MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University
**SEVENTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION
NOV/DEC 2016
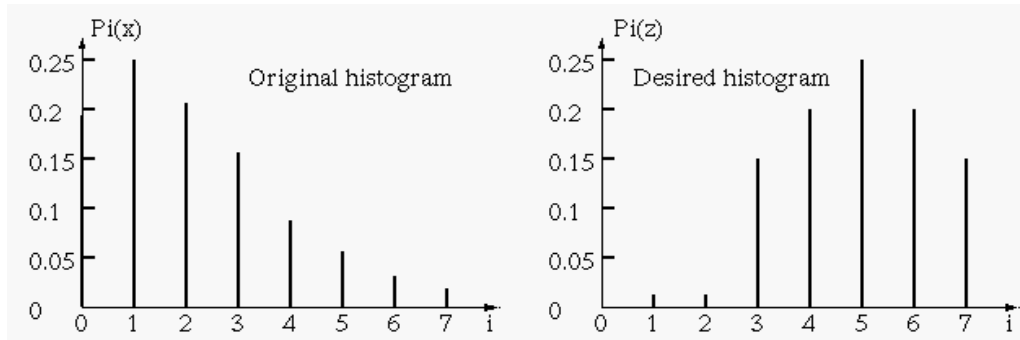SUBJECT: DIGITAL IMAGE PROCESSING (ECE - 437)**

TIME: 3 HOURS   MAX. MARKS: 50

Instructions to candidates
- Answer **ANY FIVE** full questions.
- Missing data may be suitably assumed.

1A. Perform the histogram specification for the given image and histogram desired as shown below

1B. Find first and second order derivative on the following gray level profile as shown below. Discuss the significance of the derivative on edge detection.
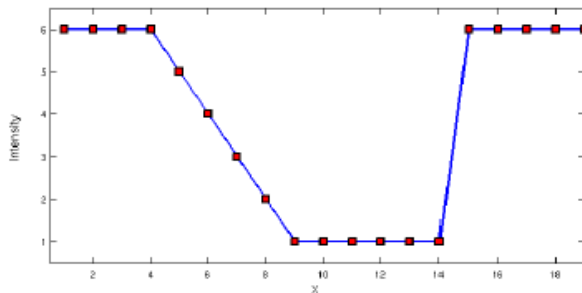
1C. Write a short note on neighbors of a pixel.

(5+3+2)

2A. Show that Fourier transform of the 2-D sine function
$f(x, y) = A\sin(u_0 x + v_0 y)$ is the pair of conjugate impulses
$$F(u,v) = -j\frac{A}{2}[\delta(u - \frac{u_0}{2\pi}, v - \frac{v_0}{2\pi}) - \delta(u + \frac{u_0}{2\pi}, v + \frac{v_0}{2\pi})]$$

2B. Find the 2D convolution between h(x,y) and f(x,y)

$$f(x,y) = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \quad h(x,y) = \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{bmatrix}$$

2C. Give the mask used for high boost filtering.

(5+3+2)

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3A. Answer following.
    a. What is point processing? Explain any two point processing technique with proper example.
    b. Give the condition 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?

3B. Write the result of averaging filter of 3 x 3 mask for given sub image.

1	4	5	8
0	1	14	11
0	8	7	9
1	2	0	3

3C. Find the number of bits required to store a 256 X 256 image with 32 gray levels?

                                          (5+3+2)

4A. Given a four symbol source {a b c d } with source probabilities {0.1 0.4 0.3 0.2} arithmetically encode the sequence bbadc. Write the arithmetic decoding algorithm.

4B. Write the steps involved in frequency domain filter.

4C. Write a complete MATLAB program to enhance a given image using 2nd order derivatives.

                                          (5+3+2)

5A. Explain the following based on the segmentation
    a. Region extraction
    b. Pixel based approach
    c. Multi-level thresholding
    d. Line detection

5B. Explain following piecewise linear transformation
    a. Contrast Stretching
    b. Gray –level slicing
    c. Image subtraction

5C. Give the formula for transform function of a Butterworth low pass filter.

                                          (5+3+2)

6A. Let A denote the set shown shaded in the following figure. Refer to the structuring element shown. Sketch the result of the following morphological operation.
    a. A eroded B4 dilated with B2
    b. A eroded B1 dilated with B3
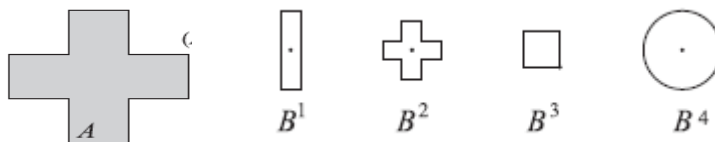
6B. Show that the subtracting the Laplacian form an image is proportional to unsharp masking.

6C. Define
    a. Shape number
    b. Fourier descriptors

                                          (5+3+2)