Experiment No. 4
Topic : To implement midpoint Ellipse algorithm
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Date of Performance:
Date of Submission:

Experiment No. 4

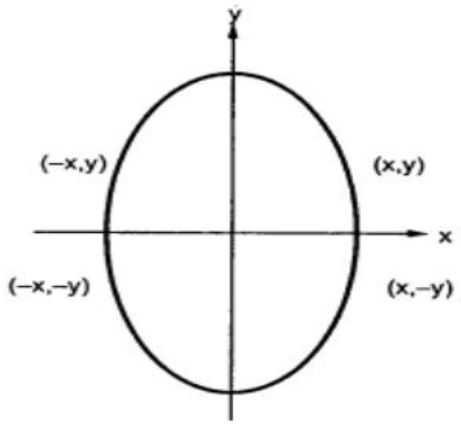
Aim-To implement midpoint Ellipse algorithm

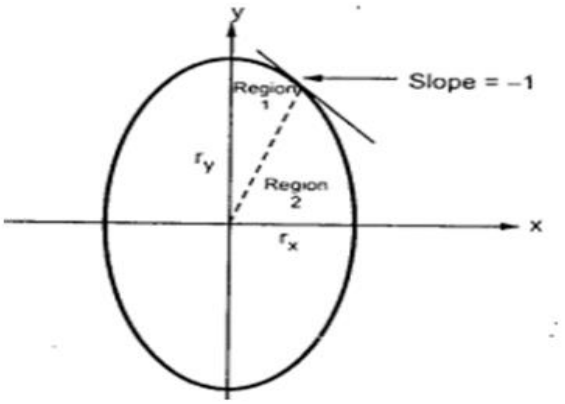
Objective:

Draw the ellipse using Mid-point Ellipse algorithm in computer graphics. Midpoint ellipse algorithm plots (finds) points of an ellipse on the first quadrant by dividing the quadrant into two regions.

Theory:

Midpoint ellipse algorithm uses four way symmetry of the ellipse to generate it. Figure shows the 4-way symmetry of the ellipse.





Here the quadrant of the ellipse is divided into two regions as shown in the fig. Fig. shows the

division of first quadrant according to the slope of an ellipse with rx < ry. As ellipse is drawn from 90 0 to 0 0 , x moves in positive direction and y moves in negative direction and ellipse passes through two regions 1 and 2.

The equation of ellipse with center at (xc, yc) is given as -

[(x – xc) / rx] 2 + [(y – yc) / ry] 2 = 1

Therefore, the equation of ellipse with center at origin is given as -

[x / rx] 2 + [y / ry] 2 = 1

i.e. x 2 ry 2 + y 2 rx 2 = rx 2 ry 2

Let, f ellipse (x, y) = x2 ry2 + y2 rx2 - rx2 ry2

Algorithm:

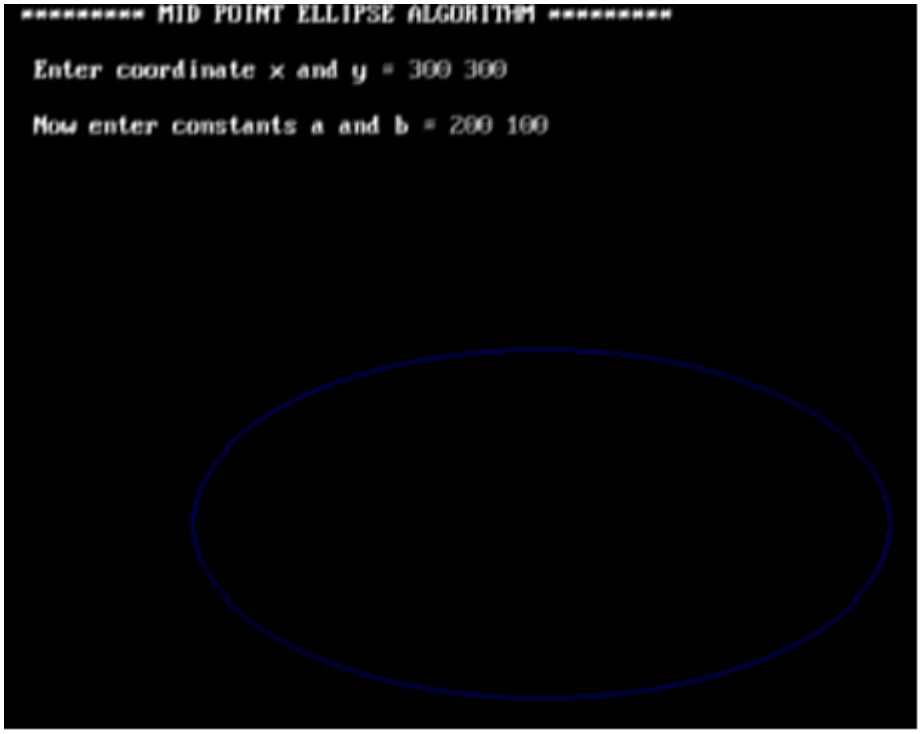
1. Take input radius along x axis and y axis and obtain center of ellipse.
2. Initially, we assume ellipse to be centered at origin and the first point as : (x, y0)= (0, ry).
3. Obtain the initial decision parameter for region 1 as: p10=ry2+1/4rx2-rx 2ry
4. For every xk position in region 1 :
5. If p1k<0 then the next point along the is (xk+1 , yk) and p1k+1=p1k+2ry2xk+1+ry2
6. Else, the next point is (xk+1, yk-1)
7. And p1k+1=p1k+2ry2xk+1 – 2rx2yk+1+ry2
8. Obtain the initial value in region 2 using the last point (x0, y0) of region 1 as: p20=ry2(x0+1/2)2+rx2 (y0-1)2-rx2ry2
9. At each yk in region 2 starting at k =0 perform the following task.
10. If p2k>0 the next point is (xk, yk-1) and p2k+1=p2k-2rx2yk+1+rx2
11. Else, the next point is (xk+1, yk -1) and p2k+1=p2k+2ry2xk+1 -2rx2yk+1+rx2
12. Now obtain the symmetric points in the three quadrants and plot the coordinate value as: x=x+xc, y=y+yc
13. Repeat the steps for region 1 until 2ry2x&gt=2rx2y

Program

```
#include<stdio.h>
#include<conio.h>
#include<graphics.h>
void pixel(int x,int y,int xc,int yc)
{
        putpixel(x+xc,y+yc,BLUE);
        putpixel(x+xc,-y+yc,BLUE);
        putpixel(-x+xc,y+yc,BLUE);
```

```
        putpixel(-x+xc,-y+yc,BLUE);
        putpixel(y+xc,x+yc,BLUE);
        putpixel(y+xc,-x+yc,BLUE);
        putpixel(-y+xc,x+yc,BLUE);
        putpixel(-y+xc,-x+yc,BLUE);
}
main()
{
        int gd=DETECT,gm=0,r,xc,yc,x,y;
        float p;
        //detectgraph(&gd,&gm);
        initgraph(&gd,&gm," ");
        printf("\n ********* MID POINT ELLIPSE ALGORITHM ********* ")
        printf("\n Enter the radius of the circle:");
        scanf("%d",&r);
        printf("\n Enter the center of the circle:");
        scanf("%d %d",&xc,&yc);
        y=r;
        x=0;
        p=(5/4)-r;
        while(x<y)
        {
                if(p<0)
                {
                        x=x+1;
                        y=y;
                        p=p+2*x+3;
                }
                else
                {
                        x=x+1;
                        y=y-1;
                        p=p+2*x-2*y+5;
                }
                pixel(x,y,xc,yc);
        }
        getch();
        closegraph();
}
```

Output:



Conclusion: Comment on

1. Slow or fast
2. Difference with circle
3. Importance of object

Speed: The midpoint ellipse algorithm is relatively faster compared to other algorithms for drawing ellipses. It efficiently utilizes incremental calculations, which helps in reducing computational overhead, making it suitable for real-time graphics applications.

Differences with circles: The midpoint ellipse algorithm differs from the midpoint circle algorithm in terms of the decision parameters and the way points are plotted. While both algorithms utilize the concept of symmetry and incremental calculations, the parameters and equations for ellipses are different from those for circles due to the variation in the geometry of these two shapes.

Importance of the object: The significance of the object being drawn lies in the context of the application. Ellipses are fundamental geometric shapes used in various computer graphics applications, including drawing, modeling, and image processing. They are essential for representing various objects such as orbits, paths, shapes, and boundaries in computer graphics. The midpoint ellipse algorithm provides an efficient and accurate way to render ellipses, which is crucial for generating complex graphics and accurately representing objects in a wide range of applications.