576 Fall22 HW1
Name: Sung-Fu Han
USC ID: 2644230653

Q1-1
>

original data	quantized data
1.8	1.75
2.2	2.25
2.2	2.25
3.2	3.25
3.3	3.25
3.3	3.25
2.5	2.5
2.8	2.75
2.8	2.75
2.8	2.75
1.5	1.5
1	1
1.2	1.25
1.2	1.25
1.8	1.75
2.2	2.25
2.2	2.25
2.2	2.25
1.9	2
2.3	2.25
1.2	1.25
0.2	0.25
-1.2	-1.25
-1.2	-1.25
-1.7	-1.75
-1.1	-1
-2.2	-2.25
-1.5	-1.5

-1.5	-1.5
-0.7	-0.75
0.1	0
0.9	1

Q1-2
> 32 symbols * 5 bits/symbol = 160 bits

Q2-1
Given YUV 4:2:0 and 12 bits per channel, bits per pixel is
4 (Y)*12 bits + 1(U)*12bits + 1(V)*12 bits / 4 pixels = 18 bits/pixel

bit rate of HD camera with YUV 4:2:0 is
1920(W) * 1080(H) * 24 (Hz) * 18 bits/pixel = 895,795,200 bits/sec = 111,974,400 bytes/sec

the max bit rate the disk can accept safely is 12 Mbytes/sec = 12,000,000 bytes/sec

111,974,400 bytes/sec -(compression)-> 12,000,000 bytes/sec

the minimal compression rate should at least greater than
> 111,974,400/12,000,000 = 9.3312

Q2-2
the total pixel change from 1920 * 1080 to 352 * 288, so the compression rate can scale down with the same ratio

9.3312 * (352 * 288)/(1920 * 1080) = 0.456192
> since minimal compression rate is less than 1, we can simply set compression rate as 1

Q2-3
1920 * 1080 is 16:9 and its pixel aspect ratio is 1
352 * 288 is image aspect ratio is 11:9
According to Lecture 2 slide p.45, the pixel aspect ratio becomes
> (1920/11)/(1080/9) = 16/11

Q3-1

circumference = diameter * pi = 0.4244 * pi m
car speed 36 km/hr = 36000 m/ 3600 s = 10 m/s

the original rotation speed = (10 m/s) / (0.4244*pi m) = 7.5 rotations/s
Since 24 FPS > 2 * 7.5 rotations/s, there is no aliasing introduced.
> we can still see the original rotation speed: 7.5 rotations/s

Q3-2
8 FPS < 2 * 7.5 rotations/s
according to http://195.134.76.37/applets/AppletNyquist/Appl_Nyquist2.html
> The perceived alias frequency = |7.5- k*8| = 0.5 rotations/s, let k=1

Q3-3
180 km/hr = 180000 m/3600 s = 50 m/s
2 * 50/(pi * x) <= 24 FPS
50/(12 * pi) <= x
> 1.33 m <= x