UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2001/2002

September 2001

CCS504 – Computer Vision and Image Processing

CSC543 – Digital Image Processing

Duration : 3 hours

INSTRUCTION TO CANDIDATE:

- Please ensure that this examination paper contains **FIVE** questions in **THREE** printed pages before you start the examination.
- Answer **ALL** questions.
- You can choose to answer either in Bahasa Malaysia or English.

ENGLISH VERSION OF THE QUESTION PAPER

1. (a) Explain 'sampling' and 'quantization' with respect to Image Processing.

(4 marks)

(b) State Convolution theorem and explain its use in Image Processing.

(4 marks)

(c) Explain as to how a camera can be calibrated?

(4 marks)

(d) The coordinates of 5 corners of a 1 unit cube are: (0,0,1), (0,0,2), (-1,0,2), (-1,0,1), (0,1,1). This cube is rotated with respect to the axis passing through the corners (0,0,1) and (0,0,2), by an angle of 90 deg. Find and list the coordinates of all the 8 corners after rotation and list them by the side of the coordinates of the corners before rotation.

(8 marks)

2. (a) With the help of suitable transformation (show it graphically), explain how the compression of dynamic range transformations is done.

(4 marks)

(b) What is a histogram of a digital image? What information can you obtain from the histogram of images? Explain with examples.

(4 marks)

(c) Explain, step by step, the procedure for enhancing an image by processing it so that the number of pixels having a particular gray level in the image is approximately same for all gray levels. Illustrate your steps with suitable sketches.

(8 marks)

(d) What is image subtraction? Discuss a typical use of this processing technique.

(4 marks)

3 (a) Explain, with suitable sketches the high pass and low pass ideal filters' transfer functions, in the frequency domain.

(4 marks)

(b) Under what condition does the Butterworth lowpass filter becomes an ideal lowpass filter?

(2 marks)

(c) Describe the RGB color model. Discuss typical points in the model.

(6 marks)

(d) Explain with suitable sketches as to how spatial transformation and gray level interpolation are used in image restoration.

(8 marks)

4. (a) Explain Huffman coding and Huffman's procedure to perform error free image compression. Illustrate with the help of the 8 symbols whose probabilities are shown below:

a - 0.25;	b - 0.25;	c - 0.125;	d - 0.125;
e - 0.0625;	f - 0.0625;	g - 0.0625;	h - 0.0625;

(10 marks)

(b) Discuss the use of transforms in image data compression.

(4 marks)

(c) What are the basic types of discontinuities in images? Briefly describe the method of detecting them.

(6 marks)

5. (a) Discuss the data structure, Quadtree, used with Computer Vision Systems.

(4 marks)

(b) Explain the concept of progressive Image transmission.

(4 marks)

(c) What are biometrics based vision systems? What are the biometrics used with such systems? Explain.

(3 marks)

(d) What are the two kinds of biometrics systems? Discuss them.

(3 marks)

(e) Present an overview of any one biometrics based vision system.

(6 marks)