Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2015/2016

COURSE NAME	:	IMAGE PROCESSING
COURSE CODE	:	BEC 42203
PROGRAMME	:	BACHELOR OF ELECTRONIC ENGINEERING WITH HONOURS
EXAMINATION DATE	:	DECEMBER 2015 / JANUARY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 The first step in image restoration is finding an appropriate image degradation model. The most common choice is: $g(x,y) = f(x,y)*h(x,y) + n(x,y)$.

(a) Explain briefly what do g(x,y), f(x,y), h(x,y) and n(x,y) represents in the above equation?

(4 marks)

(b) How would you model the image degradation situation where the camera is out of focus when the image is taken? Specifically, how will h(x,y) and n(x,y) be effected?

(4 marks)

(c) List TWO (2) types of noise.

(2 marks)

(d) Explain briefly the characteristics of each noise type.

(4 marks)

Q2 A simple one dimensional (1D) wavelet transform works by performing just two operations: taking averages of two values and differencing. Given a vector:

$$V = [71, 67, 24, 26, 36, 32, 14, 18]$$

(a) Create a new vector *V1* of four elements, which consists of the averages of the pairs of elements from *V*.

(8 marks)

(b) Create a new vector *V2* of four elements, which consists of the differences of the first four elements of *V* with the elements of *V1*.

(8 marks)

(c) Create a new vector *d1*, which is the discrete wavelet transform at decomposition level 1 of the original vector *V*.

(8 marks)

(d) Image compression is useful to reduce the amount of data required to represent an image. Draw a diagram showing a wavelet coding system starting from input image to decompressed image.

(10 marks)

Q3 The most common techniques for edge detection make use of the first and second derivatives of an image to locate discontinuities in image intensity.

(a) A binary image contains straight lines oriented horizontally and –45degree. Assume that the intensities of the lines and background are 1 and 0, respectively. Propose TWO (2) 3x3 masks that can be used to detect 1-pixel breaks in these respective lines. Use coefficients valued -1 and 2 for the mask.

(9 marks)

(b) Most common edge detection methods are based on first-order derivative and second-order derivative. Categorize the following edge detection methods into first-order or second-order derivatives:(i) Laplacian method, and (ii) Sobel method.

(2 marks)

(c) Propose a set 3x3 masks of Prewitt method for finding horizontal edges and vertical edges, respectively.

(9 marks)

(d) Give TWO (2) advantages of the second-order derivative over the first-order derivative.

(4 marks)

(e) One important uses of thresholding is to isolate objects from their background.Give an example where a single threshold value will not isolate an object and its background completely.

(2 marks)

(f) In Q(e) case, we can use adaptive thresholding. Explain briefly how adapative thresholding is performed.

(4 marks)

Q4 The following matrices as shown in **Figure Q4** represent an image *A* and structuring elements *B*. Assume that the intensities of the object and background are 1 and 0, respectively.

0	1	1	1
0	1	1	1
0	0	1	1
0	0	0	1
0	0	0	0

A

0	0	0
0	0	0
0	0	0

B

FIGURE Q4

(a) Provide the equation for dilation,erosion, opening and closing for *A* and *B*, respectively.

(8 marks)

(b) Create theoutput matrix *D* for the erosion for A and *B*.

(10 marks)

(c) Based on the results in Q4(b), explain the effect of erosion to image *A*.

(2 marks)

(d) If we continue to apply erosion to image *A*, predict what will happen to the output image.

(2 marks)

- END OFQUESTIONS -