

## ASSIGNMENT 1

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Semester:5

Section: A

Roll no: UG/02/BTCSE/2022/051

Subject: Introduction to python

### QUESTION:

Minimizing a multivariable function:

Problem statement-

$$f(x, y) = x^2 + y^2 + 3x + 4y + 5$$

### SOURCE CODE:

```
from SciPy. Optimize import minimize
```

```
# Define the multivariable function
```

```
def objective(vars):
```

```
    x, y = vars
```

```
    return x**2 + y**2 + 3*x + 4*y + 5
```

```
# Initial guess
```

```
initial_guess = [0, 0]
```

```
# Minimize the function
```

```
result = minimize(objective, initial_guess)
```

```
print("Minimum found at (x, y):", result.x)
```

```
print("Minimum value of the function:", result.fun)
```

### OUTPUT:

```
Minimum found at (x, y): [-1.49999997 -2.00000001]
```

```
Minimum value of the function: -1.2499999999999991
```

SOURCE CODE:

```
import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D

# Define the function f(x, y)
def f(x, y):
    return x**2 + y**2 + 3*x + 4*y + 5

# Generate x and y values
x = np.linspace(-3, 1, 400)
y = np.linspace(-3, 1, 400)
x, y = np.meshgrid(x, y)
z = f(x, y)

# Minimum point coordinates
min_x = -1.5
min_y = -2.0
min_z = f(min_x, min_y)

# Create a 3D plot
fig = plt.figure(figsize=(10, 7))
ax = fig.add_subplot(111, projection='3d')

# Plot the surface
ax.plot_surface(x, y, z, cmap='viridis', alpha=0.8)

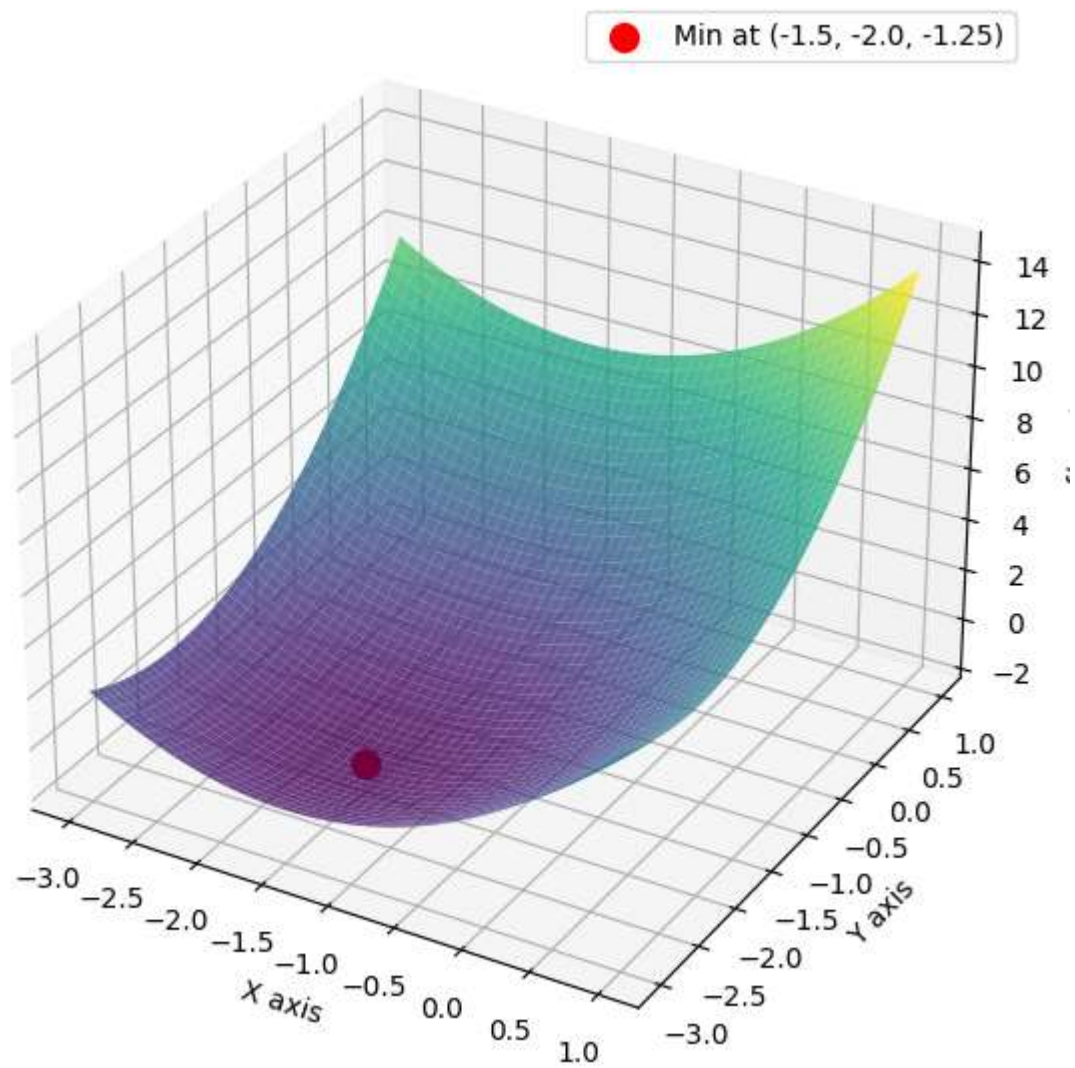
# Highlight the minimum point
ax.scatter(min_x, min_y, min_z, color='red', s=100, label=f"Min at ({min_x}, {min_y}, {min_z})")
```

```
# Set labels  
ax.set_xlabel('X axis')  
ax.set_ylabel('Y axis')  
ax.set_zlabel('f(x, y)')
```

```
# Add a legend  
ax.legend()
```

```
# Show the plot  
plt.show()
```

OUTPUT:



0