

American University of Beirut

Faculty of Engineering and Architecture

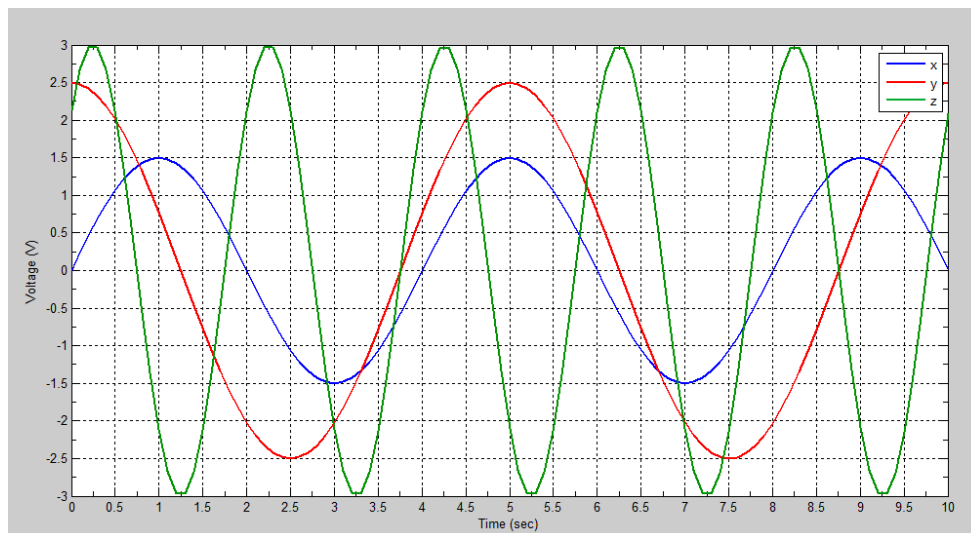
Department of Electrical and Computer Engineering

EECE200 – Introduction to Engineering– Fall 2014

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.



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

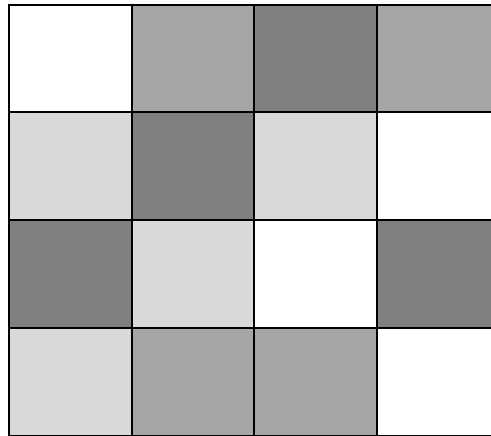
Problem 2 [10 points]

- Group the below applications based on whether they use Analog or Digital signals:
HDMI, electric guitar amplification board, black and white TV, USB connection, image processing
MRI scanning modem, CPU signals, video tape, volume control of old radio, DVB TV, serial
connection cable, LANDLINE TELEPHONE, microphone. [6 points]

- b. What is the frequency range of FM radio used in Lebanon? What is the bandwidth allocated for each station? [1points]
- c. Find 3 advantages of using FM over AM for radio stations [3 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 30 frames (pictures) per second; what would the size of the file be in mega bytes if I record on my computer 5 minutes of the movie? [5 points]

Problem 4 [35 points]

- a. Use the algorithm described in class to calculate the decimal equivalent of 100110.101_2 . Show all steps [9 points].
- b. Use the algorithm described in class to calculate the binary equivalent of 250.25_{10} . Show all steps in details [9 points].
- c. Convert 135_8 from octal to binary representation. Show all steps. [4 points]
- d. Convert 11010110_2 from binary to hexadecimal representation. Show all steps. [4 points]
- e. Convert $D32_{16}$ from hexadecimal to decimal representation. Show all steps. [9 points]