DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF TECHNOLOGY
B.TECH SEMESTER – VII [CE]
SUBJECT: (CE – 714) IMAGE PROCESSING

Examination	: Regular	**Seat No**	: CE-84
Date	: 26/11/2019	**Day**	: Tuesday
Time	: 11-30 to 2-30pm	**Max Marks**	: 60

INSTRUCTIONS:
1. Figures to the right indicate maximum marks for that question.
2. The symbols used,carry their usual meanings.
3. Assume suitable data, if required & mention them clearly.
4. Draw neat sketches wherever necessary.

SECTION I

Q.1 Do as Directed. **[10]**

(a) Find out the Fourier transform of an impulse located at $t = t_0$. [2]
(b) What is moiré pattern? When does it arise in digital image processing? [2]
(c) Write the steps of region splitting and merging algorithm. [2]
(d) State True/False: "Ringing in the Butterworth Low-Pass Filters becomes significant for higher order filters". Justify your answer. [2]
(e) Obtain and sketch the intensity transformation function for generating the 8th bit (Most Significant Bit) plane of an 8-bit image. [2]

Q.2 Answer *ANY TWO* of the following questions. **[10]**

(a) Following figure 1 shows an image of size 101x101 pixels with five labeled points. And figure 2 shows Hough mapping of each of these points onto the ρθ-plane. In figure 2 the range of θ values is $\pm 90^0$ and the range of the ρ axis is $\pm\sqrt{2D}$, where D is the distance between corners in the image. [5]
1. Explain why the Hough mapping of point 1 in figure 1 is a straight line in figure 2?
2. Is this the only point that would produce that result? Justify your answer.
3. What is indicated by the curves intersecting at point A in figure 2?
4. Which point in figure 2 indicates that points 2, 3 and 4 lie on a straight line? Find the values of the orientation (θ) and the distance from the origin (ρ) of that straight line.

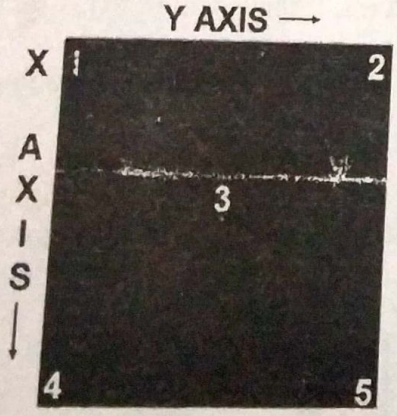


Figure:1

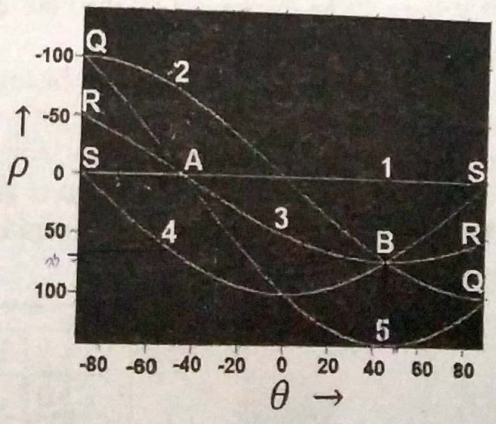
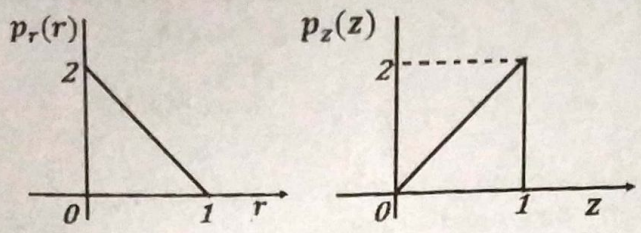


Figure:2

n what kind of situation(s)/problem(s) encountered during image thresholding, we have to make use [5]
f the following techniques? Also state how the technique will solve the situation(s)/problem(s).

- Using edge as mask image
- Image partitioning

(c) An image with intensities in the range [0,1] has the PDF $p_r(r)$ shown in the following diagram. It is desired to transform the intensity levels of this image so that they will have the specified $p_z(z)$ shown. Assume continuous quantities and find the transformation (in terms of r and z) that will accomplish this. [5]



Q.3 Answer the following questions. **[10]**

(a) The histogram of a ***3-bit*** image is shown in the Figure-I. What would be the histogram of the output image if the transformation shown in the Figure-II is applied to this image? What will be the value of the average intensity and the intensity variance of this new image? [5]

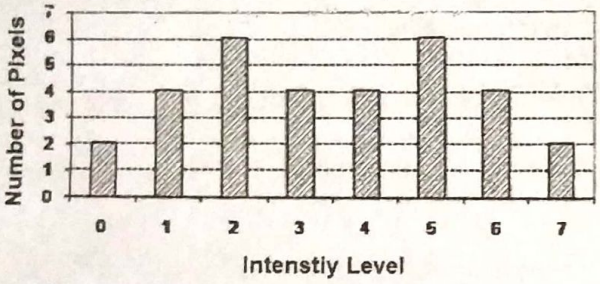


Figure: I

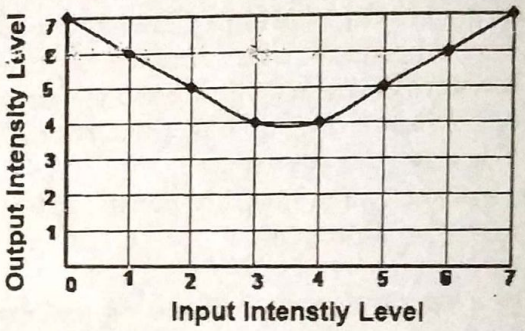


Figure: II

(b) Give details on Ideal Lowpass Filters(ILPFs). Also discuss the impact of the cut off frequency on blurring and ringing properties of the ILPFs. [3]

(c) State True/False: "The effects of aliasing can be reduced by smoothing the input function". Justify your answer. [2]

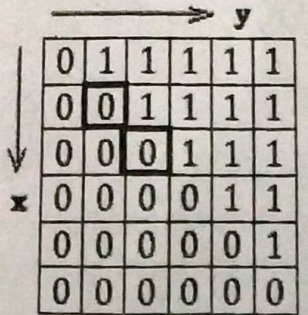
OR

Q.3 Answer the following questions. **[10]**

(a) What is the impact on the Fourier transform, if the function f(t) is sampled at the rate higher than the Nyquist rate? What will be the impact on the Fourier transform, if the function f(t) is sampled at the rate lower than the Nyquist rate? [2]

(b) Give details on image negatives. Sketch the histogram of an image obtained by adding (pixel by pixel) the original image of size 8x8 and its negative. [3]

(c) Consider an image shown in figure below containing a straight edge segment. Each square corresponds to a pixel. Determine the direction of gradient vector and the direction angle of the edge at **both** the highlighted points. Use prewitt operaters to determine the gradient vector. What is the significance of your result? [3]



(d) State and prove periodicity property of 2D Discrete Fourier Transform. [2]

SECTION II [10]

Q.4 Answer the following questions.

(a) Define false contouring. [2]
(b) What is spatial and temporal redundancy? Explain. [2]
(c) Define Compression ratio and relative data redundancy with example. [2]
(d) Discuss various distance measures. [2]
(e) Discuss contra-harmonic mean filter. [2]

Q.5 Answer *ANY TWO* of the following questions. [10]

(a) i. Explain hit-or-miss transform with example. [3]
ii. Is dilation operation associative? Give example. [2]

(b) Apply morphological region filling algorithm on the following image using structuring element. [5]
Generate the step by step output using seed point S.

A

		1	1	1	1	1	
		1	1	1	S	1	
	1		1			1	
	1					1	
	1		1			1	
	1				1		
	1	1	1		1		
				1			

B

	1	
1	1	1
	1	

(c) Discuss various types of order statistic filters. [5]

Q.6 Answer the following questions. [10]

(a) Consider the LZW compression and decompression algorithms. Assume that the scheme has an initial table with code words 0 through 255 corresponding to the 8-bit ASCII characters; character "a" is 97 and "b" is 98. Decode the following sequence of code words, each of which is 9 bits long. [5]
Sequence: 97 97 98 98 257 256

(b) Encode the following data using the loseless predictive coding method for the second order linear predictor. [5]
21 21 21 21 95 169 243 243 243 243

OR

Q.6 Answer the following questions. [10]

(a) Explain components of an image processing system. [5]
(b) Explain brightness adaptation and discrimination. [5]