Uva Wellassa University, Sri Lanka
End Semester Examination – June/July 2010
CST 304-3 DIGITAL IMAGE PROCESSING
Time: Three (03) hours

Total 05 Questions
Answer all **five (05)** questions

Q1

I. Describe the phenomenon brightness adaptation in the human eye. (4 marks)

II. Describe two methods used for zooming a digital image, and discuss their relative performance. (6 marks)

III. The intensity distribution in an image is uniform over a range from 0 to 1. The image is passed through a power low intensity transformation with $\gamma = 0.5$. What is the distribution (density) of the output image? The cumulative distributions is

$$F_X(x) = \begin{cases} 0 & x < 0 \\ x & 0 < x < 1 \\ 1 & 1 < x \end{cases}$$

(10 marks)

Q2

I. Describe the techniques that you may use to improve:

a. A poorly focused image.

b. An image superimposed with pure black and pure white noise pixels.

(4 marks)

II. What sequence of application of the above techniques would you follow to restore an image with both of the above defects? Give reasons for the selection of techniques and the sequence you suggest. (2 marks)

III. Gray levels of an image region are shown below

20	18	16	25	26
22	25	27	26	26
20	**32**	**29**	**25**	17
18	26	24	23	19
26	27	20	21	23

a. Compute the resulting gray levels for the three pixels (shown in **BOLD**) after applying the following mask. (6 marks)

-2	-1	-2
-1	12	-1
-2	-1	-2

b. Briefly describe the effects of the above mask. (2 mark

c.

1	2	1
2	4	2
1	2	1

We are given a 3x3 mask for low-pass filtering, shown above. Describe an effici method for convolving an image with this filter. Estimate the number of operati (additions and multiplications) required to convolve an nxn image using y method. (6 mar

Q3

I. We wish to convolve a 1024 x 1024 image with a filter that has a support 100x100 points. Describe how to do this with the FFT. Your method should a wraparound artifacts. (10 ma

II. What is meant by histogram equalization? (2 ma

III. What is meant by bit plane slicing? (2 mar

IV. Differentiate linear spatial filter and non-linear spatial filter. (6 ma

Q4

I. Briefly describe the followings.

a. Image enhancement.

b. Image segmentation. (4 M

II. Describe the effects of using median filter and local averaging for noise removal giving advantages and disadvantages of each method. (4 M

III. Gray levels of a image region are shown below

21	18	16	15	12	10
22	**05A**	17	13	16	20
22	23	16	15	12	30
18	26	14	**73B**	14	40
26	27	12	11	11	50
11	12	09	09	80	60
10	20	30	40	50	60

Compute the resulting gray levels for the pixels A and B (shown in bold) after performing

a. Local averaging with a 3*3 mask. (2 Marks)

b. Median filtering with a 3*3 mask. (2 Marks)

c. Midpoint filtering with a 3*3 mask. (2 Marks)

IV. The shape and aspect ratio correction feature of a digital multimedia projector requires that a 2040x2040 digital image be projected onto the shape given in figure 4(d) when projecting with a certain upwards inclination

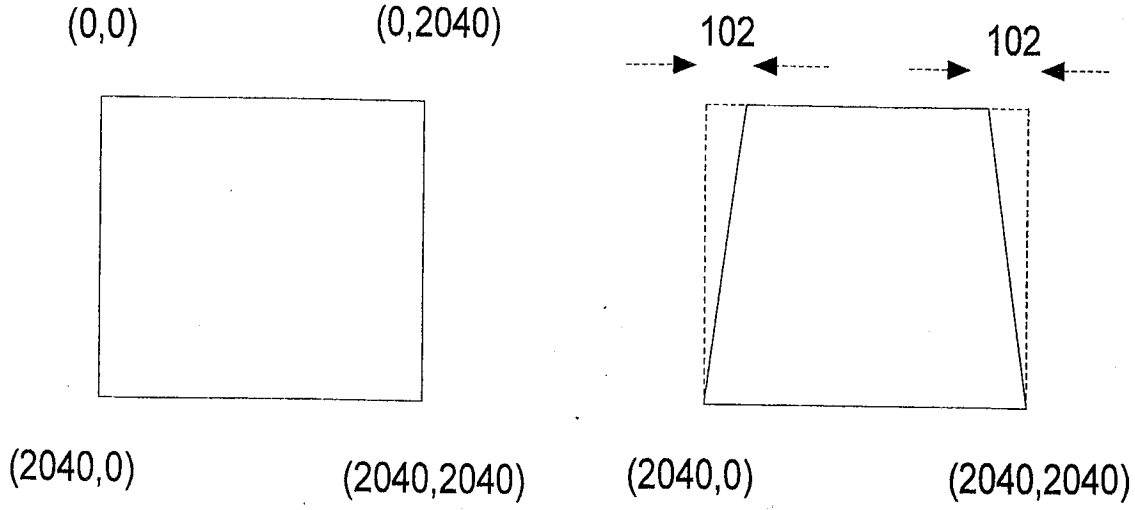

figure 4(d)

V. Obtain the transfer functions you would use to map the gray levels to effect this shape correction (6 Marks)

a. Compute the resulting gray levels for the three pixels (shown in **BOLD**) after applying the following mask. (6 marks)

-2	-1	-2
-1	12	-1
-2	-1	-2

b. Briefly describe the effects of the above mask. (2 marks)

c.

1	2	1
2	4	2
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Q5

I. Describe in detail the basic steps for image enhancement in the frequency domain. (5 marks)

II. What is a notch filter used in image processing? Explain the effect of notch filter on the image if the notch is placed at (0,0) frequencies. Describe an example where one may need a notch filter at ($u0 \neq o$ and $v0 \neq o$). (5 marks)

III. Describe three (03) types of law pass filters for image processing, and compare the performances of each of these filters. (5 marks)

IV. Discuss the merits and demerits of frequency domain approach and spatial domain approach for image enhancement. (5 marks)