090

The Open University of Sri Lanka
Faculty of Natural Sciences
B.Sc./ B. Ed. Degree Programme

Department	: Computer Science
Level	: 5
Name of the Examination	: Final Examination
Course Code and Title	: CSU5311, Computer Graphics
Academic Year	: 2020/2021
Date	: 05.04.2022
Time	: 1.30 p.m. -3.30 p.m.
Duration	: 2 hours

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **06** questions in **05** pages.
3. Answer **any four (4) questions** only. All questions carry equal marks.
4. Answer for each question should commence from a new page.
5. Involvement in any activity that is considered as an exam offence will lead to punishment.
6. Having any unauthorized documents/ mobile phones in your possession is a punishable offense
7. Use blue or black ink to answer the questions.
9. Clearly state your index number in your answer script.

Q1) a) Explain following terms

i) Pixel ii) Flood fill algorithm

b) i) What is meant by Visible Surface Detection?
ii) What are the two (2) fundamental visible surface detection methods? Explain them briefly
iii) List two (2) differences between visible surface detection methods that were explained in (ii)

c) Using the **Bresenham's algorithm,** show how to decide which pixels would be fixed for drawing a line from (0,2) to (4,5). Show the initial calculations Δx, Δy, and decision parameters. Show the values of the decision parameters x and y in each iteration.

d) Implement the flood filling algorithm using C++ .

Q2) a) i) What is view volume? What are the factors that affect the View Volume.
ii) Explain Parallel projection View Volume and Perspective Projection View Volume describing how they affect the output image.

b) i) State the steps of calculating pixel positions for positive slope of Digital Differential Analyzer (DDA) algorithm
ii) Implement the Digital Differential Analyzer (DDA) algorithm to draw a line with positive slope (m<=1) using C++.

c) Explain Diffuse reflection and Specular reflection in brief.

d) How does the Z-buffer algorithm determine which surfaces are hidden?

Q3) a) i) What is Perspective Projection.
ii) State two (2) differences between Parallel Projection and Perspective Projection.

b) i) What is a colour model?
ii) Explain RGB and CMY/CMYK colour model clearly indicating differences.

c) i) What are the steps that needed to be followed to draw a circle using the midpoint circle algorithm?
ii) Implement the above steps of mid-point circle algorithm using C++. (Write the

complete C++ program)

d) Consider a Cuboid ABCDEFGH whose vertices are A (0,0,2), B (0,4,2), C (2, 4,0), D(2,2,4), E(2,0,0), F(0,0,2), G(2,0,2), H(0,0,0). Transform the vertices of Cuboid by positive rotation around z axis of 90^0 with respect to origin followed by scaling Sx=0.5, Sy=1, and Sz=1. Calculate the intermediate and resulting cuboid coordinate points clearly indicating the intermediate steps.

Q4) a) i) What is **local illumination model.**

ii) Provide two (2) differences between local illumination models and global illumination models.

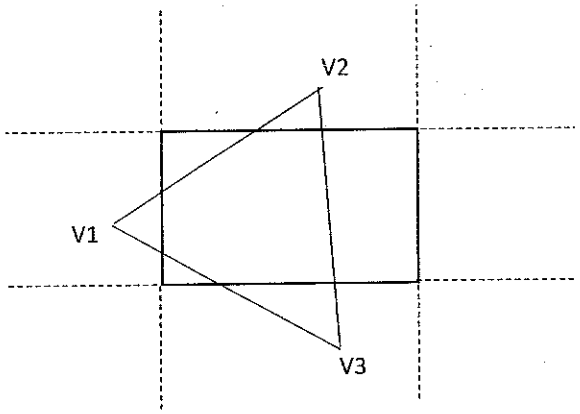
b) Consider a triangle ABC whose vertices are A (2 2), B (4 2) and C (4 4). Find the transformed coordinates after each of following transformations (use homogeneous coordinate matrix)

i) 60^0 clockwise rotation about origin

ii) Reflection about line y= -x

c) Clearly explain the 2D Clipping and 3D Clipping.

d) Find the clipping polygon in the following figure using Sutherland-Hodgeman Polygon Clipping Algorithm by clearly indicating the steps



Q5) a) i) What are the two technologies that are used to produce images in the output screen? Explain them briefly.

ii) State two (2) differences between the above two techniques

b) Find the clipping lines in the following figure using the Liang Barsky Line Clipping algorithm by clearly indicating the steps.

Clipping window $Xw_{min} = 2$, $Xw_{max} = 6$, $Yw_{min} = 2$, $Yw_{max} = 6$

i. AB line -A (1,5), B (5,1)

c) State whether the following statements are **TRUE or FALSE**. If any statement is **FALSE** Correct it.

i) Emissive displays use optical effects to convert sunlight or light from some other source into graphics patterns. liquid-crystal display

ii) A pixel can represent a single mathematical point.

iii) Colours perceived in additive models are the result of transmitted light.

iv) Colours perceived in additive models are the result of reflected light.

v) In uniform scaling, basic shape are altered but in differential scaling, both shape and size are changed.

d) Decide the suitable transformations that you can perform between initial image and the final image. Prove it by applying suitable transformations. Clearly indicate the intermediate steps.

Initial image coordinates – A (2,0) , B (4,0), C (4,3), D (2,3)

Final image coordinates - A (-2,-1) , B (-4,-1), C (-4,-4), D (-2,-4)

Q6) a) Explain following terms

i) Shadow mask method ii) Illumination model

b) Derive the composite transformation matrix for fixed-point rotation matrix using the basic transformations.

c) Consider a triangle ABC whose vertices are A (2 2), B (4 2) and C (4 4). Transform the vertices of ABC triangle by translating 1 unit down and 2 unit right followed by positive rotation of 90^0 about on the pivot point (2,3).

Using the basic transformations, derive the composite transformation matrix and

calculate the vertices of result triangle A'B'C'.

d) Implement the given functions in C++ to display the following output.(don't implement the point2d and matrix class, Implement only the given function)

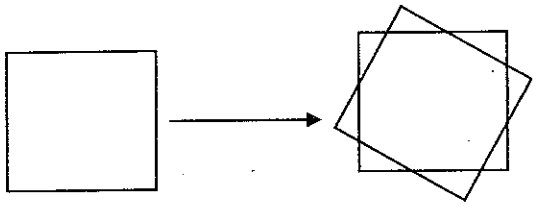


Fig1 Fig2

// Function used to set the values to rotation matrix –

void matrix::frotate(int deg, double xr, double yr)

// Function used to rotate a point around a given fixed point –

pnt2ds matrix::frotatepoint(pnt2ds n, int deg, double xr, double yr)

```
int main{
pnt2ds a(100,100,1);
pnt2ds b(200,100,1);
pnt2ds c(100,200,1);
pnt2ds d(200,200,1);
line(a.getx(),a.gety(),b.getx(),b.gety());
line(a.getx(),a.gety(),c.getx(),c.gety());
line(c.getx(),c.gety(),d.getx(),d.gety());
line(d.getx(),d.gety(),b.getx(),b.gety());
// complete the code to draw the figure 2
getch();
   return 0;
}
```