CHUKA UNIVERSITY

THIRD YEAR SEMESTER TWO EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF COMPUTER SCIENCE AND BACHELOR OF APPLIED COMPUTER SCIENCE

COSC 371 AND ACSC 374: COMPUTER GRAPHICS

STREAM (BSC. COMPUTER SCIENCE AND BSC. APPL.COMPUTER SCIENCE)

INSTRUCTIONS:

ANSWER YOUR QUESTIONS IN ANSWER BOOKLET PROVIDED.

ANSWER QUESTION ONE [COMPULSORY] AND ANY OTHER TWO QUESTIONS.

QUESTION ONE (THIRTHY MARKS)

a) Explain the need for understanding the human visual system when studying computer graphics. (3 marks)

b) Describe the principles of operation of each of the following line drawing algorithms stating the merits and demerits of each:
   i) The simple DDA
   ii) Brenham's
   (6 marks)
   iii) Explain the importance of shadows in graphics rendering systems (2 marks)

c) Explain each of the following with respect to graphics and explain their importance:
   i) Clipping.
   ii) Shading.
   iii) Morphing.
   (6 marks)

d) Describe the transform needed to transform the triangle from B to A in Figure 1, (4 marks)

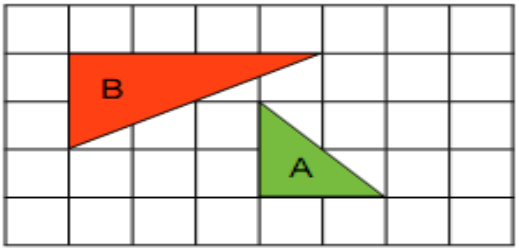

Figure 1: Transform from A to B

e) A raster graphics system has a resolution of 1024X512. Determine the size of the frame buffer (in Megabytes) to store an image if each pixel takes 16-bits of memory. (3marks)
f) State three coordinate systems that you may encounter in a rendering pipeline. (3 marks)
g) State Three merits of using OpenGL in graphics rendering. (3 marks)

SECTION B (40 MARKS) CHOOSE TWO QUESTIONS

QUESTION TWO (20 MARKS)

a) A Rectangle is defined in two dimensions by its vertices (2,4), (5,4), (5,6) and (2,6). Derive the matrices to perform each of the following transformation, and evaluate the coordinates of the resulting vertices.
   i) Translate the rectangle in space by 5 units in the x-direction and 3-units in the y-direction. (4 marks)
   ii) Scale the original triangle by a factor of 7.5; (4 marks)
   iii) Rotate the original triangle by $35^{o\ anti}$-clockwise about the origin. (4 marks)

b) With the aid of diagrams describe each of the following projections:

   i) Orthographic (or Parallel projection) (3 marks)
   ii) Isometric (3 marks)

c) State two advantages of solid geometric models. (2 marks)

QUESTION THREE (20 MARKS)

a) i) With the aid of a pseudo code, explain the simple Digital Differential Analyzer (DDA) algorithm for generating a line whose end points are (x_0, y_0) and (x_1, y_1). (6 marks)

ii) A line has two end points $(x_0, y_0) = (2,6)$ and $(x_1, y_1) = (12,12)$. Execute the simple DDA algorithm manually and show the pixels generated. (4 marks).

iii) Calculate the length of the line in a(ii). (2 marks)

b) i) Outline the procedure of **ray-tracing** method of rendering of scenes in computer graphics. (4 marks)

ii) Make a comparative analysis of the wire frame and solid modeling. (4 marks)

QUESTION FOUR (20 MARKS)

a) Explain three application areas of computer graphics (3 marks)

b) List four graphics input devices (2 marks)

c) With the aid of a diagram, explain how the Cathode Ray Tube works (5 marks)

d) i) Explain why curves and surfaces are normally represented in parametric form. (2 marks)

ii) State three properties of Bezier curves. (3 marks)

iii) A Bezier curve has the following control points: (2,0), (4,3), (5,2), (4, -2), (5, -3) and (6, -2). Derive the parametric equation of the curve, in the form: $x= f_1(t)$, $y= f_2(t)$. (5 marks)

QUESTION FIVE (20 MARKS)

a) Describe each of the following shading algorithms

i) Phong (2 marks)

ii) Gouraud (2 marks)

b) Write a program using **OpenGL (or any other graphics Engine)** to perform the following: Draw a house consisting of two figures; a square and a triangle. The square is defined by points (-0.4, 0.4), (-0.4, -0.4), (0.4, -0.4), (0.4, 0.4) and is BLUE in colour and the triangle is defined by (0.0, 0.9), (-0.4,0.4), (0.4, 0.4) and is yellow in colour. (7 marks)

c) Explain the basic principles of creating computer animation. (6 marks)

d) Explain hidden line removal with respect to visual realism. (3 marks)