DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY
UNIVERSITY EXAMINATIONS 2023/2024 ACADEMIC YEAR
THIRD YEAR FIRST SEMESTER EXAMINATION FOR DEGREE OF BACHELOR SCIENCE IN INFORMATION TECHNOLOGY

CIT 3104: COMPUTER GRAPHICS

DATE: 3RD AUGUST 2023 TIME: 11.00-01.00 PM.

Instructions: Answer Question 1 and Any Other Two

QUESTION 1: (30 Marks)

a) Distinguish between the following terms
   i. Emissive and non-emissive displays **(2 marks)**
   ii. Image processing and image synthesis **(2 marks)**
   iii. Interlacing scan and progressive scan **(2 marks)**

b) Suppose RGB raster system is to be designed using an 12 inch X 20 inch screen with a resolution of 100 pixels per inch in each direction. If we want to store 6 bits per pixel in the frame buffer, how much storage (in kilobytes) do we need for frame buffer? **(4 marks)**

c) Identify and explain three types of Geometric primitives used in OpenGL **(3 marks)**

d) A point has coordinates in the following coordinates D(5, 6, 7). The translation is done in the x and y -direction by 3 three coordinates and in the z- direction by two coordinates. Find coordinates of the new position **(4 marks)**

e) Explain three factors you would consider before selecting a display technology **(4marks)**

f) Briefly Discuss the basic principles in displaying polygons under OpenGL **(3 marks)**

g) Describe the steps to be followed in Digital Differential Analyzer scan conversion algorithm. **(6 Marks)**

Question 2: (15 Marks)

a) Clipping is an important concept used in computer graphics and computer vision. In this context:
   i. Define clipping. **(1 Mark)**
   ii. Highlight any FOUR types of clipping. **(4 Marks)**

b) Digitize the line with endpoints (20, 10) and (30, 18) using Bresenham's Line Drawing algorithm and provide the sketch for the resulting pixels. **(10 Marks)**

Question 3: (15 Marks)

a) An openGL callback function is different from a normal function as it is never called directly by the application.
   i) Briefly Explain the purpose of the ***glutDisplayFunc()*** call back function. **(2 Marks)**
   ii) Write a program to demonstrate how the ***glutDisplayFunc()*** call back function is used in openGL programs. **(8 Marks)**

b) Study the OpenGL code snippet below and sketch the graphic that will render when executed.

```
glBegin(GL_TRIANGLE_STRIP);
glColor3f(1,1,1); // color
glVertex2f(0,0); //v1
glVertex2f(0,1); // v2
glVertex2f(1,0); // v3
glVertex2f(1,1); // v4
glVertex2f(2,0); // v5
glEnd();
```

(5 Marks)

Question 4: (15 Marks)

a) Rotate a line CD whose endpoints are (3, 4) and (12, 15) about origin through a 45° anticlockwise direction **(6marks)**

b) Consider two raster systems with the resolutions of 1280 x 720 and 2048 x 1536.

i. How many pixels could be accessed per second in each of these systems by a display controller with a refresh rate of 120Hz? **(2 marks)**

ii. What is the access time per pixel in each system? **(2 marks)**

c) Describe the architecture of a virtual reality system. **(5 marks)**