UNIVERSITY OF MORATUWA
Faculty of Information Technology

B.Sc. (Hons.) in Information Technology
and
B.Sc. (Hons.) in Information Technology & Management
Level 2 – Semester 2 Examination
IN 2600 – COMPUTER GRAPHICS AND ANIMATION

Time Allowed: 3 hours May 2015

INSTRUCTIONS TO CANDIDATES

1. This paper contains 5 questions on 5 Pages.
2. The total marks obtainable for this examination is 100. The marks assigned for each question & sections thereof are included in square brackets.
3. This examination accounts for 70% of the module assessment.
4. This is a closed book examination.
5. Start the answer to each question on a new page.
6. Answer ALL questions.

ADDITIONAL MATERIAL

None

Continued...

Question 1

(a) Name four (4) application areas of Computer Graphics and Animation.

[2 Marks]

(b) What are the advantages and disadvantages of Photoreal rendering compared to Non-photoreal rendering?

[4 Marks]

(c) Briefly explain the steps in traditional computer graphics pipeline.

[6 Marks]

(d) Briefly explain the functionality of the Framebuffer.

[3 Marks]

(e) Give three (3) advantages of 'character rigging' compared to 'key framing' in generating computer animations.

[3 Marks]

(f) Write two (2) functionalities provided by the OpenGL Utility Toolkit for graphics programming.

[2 Marks]

Question 2

(a) What is Ray Tracing?

[2 Marks]

(b) Briefly explain the advantages of 'Backward Ray Tracing' compared to 'Forward Ray Tracing'.

[3 Marks]

(c) Give two (2) drawbacks of the Digital Differential Analyzer (DDA) Algorithm.

[2 Marks]

(d) Using the Mid Point Line algorithm, calculate the pixel coordinates of the line from (12, 3) to (18, 8).
Clearly indicate the conventions used for making decisions.

[10 Marks]

(e) Using a suitable example, briefly explain the main advantage of using the eight way symmetry of a circle for scan conversion in circle drawing algorithms.

[3 Marks]

Continued...

Question 3

(a) Briefly explain why clipping is required for computer graphics?

[3 Marks]

(b) Coordinates of a view port and the line AB are given below. Using the Cohen-Sutherland line clipping algorithm, write the 4-bit code for each end-point and determine whether this is a trivially acceptance case or a trivially rejection case or a non-trivial case. *(Clearly indicate the steps you've followed.)*

- View port: (10, 10), (50, 10), (10, 50), (50, 50)
- A: (20, 30)
- B: (60, 45)

[3 Marks]

(c) The polygon ABCDEFA contains the following coordinates.

- A: (20, 50)
- B: (70, 50)
- C: (70, 10)
- D: (40, 10)
- E: (40, 30)
- F: (20, 30)

Coordinates of the view port are (0,20), (0,60), (50,20) and (50, 60).

(i) Illustrate the scenario of the view port and the polygon ABCDEFA using an appropriate diagram.

[2 Marks]

(ii) Clip the polygon using the Sutherland-Hodgman Polygon Clipping algorithm. *(Inputs and outputs for each clipping edge should be clearly indicated.)*

[12 Marks]

Question 4

(a) Write transformation matrices for the following transformations.

(i) 3D translation where the translation factors are t_x, t_y and t_z along principal coordinates.

[1 Marks]

(ii) 2D non-uniform scaling where the scaling factors are s_x, s_y along principal coordinates.

[1 Marks]

(iii) 2D Rotation (counter clock wise) where the angle of rotation is θ.

[1 Marks]

Continued...

(b) (i) Coordinates of the polygon ABCA are given below.

- A: (20, 20, 0)
- B: (30, 40, 0)
- C: (40, 20, 0)

Translate the polygon by;

- 10 units along the x-axis
- 20 units along the y-axis
- (-10) units along the z-axis

Clearly indicate the transformed coordinates of each vertex.

[5 Marks]

(ii) Coordinates of the polygon KLMNK are given below.

- K: (0, 0)
- L: (0, 10)
- M: (10, 10)
- N: (10, 0)

Scale the above polygon;

- 2 times along the x-axis
- 0.5 times along the y-axis

Clearly indicate the transformed coordinates of each vertex.

[6 Marks]

(iii) Coordinates of the line PQ are given below.

- X: (0, 0)
- Y: (10, 20)

Rotate the line PQ by 60^0 anti-clockwise.
($\text{Sin } 60^0 = \sqrt{3}/2$, $\text{Cos } 60^0 = 1/2$)

Clearly indicate the transformed coordinates of each vertex.

[6 Marks]

Question 5

(a) Using a suitable diagram, briefly explain the following two types of projection.

(i) Perspective projection
(ii) Parallel projection

[4 Marks]

Continued...

(b) Discuss the advantages and disadvantages of perspective projection and parallel projection.

[4 Marks]

(c) What is a texture in computer graphics?

[2 Marks]

(d) Briefly explain the advantages of texture mapping in computer graphics.

[4 Marks]

(e) Suppose that you've been asked to create a simulation of a human hand and simulate the different grasp patterns. Briefly explain the major tasks associated with this process. (Implementation details are *not* required.)

[6 Marks]

End of the Question Paper