

# Theory

## Question 1

Quantized sequence: 1.75, 2.25, 2.25, 3.25, 3.25, 3.25, 2.50, 2.75, 2.75, 2.75, 1.50, 1.00, 1.25, 1.25, 1.75, 2.25, 2.25, 2.25, 2.0, 2.25, 1.25, 0.25, -1.25, -1.25, -1.75, -1.00, -2.25, -1.50, -1.50, -0.75, 0.00, 1.00

TODO: CALCULATE THE LEVELS

Bits:  $\log_2 32 = 5$

## Question 2

### Part 1

Bits/s =  $1080 \times 1920 \times 24 \times (12 + 3 + 3) = 895795200$

To make this fit 12Mb/second (the slowest configuration), it must be compressed by bits/s /

$12\text{Mb/s} = 895795200 / (8 \times 10^6) = 9.33$

### Part 2

$352 \times 255 \times 18 \times 24 / (8 \times 10^6) = 5$

Since 5 is much less than 12 MB/s, we don't need to do anything.

### Part 3

$1920:1080 = 16:9$

$352:288 = 11:9$

Thus, each pixel width should be 11/16th of the original with the second optional feature turned on

## Question 3

### Part 1

rotations/hr =  $36\text{km/hr} / (0.4244 \times \pi) = 27000$

rotations/s =  $27000/3600 = 7.5$

### Part 2

$7.5 - 8 = 0.5$  rotations/s in the opposite direction

### Part 3

By nyquist → frequency (24fps) should be at least  $2F$ , so  $F=12$  rotations/s

$$180\text{km/hr} = 50\text{m/s}$$

$$\text{circumference} = \pi \cdot d$$

$$d = \text{circumference} / \pi = 50 / (12\pi) = 1.3\text{m}$$

The diameter must be at least 1.3 meters