Assignment 1: Revised

Subject: Computer Graphics

Chapter: Introduction, Graphics Hardware

1. Explain, in short, the use of computer graphics emphasizing the application of graphics in various fields.
2. Explain the architecture of Vector Scan System and Raster Scan system with their block diagrams. Also tabulate the differences between vector and raster scan systems.
3. Explain shadow mask method and beam penetration method.
4. What is video controller? Explain the basic video-controller refresh operations with proper block diagram.
5. What is flat panel display? Explain the working principles of LCD monitor with figure.
6. Consider two raster systems with resolutions of 640x840 and 1280x1024. How many pixels could be accessed per second in each of these systems by a display controller that refreshes the screen at a rate of 60 frames per second? What is the access time per pixel in each system?
7. Consider a noninterlaced raster monitor with a resolution of n by m (m scan lines and n pixels per scan line), a refresh rate of r frames per second, a horizontal retrace time of t_{horiz}, and a vertical retrace time of t_{vert}. What is the fraction of the total refresh time per frame spent in retrace of the electron beam?

Chapter: Scan Conversion Algorithms

8. Write Bresenham's line drawing algorithm for slope $|m|<1$. how does it differ from the algorithm for slope $|m|>1$? How can this line (with end points A(x1,y1), B(x2,y2) and slope less than 1 be drawn if the starting point is taken as B(x2, y2)? Digitize a line with end points A(2,10) and B(5,18) using Bresenham's line drawing algorithm.
9. Describe the symmetric property of a circle. Also derive the mid-point circle algorithm. Digitize a circle $(x-2)^2+(y-3)^2=25$ using a midpoint circle drawing algorithm.
10. While scan converting an ellipse, how do we know that we have reached the second region of the first quadrant of the ellipse? Find the raster position along the region 1 of the ellipse path in first quadrant. The semi major and semi minor axes are 8 and 7 respectively.
11. Explain the boundary fill and flood fill algorithm in detail.
12. Which on is better 4-connected or 8-connected approach for fill algorithm? Explain with suitable examples.

Chapter : Two-Dimensional transformations and viewing

13. Discuss why homogeneous coordinates are sued in computer graphics for transformation computations? Also explain homogeneous transformation matrix for various 2D basic transformations.
14. Reflect a rectangle A(2,2) B(5,2) C92,4) D(5,4) about a line x=y.
15. Given a diamond shaped polygon with vertices V1(5,5), V2(3,3), V3(5,1) and V4(7,3), reflect the object about a line y=x+2.
16. Derive the composite transformation matrix for reflection of an object about a line y=mx+c. Apply the derived matrix for the object A(4,2), B(7,3), C(9,2), D(10,1) on the line y=3x.
17. A mirror is placed vertically such that it passes through the points (10,0) and (0,10). Find the reflected view of triangle ABC with coordinates A(5,50), B(20,40) and C(10,70).

18. Scale a triangle A(0,0), B(1,1), C(3,2) by twice its original size, about origin and about point P(-1,-2).
19. Perform a 45 degree rotation of a triangle A(2,3), B(5,3) and C(3,1) about the origin and about a fixed point by 30 degree,
20. A point (-5,3) is required to be rotated by 45 degrees in clockwise direction and then scaled by a factor of 3, what will be the final transformed position after applying these transformations.
21. What is windowing and clipping? Derive window too viewport transformation matrix.
22. Determine window to viewport transformation matrix for window (5,10), (15,20) and for viewport (8,12) (12,18). Note the coordinates values are for lower left and upper right corner.
23. Define window and viewport. What are the different steps of 2D world to screen viewing transformation? Describe with matrix representation at each step.
24. Explain the 2D viewing pipeline along with the derivation for the window to viewport transformation.
25. Clip the line from (-2,3) to (18,13) against the window dimension, lower left corner (0,0) and upper right corner (20,100) using Cohen Sutherland algorithm.
26. Clip the line P1P2 with PI(0,120) and P2(130,5) suing Cohen-Sutherland Line Algorithm. Given that rectangular window ABCD has end-points A(10,100), B(150,100), C(150,10) and D(10,10).
27. What is windowing and clipping; how a polygon can be clipped? explain. Why clipping is necessary in computer graphics? Clip the given polygon using Sutherland-Hodgeman Algorithm and explain every step considered.