BITS, Pilani – Dubai
Dubai International Academic City, Dubai

Fourth Year (Computer Science)
Second Semester, 2007-2008

Comprehensive Exam

Course No: CS UC471
Date: 28th May 2008
Duration: 3 Hours

Course Title: Computer Graphics
Weightage: 40%
Max. Marks. 40

Answer ALL questions
5 marks for each question

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1. Describe the scan conversion algorithm for polygons. Specify suitable data structures for its efficient implementation. Mention clearly how the algorithm handles special cases of vertices and horizontal edges of the polygon.

2 Derive the Cohen-Sutherland line-clipping algorithm. Use diagrams to show the outcode used by the algorithm and the step-by-step processing of lines against the clip window.

3. 2D transformations given below are applied in the order in which they are listed. Compose them and express the net result in a 3x3 matrix form.
   a. Translation T(-3, -2)
   b. Scaling S(2, 2)
   c. Rotation R(90^0)
   d. Translation T(3, 2)

   Apply the resulting transformation on the point (4, 2).
   Give an interpretation for the series of transformations given above.

4. Describe briefly a method for finding the intersection of line segment joining A to B with a Bezier curve defined by control points P, Q, R & S.

   Describe the boundary representation scheme for representing solid objects. Explain how it is efficiently implemented using the winged edge representation for polyhedral objects.

6 Explain the depth-sort algorithm for determining visible surfaces. Show two examples of cyclic overlap and how it can be resolved. In what situation is this algorithm better compared to others?

7 Describe Gouraud and Phong shading methods for displaying planar polyhedral objects. Compare the advantages and disadvantages of these methods.

8. Write short notes on the following:
   a. Geometric projections
   b. Bicubic parametric surfaces
   c. Regular sets
   d. Octrees
   e. Diffuse reflection

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Fourth Year (Computer Science)
Second Semester, 2007-2008

Test 2 (Open Book)
Text book, Reference books, and Class Notes may be used

Course No: CS UC471
Date: 11th May 2008
Duration: 50 minutes

Course Title: Computer Graphics
Weightage: 20%
Max. Marks. 20

Answer ALL questions
4 marks for each question

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1 An object is to be scaled by a factor S in the direction whose direction cosines are (α, β, γ). Derive the transformation matrix.

2. Give the viewing parameters for top, front, and side views of the object "house" defined in the text book with the VRP in the middle of the window. Must the PRP be different for each of the views? Why or why not?

3. Show that the two curves $\gamma(t) = (t^2 - 2t, t)$ and $\eta(t) = (t^2+1, t+1)$ are both C^1 and G^1 continuous where they join at $\gamma(1) = \eta(0)$.

4. Describe a method for finding the normal to a parametric bicubic surface at any point on it.

5 Write an algorithm for finding the volume of a solid object represented by an octree. Assume that the root of the octree represents a cube of size d.

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BITS, Pilani – Dubai
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Fourth Year (Computer Science)
Second Semester, 2007-2008

Test

Course No: CS UC471
Date: 30th Mar 2008
Duration: 50 minutes

Course Title: Computer Graphics
Weightage: 20%
Max. Marks. 20

Answer ALL questions
4 marks for each question

Derive the midpoint line algorithm for scan converting a straight line. State explicitly the assumptions that you make about the input line.

2 Develop a scan algorithm for triangles that take advantage of the simple nature of this shape compared to a general polygon.

3 Apply Cohen-Sutherland line-clipping algorithm to clip the line joining (5, 8) to (11, 1) against the window with xmin = 1, xmax = 8, ymin = 2, ymax = 7. Take the edges of the window in the order top, bottom, right, and left while checking for intersection with the line segment.

4. Consider a convex polygon with n vertices being clipped against a clip rectangle. What is the minimum number of vertices in the resulting clipped polygon? What is the minimum number? What are the minimum and maximum number of vertices in the clipped polygon if the input polygon is concave and the output is a single connected polygon?

5 Two rectangles R1 and R2 with sides parallel to coordinate axes are defined as below:

R1 : xmin = a, xmax = b, ymin = c, ymax = d
R2 : xmin = p, xmax = q, ymin = r, ymax = s

Obtain a 2d transformation that will transform R1 to R2

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