

American University of Beirut

Faculty of Engineering and Architecture

Department of Electrical and Computer Engineering

EECE200 – Introduction to Engineering– Fall 2013

Homework 1 Solution

Problem 1 [30 points]

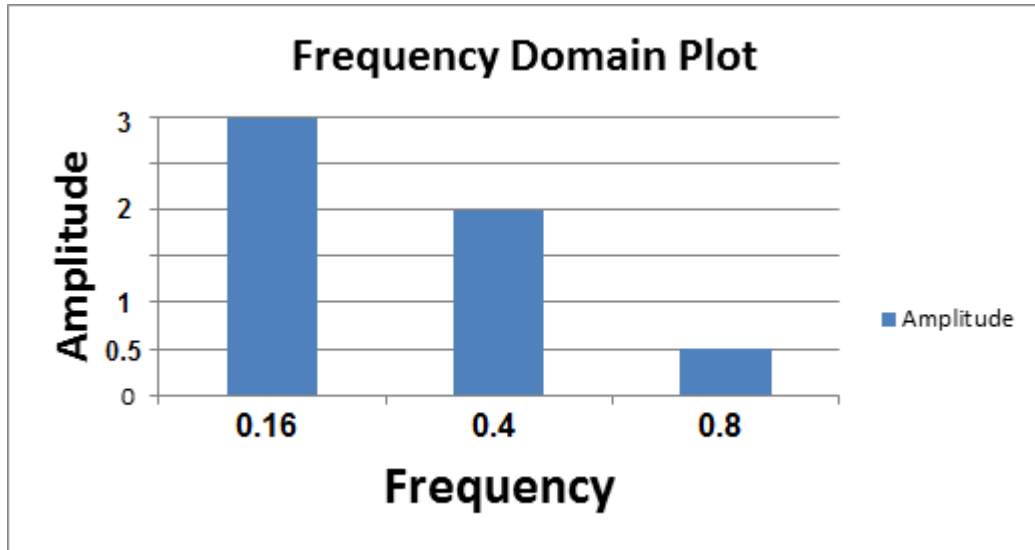
- a. The amplitude of x is 0.5V [1]
The amplitude of y is 3V [1]
The amplitude of z is 2V [1]
- b. For x
 $T = 1.25 - 0 = 1.25 \text{ sec}$ [1]
 $F = 1/T = 0.8 \text{ Hz}$ [1]
 $\omega = 2\pi F = 5.024 \text{ rad/sec}$ [1]
- For y
 $T = 6.26 - 0 = 6.26 \text{ sec}$ [1]
 $F = 1/T = 0.16 \text{ Hz}$ [1]
 $\omega = 2\pi F = 1 \text{ rad/sec}$ [1]
- For z
 $T = 2.5 - 0 = 2.5 \text{ sec}$ [1]
 $F = 1/T = 0.4 \text{ Hz}$ [1]
 $\omega = 2\pi F = 2.512 \text{ rad/sec}$ [1]
- c. Signal x has the highest frequency (0.8Hz) [1]
- d. For x
At $T = 1.5 \text{ sec}$ $x = 0.5$; $0.5 = 0.5\sin(5.024t + \phi_1)$; $\sin(5.024t + \phi_1) = 1$; $5.024t + \phi_1 = \pi/2$ [1]
 $\phi_1 = \pi/2 \text{ rad/s}$ [1]
 $\phi_1 = 90 \text{ deg}$ [1]
On the graph at $T = 0 \text{ sec}$, $x = 0.5$. Substituting in the equation verifies the calculated results [1]
- For y
At $T = 1.56 \text{ sec}$ $y = 3$; $3 = 3\sin(1t + \phi_2)$; $\sin(1t + \phi_2) = 1$; $1t + \phi_2 = \pi/2$ [1]
 $\phi_1 = 0 \text{ rad/s}$ [1]
 $\phi_1 = 0 \text{ deg}$ [1]
On the graph at $T = 0 \text{ sec}$ the signal has a 0 amplitude. Substituting in the equation verifies the calculated results [1]
- For z
At $T = 0.3 \text{ sec}$ $z = 2$; $2 = 2\sin(2.512t + \phi_3)$; $\sin(2.512t + \phi_3) = 1$;
 $2.512t + \phi_3 = \pi/2$ [1]

$\phi_3 = \pi/4$ rad/s [1]

$\phi_3 = 45$ deg [1]

On the graph at $T=0$ sec , $z=1.45$. Substituting in the equation verifies the calculated results [1]

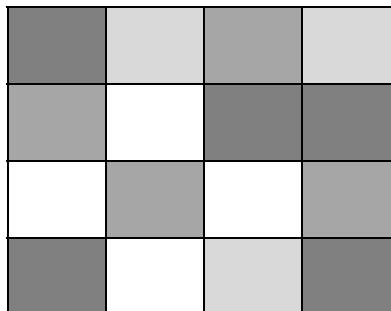
- e. 1 point for each correct column (total 3) and one point for labeling each axis (total 2) [5 points].



Problem 2 [10 points]

- a. Nostalgie , 88 MHz, within FM range: 88-108MHz
(1) for the name of the station (1) for the frequency of the station and (2) for mentioning the range
- b. Total bandwidth of AM radio is $1700-530= 1170$ KHZ. Since each station is assigned a 10KHz bandwidth, total number of stations that the AM bandwidth can afford = $1170/10=117$ stations
(2) for the correct number and (3) for the verification
- c. Yes, DVD is used in Lebanon by Cable Vision, LBCI recently did tests on DVB as well. [2]
- d. No, new sets are required that can receive the digital signals. [2]

Problem 3 [25 points]



- a. $4 \times 4 = 16$ pixels [2]

- b. 2 bits are needed to represent the pixel because we have 4 levels of gray which are represented with 2 bits ($2^2=4$ levels) [1] for the number of bits and [1] for verification

Very Dark grey: 00 [2]

Dark grey: 01 [2]

Light grey: 10 [2]

White: 11 [2]

- c. [0.5] for each correct element in the matrix

0	2	1	2
1	3	0	0
3	1	3	1
0	3	2	0

- d. $16 \text{ (elements)} \times 2 \text{ (bits for each element)} \times 40 \text{ (frames per second)} \times 60 \text{ (sec per minute)} \times 3 \text{ (minutes)} / 8 \text{ (bits per byte)} = 28800 \text{ bytes. } 28800 / 1024 = 28.125 \text{ Kbytes. } 29.2968 / 1024 = 0.02746 \text{ Mbytes [5]}$

Problem 4 [35 points]

- a. $11001.010_2 = 1x2^4 + 1x2^3 + 0x2^2 + 0x2^1 + 1x2^0 + 0x2^{-1} + 1x2^{-2} + 0x2^{-3} = 25.25$ [9]
 b. $364.125_{10} = 101101100.001$ [4] on the answer and [5] on the steps

364/2	182	0
182/2	91	0
91/2	45	1
45/2	22	1
22/2	11	0
11/2	5	1
5/2	2	1
2/2	1	0
1/2	0	1

$0.125 \times 2 = 0.25$; $0.25 \times 2 = 0.5$; $0.5 \times 2 = 1$

- c. $261_8 = 2x8^2 + 6x8^1 + 1x8^0 = 177_{10} = 10110001_2$ [2] for the answer and [2] for the steps

177/2	88	1
88/2	44	0
44/2	22	0
22/2	11	0
11/2	5	1
5/2	2	1
2/2	1	0
1/2	0	1

- d. $1001011_2 = 4B_{\text{HEX}}$ [4]
 $0100_2 = 4_{\text{HEX}}$; $1011_2 = B_{\text{HEX}}$
 e. $2AB_{16} = 2x16^2 + 10x16^1 + 11x16^0 = 683$ [9]