University Kasdi Merbah-Ouargla
Departement of computer science and TI
Module : Digital Image
Duration : 1.5H
25/01/2022

EXAM

First Name:………………………………Family Name:……………………………………

MARK

Select the suitable answer

1) Electromagnetic spectrum can be thought as
   - ☐ Images
   - ☐ Waves
   - ☐ Photons
   - ☒ Waves or photons
   - ☐ None of the above

2) Which imaging modality can a satellite use to take images for the earth
   - ☐ X-Ray
   - ☐ Gamma-Ray
   - ☒ Infrared
   - ☐ Ultraviolet
   - ☐ None of the above

3) The energy of photons in electromagnetic spectrum is
   - ☐ Proportional to wavelength
   - ☒ Proportional to frequency
   - ☐ Not Proportional to frequency
   - ☐ There is no relationship between energy and frequency / wavelength
   - ☐ None of the above

4) To take an image for a molecule with a diameter = 10^{-7} , the energy source must emit
   - ☐ Radio waves
   - ☐ Micro waves
   - ☒ Gamma rays
   - ☐ Infrared
   - ☐ None of the above

5) An image I is sampled with sampling ratio = x, and another image $I2$ is sampled with sampling ratio = y, such that $x > y$
   - ☒ I will have a better spatial resolution than $I2$
   - ☐ $I2$ will have a better spatial resolution than I
   - ☐ I will have the same spatial resolution as $I2$
   - ☐ Cannot judge the spatial resolution because we haven't information about quantization
   - ☐ None of the above

6) A 100x100 color BMP image with a BPP = 8 require
   - ☐ 27.5 ko
   - ☐ 28.2 ko
   - ☒ 29.2 ko
   - ☐ 30.1 ko
   - ☐ None of the above

7) Enlarging an image I by twice (i.e., height x 2, and width x 2), we denote the enlarged image by $I2$

   - ☐ Pixel resolution of $I2$ < Pixel resolution of I
   - ☐ Spatial resolution of $I2$ > Spatial resolution of I
   - ☒ Spatial resolution of $I2$ = Spatial resolution of I
   - ☐ We cannot compare neither pixel resolution nor spatial resolution
   - ☐ None of the above

8) Which formula from the following can be used to convert color to gray level image
   - ☐ $0.51 \times R + 0.29 \times G + 0.2 \times B$
   - ☒ $0.26 \times R + 0.68 \times G + 0.06 \times B$
   - ☐ $0.29 \times R + 0.11 \times G + 0.58 \times B$
   - ☐ $0.23 \times R + 0.58 \times G + 0.11 \times B$
   - ☐ None of the above

9) The RGB color space counts about
   - ☐ 15000000 color
   - ☐ 12000000 color
   - ☐ 13000000 color

☒ 17000000 color
☐ None of the above

10) Given an image I such that 85% of pixel intensities ranges from 11 to 37, to get an image with a better quality, we can
☐ Convolve the image with the mask [-1 0 1; -2 0 2; -1 0 1]
☐ Convolve the image with the mask [1/9 1/9 1/9; 1/9 1/9 1/9; 1/9 1/9 1/9]
☐ Quantize image into [0 100 150 255]
☐ Decrease the pixel resolution with 85%
☒ None of the above

11) The intensities of an image $I1$ ranges from 50 to 150, and intensities of $I2$ ranges from 100 to 255, respectively
☐ $I1$ looks darker than $I2$
☐ $I2$ looks darker than $I1$
☐ We can decide if the contrast is calculated
☐ We can decide by increasing the pixel resolution
☒ None of the above

12) Given an image I, suppose that we want to improve the contrast of I by adjusting its dynamic, suppose also that minimum intensity in I is 10 and max intensity is 100. By setting $a = \frac{1}{2}$ and $b = 1$, contrast of the resulting image, denoted as I_R, then
☒ Contrast of $I \geq$ Contrast of I_R
☐ Contrast of $I \leq$ Contrast of I_R
☐ Contrast of $I =$ Contrast of I_R
☐ We cannot know because min and max intensity in I_R are unknown
☐ None of the above

13) With a BPP = 10, we can quantize image into
☐ 10 levels
☐ 2048 level
☐ 12 level
☒ 1024 level
☐ None of the above

14) Gray level histograms of two image look like a Gaussian curve, if you know that $\mu_1 \cong \mu_2$ and $\sigma_1 \gg \sigma_2$, we refer to max value of the first and second image by M_1 and M_2, respectively
☒ $M_1 < M_2$
☐ $M_1 > M_2$
☐ $M_1 \geq M_2$
☐ $M_1 = M_2$
☐ None of the above

15) Given two strictly identical images I and R, such that size of I = size of $R \times 2$. We calculate the gray-level histogram of each image. We denote the histogram of I and R by H_I and H_R, respectively.

- ☐ H_I is identical to H_R
- ☐ Values of H_I are bigger than corresponding values of H_R
- ☐ We cannot decide because by changing pixel resolution, gray-level values will change also.
- ☒ PMF of I is identical to PMF of R
- ☐ None of the above

16) In histogram equalization algorithm, if we multiply L_{max} by PMF instead of CDF values

- ☐ Resulting image will look very bright
- ☐ Resulting image will look very dark
- ☐ Resulting image will look blurry
- ☐ Contrast of resulting image will be improved
- ☒ None of the above

17) F is a 5×5 filter, which of the following filters can be considered as a Gaussian filter

- ☐ $F(0,0) = 0.078, F(1,2) = 0.071, F(2,2) = 0.23, F(3,2) = 0.19$
- ☐ $F(1,2) = 0.051, F(2,1) = 0.031, F(2,2) = 0.50, F(5,2) = 0.01$
- ☐ $F(3,1) = 0.025, F(4,2) = 0.026, F(2,2) = 0.01, F(3,3) = 0.26$
- ☒ $F(4,2) = 0.036, F(2,4) = 0.036, F(2,2) = 0.15, F(5,5) = 0.01$
- ☐ None of the above

18) Applying a mean filter on image which **doesn't** contain a noise

- ☐ The resulting image remains the same as the original image
- ☐ The resulting image has a better spatial resolution than the original image
- ☒ The resulting image will look blurry compared to the original image
- ☐ Cannot say anything because resulting image depends on the filter size
- ☐ None of the above

19) After applying vertical Sobel operator on image I, we found that magnitude of gradient at a specific pixel $I'(x, y) = 640$. Referring to this pixel by P and by V_p for its intensity, the neighborhood of P is

- ☐ [1 15 13; 2 V_p 255; 100 150 200]
- ☐ [20 20 240; 20 V_p 240; 20 20 240]
- ☐ [10 10 10; 10 V_p 10; 130 130 130]
- ☒ [30 30 190; 30 V_p 190; 30 30 190]
- ☐ None of the above