Q.4) Consider a fuzzy set A whose membership value is a random value between 0-1, A will have 10 random values from 1-10 where the membership grade of this value will also be random value between 0-1

i) fit the triangular, trapezoidal & gaussian membership on the fuzzy set A

ii)Display the graph corresponds to each membership function(trapezoidal, triangular, gaussian)

#assign 4

#consider a fuzzy set A with the random membership values/grade in b/w 0-1, fit triangular,trapezoidal,gaussian MF on A, plot the graph for each MF

```
import numpy as np
import matplotlib.pyplot as plt
from scipy.stats import norm

# Generate the Fuzzy Set A
np.random.seed(42)  # For reproducibility
A = np.arange(1, 11)  # Elements of the fuzzy set A
membership_grades = np.random.rand(10)  # Membership grades for the elements of A

#i)
# Define Membership Functions

# Triangular Membership Function
def triangular(x, a, b, c):
    return np.maximum(np.minimum((x - a) / (b - a), (c - x) / (c - b)), 0)

# Trapezoidal Membership Function
```

```
def trapezoidal(x, a, b, c, d):
    return np.maximum(np.minimum(np.minimum((x - a) / (b - a), 1), (d - x) / (d - c)), 0)

# Gaussian Membership Function
def gaussian(x, mu, sigma):
    return norm.pdf(x, mu, sigma)



#  User-defined Parameters(main func to def)

# Triangular Membership Function Parameters
tri_params = tuple(map(float, input("Enter the parameters for the Triangular Membership Function (a, b, c) separated by spaces: ").split()))

# Trapezoidal Membership Function Parameters
trap_params = tuple(map(float, input("Enter the parameters for the Trapezoidal Membership Function (a, b, c, d) separated by spaces: ").split()))

# Gaussian Membership Function Parameters
gauss_params = tuple(map(float, input("Enter the parameters for the Gaussian Membership Function (mu, sigma) separated by spaces: ").split()))



#ii)
# Plot the Membership Functions
#The x array is used to create a smooth, continuous range of values over which we can evaluate and plot the membership functions (triangular, trapezoidal, and Gaussian).
#It creates an array x containing 1000 evenly spaced values starting from 0 and ending at 11.
x = np.linspace(0, 11, 1000)  # Range for plotting the membership functions
```

```
# Plot Triangular Membership Function
plt.figure(figsize=(6, 4))  #it sets the dimensions of the plot(the entire plot area) to 6 inches wide and 4 inches tall.
tri_membership = triangular(x, *tri_params)
plt.plot(x, tri_membership, label="Triangular")
plt.scatter(A, membership_grades, color='red', zorder=5) #zorder=5 ensures that these points are plotted on top of the membership function curve.
plt.title("Triangular Membership Function")
plt.xlabel("x")
plt.ylabel("Membership Grade")
plt.legend()
plt.show()

# Plot Trapezoidal Membership Function
plt.figure(figsize=(6, 4))
trap_membership = trapezoidal(x, *trap_params)
plt.plot(x, trap_membership, label="Trapezoidal")
plt.scatter(A, membership_grades, color='red', zorder=5)
plt.title("Trapezoidal Membership Function")
plt.xlabel("x")
plt.ylabel("Membership Grade")
plt.legend()
plt.show()

# Plot Gaussian Membership Function
plt.figure(figsize=(6, 4))
gauss_membership = gaussian(x, *gauss_params)
plt.plot(x, gauss_membership, label="Gaussian")
plt.scatter(A, membership_grades, color='red', zorder=5)
plt.title("Gaussian Membership Function")
plt.xlabel("x")
plt.ylabel("Membership Grade")
```

plt.legend()

plt.show()

```
Enter the parameters for the Triangular Membership Function (a, b, c) separated by spaces:  2 5 8
Enter the parameters for the Trapezoidal Membership Function (a, b, c, d) separated by spaces:  1 3 7 9
Enter the parameters for the Gaussian Membership Function (mu, sigma) separated by spaces:  5 1.5
```