicates time in minutes.

(a) What is the frequency \( f_{HR} \) (in cycles/minute) associated with the hour hand?

(b) What is the frequency \( f_{MIN} \) (in cycles/minute) associated with the minute hand?

ECE 201 In-Class Problem 3

(a) What should the sampling rate \( f_s \) be for the hour hand to be sampled without aliasing? (\( f_s \) is in samples/minute)

(b) What should the sampling rate \( f_s \) be for the minute hand to be sampled without aliasing? (\( f_s \) is in samples/minute)

ECE 201 In-Class Problem 4
Suppose that \( x(t) = e^{j2\pi f_{HR}t} + e^{j2\pi f_{MIN}t} \) and \( f_s = 1/55 \) samples/minute. (1 sample every 55 minutes). Sketch the spectrum of the sampled signal \( x[n] \). Does this explain the behavior of the sampled signal in the video? Why or why not?