Q.7) Let A & B are 2 fuzzy sets which have 20 elements with 20 membership values,

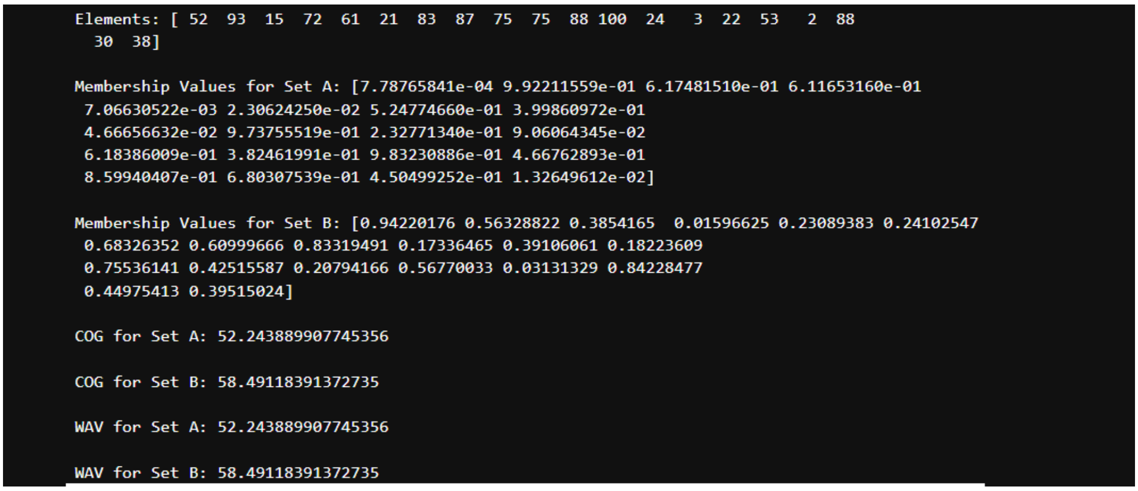
i)find centre of gravity(COG) ,

ii)WAV

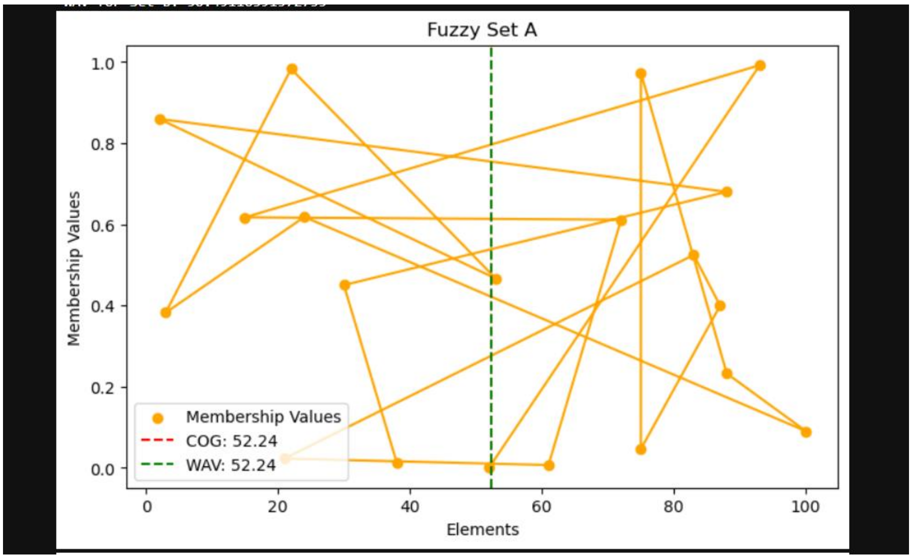
plot the graph for COG & WAV.

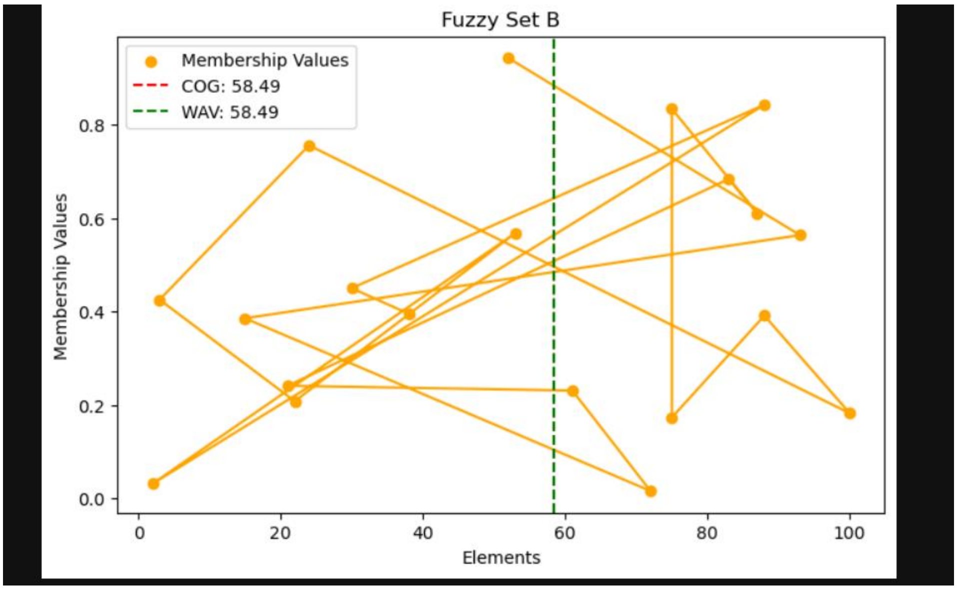
```
import numpy as np
import matplotlib.pyplot as plt

# Set a random seed for reproducibility
np.random.seed(42)

# Generate 20 random elements for fuzzy sets A and B
elements = np.random.randint(1, 101, 20)  # Elements are integers between 1 and 100

# Generate 20 random membership values between 0 and 1
membership_values_A = np.random.random(20)
membership_values_B = np.random.random(20)

# # Generate more varied membership values between 0 and 1
# membership_values_A = np.random.uniform(0.1, 1.0, 20) #generates 20 random membership values for each fuzzy set (A and B) with values uniformly distributed between 0.1 and 1.0
# membership_values_B = np.random.uniform(0.1, 1.0, 20)


# # user i/p
# # Function to get user input for elements and membership values
# def get_user_input():
#     print("Enter 20 elements (separated by spaces):")
#     elements = list(map(int, input().split()))   # split()-It splits the string into a list of substrings based on spaces (by default), map()-it converts each substring from split() into an integer, Finally, list() converts the map object into a list
#     if len(elements) != 20:
#         raise ValueError("Please enter exactly 20 elements.")

#     print("Enter 20 membership values for Set A (separated by spaces):")
#     membership_values_A = list(map(float, input().split()))
#     if len(membership_values_A) != 20:
#         raise ValueError("Please enter exactly 20 membership values for Set A.")

#     print("Enter 20 membership values for Set B (separated by spaces):")
#     membership_values_B = list(map(float, input().split()))
#     if len(membership_values_B) != 20:
#         raise ValueError("Please enter exactly 20 membership values for Set B.")

#     return np.array(elements), np.array(membership_values_A), np.array(membership_values_B)

# # Get user input
# elements, membership_values_A, membership_values_B = get_user_input()

#i)
# Calculate the Center of Gravity (COG) for A and B
COG_A = np.sum(elements * membership_values_A) / np.sum(membership_values_A)
COG_B = np.sum(elements * membership_values_B) / np.sum(membership_values_B)

#ii)
# Calculate the Weighted Average Value (WAV) for A and B
WAV_A = np.sum(membership_values_A * elements) / np.sum(membership_values_A)
WAV_B = np.sum(membership_values_B * elements) / np.sum(membership_values_B)

# Print the results
```

```
print("Elements:", elements)
print("\nMembership Values for Set A:", membership_values_A)
print("\nMembership Values for Set B:", membership_values_B)
print("\nCOG for Set A:", COG_A)
print("\nCOG for Set B:", COG_B)
print("\nWAV for Set A:", WAV_A)
print("\nWAV for Set B:", WAV_B)



#et)
# Function to plot a fuzzy set with COG and WAV
def plot_fuzzy_set(elements, membership_values, COG, WAV, title):
   plt.figure(figsize=(8, 5))
   plt.scatter(elements, membership_values, color='orange', label='Membership Values')
   plt.plot(elements, membership_values, color='orange')
   plt.axvline(COG, color='red', linestyle='--', label=f'COG: {COG:.2f}')  # this line of code draws a red, dashed vertical line at the x-coordinate COG , label=f'COG: {COG:.2f}': This assigns a label to the line that will be used in the plot legend & {COG:.2f}  formats the COG value to two decimal places
   plt.axvline(WAV, color='green', linestyle='--', label=f'WAV: {WAV:.2f}')
   plt.title(title)
   plt.xlabel('Elements')
   plt.ylabel('Membership Values')
   plt.legend()
   plt.show()


# Plot fuzzy set A
plot_fuzzy_set(elements, membership_values_A, COG_A, WAV_A, 'Fuzzy Set A')


# Plot fuzzy set B
plot_fuzzy_set(elements, membership_values_B, COG_B, WAV_B, 'Fuzzy Set B')
```



```
Elements: [ 52  93  15  72  61  21  83  87  75  75  88 100  24   3  22  53   2  88
  30  38]

Membership Values for Set A: [7.78765841e-04 9.92211559e-01 6.17481510e-01 6.11653160e-01
 7.06630522e-03 2.30624250e-02 5.24774660e-01 3.99860972e-01
 4.66656632e-02 9.73755519e-01 2.32771340e-01 9.06064345e-02
 6.18386009e-01 3.82461991e-01 9.83230886e-01 4.66762893e-01
 8.59940407e-01 6.80307539e-01 4.50499252e-01 1.32649612e-02]

Membership Values for Set B: [0.94220176 0.56328822 0.3854165  0.01596625 0.23089383 0.24102547
 0.68326352 0.60999666 0.83319491 0.17336465 0.39106061 0.18223609
 0.75536141 0.42515587 0.20794166 0.56770033 0.03131329 0.84228477
 0.44975413 0.39515024]

COG for Set A: 52.243889907745356

COG for Set B: 58.49118391372735

WAV for Set A: 52.243889907745356

WAV for Set B: 58.49118391372735
```


Fuzzy Set A
Membership Values
Elements
Membership Values
COG: 52.24
WAV: 52.24


Fuzzy Set B
Membership Values
Elements
Membership Values
COG: 58.49
WAV: 58.49