Due 17/11/11

EECE 200

Section 4

Assignment #1

Problem 1:

1. The amplitude of y1 is 10 V

The amplitude of y2 is 5 V

The amplitude of y3 is 2 V

b) For y1: f= 47.6 Hz T=0.021s ω=2πf= 299.07 rad/s

For y2: f=238.09 Hz T= 4.2x10^-3s ω=1495.96 rad/s

For y3: f=160 Hz T=6.25x10^-3 s ω=1005.30 rad/s

1. The signal which has the highest frequency is y2.

d) Each cycle in a sine signal is equivalent to π rd and has to begin at V=0 so that the phase is equal to zero. We notice that both y1 and y23 begin at zero, however, we can notice a lag in y2 which is equal to half a cycle since it begins a the highest value of the sine wave. We can deduct that y3 has a phase of 90 degrees.

If y(t)=Asin(ωt +θ)

At t=0, for y1, y(0)=0 ⇒ Asin(θ)= 0 where A is the amplitude.

⇒ sin (θ)=0 (because A≠0)

⇒ θ = 0 rad and θ = 0°

For y2, y(0)=5⇒ 5sin(θ)=5

⇒ sin(θ)=1

⇒ θ= π/2 rad and θ= 90°

For y3, y(0)=0 ⇒ sin(θ)=0

⇒ θ= 0 rad

⇒ θ= 0°

e)

Problem 2:

1. One the the FM stations in Lebanon is Mix FM with frequency 104.4 Mhz

Knowing that the FM stations’ bandwidth is from 88 to 108 Mhz, Mix FM is within the dedicated bandwidth.

1. We know that each AM station has a frequency of 10 Khz, and that the AM stations range is from 530 to 1170 kHz. Thus, the AM dedicated bandwidth can afford (1170-530)/10= 117 stations.
2. Yes, the bandwidth of TV stations is bigger than FM stations because a standard definition video signal requires over 5MHz of bandwidth, whereas audio requires only 20 kHz.

1. Yes, the bandwidth of black and white TV station is bigger than that of a color TV station. In fact we know that the bandwidth= number of pixels per second/ number of pixels per cycle. Furthermore, we know that a black and white TV sends 2 pixels per cycle, and we know that the more colors we have, the more pixels per second we will have. This means the denominator of the quotient that gives the bandwidth will increase, so that the bandwidth of a color TV becomes smaller.

Problem 3:

a)The dimensions of this image in pixels is 5x5=25 pixels.

1. We have 4 levels of grey. We need 2 bits in order to represent one pixel.

Let the black be represented by 00

Dark grey: 01

Light grey: 10

White: 11

1. The matrix representation ofthis image is

[00 11 10 11 01

10 11 01 11 11

00 11 10 11 10

11 11 11 01 11

10 00 01 11 00]

1. The movie is playind at a rate of 30 frames per second for 2.5 minutes which is 160 seconds. So, during these 2,5 minutes, there are 150x30=4500 frames. Moreover, each frame is made of 25 pixels, so the 4500 frames contain 4500x25=112 500 pixels. Each pixel is represented by two bits, so the 112 500 pixels need 225 000 bits to be represented. 225 000 bits is equivalent to 0.028125 Mega bytes.

Problem 4:

1. The decimal equivalent of 10011101.011101 is:

1x2^7 + 0x2^6 + 0x 2^5 + 1x 2^4 + 1x2^3 + 1x2^2 + 0x2 + 1x2^0 + 0x2^-1 + 1x2^-2 + 1x2^-3 + 1x2^-4 + 0x2^-5 + 1x2^-6 = 128 + 16 + 8 + 4 + 1 + ¼ + 1/8 + 1/16 + 1/64 = 157.453125

b)

|  |  |  |  |
| --- | --- | --- | --- |
| Div. | Quotient | Remainder | Binary number |
| 485/2 | 242 | 1 | 1 |
| 242/2 | 121 | 0 | 01 |
| 121/2 | 60 | 1 | 101 |
| 60/2 | 30 | 0 | 0101 |
| 30/2 | 15 | 0 | 00101 |
| 15/2 | 7 | 1 | 100101 |
| 7/2 | 3 | 1 | 1100101 |
| 3/2 | 1 | 1 | 11100101 |
| 1/2 | 0 | 1 | 111100101 |

For the fractional part:

0.23x2=0.46

0.46x2=0.92

0.92x2=1.84

1.84x2=

1. To convert 1574 from octal to binary, each digit has to be conerted into 3 digits. This gives:

1=0x2^2 + 0x2^1 + 1\*2^0

5= 1x2^2 + 0x2^1 + 1x2^0

7= 1x2^2 + 1x2^1 + 1x2^0

4= 1x2^2 + 0x2^1 + 0x2^0

This gives, in octal, starting from the first digit on the right: 1101111100

d)

|  |  |  |
| --- | --- | --- |
| 00012 | 00012 | 11112 |
| 0x23+0x22+0x21+1x20  = 1 | 0x23+0x22+0x21+1x20  = 1 | 1x23+1x22+1x21+1x20  = 15 = F |
|  |  |  |

We conclude that 100011111 in binary gives 11F in hexadecimal.

e)

|  |  |  |  |
| --- | --- | --- | --- |
| 116 | C = 1216 | 816 | B=1116 |
| = 0x23+0x22+0x21+1x20 | =  1x23+1x22+0x21+0x20 | = 1x23+0x22+0x21+0x20 | = 1x23+0x22+1x21+1x20 |
|  |  |  |  |
| = 0001 | = 1100 | = 1000 | = 1011 |

1C8B in hexadecimal gives in decimal: 1110010001011.