IMAGE PROCESSING
(INFO 4102)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) What is the sum of the coefficient of the mask defined using gradient?
(a) 1 (b) -1
(c) 0 (d) None of the mentioned.

(ii) If the images are displayed using 8-bits, then, what is the range of the value of an image if the image is a result of subtraction operation?
(a) 0 to 255 (b) 0 to 511
(c) -255 to 0 (d) -255 to 255.

(iii) The expression $[\partial^2 f(x,y)/\partial x^2 + \partial^2 f(x,y)/\partial y^2]$ is considered as _____ where f(x, y) is an input image.
(a) Laplacian of f(x, y) (b) Gradient of f(x, y)
(c) Gaussian of f(x, y) (d) None of the above

(iv) Which of the following filter is used to find the brightest point in the image?
(a) Max filter (b) Mean filter
(c) Median filter (d) None of the above.

(v) If $h(r_k) = n_k$, r_k the kth gray level and n_k total pixels with gray level r_k, is a histogram in gray level range [0, L – 1]. Then how can we normalize a histogram?
(a) If each value of histogram is added by total number of pixels in image, say n, $p(r_k)=n_k+n$
(b) If each value of histogram is subtracted by total number of pixels in image, say n, $p(r_k)=n_k-n$
(c) If each value of histogram is multiplied by total number of pixels in image, say n, $p(r_k)=n_k * n$
(d) If each value of histogram is divided by total number of pixels in image, say n, $p(r_k)=n_k / n$.

(vi) What is standard deviation value for constant area?
(a) 0 (b) 1
(c) -1 (d) None of the mentioned.

(vii) Image compression is
(a) making image look better
(b) sharpening the intensity-transition regions
(c) minimizing degradation over image
(d) reducing the redundancy of the image data.

viii) Why is scaling of Laplacian filtered images necessary?
(a) Because it contains high positive values
(b) Because it contains high negative value
(c) Because it contains both positive and negative values
(d) Scaling is not required.

(ix) Inverse transformation plays an important role in which of the following Histogram processing techniques?
(a) Histogram Linearization
(b) Histogram Equalization
(c) Histogram Matching
(d) None of the mentioned.

(x) For Image Enhancement a general-approach is to use a function of values of f (input image) in a predefined neighbourhood of (x, y) to determine the value of g (output image) at (x, y). The techniques that use such approaches are called _____
(a) Contouring
(b) Contrast stretching
(c) Mask processing
(d) Histogram.

Group – B

2. (a) Do histogram equalisation on the following image which has 8 discrete pixel levels (0 - 7), transforming it into a histogram equalised image also with 8 discrete grey levels in the range (0-7).

1	1	1	1	1	1	1	1
0	2	5	5	5	5	2	0
0	2	6	7	3	2	3	0
0	3	3	2	2	3	3	0
0	2	3	2	2	3	3	0
0	3	2	4	4	2	3	0
0	2	6	4	4	4	4	0
1	1	1	1	1	1	1	1

(b) Explain relationship between image size, intensity resolution and image quality with example.

7 + 5 = 12

3. (a) What is the relationship between sample size and image quality?

(b) What are 4-adjacency, 8-adjacency and m-adjacency?

(c) What is meant by bit plane slicing? Perform Bit-plane slicing for the image given below.

1	2	3
6	5	4
7	3	1

3 + 3 + (2 + 4) = 12

Group – C

4. (a) Explain image sharpening using Ideal low-pass, Butterworth low-pass and Gaussian low-pass filters.

(b) Explain the following two properties of 2D-DFT:
(i) Convolution
(ii) Correlation

(3 × 3) + 3 = 12

5. (a) What is difference between image enhancement and Image restoration? Draw and explain the basic block diagram of the restoration process.

(b) Explain the order statistics filters used for restoring images in the presence of noise.

(3 + 3) + 6 = 12

Group – D

6. (a) Consider the following raw data:
aaaabbbb
aaaabbbb
Compare the efficiency of Huffman Encoding and LZW Encoding to compress this data.

(b) What are the different types of redundancies? Which type of redundancy is related with lossy compression? Explain.

8 + (2 + 2) = 12

7. (a) Describe the compression and decompression steps followed in JPEG compression technique with appropriate block diagram.

(b) "Vector quantization is better than scalar quantization" – Justify this statement.

8 + 4 = 12

Group – E

8. Find out the output of the first order and second order derivative for following data. Discuss property and applications of both.

7	7	7	6	5	4	3	2	1	0	0	0	4	0	0	0	1	2	3	4	5	6	7	7	7

12

9. Write the steps to develop an algorithm for Hough edge linking algorithm. Using this algorithm, show that points (0, 0), (1, 1), (2, 2) and (3, 3) are on the same line.

(6 + 6) = 12

Department & Section	Submission Link
IT	https://classroom.google.com/c/MTQ3MzIyOTUxMDk4/a/Mjc0MTYwNzY3ODY5/details