

CSCI 576 Assignment 1.

Written Part

$$\begin{aligned} \text{Q1. ① bit per pixel} &= (4 \times 8 + 2 \times 8 + 0 \times 8) \text{ bits} / 4 \text{ pixel} \\ &= 12 \text{ bits per pixel.} \end{aligned}$$

$$\begin{aligned} \text{bit-rate} &= 450 \text{ line per frame} \times 520 \text{ pixels per line} \times 25 \text{ Hz} \\ &\quad \times 12 \text{ bits per pixel} \\ &= 70.2 \text{ Mbit per second.} \end{aligned}$$

$$\begin{aligned} \text{② bit per pixel} &= (4 \times 8 + 2 \times 6 + 0 \times 8) \text{ bits} / 4 \text{ pixel.} \\ &= 11 \text{ bits per pixel.} \end{aligned}$$

$$\begin{aligned} \text{bit-rate} &= 450 \text{ lines per frame} \times 520 \text{ pixels per line} \times 25 \text{ Hz} \\ &\quad \times 11 \text{ bit per pixel} \\ &= 64.35 \text{ Mbit / second} \end{aligned}$$

$$10 \text{ minutes} = 10 \times 60 \text{ second} = 600 \text{ second}$$

$$\begin{aligned} \text{Result} &= 64.35 \text{ Mbit / second} \times 600 \text{ second} \\ &= 38610 \text{ Mbit.} \end{aligned}$$

$$\begin{aligned} \text{Q2. ① } &1.75, 2.25, 2.25, 3.25, 3.25, 3.25, 2.5, 2.75, 2.75, 2.75, \\ &1.5, 1.0, 1.25, 1.25, 1.75, 2.25, 2.25, 2.25, 2, 2.25, \\ &1.25, 0.25, -1.25, -1.25, -1.75, -1, -2.25, -1.5, -1.5, -0.75, \\ &0.1, 1. \end{aligned}$$

② According to $2^5 = 32$, then we get that we should use 5 bits per signal. In order to transmit it, we need 32×5 bits, is 160 bits.

Q3.

① The circumference of the circle = $\pi \times \text{diameter}$

$$= 3.14 \times 0.4244$$

$$= 1.332616 \text{ meters.}$$

$$36 \text{ km/hr} = 36 \text{ km} / 60 \text{ minutes} = 36 \text{ km} / 3600 \text{ second} = 0.01 \text{ km/s} = 10 \text{ m/s}$$

$$\text{The rate of tire rotation} = 10 / 1.332616$$

$$= 7.504 \text{ rotations/sec.}$$

$$\textcircled{2} \begin{cases} 7.504 \text{ rotations/sec} \\ 8 \text{ fps.} \end{cases}$$

$$360 \times 7.504 / 8 = 337.68 \text{ degree}$$

$$360 - 337.68 = 22.32 \text{ degree}$$

$$22.32 / 360 \times 8 \text{ fps} = 0.496 \text{ rotations/second.}$$

$$\textcircled{3} \frac{7.504 \text{ rotations/sec}}{24 \text{ fps}} = 0.313 \text{ rotation/frame}$$

$$\text{Convert } [0.313 \text{ rotation/frame}] = 0.313 \text{ rotation/frame.}$$

$$0.313 \text{ rotation/frame} \times 30 \text{ frame/second} = 9.39 \text{ rotations/second}$$

$$9.39 \text{ rotations/second} \times 1.332616 = 12.513 \text{ m/s} = 45 \text{ km/hr}$$

Thus, maximum speed is 45 km/hr