PhD. / M.Sc. Engg. CSE

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13 August 2018 (Afternoon)

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

MID SEMESTER EXAMINATION — **SUMMER SEMESTER, 2017-2018**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 75**

CSE 6265: Advanced 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.

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1. a) Define the following terms: 2×5
   i. Digital Image
   ii. Linear Operator
   iii. *m*-adjacency
   iv. Spatial Resolution
   v. Brightness

   b) Suppose you have a gray-scale image of size 50×50 pixels. Your job is now to expand this image to a size of 732×732 pixels. How can you carry out this expansion with less amount of blocking effects? 8

   c) Suppose that an area with center at (x_0, y_0) is illuminated by a light source with intensity distribution of $i(x, y) = Ke^{-[(x-x_0)^2+(y-y_0)^2]}$. 7

   Assume for simplicity that the reflectance of the area is constant and equal to 1.0, and let K=255. If the resulting image is digitized with k bits of intensity resolution, and the eye can detect an abrupt change of eight shades of intensity between adjacent pixels, what value of k will cause visible false contouring?

2. a) 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

   b) 'A perfectly histogram equalized (HE) 8-bit gray-scale image will have an average intensity at the middle of its intensity range' – Justify this statement. 7

   c) An automobile manufacturer is automating the placement of certain components on the bumpers of a limited-edition line of sports cars. The components are color coordinated, so the robots need to know the color of each car in order to select the appropriate bumper component. Models come in only four colors: blue, green, red, and white. You are hired to propose a solution based on imaging. How would you solve the problem of automatically determining the color of each car, keeping in mind that cost is the most important consideration in your choice of components? 10

3. a) Give the mathematical equation representing the correlation of a filter *w(x,y)* with an image *f(x,y)*. Show the results of applying a Sobel fitler on an image of size 5×5 pixels. Explain four different outputs (i.e., at four different positions) of the correlation response with that filter. 10

   b) Explain why the output of applying a median filter preserves more edge sharpness in compared to that of applying an averaging filter. 8

   c) What is isotropic filter? Prove that a Gradient mask is not isotropic. 2+5

4. a) Write short notes on the following color models. Draw appropriate figures. 4+4
   i. HSI
   ii. CMYK

   b) How can you apply the High-boost filter operation on a 24-bit RGB color image without any effect on its color information? Explain the working mechanism of High-boost filter too. 7

   c) Consider a color image corrupted by adding Gaussian noise (with same parameters) separately to each of its RGB channels. Now you have converted the RGB color image to HSI counterpart and found noise to be significantly visible in H and S channels. However, the presence of noise is less visible in the I channel. Explain why. 10