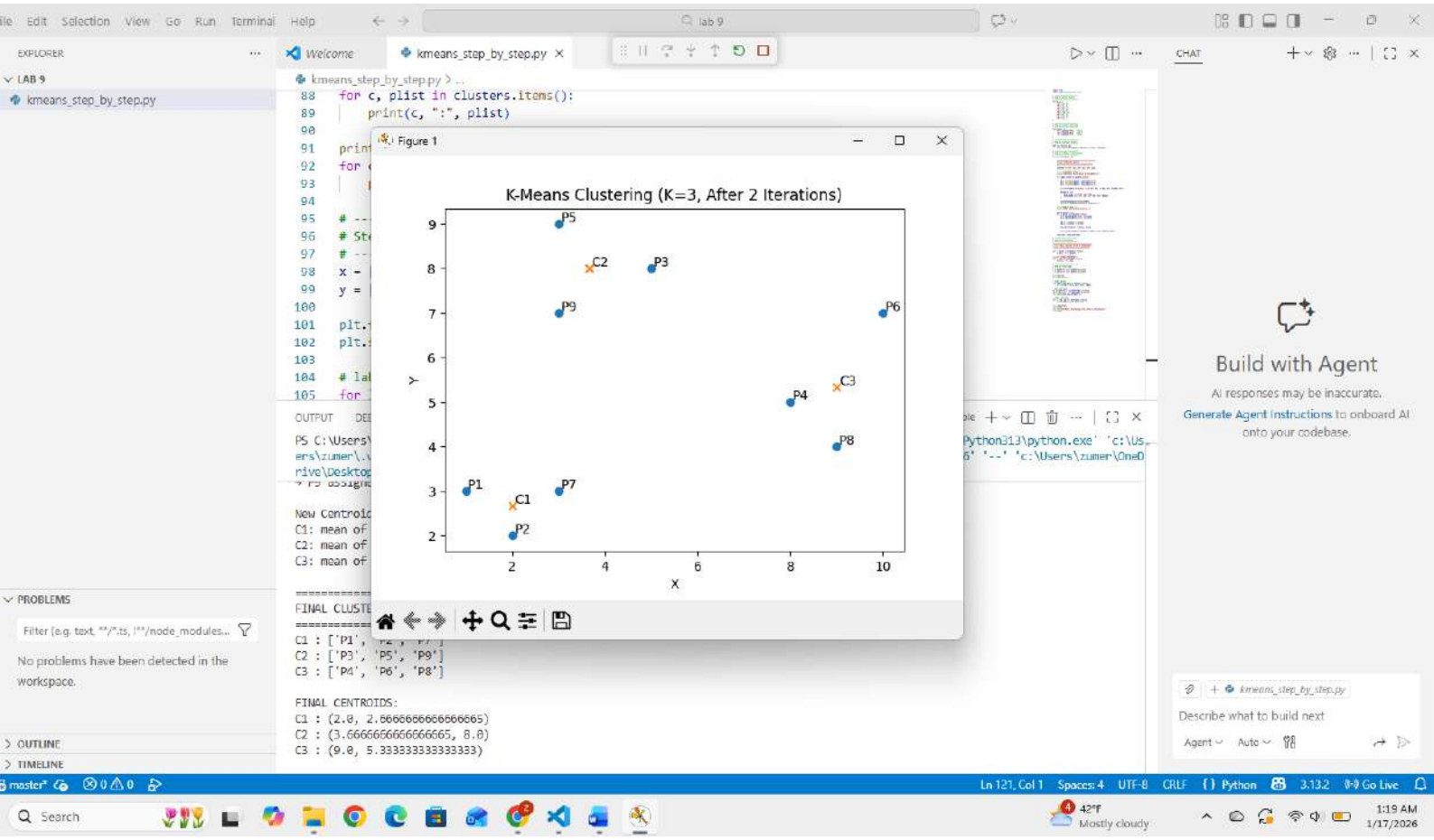


Figure 1
K-Means Clustering (K=3, After 2 Iterations)
P5
C2
P3
P9
P6
C3
P4
P8
P1
C1
P7
P2
X
Y

OUTPUT DEBUG CONSOLE TERMINAL PORTS Python Debug Console

```
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 9>  & 'c:\Users\zumer\AppData\Local\Programs\Python\Python313\python.exe' 'c:\Users\zumer\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher' '54506' '--' 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 9\kmeans_step_by_step.py'
→ P4 assigned to C3
P5 distances -> C1:6.41, C2:1.20, C3:7.03
→ P5 assigned to C2
P6 distances -> C1:9.10, C2:6.41, C3:1.94
→ P6 assigned to C3
P7 distances -> C1:1.05, C2:5.04, C3:6.44
→ P7 assigned to C1
P8 distances -> C1:7.13, C2:6.67, C3:1.33
→ P8 assigned to C3
P9 distances -> C1:4.45, C2:1.20, C3:6.23
→ P9 assigned to C2

New Centroid Calculation:
C1: mean of ['P1', 'P2', 'P7'] = (2.00, 2.67)
C2: mean of ['P3', 'P5', 'P9'] = (3.67, 8.00)
C3: mean of ['P4', 'P6', 'P8'] = (9.00, 5.33)

==============================
FINAL CLUSTERS AFTER 2 ITERATIONS
==============================
C1 : ['P1', 'P2', 'P7']
C2 : ['P3', 'P5', 'P9']
C3 : ['P4', 'P6', 'P8']

FINAL CENTROIDS:
C1 : (2.0, 2.6666666666666665)
C2 : (3.6666666666666665, 8.0)
C3 : (9.0, 5.333333333333333)
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 9>
```

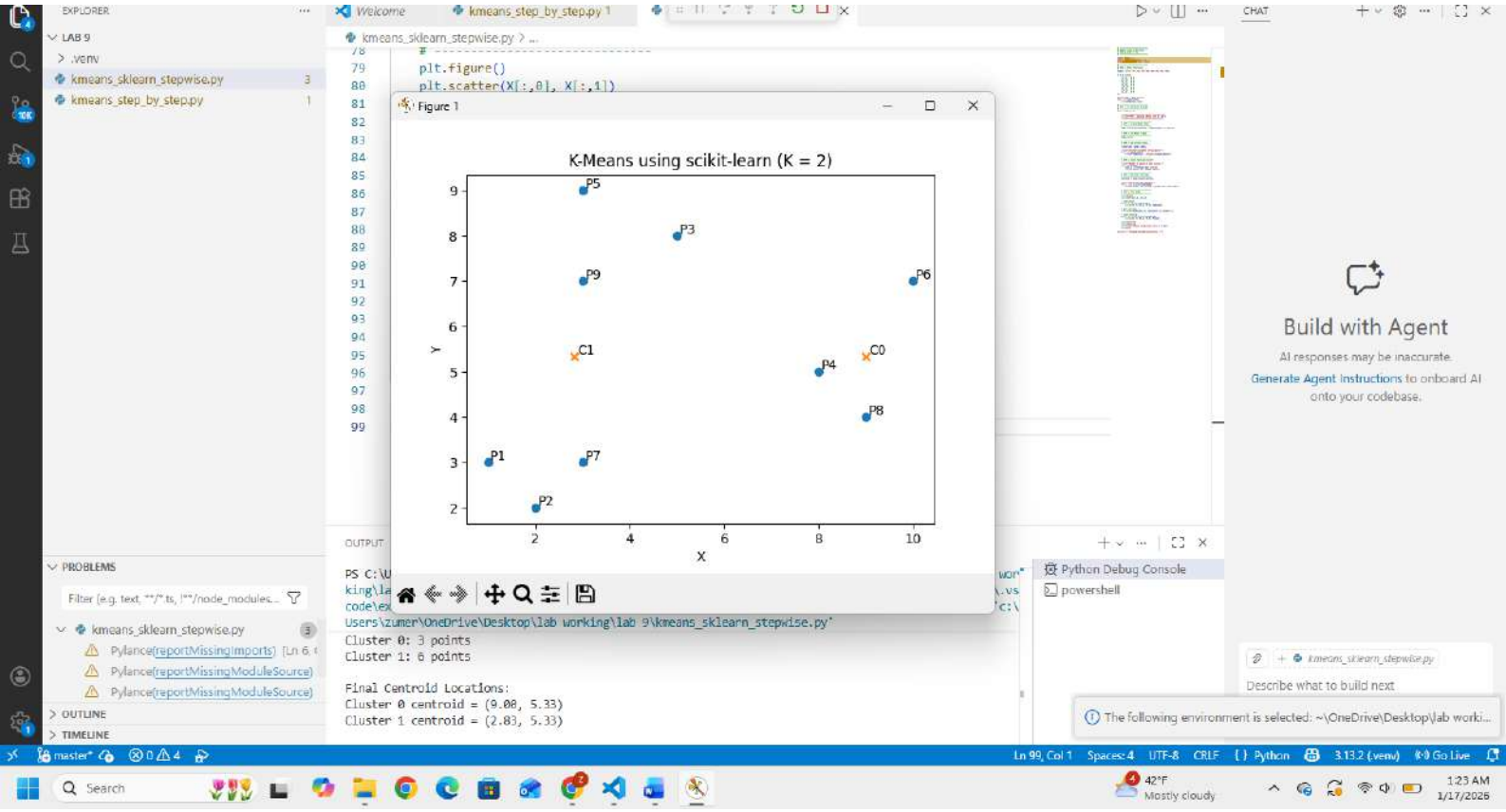


Figure 1
K-Means using scikit-learn (K = 2)
P5
P3
P9
P6
C1
C0
P4
P8
P1
P7
P2
X
Y
2
4
6
8
10
2
3
4
5
6
7
8
9

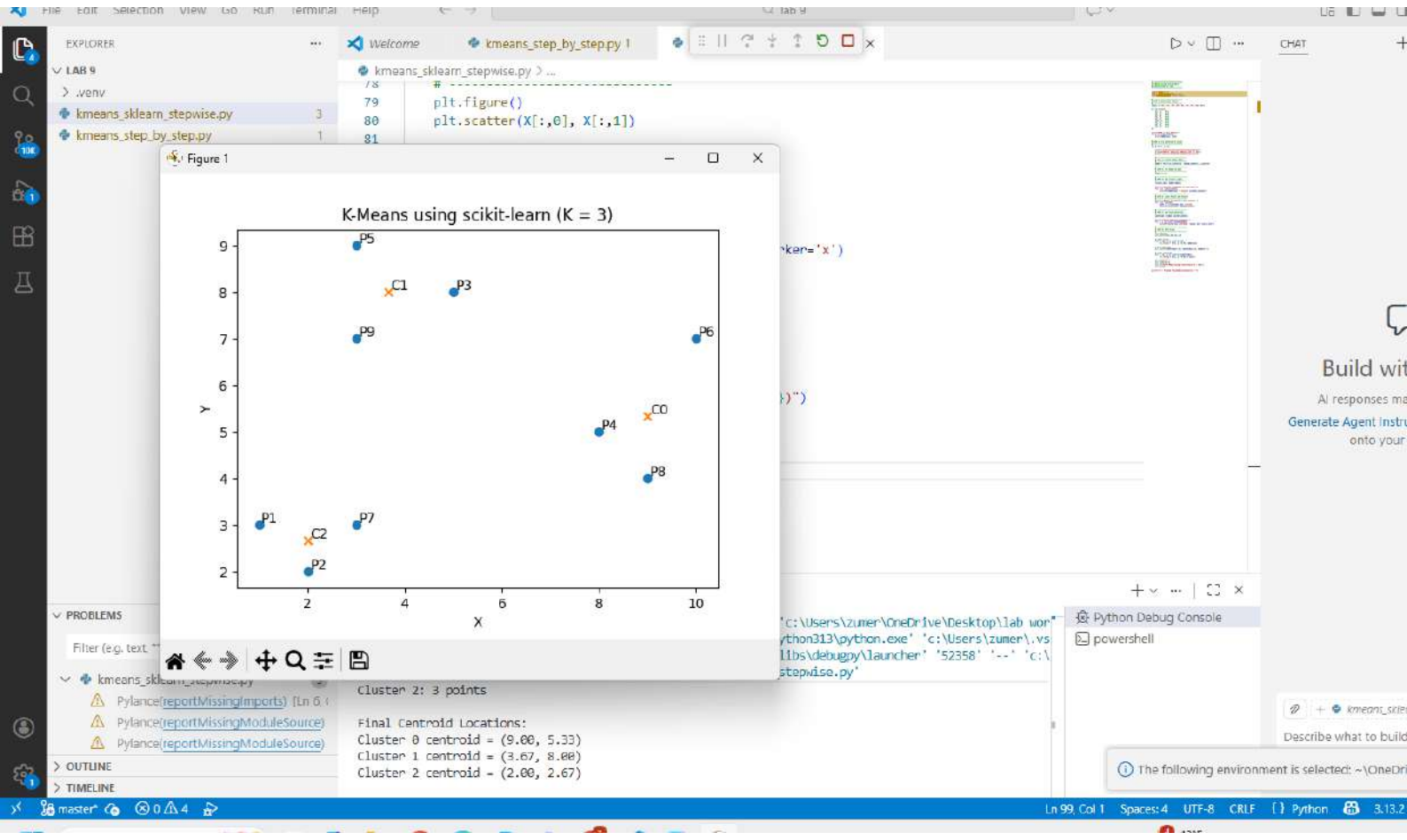
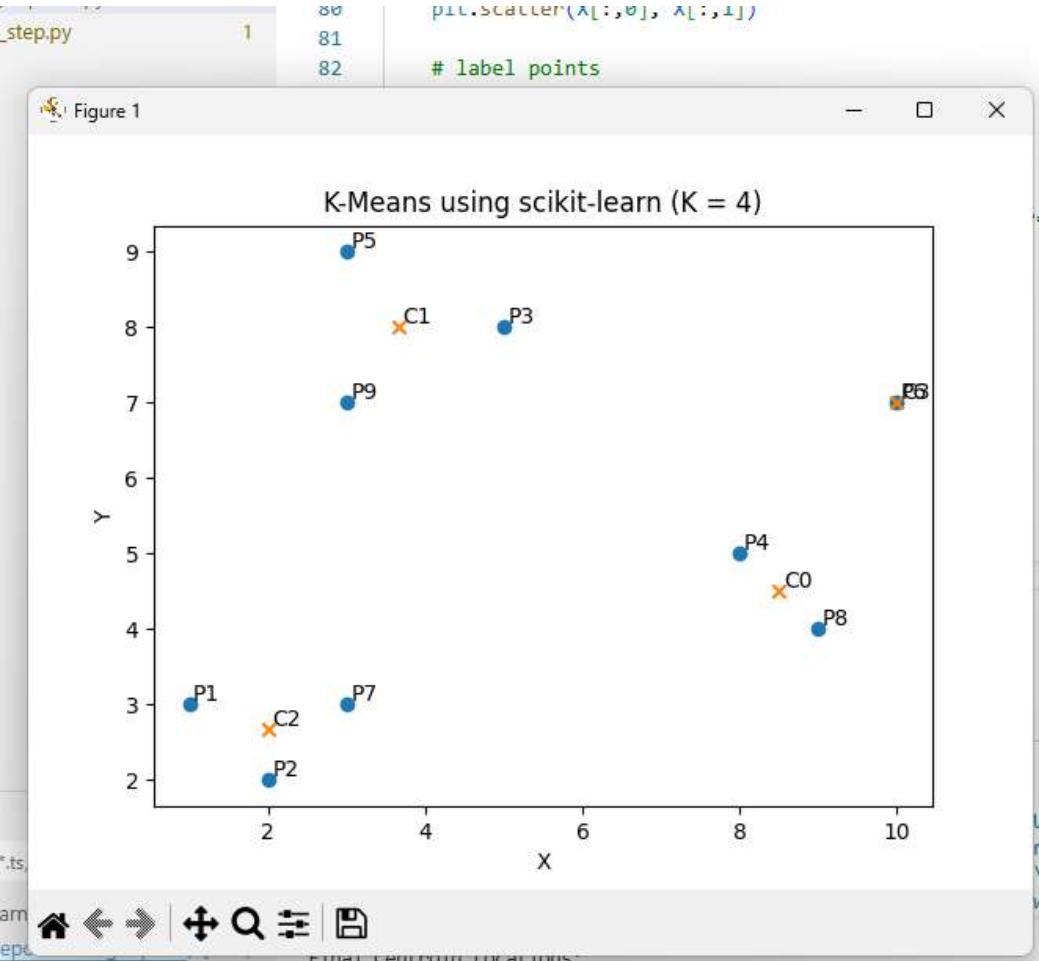


Figure 1
K-Means using scikit-learn (K = 3)
P5
C1
P3
P9
P6
C0
P4
P8
P1
C2
P7
P2
X
Y
Cluster 2: 3 points
Final Centroid Locations:
Cluster 0 centroid = (9.00, 5.33)
Cluster 1 centroid = (3.67, 8.00)
Cluster 2 centroid = (2.00, 2.67)

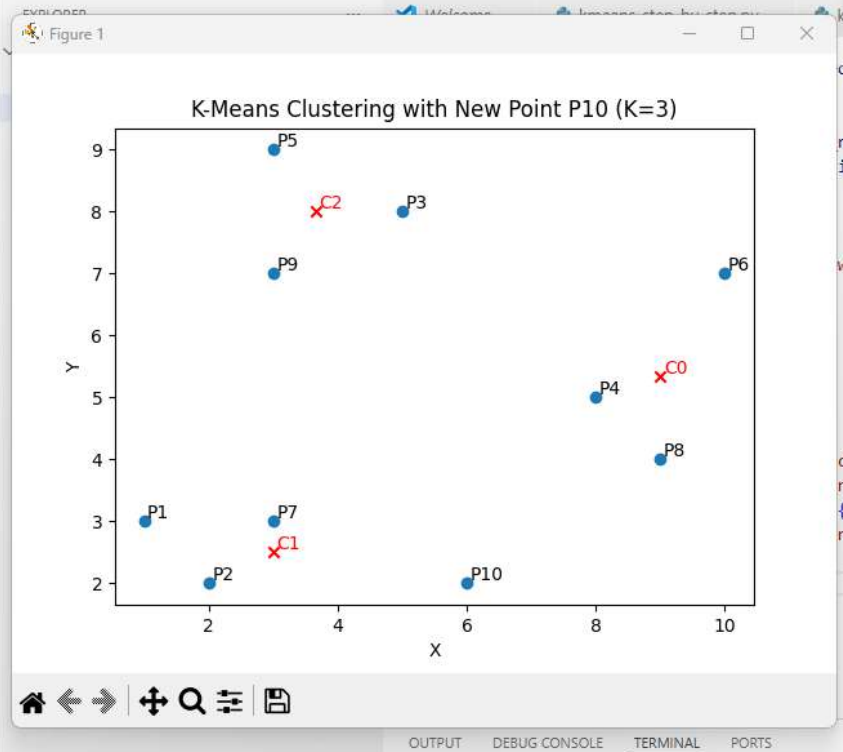



```
    plt.scatter(X[:,0], X[:,1])

    # label points
```

```
='x')
```

```
Users\zumer\OneDrive\Desktop\lab wor"
n313\python.exe' 'c:\Users\zumer\.vs
\debugpy\launcher' '52358' '--' 'c:\
wise.py'
```

```
Final centroid locations:
Cluster 0 centroid = (8.50, 4.50)
Cluster 1 centroid = (3.67, 8.00)
Cluster 2 centroid = (2.00, 2.67)
```



kmeans_add_point.py

```
oids_new[:,1], marker='x', color='red')

new):
i}", color='red')

w Point P10 (K=3)")

cluster assignments slightly.
nt depending on which cluster it joins.
{}, which causes its centroid to move closer to P10.
ns similar, but centroids adjust to accommodate the new data.
```

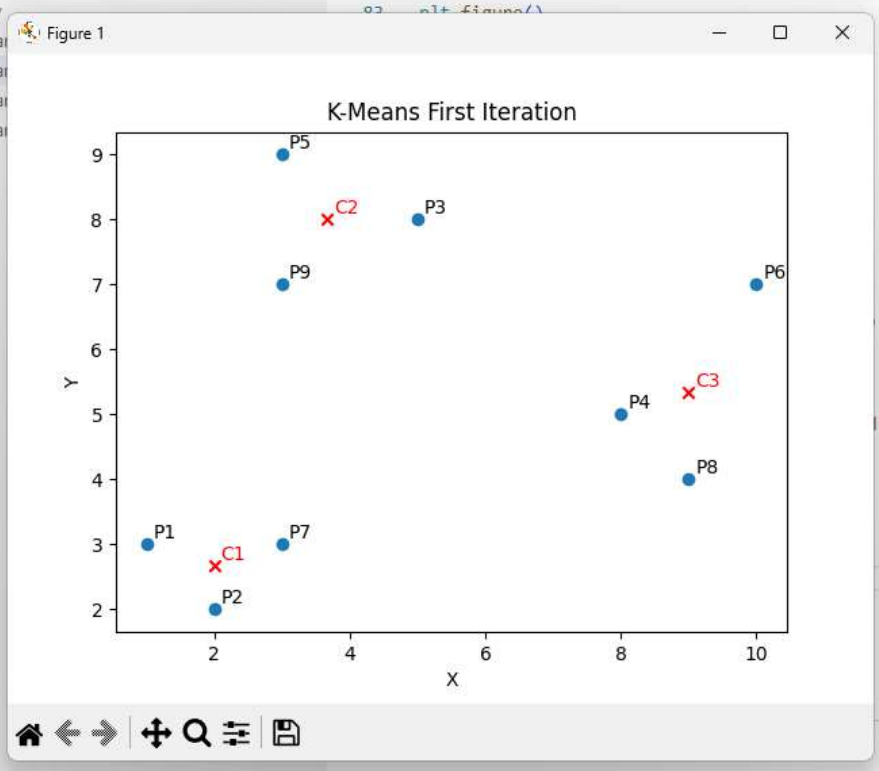
OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
ktop\lab working\lab 9\.venv\Scripts\python.exe' 'c:\Users\zumer\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bund
uncher' '51531' '--' 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 9\kmeans_add_point.py'
P10 -> Cluster 1

New Centroids after adding P10:
C0: (9.00, 5.33)
C1: (3.00, 2.50)
C2: (3.67, 8.00)

P10 joins Cluster 1
```

PROBLEMS
OUTLINE
TIMELINE

master* 0 0 Ln 108, Col 1 Spaces: 4 UTF-

```
88
OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS
ktop\lab working\lab 9\.venv\Scripts\python.exe' 'c:\Users\zumer\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundle
uncher' '51531' '--' 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 9\kmeans_add_point.py'
P3 -> Cluster 1
P4 -> Cluster 0
P5 -> Cluster 1
P6 -> Cluster 0
P7 -> Cluster 2
P8 -> Cluster 0
P9 -> Cluster 1
Centroids: [[9.         5.33333333]
 [3.66666667 8.        ]
 [2.         2.66666667]]

STEP 3: Added new point P10 [6,2]

STEP 4: New K-Means Clustering with P10
P1 -> Cluster 1
P2 -> Cluster 1
P3 -> Cluster 2
P4 -> Cluster 0
P5 -> Cluster 2
P6 -> Cluster 0
P7 -> Cluster 1
P8 -> Cluster 0
P9 -> Cluster 2
P10 -> Cluster 1

New Centroids after adding P10:
C0: (9.00, 5.33)
C1: (3.00, 2.50)
C2: (3.67, 8.00)

P10 joins Cluster 1

STEP 7: Explanation:
- Adding a new data point can change cluster assignments slightly.
- Centroids shift towards the new point depending on which cluster it joins.
- In this example, P10 joins Cluster 1, which causes its centroid to move closer to P10.
- The overall cluster structure remains similar, but centroids adjust to accommodate the new data.
```




```
P7      0.00            4.00            6.08            C1
P8      6.08            6.71            0.00            C3
P9      4.00            0.00            6.71            C2

New Centroids After First Iteration:
C1: (2.00, 2.67)
C2: (3.67, 8.00)
C3: (9.00, 5.33)
```

```
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 9>
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 9> ^C
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 9>  c:; cd 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 9'; & 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 9\.venv\Scripts\python.exe' 'c:\Users\zumer\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher' '57657' '--' 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 9\kmeans_first_iteration.py'
Distance Table (First Iteration):
Point   Dist to C1      Dist to C2      Dist to C3      Assigned Cluster
P1      2.00            4.47            8.06            C1
P2      1.41            5.10            7.28            C1
P3      5.39            2.24            5.66            C2
P4      5.39            5.39            1.41            C3
P5      6.00            2.00            7.81            C2
P6      8.06            7.00            3.16            C3
P7      0.00            4.00            6.08            C1
P8      6.08            6.71            0.00            C3
P9      4.00            0.00            6.71            C2

New Centroids After First Iteration:
C1: (2.00, 2.67)
C2: (3.67, 8.00)
C3: (9.00, 5.33)
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 9>
```