COMSATS University Islamabad, Lahore Campus
Department of Electrical and Computer Engineering

Terminal Examination – FALL 2021

Course Title:	Digital Image Processing			Course Code:	CPE415	Credit Hours:	4(3,1)
Course	Dr. Ikramullah Khosa			Program Name:	BS Computer Engineering		
Semester:	7th	Batch:	FA18-BCE	Section: A/B	Date:	10-01-2022	
Time Allowed:	**3 Hours**			**Maximum Marks:**		80	
Student's Name:				Reg. No.			

Important Instructions / Guidelines:

- This is a closed-book, closed-notes examination.

Question 1 (CLO-1/PLO-1) **(7 Marks)**

The probabilities of individual gray levels for a 3-bit coded image are given in the following table. **Apply** histogram equalization and **compute** the new pixel intensities after equalization. **Show** the original and equalized histograms as well as the transformation function.

r_k	$P_r(r_k) = n_k/MN$
$r_0 = 0$	0.2
$r_1 = 1$	0.3
$r_2 = 2$	0.25
$r_3 = 3$	0.15
$r_4 = 4$	0.1
$r_5 = 5$	0
$r_6 = 6$	0
$r_7 = 7$	0

Question 2 (CLO-1/PLO-1) **(7 Marks)**

Consider the image shown in Figure 1. **Apply** the concepts of color image processing to **show** the CMY components of the image as they would appear on the monochrome monitor.

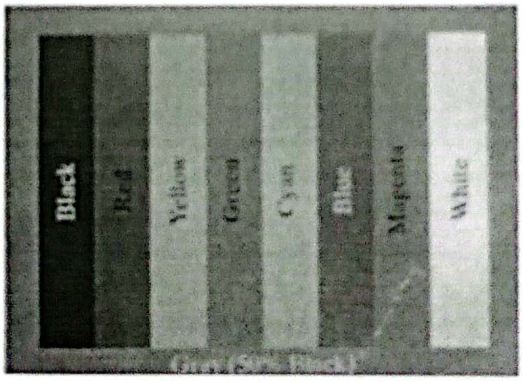

Figure 1

Question 3 (CLO-2/PLO-2) **(7 Marks)**

Relate the concepts of image segmentation and **identify** that the Sobel and Prewitt masks give isotropic results only for horizontal and vertical edges, and for edges oriented at $\pm 45^{\circ}$ respectively.

Question 4 (CLO-2/PLO-2) **(7 Marks)**

Relate the concepts of image segmentation to **identify** whether the threshold obtained with the basic global thresholding algorithm is independent of the starting point? If your answer is yes, prove it. If your answer is no, give an example.

Question 5 (CLO-2/PLO-2) **(7 Marks)**

Analyze the image shown in Figure 2 and **deconstruct** into segments using split and merge procedure (employing Quad Tree method). Show the final quad tree after the segmentation process is finished.

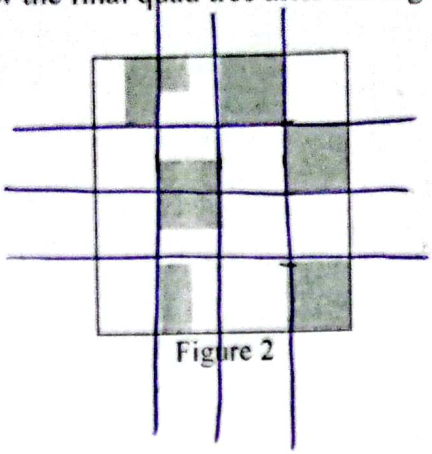

Figure 2

Question 6 (CLO-2/PLO-2) **(7 Marks)**

Analyze the shape shown in the Figure 3 and **outline** the following:

1) Chain Code (using general 8-directional code) with the order of 12 (i.e. 12 segments) (2 Mark)
2) Difference (2 Mark)
3) Shape number (1 Mark)
4) Signature (2 Mark)

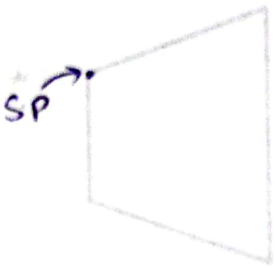

Figure 3

Question 7 (CLO-2/PLO-2) **(8 Marks)**

Analyze the image shown in Figure 4 and **illustrate** the two Gray Level Co-occurrence Matrices (GLCMs). To identify the size of the matrix, consider the pixel intensity range of the image. The position operators to calculate two GLCMs are:

1) One pixel to right and one pixel below (4 Mark)
2) One pixel to left and two pixels below (4 Mark)

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

Figure 4

End of paper