Assignment 1
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Q.1

Given Information: Lines per frame: 450
Pixels per Line: 520 so total pixel per frame is 450*520=234000
Frame rate: 25Hz, Subsampling scheme: 4:2:0, Aspect ratio: 16:9

Total pixels = #frames * #pixels per line * Frequency
Total pixels = 450 * 520 * 25. Not we need to find total bits/sec ? Let's find out avg bits per pixel as per 4:2:0 subsampling. So for 4 pixels, we keep all Y's, 2 Cr and no Cb then 4*8+8*2+0*8 So avg bits per pixel is 48/4=12 bits/pixel

a) Bit rate = 450*520*25*12 = 70.2 Mbps
b) Re-quantize each channel with 6 bits per sample with 4:2:0 then 4*8+2*6+0*6=44 so avg = 11 bits/pixel and total bit for 600 seconds video is:
450*520*25*11*600 = 4.83 G

Q. 2

a) Given audio signal 1.8, 2.2, 2.2, 3.2, 3.3, 3.3, 2.5, 2.8, 2.8, 2.8, 1.5, 1.0, 1.2, 1.2, 1.8, 2.2, 2.2, 2.2, 1.9, 2.3, 1.2, 0.2, -1.2, -1.2, -1.7, -1.1, -2.2, -1.5, -1.5, -0.7, 0.1, 0.9
Dividing this signal into[-4,4] 32 levels so
0 -> -3.75, 1-> -3.5, 2->-3.25 and so on
So for
x=1.8, level is Round((1.8+3.75)/.25) = 22
x=2.2, level is Round((2.2+3.75)/.25) = 24
x=3.2 level is Round((3.2+3.75)/.25) = 28
and so on then the sequence will be
22, 24, 24, 28, 28,28, 25, 26, 26, 26, 21, 19, 20, 20, 22, 24, 24, 23, 24,20, 16,10,10,8,11,6,9,9,12,15,19

b) Pow(2, x) = 32 so x=5 bits /sample for each level the total bits to be transmitted for all level is 5*32 = 160 bits

Q.3

a) Given information: Speed of the car = 36 *1000 m/hr, So 10 m/s
Distance covered by car in one wheel rotation is 2pi*r = 2*3.14*2122=1.33m
Number of wheel rotation in 1.33 m = 1
Number of wheel rotation in 10 m =(1/1.33)*10 rotation in one sec
So rotation rate is **7.5 rotation/seconds**

b) No of rotation =7.5 so total degree is 7.5*360 degree rotations.
No of frames in 1 sec = 8
8 frames = 7.5*360 degree rotation in one sec
1 frame = (7.5*360)*8 = 337.5 degree rotation (aliasing effect)
Net wheel turn is 360-337.5 = 22.5 degree turn per frame
So total rotation = 22.5*8/360 = **0.5 rotation/sec**

c) Given, 1 sec 30 frames
Let's say it takes x rotation to complete the 30 frames in one second to avoid aliasing effect so
1/1.33 * 10*x/36 = 360/30
X= 36*3*1.33= 144.6m/sec

So car can go at speed of 520.5 km/hrs on 30 frames per seconds video recording camera to avoid aliasing