

1. Given an image of size 1024 x 768, what is the size in bytes of the image if:

- is a binary one.
- is a grayscale one with 256 levels.
- is a RGB colored one with 8 bits per channel.
- is a RGB colored one with 2 bits per channel.

a) binary image  $\Rightarrow$  1 bit/pixel

$$1024 \times 768 = \underline{786432} \text{ pixels} \times 1 \text{ bit} = 786432 \text{ bits}$$

$$\Rightarrow \frac{786432}{8} = 98304 \text{ bytes}$$

b) 256 levels  $\rightarrow$  8 bits ( $2^8$ )

$$786432 \times 8 = 6291456 \text{ bits}$$

$$\hookrightarrow \frac{\phantom{6291456}}{8} = 786432 \text{ bytes}$$

c) RGB  $\rightarrow$  3 channels 8 bits each

$\rightarrow$  24 bits/pixel

$$786432 \times 24 = \dots \text{ bit}$$

$$\hookrightarrow \frac{\phantom{786432 \times 24}}{8} = \dots \text{ bytes}$$

d) 3 channels 2 bits each  $\rightarrow$  6 bits/pixel - ...

2. A RGB image uses 2 bits per channel to code a pixel, how many different colors we can use ?

2 bits per channel  $\Rightarrow 2^2 = 4$  different values per channel

3 channels  $\Rightarrow 4^3 = 64$  different colors

3. Write the algorithm that transforms a gray scale image to a binary one.

- Read grayscale image  $G$
- Choose threshold  $T$
- For each pixel  $(i, j)$  in  $G$ :
  - \* if  $G(i, j) \geq T$  set  $B(i, j) = 1$
  - \* else set  $B(i, j) = 0$
- Return binary image  $B$

4. Write the algorithm that transform a grayscale image of 256 gray levels to a gray scale one with 16 levels.

$$\text{for each pixel } \rightarrow \text{new}(ij) = \left\lfloor \frac{\text{old}(ij)}{16} \right\rfloor \rightarrow \text{floor}$$

7. What are the aspect ratios of the following images:

- a. 300 x 300  $\rightarrow 1:1$
- b. 600 x 480  $\rightarrow 5:4$
- c. 1280 x 960  $\rightarrow 4:3$
- d. 1440 x 810  $\rightarrow 16:9$