BANGLADESH UNIVERSITY OF PROFESSIONALS
Military Institute of Science and Technology
B.Sc. in Computer Science and Engineering
Student Group : 0 < Earned Credit Hour <= 36, Final Examination (Fall) : Dec 2020

Subject: CSE-413, Computer Graphics

Total: 2.00 hours **Full Marks: 180**
Section B : 1.00 hour **Section B : 90**

INSTRUCTIONS:

a. Use **SEPARATE** answer scripts for each section.
b. **Question – 5 and Question – 8 (Viva Voce)** in **Section B** are compulsory.
c. Answer any **OTHER ONE** question from this section **(From Q - 6 & Q - 7)**.
d. Figures in the margin indicate full **marks**.
e. Assume reasonable data if necessary.
f. **Symbols** used have their usual meanings.

SECTION-B

Question – 5 (Compulsory)

a. Imagine a scenario: **16**
- ~~camera is at (2,7,3)~~
- The projection plane equation: $2x + 3y + 4z = 10$

Now generate the projection matrix for the projected point $P'(x', y', z')$ for any point $P(x, y, z)$.

b. ~~For a camera, the definition is:~~ **10**
i) Position of the camera at (1,1,1)
ii) Looking direction (l) = $-Y$ axis
up direction (u) = $-Z$ axis
right direction (r) = X axis

Now, to align the camera as l=Y axis, u=Z axis and r=X axis at (0, 0, 0) point, calculate the transformation matrix.

c. Using the projection of a polygon, is it possible to derive the equation of the plane in which the polygon lies? If yes, explain the procedure with proper example. **10**

Question – 6

a. To draw a set of overlapping polygons, it is required to prioritize the objects according to their depth from the view point. Using an appropriate depth sort algorithm: **6+10**
i) How can you calculate the x-extent, y-extent and z-extent of a polygon?
ii) Briefly discuss how can you find the sequence of the overlapping polygons.

b. Generate a Binary Space Partitioning Tree from the given set of polygons. **12**
Note: You need to provide a short description for each step.
Use the polygon 3 as the starting point.
The arrows indicate the front side of the object.

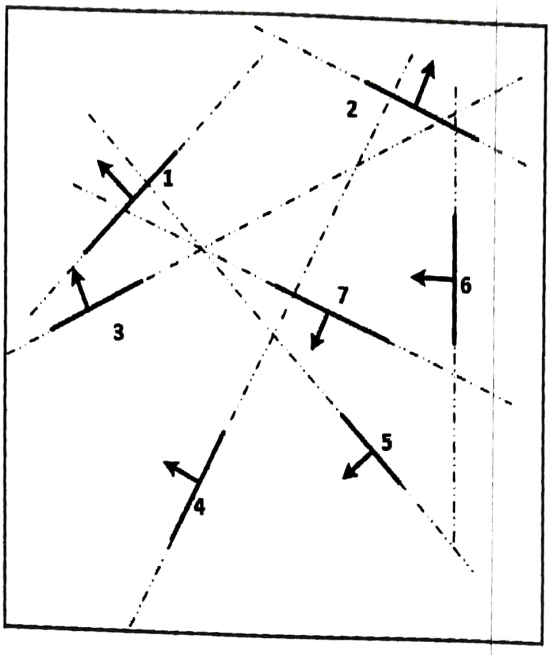

Figure for Question 6(b)

c. An algorithm examines all n objects for each pixel and finds the closest one to draw. Now, explain the advantages and disadvantages of this kind of algorithms. **8**

Question – 7

a. When ray tracing is performed, it is necessary to compute only whether a ray intersects an extent or not, not what actual points of intersection are. Consider each point (x, y, z) along the ray from (3, 8, 10) to (1, 1, 1) and a sphere with center at (4, 5, 7) and radius 10. Derive the ray-sphere intersection equation using the quadratic formula and show how it can be simplified to determine only the ray and the sphere just intersect or not. **12**

b. i) Shortly describe the importance of geometric continuity and parametric continuity in case of joining two curves. **6+12**

ii) "First degree continuity in the parameter of t implies first degree of geometric continuity and vice versa"- what do you think about the statement? Justify your answer with appropriate examples.

c. How can you differentiate between optimizing and avoiding intersection calculations (for a ray and an object) as efficiency considerations for ray tracing? **6**

Question – 8 Viva Voce (Compulsory) **18**