BITS-Pilani, K K Birla Goa Campus

Digital Image Processing (EEE F435) [IC: Ashish Chittora]

Mid-Semester Examination, Semester-I (2019-20) [Closed Book]

Maximum Marks: 60 **Duration: 90 Minutes**

Note: This is a closed book exam and all questions are compulsory to attempt. Start each answer from new page and clearly write the question number at the start.

Q.1. Consider the image segment in Fig. 1. (a) Let V = {0,1} and compute the shortest 4-, 8- and m-path between p and q pixels. If a particular path does not exist between the two, explain why? (b) Repeat with V = {1,2}. [10]

Q.2. Perform histogram equalization on a 3-bit, 6 X 6 image (Fig. 2). Build an intensity look-up table and show the final image. [10]

Q.3. Perform two stage compression (run length encoding and Huffman coding on run lengths) on a binary image (Fig. 3). Also compute the compression ratio assuming that in the original image each pixel occupies 1 bit. [Resulting code: (value of the 1st pixel of the row) (Huffman-coded bit representation of 1st run-length) (Huffman-coded bit representation of 2nd run-length)…] [12]

3	1	2	1	(q)
2	2	0	2	
1	2	1	1	
(p) 1	0	1	2	

Fig. 1

0	0	1	4	5	4
0	1	2	5	4	3
1	2	3	4	3	1
4	5	4	3	1	0
5	4	3	1	0	0
4	4	3	1	0	0

Fig. 2

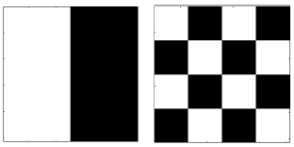
0	0	0	0	0	0	0	0	0	0
1	1	1	0	0	0	0	0	0	1
0	1	1	1	0	0	0	0	0	1
0	0	1	1	1	0	0	0	0	1
0	0	0	1	1	1	0	0	0	1
0	0	0	0	0	0	0	1	1	1
0	0	0	0	0	0	0	1	1	1
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

Fig.3

Q.4. If ∇^2 is a laplacian operator and **c** is a user defined constant. Find the kernel K which can perform following operation on image f(x,y) and produce image g(x,y). [08]

$$g(x,y) = f(x,y) + c\,\left[\nabla^2 f(x,y)\right], \quad \forall (x,y) \in \Omega \subset \mathbb{R}^2,$$

Q.5. The binary images shown are quite different but their histograms are the same. Suppose each image is blurred with a 3 X 3 averaging kernel. (a) Would the histogram of the blurred images still be equal? Explain. (b) If no, sketch the two histograms. [10]



Q.6. Write a MATLAB program to apply the given piecewise linear transformation on a gray image 'pic.tif'. Display original image and enhanced image in a single figure window. [10]