EEL715 - DIGITAL IMAGE PROCESSING.

02/05/2015   **MAJOR.**   Max. Marks : 60.
          Duration : 2 hrs.

(All questions carry equal marks)

Q1. a) What are the three basic objectives of the Canny Operator?

b) How are these achieved in the canny detector?

c) Write down the Algorithm of the Canny detector

d) Described the "hysteresis thresholding" technique used in the Canny detector

Q2. a) What are the 2 fundamental ideas of selecting the $\nabla^2 G$ operator in Marr-Hildreth edge detector

b) Obtain the expression corresponding to the $\nabla^2 G$ operator

c) If the LoG is approximated using a DoG obtain the condition on the values of variance so that both LoG & DoG have the same zero crossings

Q3. a) Given two points $(1,1)$ and $(2,0)$ in the $x-y$ plane. obtain the $\rho-\theta$ representations of all lines passing through these points individually.

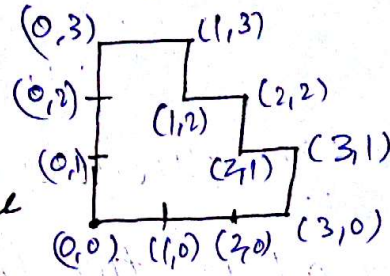b) Using these curves obtain the equation of the line passing through both these points.

Q4. Given the following histogram of a 4-level image
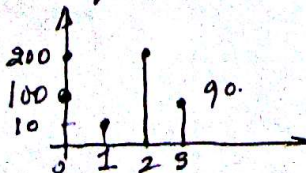
use otsu's method to obtain the 2 thresholds to divide the image into 3 classes.

Q5.A) For the following figure

(0,3) ———— (1,3)
(0,2) ┤   ┌──── (2,2)
        (1,2)
(0,1) ┤   (2,1) (3,1)
        (0,0) (1,0) (2,0) (3,0)

a) obtain the shape no.

b) what is the order of the shape no

c) How does one obtain the (i) order and (ii) eccentricity.

Q5.B) Assuming bottom left pt. in the previous figure to be the origin and each edge segment to be of unit length.

a) obtain the Fourier descriptor of the boundary.

b) Reconstruct the boundary using only the
   (i) First Fourier coefficient (ii) First two Fourier coefficients
   and comment on the result.

Q6. Given the following 3 values of 2 attributes of an image

$$\bar{a} = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix} \quad \text{and} \quad \bar{b} = \begin{bmatrix} -1 \\ 1 \\ 0 \end{bmatrix}$$

a) Obtain the principal components.

b) Use only one component to reconstruct the image. What is the error in reconstruction?

c) Illustrate the process geometrically.