



**UNIVERSITY OF MORATUWA**  
Faculty of Information Technology

**037**

B.Sc. (Hons.) in Information Technology and  
B.Sc. (Hons.) in Information Technology and Management  
Level 2 – Semester 2 Examination  
**IN 2600 – Computer Graphics**

Time Allowed: 3 hours

May 2012

**INSTRUCTIONS TO CANDIDATES**

1. This paper contains 4 questions on 4 Pages (Including this page).
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 60% of the module assessment.
4. This is a closed book examination.
5. Answer **ALL** questions.

**ADDITIONAL MATERIAL**

None

Continued...

**Question 1**

- (a) Briefly explain the functionality of Liquid Crystal Displays and Color Cathode Ray Tubes using suitable diagrams.

[6 Marks]

- (b) What is meant by photo-real rendering? Give an example.

[3 Marks]

- (c) Explain four different challenges face by the graphic designers when modeling a graphic. Give examples for each.

[10 Marks]

- (d) Explain an advantage and a disadvantage of perspective projection by giving suitable examples.

[6 Marks]

**Question 2**

- (a) Explain the inappropriateness of incremental algorithm for line drawing by illustrating two key features.

[4 Marks]

- (b) Construct the Bresenham's midpoint algorithm for  $1 < m$  ( $m$ =slope of the line). (Clearly indicate the steps and the decisions you take using appropriate diagrams)

[6 Marks]

- (c) A straight line goes through points (2, 5) and (7, 14). Calculate the pixels between the given points using the midpoint algorithm.

[8 Marks]

- (d) A straight line goes through points (5, 4) and (13, 8). Calculate the pixels between the given points using the midpoint algorithm.

[7 Marks]

**Question 3**

- (a) (i) Briefly explain the terms world coordinates and viewport using suitable diagrams.  
(ii) Illustrate the steps for mapping a point  $A(X,Y)$  in world coordinates to a point  $a(x,y)$  in viewport.

[6 Marks]

- (b) Determine whether the straight lines given below are inside, outside or need to be clipped from the clipping window using Liang-Barsky line clipping algorithm. If the line needs to be clipped then determine the clipping points. Also indicate if the lines are parallel to a clipping window.

A clipping window WXYZ contains the following coordinates:

W: (9,5)  
X: (19,5)  
Y: (19,12)  
Z: (9,12)

- (i) Pa (4, 1) and Pb (28, 5)
- (ii) P3 (4, 5) and P4 (22, 10)
- (iii) P5 (11, 9) and P6 (19, 11)
- (iv) P7 (14, 2) and P8 (14, 16)

Show your steps in the calculations clearly.

[10 Marks]

- (c) A polygon ABCDEA contains the following coordinates.

A: (16,7)  
B: (22, 7)  
C: (22, 15)  
D: (16,15)  
E: (6,9)

Answer the following questions based on the polygon ABCDEA and the clipping window WXYZ given in section (b).

- (i) Illustrate the scenario of the view port and the polygon ABCDEA using appropriate diagrams
- (ii) Clip the polygon using the Sutherland-Hodgman Polygon Clipping algorithm. (Inputs and outputs for each edge should be clearly indicated)

[9 Marks]

#### Question 4

- (a) Basic structure of a house is given below.

The outline of the house is denoted as O, a door inside the house as D, a window inside the house as W and a small window inside the door as S. The coordinates for each are given below

O : (4,3), (23,3), (23, 16), (21, 20), (7, 20), (4, 16), (4,3)  
D: (7, 3), (12, 3), (12, 12), (7, 12), (7, 3)  
W: (15, 8), (21, 8), (23, 13), (15, 13), (15, 8)  
S: (8, 9), (11, 9), (11, 11), (8, 11), (8, 9)

- (i) Develop a hierarchical model for the above structure
- (ii) Construct the transformation function based on the hierarchical model for the following order of transformations.
  - a. Rotate the whole structure by  $30^\circ$  degrees anti-clockwise relative to the origin.
  - b. Translate the whole structure by (2,3).
  - c. Scale the window (w) by 0.5 relative the origin with uniform scaling.
- (iii) Calculate the coordinates of the window (W) after the transformations.  
(Hint:  $\sin(30^\circ) = 0.5$  ,  $\cos(30^\circ) = 0.866$ )  
*[12 Marks]*
- (b) Briefly explain the difference between Multiview Orthographic and Oblique projections in terms of direction of projection (DOP) and view plane normal (VPN).  
*[4 Marks]*
- (c)
  - (i) What is meant by a view volume?
  - (ii) State the importance of back and front clipping in a 3D scenario.*[6 Marks]*
- (d) Explain the importance of unit texture plane in the process of texture mapping using suitable diagrams.  
*[3 Marks]*

**End of Paper**