National University of Computer and Emerging Sciences, Lahore Campus

	Course:	Digital Image Processing	Course Code:	EE409
	Program:	BS(Computer Science)	Semester:	Spring 2018
	Duration:	60 Minutes	Total Marks:	80
	Paper Date:	April 2018	Weight	15%
	Section:	ALL	Page(s):	1
	Exam:	Midterm-II		

Instructions

1: Please show all your work.

2: You are allowed 2 sheets of helping material on the exam.

3: Answers are to be written in the space provided for each question. You can use an extra sheet if the space provided is not enough.

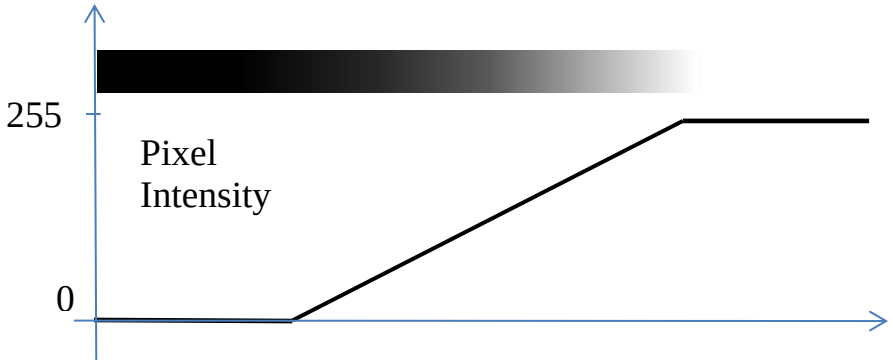
4: All questions are explained clearly. If you find some question's statement ambiguous, you can make reasonable assumptions as long as you state them clearly.

Good luck!

Problem 1:

(a): Let S1=Set of all 1s in $\begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$. Does S1 form a connected set under 8-point neighborhood and toroidal boundary conditions? (10 *points*)

(b): The intensity values going from left to right have been shown as a graph and as image in the figure. Apply the LoG filter on this ramp image, by drawing the second horizontal derivative. Where will LoG place the edge in this case? If this is incorrect, can you think of a way to correct it? (15 *points*)



Problem 2

(a): A filter's kernel is given as $\begin{bmatrix} 1 & 2 & 1 \\ -2 & -4 & -2 \\ 1 & 2 & 1 \end{bmatrix}$ and we wish to find what this filter does. Please give a precise answer with a mathematical reason instead of guessing.

(15 *points*)

(b):
We define complimentary colors as colors which when mixed result in white. In this way, the complimentary colors of RGB are CMY such that R+C = white, G+M=white etc.

We want to design the matrix *M* to convert from RGB coordinates to CMY coordinates. Use this complimentary relationship to find the values in matric *M* needed to perform this transformation.

(15 *points*)

Problem 3 (a) : A convex hull in image processing, described simply, is a region or image segment containing a set of points such that every linear combination of every pair of points is also part of the hull.

In other words, taken any two points in the region, all points on the straight line connecting these two points are also in the region.
Prove (or disprove) that each region formed as result of region growing algorithm is a convex hull. Use properties of connected sets. (15 *points*)

(b): You want to segment the text in the following images, such that the background has no effect on the text you read.
Describe a method to dynamically change the threshold and segmentation to make this happen. What result will you get by applying your method to each of the images?

(10 *points*)