Q.2 a. What are the advantages of Interactive Computer Graphics? What are the uses of Computer Graphics?

Answer: Page Number 65 of Text Book

b. Write short notes on:
(i) Refresh display
(ii) GUIss

Answer:
(ii) Page Number 54 of Text Book

Q.3 a. Write and explain a Mid-point Circle Generating algorithm.

Answer: Page Number 120 of Text Book

b. Define Polygon. What are the types of Polygons? Give example of each.

Answer:
Definition: - A closed plane figure is having three or more sides is called as polygon. Triangles, rectangles, and octagons are all examples of polygons. A **regular polygon** is a polygon all of whose sides are the same lengths and all of whose interior angles are the same measures. **Types of Polygon** The polygons are divided into two categories as,

1) Convex Polygon.

2) Concave Polygon.

1) Convex Polygon:-

A convex polygon is a polygon in which the line segment joining any two points the polygon lies completely inside the polygon. So it is very easy to perform inside test on a pixel to be filled with given color.

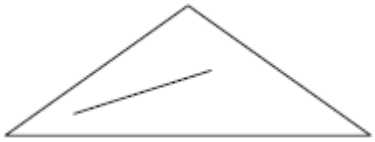

Fig (a) Convex Polygon

2) Concave Polygon: - A concave polygon is a polygon in which the line segment joining any two points within the polygon may or may not lay completely inside the polygon.

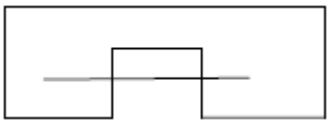

Fig (b) Concave Polygon

Q.4 a. Rotate an object defined by A(0,0), B(1,0), C(1,1), and D(0,1) in clockwise direction by 45^0 about origin.

Answer:

Q.4 a. Given A(0,0) B(1,0) C(1,1) D(

$\theta = 45^\circ$

To find : To rotate an object ABCD

Soln $\theta = 45^\circ$

The matrix will be

$$R = \begin{vmatrix} \cos 45^\circ & -\sin 45^\circ & 0 \\ \sin 45^\circ & \cos 45^\circ & 0 \\ 0 & 0 & 1 \end{vmatrix}$$

$$= \begin{vmatrix} 1/\sqrt{2} & -1/\sqrt{2} & 0 \\ 1/\sqrt{2} & 1/\sqrt{2} & 0 \\ 0 & 0 & 1 \end{vmatrix}$$

$A' = [A][R]$

$$= [0 \ 0 \ 1] \begin{vmatrix} 1/\sqrt{2} & -1/\sqrt{2} & 0 \\ 1/\sqrt{2} & 1/\sqrt{2} & 0 \\ 0 & 0 & 1 \end{vmatrix}$$

$= [0 \ 0 \ 1]$

$A' = (0, 0)$

$B' = [B][R]$

$$B' = [1 \ 0 \ 1] \begin{vmatrix} 1/\sqrt{2} & -1/\sqrt{2} & 0 \\ 1/\sqrt{2} & 1/\sqrt{2} & 0 \\ 0 & 0 & 1 \end{vmatrix}$$

$$= \begin{vmatrix} 1/\sqrt{2} & -1/\sqrt{2} & 1 \end{vmatrix}$$

$B' = (1/\sqrt{2}, -1/\sqrt{2})$

$C' = [C][R]$

$$C' = [1 \ 1 \ 1] \begin{vmatrix} 1/\sqrt{2} & -1/\sqrt{2} & 0 \\ 1/\sqrt{2} & 1/\sqrt{2} & 0 \end{vmatrix}$$

$= [2/\sqrt{2} \quad 0 \quad 1]$

$C' = (2/\sqrt{2}, 0)$

$D' = [D][R]$

$$D' = [0 \quad 1 \quad 1] \begin{vmatrix} 1/\sqrt{2} & -1/\sqrt{2} & 0 \\ 1/\sqrt{2} & 1/\sqrt{2} & 0 \\ 0 & 0 & 1 \end{vmatrix}$$

$= [1/\sqrt{2} \quad 1/\sqrt{2} \quad 1]$

$D' = (1/\sqrt{2}, 1/\sqrt{2})$

∴ The new co-ordinates will be

$A'(0,0)$, $B'(1/\sqrt{2}, -1/\sqrt{2})$ $C'(2/\sqrt{2}, 0)$ $D'(1/\sqrt{2}, 1/\sqrt{2})$

b. Explain homogeneous co-ordinate system. Why is it required to be considered while transforming an object from one reference frame to other reference frame?

Answer: Page Number 209 of Text Book

Q.5 a. Define the terms:

(i) Windowing **(ii) Clipping**

(iii) Window **(iv) Viewport**

Answer:

i. Page Number 237 of Text Book

ii. Page Number 257 of Text Book

iii. Page Number 242 of Text Book

iv Page Number 244 of Text Book

b. What is Viewing Transformation? Find the normalization transformation for window to viewport which uses the rectangle whose lower left corner at (1, 1) and upper right corner at (3, 5) as a window and the viewport that has lower left corner at (0, 0) and right corner at (½, ½).

Answer:

Q.5 b.

Given co-ordinates for window

$x_{wmin} = 1 \quad y_{wmin} = 1$

$x_{wmax} = 3 \quad y_{wmax} = 5$

Co-ordinates for viewport

$x_{vmin} = 0 \quad y_{vmin} = 0$

$x_{vmax} = 1/2 = 0.5 \quad y_{vmax} = 1/2 = 0.5$

Normalization transformation = ?

$$S_x = \frac{x_{vmax} - x_{vmin}}{x_{wmax} - x_{wmin}}$$

$$= \frac{0.5 - 0}{3 - 1} = 0.25$$

$$S_y = \frac{y_{vmax} - y_{vmin}}{y_{wmax} - y_{wmin}}$$

$$= \frac{0.5 - 0}{5 - 1} = 0.125$$

Transformation matrix is gives as

$$N = \begin{vmatrix} S_x & 0 & 0 \\ 0 & S_y & 0 \\ x_{vmin} - x_{wmin} S_x & y_{vmin} - y_{wmin} S_y & 1 \end{vmatrix}$$

$$N = \begin{vmatrix} 0.25 & 0 & 0 \\ 0 & 0.125 & 0 \\ -0.25 & -0.125 & 1 \end{vmatrix}$$

Q.6 a. What is projection? Explain orthographic and isometric projections in detail.

Answer: Page number 193-194 of Text Book

b. Explain how Bezier curves are developed? List any 5 characteristics of Bezier curves

Answer: Page number 228 of Text Book

Q7 a. Write the Depth Buffer Method or z-Buffer algorithm for detecting visible surfaces.

Answer:

Q.7 a. Given end points of a line are (0,0) and (5,5)

$x_1 = 0, \quad y_1 = 0$

$x_2 = 5 \quad y_2 = 5$

To find the pixels (x, y) through which line is generated

Length = abs $(y_2 - y_1)$

= abs $(5 - 0)$

length = 5

Now, $\Delta x = (x_2 - x_1) / \text{length}$

$= (5 - 0) / 5$

$\therefore \boxed{\Delta x = 1}$

$\Delta y = (y_2 - y_1) / \text{length}$

$= (5 - 0) / 5$

$\therefore \boxed{\Delta y = 1}$

$x = x_1 + 0.5 \text{ sign}(\Delta x)$

$= 0 + 0.5 \text{ sign}(1)$

$\therefore \boxed{x = 0.5}$

Here, sign (1) = 1. Since sign function returns 1 for value greater than zero.

$y = y_1 + 0.5 \text{ sign}(\Delta y)$

$= 0 + 0.5 \text{ sign}(1)$

$\therefore \boxed{y = 0.5}$

i	Plot	x	y
1	(0,0)	0.5	0.5
2	(1,1)	1.5	1.5
3	(2,2)	2.5	2.5
4	(3,3)	3.5	3.5
5	(4,4)	4.5	4.5

b. Can lines behind any face be hidden completely or be drawn with different attributes? Discuss. Also describe briefly "direct Method" and "Visible Surface Detection Method".

Answer: Page Number 498 of Text Book

Q8. a. What is animation? What are the different methods to produce real time animation?

Answer: Page Number 604 of Text Book

b. Discuss various devices for producing animation. Compare NTSC and PAL video formats.

Answer: Page Number 420-422 of Text Book

Q9 a What are the various components of multimedia? How do they affect human perception and understanding?

Answer: Page Number 443-445 of Text Book

b. What are the differences between BMP and PCX file formats? Discuss the Audio components of multimedia.

Answer: Page Number 447-449 of Text Book

Text Book

Computer Graphics, Amarendra N. Sinha, Arun D. udai, TMH, 2008