Cairo University
Faculty of Computers and Information
Final Exam

Program: Bio-Informatics
Course Name: Computer Graphics and Data Visualization **Date: 24/1/2019**
Course Code: BIT416 **Duration: 2 hours**
Instructor(s): Prof. Reda A.Wahab **Total Marks: 60**

TRY ALL QUESTIONS

Question 1 [20 marks]

[a] Describe the Bresenham algorithm for drawing lines. Explain the difference between the Bresenham algorithm and DDA.

[b] Trace the mid-point line drawing algorithm as it draws the line with end points (6, 10) and (12, 18)

[c] Write the flood fill recursive algorithm? Write a queue based non-recursive version of the algorithm.

[d] Trace the convex polygon filling algorithm. Compute the edge table values for a polygon of vertices (15, 10), (80,12), (60, 15), (10, 16) [not solved]

Question 2 [20 marks]

[a] Write the general form of the affine transform in homogeneous space.

[b] Write the 2D transformation and OpenGL code to rotate some point 30 degrees in the anticlockwise direction about the point (10, 12)

[c] Write the 3D transformation matrix and OpenGl code needed to rotate some point 60 degrees clockwise about the y-axis.

[d] Write the 3D transformation needed to scale an object about the fixed point (3, 4, 7) uniformly with a scaling factor of 0.5.

[e] Find the affine transformation needed to compute the position of some 3D world point in the coordinate system of origin $(20, 25)$ and basis vectors: $(0.6, 0.8,0)$, $(-0.8, 0.6,0)$, $(0, 0,1)$.

Question 3 [20 marks]

[a] What are the basic camera view and projection parameters of the camera model? Describe the sequence of operations needed to compute the position of the image of a point on the screen given the camera view and projection parameters and the view port parameters.

[b] Given the following camera and viewport parameters:

Camera View Parameters	Center of projection (10, 20, 120) Target point (0,0,0) Viewer's up direction (1, 1, 0)
Frustum Projection Parameters	LEFT=-10 RIGHT=10, Bottom=-10, TOP=10, NEAR=3, FAR=50
Viewport parameters	Left=10 TOP=20 Width=300 HEIGHT=500

Find:

i. The camera view matrix
ii. The frustum projection matrix
iii. The orthogonal projection matrix
iv. The Viewport mapping matrix
v. The image of the triangle with vertices (80, 0, 0), (0,0,80), (5,0,80) on the viewport using frustum projection

Good Luck