

Lab 3

Laboratory Problem Statements

Ques. Write the program to implement Mid-point Ellipse drawing algorithm.

Code:

```
import matplotlib.pyplot as plt
```

```
def midpoint_ellipse(x_center, y_center, rx, ry):
```

```
    x = 0
```

```
    y = ry
```

```
    p1 = (ry**2) - (rx**2 * ry) + (0.25 * rx**2)
```

```
    print(f"Initial Point: X0 = {x}, Y0 = {y}")
```

```
    print(f"Initial Decision Parameter (P1) = {p1:.2f}\n")
```

```
    x_points = []
```

```
    y_points = []
```

```
    def plot_ellipse_points(x_center, y_center, x, y):
```

```
        x_points.extend([x_center + x, x_center - x, x_center + x, x_center - x])
```

```
        y_points.extend([y_center + y, y_center + y, y_center - y, y_center - y])
```

```
    print(f"{'Step':<5} {'X':<5} {'Y':<5} {'P1':<10}")
```

```
    plot_ellipse_points(x_center, y_center, x, y)
```

```
    step = 1
```

```
    while (2 * ry**2 * x) < (2 * rx**2 * y):
```

```
        x += 1
```

```
        if p1 < 0:
```

```
            p1 = p1 + 2 * ry**2 * x + ry**2
```

```
        else:
```

```
            y -= 1
```

```
            p1 = p1 + 2 * ry**2 * x - 2 * rx**2 * y + ry**2
```

```
        plot_ellipse_points(x_center, y_center, x, y)
```

```
    print(f"{'step':<5} {'x':<5} {'y':<5} {'p1':<10.2f}")
```

```
    step += 1
```

```
    p2 = (ry**2 * (x + 0.5)**2) + (rx**2 * (y - 1)**2) - (rx**2 * ry**2)
```

```
    print(f"\nRegion 2 Initial Decision Parameter (P2) = {p2:.2f}\n")
```

```
    print(f"{'Step':<5} {'X':<5} {'Y':<5} {'P2':<10}")
```

```
    while y > 0:
```

```
        y -= 1
```

```
        if p2 > 0:
```

```
            p2 = p2 - 2 * rx**2 * y + rx**2
```

```
        else:
```

```
            x += 1
```

```
            p2 = p2 + 2 * ry**2 * x - 2 * rx**2 * y + rx**2
```

```
        plot_ellipse_points(x_center, y_center, x, y)
```

```
    print(f"{'step':<5} {'x':<5} {'y':<5} {'p2':<10.2f}")
```

```
    step += 1
```

```
    return x_points, y_points
```

```
    x_center = int(input("Enter the x-coordinate of the center of the ellipse: "))
```

```
    y_center = int(input("Enter the y-coordinate of the center of the ellipse: "))
```

```
    rx = int(input("Enter the x-radius (semi-major axis) of the ellipse: "))
```

```
    ry = int(input("Enter the y-radius (semi-minor axis) of the ellipse: "))
```

```
x_points, y_points = midpoint_ellipse(x_center, y_center, rx, ry)

plt.scatter(x_points, y_points, color='red')

plt.gca().set_aspect('equal', adjustable='box')

plt.title("Midpoint Ellipse Drawing")

plt.xlabel("X-axis")

plt.ylabel("Y-axis")

plt.grid(True)

plt.show()
```

Output:

Enter the x-coordinate of the center of the ellipse: 0
Enter the y-coordinate of the center of the ellipse: 0
Enter the x-radius (semi-major axis) of the ellipse: 7
Enter the y-radius (semi-minor axis) of the ellipse: 5
Initial Point: $X_0 = 0, Y_0 = 5$
Initial Decision Parameter (P_1) = -207.75

Step	X	Y	P1
1	1	5	-132.75
2	2	5	-7.75
3	3	5	167.25
4	4	4	0.25
5	5	3	-18.75
6	6	3	306.25

Region 2 Initial Decision Parameter (P_2) = 27.25

Step	X	Y	P2
7	6	2	-119.75
8	7	1	181.25
9	7	0	230.25

