BITS, Pilani – Dubai
Dubai International Academic City, Dubai

IV Year (ALL)
First Semester, 2009-2010

Comprehensive Examination

Course No: CS C471 | **Course Title: Computer Graphics**
Date: 27th Dec 2009 | **Weightage: 40%**
Duration: 3 Hours | **Max. Marks. 40**

Answer ALL questions
5 marks for each question

1. Derive the midpoint line algorithm for scan-converting a straight line. Use a diagram to show the important parameters of decision-making. Also mention how the basic algorithm is generalised to handle lines of arbitrary slopes.

2. Describe the scan-line algorithm for scan-converting polygons. Explain the data structures used in efficiently implementing this algorithm. How are the special cases of the scan line passing through a vertex or a horizontal edge handled by the algorithm?

3. 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.

4. Prove that we can transform a line by transforming its endpoints and then constructing the line between the transformed end points.

5. Write an algorithm in pseudo-code to display a Bezier surface by drawing the parametric curves in the u and v directions by approximating them by line segments. You may assume that a 3D-line drawing function is available for generating the display. Select the set of input parameters to make the program highly adaptable.

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

[P.T.O.]

7. 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?

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

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IV Year (ALL)
First Semester, 2009-2010

Test 2 (Open Book)
Only text book and hand-written class notes are allowed

Course No: CS C471 | **Course Title: Computer Graphics**
Date: 10th Dec 2009 | **Weightage: 20%**
Duration: 50 minutes | **Max. Marks. 20**

Answer ALL questions
4 marks for each question

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. A Bezier curve is defined by the following control points.
   p0(0, 0), p1(1, 1), p2(2, 1), p3(3,0)
   Evaluate the point on the curve corresponding to the parameter u = ½.
   Draw the control polygon, curve and mark the point you have evaluated.
   Calculate the slope of the curve at its end points.

4. Use polygon-mesh representation to give a complete representation of the six faces of the unit cube.

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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IV Year (ALL)
First Semester, 2009-2010

Test 1 (Closed Book)

Course No: CS C471 | **Course Title: Computer Graphics**
Date: 18th Oct 2009 | **Weightage: 20%**
Duration: 50 minutes | **Max. Marks. 20**

Answer ALL questions
4 marks for each question

1. How long would it take to load a 640-by-480 frame buffer with 12 bits per pixel, if 10^5 bits can be transferred per second? How long would it take to load a 24-bit-per-pixel frame buffer with a resolution of 1280-by-1024 using this same transfer rate?

2. Use the midpoint method to derive the decision parameters for generating points along a straight-line with slope in the range $0 \leq m \leq 1$.

3. Find the first five points generated by the midpoint scan-conversion algorithm for circles with second order difference for the circle $x^2 + y^2 = 100$.

4. Develop a scan-conversion algorithm for triangles that take the advantage of the simple nature of this shape.

5. Derive a 2D transformation for reflection along the line joining the points P(a, b) and Q(c, d).

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BITS, PILANI – DUBAI

FIRST SEMESTER 2009 – 2010

FOURTH YEAR

Course Code: CS 471
Course Title: Computer Graphics
Duration: 25 minutes

Date: 05.10.09
Max Marks: 8
Weightage: 8%

Name: ..... **ID No:** ..... **Sec / Prog:** .....

Instructions: Indicate the correct choice in each question by clearly circling its option number.
Ambiguous answers will be treated as no answers.
There is no negative marking.

1. For which values of line slope m, does the incremental algorithm for scan conversion choose x as the independent variable?
   a. -1 <= m <= 1
   b. 0 <= m <= 1
   c. All values of m
   d. Only positive values of m.

2. Which of the following is a major drawback of the basic incremental algorithm for drawing lines?
   a. Number of points plotted is less
   b. Number of points plotted is more
   c. All types of lines cannot be drawn
   d. Calculations with real numbers are required

3. In the midpoint scan conversion algorithms for lines, what is the reason for multiplying the original decision variable F(M) by 2?
   a. To get a wider range
   b. To increase accuracy
   c. To avoid calculation with fractions
   d. None of these

4. How many pixels will be plotted by the midpoint scan conversion algorithm while drawing the line joining (0, 0) to (13, 19)?
   a. 13
   b. 14
   c. 19
   d. 20

[PTO]

5. Which of the following scan conversion algorithms uses integer multiplication?
   a. incremental line scan-conversion algorithm
   b. midpoint line scan-conversion algorithm
   c. midpoint circle scan-conversion algorithm
   d. none of the above

6. A circle with an arbitrary point as centre can be obtained from the circle of same radius with origin as centre by which of the following operations?
   a. Rotation
   b. Scaling
   c. Translation
   d. None of these

7. What is the condition for terminating the basic midpoint circle algorithm?
   a. $y > x$
   b. $y \leq x$
   c. $x < 0$
   d. $y < 0$

8. In the midpoint circle algorithm, the test point is the midpoint which of the following neighbouring points?
   a. E and NE
   b. E and SE
   c. W and NW
   d. W and SE

9. Midpoint circle scan-conversion algorithm using second order differences is ----- compared to the one using first order differences.
   a. more efficient
   b. less efficient
   c. more accurate
   d. less accurate

10. In the polygon scan conversion algorithm what is the convention used w.r.t. horizontal edges?
   a. Do not count both vertices.
   b. Count only ymin vertex.
   c. Count only ymax vertex.
   d. Count the left one, but not the right one.

11. In the edge table (ET) data structure used in the polygon scan conversion algorithm, what are the labels used for buckets pointing to edge lists?
   a. y values of polygon vertices
   b. x values of polygon vertices
   c. y values of all scan lines
   d. slopes of polygon edges

12. What is the condition for trivial acceptance of line with end points having outcodes c0 and c1 in the Cohen-Sutherland line-clipping algorithm?
    a. c0 & c1
    b. c0 | c1
    c. !(c0 & c1)
    d. !(c0 | c1)

13. What is the minimum number of iterations possible in the Cohen-Sutherland line-clipping algorithm?
    a. 0
    b. 1
    c. 4
    d. n

14. In which of the following cases does the Sutherland-Hodgman polygon-clipping algorithm output two points? s – the previous vertex; p – current vertex.
    a. s outside and p inside
    b. both s and p inside
    c. s inside and p outside
    d. both s and p outside

15. Which of the following is not true about the Sutherland-Hodgman polygon-clipping algorithm?
    a. It is based on divide-and-conquer strategy.
    b. It has exponential time complexity.
    c. The output may be a disconnected polygon.
    d. It can handle convex as well as concave polygons.

16. What is the purpose of the function invocation
    Output(p, outLength, outVertexArray)
    in the Sutherland-Hodgman polygon-clipping algorithm?
    a. To display the ouput polygon
    b. To set the number of points in the output polygon
    c. To add a vertex to the ouput polygon
    d. To clip a vertex in the output polygon

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