Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015

COURSE NAME	:	IMAGE PROCESSING
COURSE CODE	:	BEC42203
PROGRAMME	:	BACHELOR OF ELECTRONIC ENGINEERING WITH HONOURS
EXAMINATION DATE	:	JUNE 2015/JULY 2015
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) represent in the above equation?

(4 marks)

(b) How would you model the image degradation situation where the camera's sensor temperature increases 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 1D wavelet transform works by performing just two operations: taking averages of two values and differencing. Analyse the given vector:

$$V = [142, 134, 48, 52, 72, 64, 28, 36]$$

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

(8 marks)

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

(8 marks)

(c) Produce 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 forward wavelet transform with decomposotion level 2 for low pass filter output image for decomposition level 2, fLL(x,y), and high pass filter output image for decomposition level 2, fLH(x,y). Given the original image is represented as f(x,y), lowpass filter as H_bar, highpass filter as G_bar, fL(x,y) as low pass filter output image for decomposition level 1 and fH(x,y) as high pass filter output image for decomposition level 1, respectively.

(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 vertically and 45 degree. Assume that the intensities of the lines and background are 1 and 0, respectively. Provide 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.

(10 marks)

(b) Edge models: classified according to their intensity profiles. Categorize the following edge models.

(2 marks)

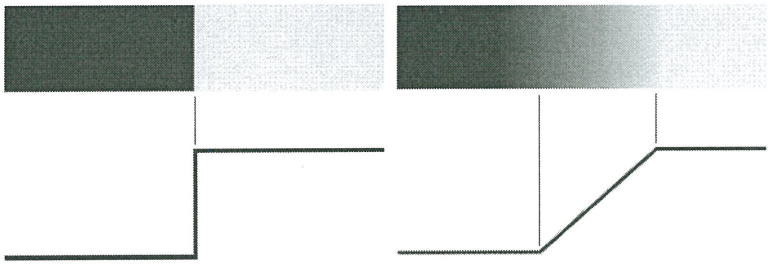

FIGURE Q3(b)

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

(10 marks)

(d) Give ONE (1) advantage of the Sobel edge detection method over the Prewitt edge detection method.

(2 marks)

(e) One important uses of thresholding is to isolate objects from their background. Give TWO (2) basic types of intensity thresholding.

(2 marks)

(f) In the above case, explain briefly the condition of threshold value, T, for each thresholding scheme.

(4 marks)

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

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

A

0	0	0
0	0	0
0	0	0

B

FIGURE Q4

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

(8 marks)

(b) Create the output matrix *D* for the dilation for A and *B*.

(10 marks)

(c) Based on the above results, explain the effect of dilation to image *A*.

(2 marks)

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

(2 marks)

- END OF QUESTION -