MAL 754: Principles of Computer Graphics

FINAL EXAMINATION

Date: 06.05.2015

Time: 2 Hours

Max. Marks: 40

Note: Answer all the SIX questions

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1).

a) Write a pseudo code algorithm for Cyrus Beck line clipping algorithm. The pseudo code should contain:

(i) Inputs; (ii) Output(s); (iii) All the steps of the algorithm.

b) What is homogeneous coordinate system? State its importance in computer graphics. (5 + 2 Marks)

2). A unit cube is placed at the origin such that its three edges lie along *X*, *Y* and *Z* axis. The cube is rotated about the *Y* axis through 45 degrees clockwise, followed by rotation about the X-axis through an angle θ and then projected onto Z=0 plane with direction projection is parallel to the unit vector along the Z-axis.

a) Find the final parallel projection transformation matrix?

b) Is it a diametric projection? State reasons for your claim.

c) Also, find the value of the angle θ and the direction of rotation (with respect to X-axis) so that this projection becomes an isometric projection? (3 + 1 + 3 Marks)

3).

a) Give a detailed description of the Phong's shading model.

b) State at least one important advantage of Gouraud shading model over Phong's shading model.

c) State at least one important advantage and disadvantage of Z buffer algorithm in comparison with scan line Z-buffer algorithm. (4 + 1 + 2 Marks)

4).

a) Give a detailed description on obtaining a combined diffuse and Phong' specular light reflection model.

b) Find the cubic Bezier curve defined by the control points P0(10,50), P1(10,40), P2(40,20) and P3(0,0) as a plane curve in the Z=0 plane. Draw a rough sketch of the curve. (4 + 3 Marks)

5). Suppose $p(u, v)$ and $q(u, v)$ be two bi-cubic Bezier surface patches defined in terms of the control points $\{p_{ij}\}$ and $\{q_{ij}\}$ respectively; u and v be the parametric variables. It is desired to join these two patches with C0- continuity along the $u=1$ curve of the $p(.,.)$ patch with $v=0$ curve of the $q(.,.)$ patch. Derive the conditions in terms of the control points to perform the above task. (6 Marks)

$$\bar{p}(u) = \sum_{i=0}^{n} \bar{p}_i B_{i,n}(u)$$

6).

a) Define B-spline curve.

b) It is desired to draw a cubic B-spline curve with four control point given: P0(5,A), P1(B,30), P2(20,C)and P3(30,12). Find the values of A,B and C so that the curve terminates at (20,27) with slope (-0.9)? (2 + 4 Marks)

$$N_{i,k}(u) = \frac{u - u_i}{u_{i+k-1} - u_i} N_{i,k-1}(u) - \frac{u - u_{i+k}}{u_{i+k} - u_{i-1}} N_{i-1,k+1}(u)$$