

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION

WINTER SEMESTER, 2017-2018

DURATION: 1 Hour 30 Minutes

FULL MARKS: 75

CSE 4733: Digital Image Processing

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

1. a) Define the following terms: 2×5
 - i. Digital Image
 - ii. Luminance
 - iii. Intensity Resolution
 - iv. Spatial Resolution
 - v. False Contouring
 - b) Describe a simple image formation model in the 2D spatial domain. 5
 - c) In order to generate digital images from sensed data, *sampling* and *quantization* are two important processes. How do these two operations affect the size and color information of an image? 10

 2. a) When and how do you use *bicubic interpolation* in digital image processing? 8
 - b) Consider the two sub-regions in an image, R_i and R_j , shown in Figure 1. For $V = \{1\}$, determine whether these two subsets are (i) 4-adjacent, (ii) 8-adjacent, or (iii) m-adjacent. Explain your answers. 9
- Figure 1.
- c) When is an operation H called linear? Show that the median operator is not linear. 8

 3. a) What conditions should an intensity transformation function $T()$ fulfill? What happens if they fail? 3+4
 - b) Draw a single intensity transformation function for spreading the intensities of a gray-scale image so the lowest intensity is 0 and the highest is $(L-1)$. Here L is the number of intensities possible. Give the mathematical definition of your transformation function. 4+4
 - c) Explain with appropriate figures, why the discrete histogram equalization technique does not, in general, yield a flat histogram. 10

 4. a) Give the mathematical equation representing the convolution of a filter $w(x,y)$ with an image $f(x,y)$. Show the results of applying a weighted average filter on an image of size 5×5 pixels. Explain some of the convolution responses with that filter. 10

- b) What is high-boost filtering and why is this filter used? Can you change this filter to perform exactly as unsharp masking? Explain the working principle of unsharp masking. 10
- c) How was the Sobel mask designed for computing the gradient of an image? 5