CS 576 – Assignment 1 – Answers

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Written Part:

Q.1:

- $$Bit\ Rate = N_i * N_p * N_{FPS} * P$$
  $$= 450\ lines/frame * 520\ pixels/line * 25\ Hz * 12\ bits/pixel$$
  $$= 70.2\ Mbit/second$$

- using 4:2:0 sub sampling schema, each Y 8 bits and each Cr 6 bits, would lead to (4*8+2*6)bits/4 pixel = 11 bits/pixel. So we have:
  $$Bit\ Rate = N_i * N_p * N_{FPS} * P$$
  $$= 450\ lines/frame * 520\ pixels/line * 25\ Hz * 11\ bits/pixel$$
  $$= 64.35\ Mbit/second$$
  So that store 10 minutes of video would need 64.35Mbit/second * 10 * 60second = 38610 Mbit

Q.2:

- 1.75, 2.25, 2.25, 3.25, 3.25, 3.25, 2.5, 2.75, 2.75, 2.75, 1.5, 1.0, 1.25, 1.25, 1.75, 2.25, 2.25, 2.25, 2, 2.25, 1.25, 0.25, -1.25, -1.25, -1.75, -1, -2.25, -1.5, -1.5, -0.75, 0.1, 1
- $32 = 2^5$, so we need 5 bits per signal, in total 32*5=160 bits.

Q.3:

- one rotation go $\pi * 0.4244 = 1.3326$ meters, one second the car go 36000/60/60 = 10 meters, so the rate of tire rotation = 10/1.3326 = 7.5 rotations/second

- In one second, frame1 the wheel moved 360*7.5/12 = 225 degrees compared to the start point. Continue calculation of each frame where the wheel is:

frame 0	degree 0	counter clockwise compare to previous frame
frame 1	225	135
frame 2	90	135
frame 3	315	135
frame 4	180	135
…	…	…

So we have the wheel moving 135 counter clockwise degree every frame, count the 12 frames/second, we have 135/360 rotations/frame * 12 frames/second = 4.5 rotations/second.