American University of Beirut

Faculty of Engineering and Architecture

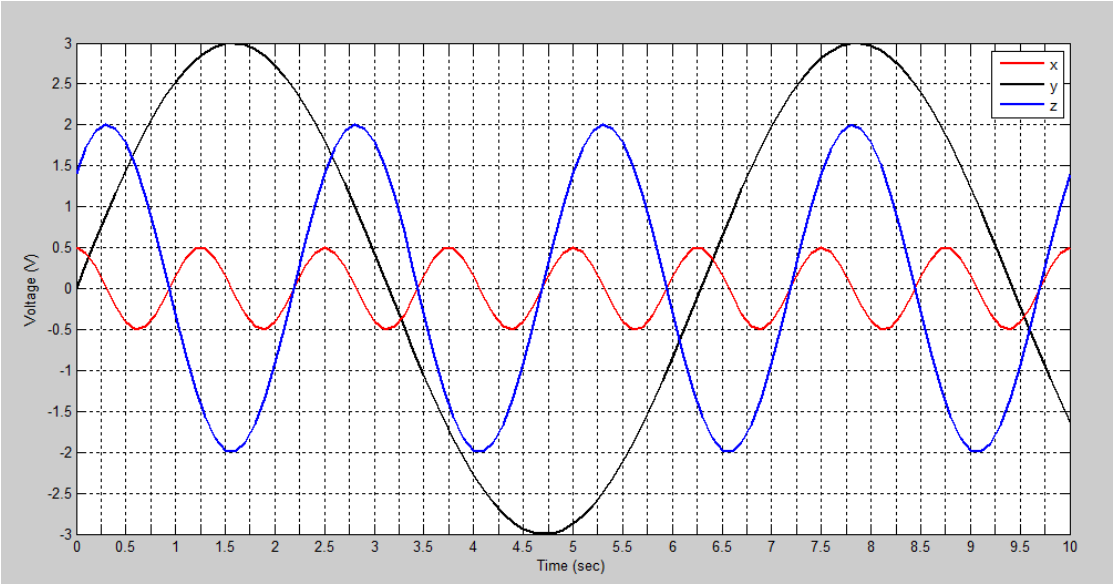
Department of Electrical and Computer Engineering

EECE200 – Introduction to Engineering– Fall 2013

Homework 1

Problem 1 [30 points]

Answer the following questions for the plot below. The amplitude is in volts and the time is in seconds



a. Find the amplitude of x, y, and z [3 points].
b. Find the frequency, period, and angular frequency ω of each of the signals x, y, and z. (Do not forget the units) [9 points].
c. Which signal has the highest frequency [1 point]?
d. If x, y, and z can be written in the form of y(t)=A sin(wt+θ), find the corresponding phase shift $\theta 1$, $\theta 2$, and $\theta 3$ of the three signals in radians and then in degrees[12 points].
   - Show your analysis.
   - Validate the calculated phases by finding the value of the signal at t=0
e. Sketch the frequency domain of the above signals [5 points].

Problem 2 [10 points]

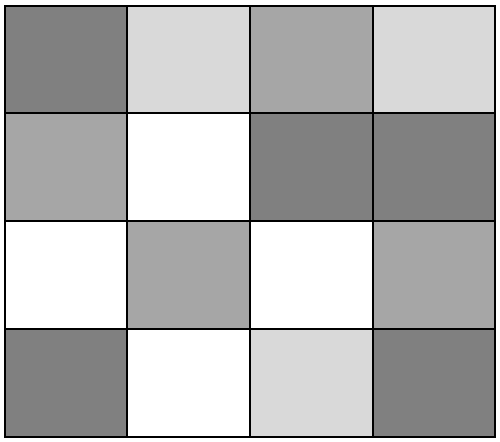
a. Name one FM station, specify its frequency and verify it fits within the FM range. [3 points]
b. What is the bandwidth needed for an AM station to transmit? How many AM stations can you fit within the whole AM range? Name one station. [3 points].

Digital Video Broadcast (DVB) is a new system that will be implemented in Lebanon by all TV broadcasters by the year 2015.

c. Is it currently used by any operator in Lebanon? If yes, name one. [2 points]
d. Are regular television sets suitable for receiving DVB signals or new TV sets are required? Why? [2 points]

Problem 3 [25 points]

Given the below image with pure shades of grey:



a. What are the dimensions of this image in pixels? [2 points]
b. How many bits are needed to represent one pixel? Verify. Write the binary representation of each grey level [10 points].
c. Show the matrix representation of this image. The matrix entries should be in decimal numbers. [8 points]
d. If the image is part of a movie that is playing at a rate of 40 frames (pictures) per second; what would the size of the file be in mega bytes if I record on my computer 3 minutes of the movie? [5 points]

Problem 4 [35 points]

a. Use the algorithm described in class to calculate the decimal equivalent of 11001.010_2. Show all steps [9 points].
b. Use the algorithm described in class to calculate the binary equivalent of 364.125_{10}. Show all steps in details [9 points].
c. Convert 261_8 from octal to binary representation. Show all steps. [4 points]
d. Convert 1001011_2 from binary to hexadecimal representation. Show all steps. [4 points]
e. Convert $2AB_{16}$ from hexadecimal to decimal representation. Show all steps. [9 points]