GENERAL SIR JOHN KOTELAWALA DEFENCE UNIVERSITY

Faculty of Engineering

Department of Electrical, Electronic and Telecommunication Engineering

BSc Engineering Degree

Semester 4 Examination – November/December 2015

(Intake 31 - EE/ET/BM/MC)

ET 4072 – IMAGE PROCESSING

Time allowed: 3 hours

Date : - 13 NOV 2015

INSTRUCTIONS TO CANDIDATES

Answer all FIVE questions.

This is a closed book examination

~~Use separate answer book for SECTION A and SECTION B~~

This examination accounts for 70% of the module assessment. A total maximum mark obtainable is 100. The marks assigned for each question and parts thereof are indicated in square brackets

If you have any doubt as to the interpretation of the wordings of a question, make your own decision, but clearly state it on the script

Assume reasonable values for any data not given in or provided with the question paper, clearly make such assumptions made in the script

All examinations are conducted under the rules and regulations of the KDU

63

1. a). Give an **advantage** and a **disadvantage** of the median filter compared to a weighted convolution filter in noise reduction.

b). Assume that you need to apply the **median filter** to an image. Suggest an approach to handle the boundary of the image in this operation. Justify your answer.

c). Consider the following 4x4 image I_1 where the values inside the cells give the intensities.

90	95	70	20
92	80	85	25
80	80	25	35
70	55	40	30

Find the output image if I_1 is convolved with a 3x3 **high pass**. State clearly the 3x3 mask that you have used.

[20 marks]

2. a). Briefly explain with a block diagram the **Image Analysis Model** consisting of an application feedback loop.

b). Assume that you are given an image of a tree leaf to recognize the tree by analyzing the edge patterns on the leaf. List **three** possible pre-processing steps that will make the analysis task easier.

c). Consider the following 3x3 image I_2 where the values inside the cells give the intensities.

8	10	12
4	20	8
4	8	6

Find the output image by zooming I_2 after applying the first-order hold method **twice**. State clearly any masks that you have used.

[20 marks]

3. a). Briefly explain three types of data redundancies that can exist in an image.

b). Explain how the number of bits in a source image and its compressed image affect compression ratio and relative data redundancy.

64

c). Consider the following 4x8 image I_3 where the values inside the cells give the intensities.

200	200	200	75	90	210	210	210
200	200	200	75	90	210	210	210
200	200	200	75	90	210	210	210
200	200	200	75	90	210	210	210
200	200	200	75	90	210	210	210

i. Compute the first order estimate of entropy for I_3.

ii. Compute the first order estimate of entropy for the difference image of I_3.

[20 marks]

4. a). Define the following adjacency types between two pixels in an image.

i. 4 - adjacency

ii. 8 - adjacency

iii. M – adjacency

b). Briefly explain with an example, the purpose of introducing M-adjacency over 8-adjacency.

c). Consider the following 8x8 binary image.

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

i. Show the M-adjacency of foreground pixels (where the intensity value is 1) with dashed lines in the image.

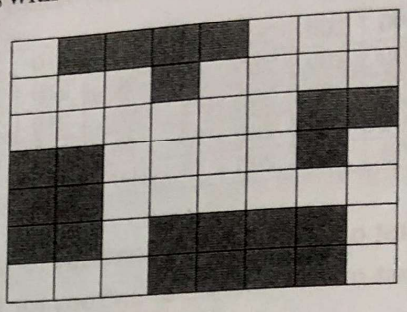
ii. List all adjacency types which are suitable to describe the adjacency of the two shaded pixels in the image.

[20 marks]

5. a). Write down a sequential algorithm to perform Connected Component Labelling (CCL).

b). Briefly explain one advantage of using CCL as a technique of noise reduction, compared to morphology based techniques.

c). Given below is a 7x8 image I_5 with 4 connected components.



Label these 4 connected components (shaded foregrounds) using the sequential algorithm that you specified in (a). Cleary show the steps in the labelling process.

[20 marks]