B.TECH/IT/7TH SEM/INFO 4102/2019

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
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> 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)   Discernible change in intensity level of image is
          (a) wide domain   (b) spatial domain
          (c) frequency domain   (d) algebraic domain.

    (ii) Process of using known to estimate unknown is called
          (a) interchange   (b) interpolation
          (c) extrapolation   (d) estimation.

    (iii) 2D Fourier transform and its inverse are infinitely
          (a) aperiodic   (b) periodic
          (c) linear   (d) non linear.

    (iv) If inner region of object is textured then approach we use is
          (a) discontinuity   (b) similarity
          (c) extraction   (d) recognition.

    (v)   Process that expands range of intensity levels in image is called
          (a) linear stretching   (b) contrast stretching
          (c) color stretching   (d) elastic stretching.

    (vi) For line detection we use mask that is
          (a) Gaussian   (b) laplacian
          (c) ideal   (d) butterworth.

    (vii) First derivative approximation says that values of constant intensities must be
          (a) 1   (b) 0
          (c) positive   (d) negative.

Group – E

8. For the given image,

$$F = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ 9 & 9 & 9 & 2 & 2 & 2 & 2 & 2 \\ 9 & 9 & 9 & 2 & 2 & 2 & 2 & 2 \\ 9 & 9 & 9 & 2 & 2 & 2 & 2 & 2 \\ 9 & 9 & 9 & 2 & 2 & 2 & 2 & 2 \\ 9 & 9 & 9 & 2 & 2 & 2 & 2 & 2 \\ 9 & 9 & 9 & 2 & 2 & 2 & 2 & 2 \\ 9 & 9 & 9 & 2 & 2 & 2 & 2 & 2 \end{bmatrix}$$

Show the result of the spilt and merge algorithm.

Given the following histogram of a 4-level image (Fig. 1). Use Otsu's method to obtain the 2 thresholds to divide the image into 3 classes.
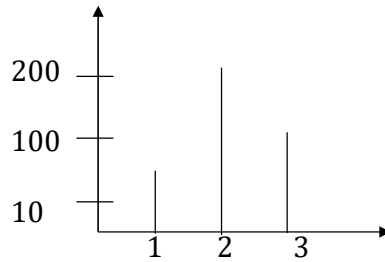

Fig. 1

4 + 8 = 12

9. Consider the given set of points:
    (1,1), (3,3), (5,5), (3,4), (3,5), (4,3).
    Find out which set of points belong to the same line using Hough transformation.

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(viii) Examples of similarity approach in segmentation are
(a) region growing   (b) region splitting
(c) extraction   (d) both A and B.

(ix) Smallest value of gamma will produce
(a) contrast   (b) darker image
(c) brighter image   (d) black and white image.

(x) If pixels cannot be reconstructed without error mapping is said to be
(a) reversible   (b) irreversible
(c) temporal   (d) facsimile.

Group – B

2. (a) Give the condition(s) under which the D4 distance between two points p and q is equal to the shortest 4-path between these points. Is this path unique?

(b) Perform histogram equalization on the following image which has 8 discrete pixel levels(0-7).

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

4 + 8 = 12

3. (a) What would be the effect of setting the lower-order bit planes to zero have on the histogram of an image in general?

(b) What would be the effect on the histogram if we set to zero the highest-order bit planes instead?

(c) Consider the image:

$$F = \begin{bmatrix} 2 & 1 & 4 & 4 \\ 3 & 1 & 5 & 5 \\ 1 & 2 & 4 & 5 \end{bmatrix}$$

Apply pixel replication techniques to increase the size of 6×8.

4 + 4 + 4 = 12

Group – C

4. (a) Compute 2D DFT of the following image segment.

$$I = \begin{bmatrix} 2 & 4 \\ 3 & 8 \end{bmatrix}$$

(b) Explain how sharpening can be done in the frequency domain using Gaussian high pass filter?

6 + 6 = 12

5. A 5×5 input image is given below

$$g = \begin{bmatrix} 2 & 1 & 3 & 4 & 5 \\ 1 & 2 & 0 & 1 & 3 \\ 2 & 0 & 0 & 2 & 1 \\ 1 & 5 & 2 & 1 & 3 \\ 3 & 4 & 1 & 2 & 0 \end{bmatrix}$$

Find the output image by applying a low pass filter, high pass filter, MAX filter, MIN filter and median filter of size 3×3.

3 + 3 + 2 + 2 + 2 = 12

Group – D

6. (a) Generate Huffman Code for the following data:

Gray Level	Probability
a1	0.1
a2	0.4
a3	0.06
a4	0.1
a5	0.4
a6	0.3

Find out the compression ratio.

(b) What is meant by Dictionary Based Compression Algorithm? Give two examples. What is the overhead of Dictionary Based Compression Algorithms?

(3 + 2)+ (3 + 2 + 2) = 12

7. (a) Explain LZW Compression Model with Suitable example and flow chart.

(b) What is codec? What is the difference between lossy and loss-less compression. Explain with example.

7 + (2 + 3) = 12