D:\Python\KMeans>kmeans.py -d input -k 10 -elbow true

Program name: D:\Python\KMeans\kmeans.

Program name(with type): D:\Python\KMeans\kmeans.py

Element number of program: 7

Argument list: ['D:\\Python\\KMeans\\kmeans.py', '-d', 'input', '-k', '10', '-elbow', 'true']

Elbow Analysis is set. Given K value (if any) will be ignored.

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Parameters Description

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Dataset: input

K: 10

Number of Observations: 10

Number of Features: 2

Epoch Number: 100

Normalization: false

Elbow Analysis: true

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false

After encoding and Normalization - X

X Y

0 -1 2

1 7 0

2 2 1

3 0 8

4 9 2

5 -3 6

6 5 0

7 8 0

8 -6 6

9 4 2

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Number of CLusters, k = 2

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Initial Centroids: [[7, 0], [8, 0]]

Epoch no.: 1

Distance Matrix ...

8.25 0.00 5.10 10.63 2.83 11.66 2.00 1.00 14.32 3.61

9.22 1.00 6.08 11.31 2.24 12.53 3.00 0.00 15.23 4.47

Cluster Assignment ...

[0, 0, 0, 0, 1, 0, 0, 1, 0, 0]

Sum of Squared Distance 570

[[-1, 2], [7, 0], [2, 1], [0, 8], [-3, 6], [5, 0], [-6, 6], [4, 2]]

[[9, 2], [8, 0]]

Updated Centroids ...

[[1.0, 3.125], [8.5, 1.0]]

Epoch no.: 2

Distance Matrix ...

2.29 6.77 2.35 4.98 8.08 4.93 5.08 7.67 7.57 3.20

9.55 1.80 6.50 11.01 1.12 12.54 3.64 1.12 15.34 4.61

Cluster Assignment ...

[0, 1, 0, 0, 1, 0, 1, 1, 0, 0]

Sum of Squared Distance 146.34375

[[-1, 2], [2, 1], [0, 8], [-3, 6], [-6, 6], [4, 2]]

[[7, 0], [9, 2], [5, 0], [8, 0]]

Updated Centroids ...

[[-0.6666666666666666, 4.166666666666667], [7.25, 0.5]]

Epoch no.: 3

Distance Matrix ...

2.19 8.73 4.14 3.89 9.91 2.97 7.03 9.62 5.64 5.15

8.39 0.56 5.27 10.43 2.30 11.63 2.30 0.90 14.35 3.58

Cluster Assignment ...

[0, 1, 0, 0, 1, 0, 1, 1, 0, 1]

Sum of Squared Distance 102.25694444444444

[[-1, 2], [2, 1], [0, 8], [-3, 6], [-6, 6]]

[[7, 0], [9, 2], [5, 0], [8, 0], [4, 2]]

Updated Centroids ...

[[-1.6, 4.6], [6.6, 0.8]]

Epoch no.: 4

Distance Matrix ...

2.67 9.75 5.09 3.76 10.91 1.98 8.04 10.65 4.62 6.17

7.69 0.89 4.60 9.77 2.68 10.92 1.79 1.61 13.63 2.86

Cluster Assignment ...

[0, 1, 1, 0, 1, 0, 1, 1, 0, 1]

Sum of Squared Distance 89.68

[[-1, 2], [0, 8], [-3, 6], [-6, 6]]

[[7, 0], [2, 1], [9, 2], [5, 0], [8, 0], [4, 2]]

Updated Centroids ...

[[-2.5, 5.5], [5.833333333333333, 0.8333333333333334]]

Epoch no.: 5

Distance Matrix ...

3.81 10.98 6.36 3.54 12.02 0.71 9.30 11.85 3.54 7.38

6.93 1.43 3.84 9.24 3.37 10.23 1.18 2.32 12.91 2.17

Cluster Assignment ...

[0, 1, 1, 0, 1, 0, 1, 1, 0, 1]

Sum of Squared Distance 79.66666666666667

[[-1, 2], [0, 8], [-3, 6], [-6, 6]]

[[7, 0], [2, 1], [9, 2], [5, 0], [8, 0], [4, 2]]

Updated Centroids ...

[[-2.5, 5.5], [5.833333333333333, 0.8333333333333334]]

Final Cluster Formation ...

Cluster # 1

Centroid: [ -2.50, 5.50 ]

Point # 0 : [-1, 2]

Point # 3 : [0, 8]

Point # 5 : [-3, 6]

Point # 8 : [-6, 6]

Cluster # 2

Centroid: [ 5.83, 0.83 ]

Point # 1 : [7, 0]

Point # 2 : [2, 1]

Point # 4 : [9, 2]

Point # 6 : [5, 0]

Point # 7 : [8, 0]

Point # 9 : [4, 2]

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Number of CLusters, k = 3

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Initial Centroids: [[7, 0], [4, 2], [0, 8]]

Epoch no.: 1

Distance Matrix ...

8.25 0.00 5.10 10.63 2.83 11.66 2.00 1.00 14.32 3.61

5.00 3.61 2.24 7.21 5.00 8.06 2.24 4.47 10.77 0.00

6.08 10.63 7.28 0.00 10.82 3.61 9.43 11.31 6.32 7.21

Cluster Assignment ...

[1, 0, 1, 2, 0, 2, 0, 0, 2, 1]

Sum of Squared Distance 96

[[7, 0], [9, 2], [5, 0], [8, 0]]

[[-1, 2], [2, 1], [4, 2]]

[[0, 8], [-3, 6], [-6, 6]]

Updated Centroids ...

[[7.25, 0.5], [1.6666666666666667, 1.6666666666666667], [-3.0, 6.666666666666667]]

Epoch no.: 2

Distance Matrix ...

8.39 0.56 5.27 10.43 2.30 11.63 2.30 0.90 14.35 3.58

2.69 5.59 0.75 6.55 7.34 6.37 3.73 6.55 8.81 2.36

5.08 12.02 7.56 3.28 12.88 0.67 10.41 12.86 3.07 8.41

Cluster Assignment ...

[1, 0, 1, 2, 0, 2, 0, 0, 2, 1]

Sum of Squared Distance 45.75

[[7, 0], [9, 2], [5, 0], [8, 0]]

[[-1, 2], [2, 1], [4, 2]]

[[0, 8], [-3, 6], [-6, 6]]

Updated Centroids ...

[[7.25, 0.5], [1.6666666666666667, 1.6666666666666667], [-3.0, 6.666666666666667]]

Final Cluster Formation ...

Cluster # 1

Centroid: [ 7.25, 0.50 ]

Point # 1 : [7, 0]

Point # 4 : [9, 2]

Point # 6 : [5, 0]

Point # 7 : [8, 0]

Cluster # 2

Centroid: [ 1.67, 1.67 ]

Point # 0 : [-1, 2]

Point # 2 : [2, 1]

Point # 9 : [4, 2]

Cluster # 3

Centroid: [ -3.00, 6.67 ]

Point # 3 : [0, 8]

Point # 5 : [-3, 6]

Point # 8 : [-6, 6]

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Number of CLusters, k = 4

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Initial Centroids: [[5, 0], [8, 0], [-6, 6], [7, 0]]

Epoch no.: 1

Distance Matrix ...

6.32 2.00 3.16 9.43 4.47 10.00 0.00 3.00 12.53 2.24

9.22 1.00 6.08 11.31 2.24 12.53 3.00 0.00 15.23 4.47

6.40 14.32 9.43 6.32 15.52 3.00 12.53 15.23 0.00 10.77

8.25 0.00 5.10 10.63 2.83 11.66 2.00 1.00 14.32 3.61

Cluster Assignment ...

[0, 3, 0, 2, 1, 2, 0, 1, 2, 0]

Sum of Squared Distance 109

[[-1, 2], [2, 1], [5, 0], [4, 2]]

[[9, 2], [8, 0]]

[[0, 8], [-3, 6], [-6, 6]]

[[7, 0]]

Updated Centroids ...

[[2.5, 1.25], [8.5, 1.0], [-3.0, 6.666666666666667], [7.0, 0.0]]

Epoch no.: 2

Distance Matrix ...

3.58 4.67 0.56 7.20 6.54 7.27 2.80 5.64 9.74 1.68

9.55 1.80 6.50 11.01 1.12 12.54 3.64 1.12 15.34 4.61

5.08 12.02 7.56 3.28 12.88 0.67 10.41 12.86 3.07 8.41

8.25 0.00 5.10 10.63 2.83 11.66 2.00 1.00 14.32 3.61

Cluster Assignment ...

[0, 3, 0, 2, 1, 2, 3, 3, 2, 0]

Sum of Squared Distance 42.85416666666667

[[-1, 2], [2, 1], [4, 2]]

[[9, 2]]

[[0, 8], [-3, 6], [-6, 6]]

[[7, 0], [5, 0], [8, 0]]

Updated Centroids ...

[[1.6666666666666667, 1.6666666666666667], [9.0, 2.0], [-3.0, 6.666666666666667], [6.666666666666667, 0.0]]

Epoch no.: 3

Distance Matrix ...

2.69 5.59 0.75 6.55 7.34 6.37 3.73 6.55 8.81 2.36

10.00 2.83 7.07 10.82 0.00 12.65 4.47 2.24 15.52 5.00

5.08 12.02 7.56 3.28 12.88 0.67 10.41 12.86 3.07 8.41

7.92 0.33 4.77 10.41 3.07 11.38 1.67 1.33 14.02 3.33

Cluster Assignment ...

[0, 3, 0, 2, 1, 2, 3, 3, 2, 0]

Sum of Squared Distance 38.66666666666667

[[-1, 2], [2, 1], [4, 2]]

[[9, 2]]

[[0, 8], [-3, 6], [-6, 6]]

[[7, 0], [5, 0], [8, 0]]

Updated Centroids ...

[[1.6666666666666667, 1.6666666666666667], [9.0, 2.0], [-3.0, 6.666666666666667], [6.666666666666667, 0.0]]

Final Cluster Formation ...

Cluster # 1

Centroid: [ 1.67, 1.67 ]

Point # 0 : [-1, 2]

Point # 2 : [2, 1]

Point # 9 : [4, 2]

Cluster # 2

Centroid: [ 9.00, 2.00 ]

Point # 4 : [9, 2]

Cluster # 3

Centroid: [ -3.00, 6.67 ]

Point # 3 : [0, 8]

Point # 5 : [-3, 6]

Point # 8 : [-6, 6]

Cluster # 4

Centroid: [ 6.67, 0.00 ]

Point # 1 : [7, 0]

Point # 6 : [5, 0]

Point # 7 : [8, 0]

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Number of CLusters, k = 5

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Initial Centroids: [[-1, 2], [9, 2], [5, 0], [0, 8], [2, 1]]

Epoch no.: 1

Distance Matrix ...

0.00 8.25 3.16 6.08 10.00 4.47 6.32 9.22 6.40 5.00

10.00 2.83 7.07 10.82 0.00 12.65 4.47 2.24 15.52 5.00

6.32 2.00 3.16 9.43 4.47 10.00 0.00 3.00 12.53 2.24

6.08 10.63 7.28 0.00 10.82 3.61 9.43 11.31 6.32 7.21

3.16 5.10 0.00 7.28 7.07 7.07 3.16 6.08 9.43 2.24

Cluster Assignment ...

[0, 2, 4, 3, 1, 3, 2, 1, 3, 2]

Sum of Squared Distance 67

[[-1, 2]]

[[9, 2], [8, 0]]

[[7, 0], [5, 0], [4, 2]]

[[0, 8], [-3, 6], [-6, 6]]

[[2, 1]]

Updated Centroids ...

[[-1.0, 2.0], [8.5, 1.0], [5.333333333333333, 0.6666666666666666], [-3.0, 6.666666666666667], [2.0, 1.0]]

Epoch no.: 2

Distance Matrix ...

0.00 8.25 3.16 6.08 10.00 4.47 6.32 9.22 6.40 5.00

9.55 1.80 6.50 11.01 1.12 12.54 3.64 1.12 15.34 4.61

6.47 1.80 3.35 9.07 3.90 9.89 0.75 2.75 12.53 1.89

5.08 12.02 7.56 3.28 12.88 0.67 10.41 12.86 3.07 8.41

3.16 5.10 0.00 7.28 7.07 7.07 3.16 6.08 9.43 2.24

Cluster Assignment ...

[0, 2, 4, 3, 1, 3, 2, 1, 3, 2]

Sum of Squared Distance 30.5

[[-1, 2]]

[[9, 2], [8, 0]]

[[7, 0], [5, 0], [4, 2]]

[[0, 8], [-3, 6], [-6, 6]]

[[2, 1]]

Updated Centroids ...

[[-1.0, 2.0], [8.5, 1.0], [5.333333333333333, 0.6666666666666666], [-3.0, 6.666666666666667], [2.0, 1.0]]

Final Cluster Formation ...

Cluster # 1

Centroid: [ -1.00, 2.00 ]

Point # 0 : [-1, 2]

Cluster # 2

Centroid: [ 8.50, 1.00 ]

Point # 4 : [9, 2]

Point # 7 : [8, 0]

Cluster # 3

Centroid: [ 5.33, 0.67 ]

Point # 1 : [7, 0]

Point # 6 : [5, 0]

Point # 9 : [4, 2]

Cluster # 4

Centroid: [ -3.00, 6.67 ]

Point # 3 : [0, 8]

Point # 5 : [-3, 6]

Point # 8 : [-6, 6]

Cluster # 5

Centroid: [ 2.00, 1.00 ]

Point # 2 : [2, 1]

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Number of CLusters, k = 6

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Initial Centroids: [[-1, 2], [-3, 6], [0, 8], [4, 2], [5, 0], [8, 0]]

Epoch no.: 1

Distance Matrix ...

0.00 8.25 3.16 6.08 10.00 4.47 6.32 9.22 6.40 5.00

4.47 11.66 7.07 3.61 12.65 0.00 10.00 12.53 3.00 8.06

6.08 10.63 7.28 0.00 10.82 3.61 9.43 11.31 6.32 7.21

5.00 3.61 2.24 7.21 5.00 8.06 2.24 4.47 10.77 0.00

6.32 2.00 3.16 9.43 4.47 10.00 0.00 3.00 12.53 2.24

9.22 1.00 6.08 11.31 2.24 12.53 3.00 0.00 15.23 4.47

Cluster Assignment ...

[0, 5, 3, 2, 5, 1, 4, 5, 1, 3]

Sum of Squared Distance 20

[[-1, 2]]

[[-3, 6], [-6, 6]]

[[0, 8]]

[[2, 1], [4, 2]]

[[5, 0]]

[[7, 0], [9, 2], [8, 0]]

Updated Centroids ...

[[-1.0, 2.0], [-4.5, 6.0], [0.0, 8.0], [3.0, 1.5], [5.0, 0.0], [8.0, 0.6666666666666666]]

Epoch no.: 2

Distance Matrix ...

0.00 8.25 3.16 6.08 10.00 4.47 6.32 9.22 6.40 5.00

5.32 12.97 8.20 4.92 14.08 1.50 11.24 13.87 1.50 9.39

6.08 10.63 7.28 0.00 10.82 3.61 9.43 11.31 6.32 7.21

4.03 4.27 1.12 7.16 6.02 7.50 2.50 5.22 10.06 1.12

6.32 2.00 3.16 9.43 4.47 10.00 0.00 3.00 12.53 2.24

9.10 1.20 6.01 10.85 1.67 12.22 3.07 0.67 14.98 4.22

Cluster Assignment ...

[0, 5, 3, 2, 5, 1, 4, 5, 1, 3]

Sum of Squared Distance 11.666666666666668

[[-1, 2]]

[[-3, 6], [-6, 6]]

[[0, 8]]

[[2, 1], [4, 2]]

[[5, 0]]

[[7, 0], [9, 2], [8, 0]]

Updated Centroids ...

[[-1.0, 2.0], [-4.5, 6.0], [0.0, 8.0], [3.0, 1.5], [5.0, 0.0], [8.0, 0.6666666666666666]]

Final Cluster Formation ...

Cluster # 1

Centroid: [ -1.00, 2.00 ]

Point # 0 : [-1, 2]

Cluster # 2

Centroid: [ -4.50, 6.00 ]

Point # 5 : [-3, 6]

Point # 8 : [-6, 6]

Cluster # 3

Centroid: [ 0.00, 8.00 ]

Point # 3 : [0, 8]

Cluster # 4

Centroid: [ 3.00, 1.50 ]

Point # 2 : [2, 1]

Point # 9 : [4, 2]

Cluster # 5

Centroid: [ 5.00, 0.00 ]

Point # 6 : [5, 0]

Cluster # 6

Centroid: [ 8.00, 0.67 ]

Point # 1 : [7, 0]

Point # 4 : [9, 2]

Point # 7 : [8, 0]

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Number of CLusters, k = 7

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Initial Centroids: [[-3, 6], [0, 8], [-1, 2], [4, 2], [9, 2], [7, 0], [8, 0]]

Epoch no.: 1

Distance Matrix ...

4.47 11.66 7.07 3.61 12.65 0.00 10.00 12.53 3.00 8.06

6.08 10.63 7.28 0.00 10.82 3.61 9.43 11.31 6.32 7.21

0.00 8.25 3.16 6.08 10.00 4.47 6.32 9.22 6.40 5.00

5.00 3.61 2.24 7.21 5.00 8.06 2.24 4.47 10.77 0.00

10.00 2.83 7.07 10.82 0.00 12.65 4.47 2.24 15.52 5.00

8.25 0.00 5.10 10.63 2.83 11.66 2.00 1.00 14.32 3.61

9.22 1.00 6.08 11.31 2.24 12.53 3.00 0.00 15.23 4.47

Cluster Assignment ...

[2, 5, 3, 1, 4, 0, 5, 6, 0, 3]

Sum of Squared Distance 18

[[-3, 6], [-6, 6]]

[[0, 8]]

[[-1, 2]]

[[2, 1], [4, 2]]

[[9, 2]]

[[7, 0], [5, 0]]

[[8, 0]]

Updated Centroids ...

[[-4.5, 6.0], [0.0, 8.0], [-1.0, 2.0], [3.0, 1.5], [9.0, 2.0], [6.0, 0.0], [8.0, 0.0]]

Epoch no.: 2

Distance Matrix ...

5.32 12.97 8.20 4.92 14.08 1.50 11.24 13.87 1.50 9.39

6.08 10.63 7.28 0.00 10.82 3.61 9.43 11.31 6.32 7.21

0.00 8.25 3.16 6.08 10.00 4.47 6.32 9.22 6.40 5.00

4.03 4.27 1.12 7.16 6.02 7.50 2.50 5.22 10.06 1.12

10.00 2.83 7.07 10.82 0.00 12.65 4.47 2.24 15.52 5.00

7.28 1.00 4.12 10.00 3.61 10.82 1.00 2.00 13.42 2.83

9.22 1.00 6.08 11.31 2.24 12.53 3.00 0.00 15.23 4.47

Cluster Assignment ...

[2, 5, 3, 1, 4, 0, 5, 6, 0, 3]

Sum of Squared Distance 9.0

[[-3, 6], [-6, 6]]

[[0, 8]]

[[-1, 2]]

[[2, 1], [4, 2]]

[[9, 2]]

[[7, 0], [5, 0]]

[[8, 0]]

Updated Centroids ...

[[-4.5, 6.0], [0.0, 8.0], [-1.0, 2.0], [3.0, 1.5], [9.0, 2.0], [6.0, 0.0], [8.0, 0.0]]

Final Cluster Formation ...

Cluster # 1

Centroid: [ -4.50, 6.00 ]

Point # 5 : [-3, 6]

Point # 8 : [-6, 6]

Cluster # 2

Centroid: [ 0.00, 8.00 ]

Point # 3 : [0, 8]

Cluster # 3

Centroid: [ -1.00, 2.00 ]

Point # 0 : [-1, 2]

Cluster # 4

Centroid: [ 3.00, 1.50 ]

Point # 2 : [2, 1]

Point # 9 : [4, 2]

Cluster # 5

Centroid: [ 9.00, 2.00 ]

Point # 4 : [9, 2]

Cluster # 6

Centroid: [ 6.00, 0.00 ]

Point # 1 : [7, 0]

Point # 6 : [5, 0]

Cluster # 7

Centroid: [ 8.00, 0.00 ]

Point # 7 : [8, 0]

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Number of CLusters, k = 8

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Initial Centroids: [[4, 2], [-3, 6], [0, 8], [2, 1], [9, 2], [-6, 6], [7, 0], [-1, 2]]

Epoch no.: 1

Distance Matrix ...

5.00 3.61 2.24 7.21 5.00 8.06 2.24 4.47 10.77 0.00

4.47 11.66 7.07 3.61 12.65 0.00 10.00 12.53 3.00 8.06

6.08 10.63 7.28 0.00 10.82 3.61 9.43 11.31 6.32 7.21

3.16 5.10 0.00 7.28 7.07 7.07 3.16 6.08 9.43 2.24

10.00 2.83 7.07 10.82 0.00 12.65 4.47 2.24 15.52 5.00

6.40 14.32 9.43 6.32 15.52 3.00 12.53 15.23 0.00 10.77

8.25 0.00 5.10 10.63 2.83 11.66 2.00 1.00 14.32 3.61

0.00 8.25 3.16 6.08 10.00 4.47 6.32 9.22 6.40 5.00

Cluster Assignment ...

[7, 6, 3, 2, 4, 1, 6, 6, 5, 0]

Sum of Squared Distance 5

[[4, 2]]

[[-3, 6]]

[[0, 8]]

[[2, 1]]

[[9, 2]]

[[-6, 6]]

[[7, 0], [5, 0], [8, 0]]

[[-1, 2]]

Updated Centroids ...

[[4.0, 2.0], [-3.0, 6.0], [0.0, 8.0], [2.0, 1.0], [9.0, 2.0], [-6.0, 6.0], [6.666666666666667, 0.0], [-1.0, 2.0]]

Epoch no.: 2

Distance Matrix ...

5.00 3.61 2.24 7.21 5.00 8.06 2.24 4.47 10.77 0.00

4.47 11.66 7.07 3.61 12.65 0.00 10.00 12.53 3.00 8.06

6.08 10.63 7.28 0.00 10.82 3.61 9.43 11.31 6.32 7.21

3.16 5.10 0.00 7.28 7.07 7.07 3.16 6.08 9.43 2.24

10.00 2.83 7.07 10.82 0.00 12.65 4.47 2.24 15.52 5.00

6.40 14.32 9.43 6.32 15.52 3.00 12.53 15.23 0.00 10.77

7.92 0.33 4.77 10.41 3.07 11.38 1.67 1.33 14.02 3.33

0.00 8.25 3.16 6.08 10.00 4.47 6.32 9.22 6.40 5.00

Cluster Assignment ...

[7, 6, 3, 2, 4, 1, 6, 6, 5, 0]

Sum of Squared Distance 4.666666666666666

[[4, 2]]

[[-3, 6]]

[[0, 8]]

[[2, 1]]

[[9, 2]]

[[-6, 6]]

[[7, 0], [5, 0], [8, 0]]

[[-1, 2]]

Updated Centroids ...

[[4.0, 2.0], [-3.0, 6.0], [0.0, 8.0], [2.0, 1.0], [9.0, 2.0], [-6.0, 6.0], [6.666666666666667, 0.0], [-1.0, 2.0]]

Final Cluster Formation ...

Cluster # 1

Centroid: [ 4.00, 2.00 ]

Point # 9 : [4, 2]

Cluster # 2

Centroid: [ -3.00, 6.00 ]

Point # 5 : [-3, 6]

Cluster # 3

Centroid: [ 0.00, 8.00 ]

Point # 3 : [0, 8]

Cluster # 4

Centroid: [ 2.00, 1.00 ]

Point # 2 : [2, 1]

Cluster # 5

Centroid: [ 9.00, 2.00 ]

Point # 4 : [9, 2]

Cluster # 6

Centroid: [ -6.00, 6.00 ]

Point # 8 : [-6, 6]

Cluster # 7

Centroid: [ 6.67, 0.00 ]

Point # 1 : [7, 0]

Point # 6 : [5, 0]

Point # 7 : [8, 0]

Cluster # 8

Centroid: [ -1.00, 2.00 ]

Point # 0 : [-1, 2]

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Number of CLusters, k = 9

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Initial Centroids: [[9, 2], [0, 8], [-6, 6], [-3, 6], [4, 2], [-1, 2], [7, 0], [2, 1], [8, 0]]

Epoch no.: 1

Distance Matrix ...

10.00 2.83 7.07 10.82 0.00 12.65 4.47 2.24 15.52 5.00

6.08 10.63 7.28 0.00 10.82 3.61 9.43 11.31 6.32 7.21

6.40 14.32 9.43 6.32 15.52 3.00 12.53 15.23 0.00 10.77

4.47 11.66 7.07 3.61 12.65 0.00 10.00 12.53 3.00 8.06

5.00 3.61 2.24 7.21 5.00 8.06 2.24 4.47 10.77 0.00

0.00 8.25 3.16 6.08 10.00 4.47 6.32 9.22 6.40 5.00

8.25 0.00 5.10 10.63 2.83 11.66 2.00 1.00 14.32 3.61

3.16 5.10 0.00 7.28 7.07 7.07 3.16 6.08 9.43 2.24

9.22 1.00 6.08 11.31 2.24 12.53 3.00 0.00 15.23 4.47

Cluster Assignment ...

[5, 6, 7, 1, 0, 3, 6, 8, 2, 4]

Sum of Squared Distance 4

[[9, 2]]

[[0, 8]]

[[-6, 6]]

[[-3, 6]]

[[4, 2]]

[[-1, 2]]

[[7, 0], [5, 0]]

[[2, 1]]

[[8, 0]]

Updated Centroids ...

[[9.0, 2.0], [0.0, 8.0], [-6.0, 6.0], [-3.0, 6.0], [4.0, 2.0], [-1.0, 2.0], [6.0, 0.0], [2.0, 1.0], [8.0, 0.0]]

Epoch no.: 2

Distance Matrix ...

10.00 2.83 7.07 10.82 0.00 12.65 4.47 2.24 15.52 5.00

6.08 10.63 7.28 0.00 10.82 3.61 9.43 11.31 6.32 7.21

6.40 14.32 9.43 6.32 15.52 3.00 12.53 15.23 0.00 10.77

4.47 11.66 7.07 3.61 12.65 0.00 10.00 12.53 3.00 8.06

5.00 3.61 2.24 7.21 5.00 8.06 2.24 4.47 10.77 0.00

0.00 8.25 3.16 6.08 10.00 4.47 6.32 9.22 6.40 5.00

7.28 1.00 4.12 10.00 3.61 10.82 1.00 2.00 13.42 2.83

3.16 5.10 0.00 7.28 7.07 7.07 3.16 6.08 9.43 2.24

9.22 1.00 6.08 11.31 2.24 12.53 3.00 0.00 15.23 4.47

Cluster Assignment ...

[5, 6, 7, 1, 0, 3, 6, 8, 2, 4]

Sum of Squared Distance 2.0

[[9, 2]]

[[0, 8]]

[[-6, 6]]

[[-3, 6]]

[[4, 2]]

[[-1, 2]]

[[7, 0], [5, 0]]

[[2, 1]]

[[8, 0]]

Updated Centroids ...

[[9.0, 2.0], [0.0, 8.0], [-6.0, 6.0], [-3.0, 6.0], [4.0, 2.0], [-1.0, 2.0], [6.0, 0.0], [2.0, 1.0], [8.0, 0.0]]

Final Cluster Formation ...

Cluster # 1

Centroid: [ 9.00, 2.00 ]

Point # 4 : [9, 2]

Cluster # 2

Centroid: [ 0.00, 8.00 ]

Point # 3 : [0, 8]

Cluster # 3

Centroid: [ -6.00, 6.00 ]

Point # 8 : [-6, 6]

Cluster # 4

Centroid: [ -3.00, 6.00 ]

Point # 5 : [-3, 6]

Cluster # 5

Centroid: [ 4.00, 2.00 ]

Point # 9 : [4, 2]

Cluster # 6

Centroid: [ -1.00, 2.00 ]

Point # 0 : [-1, 2]

Cluster # 7

Centroid: [ 6.00, 0.00 ]

Point # 1 : [7, 0]

Point # 6 : [5, 0]

Cluster # 8

Centroid: [ 2.00, 1.00 ]

Point # 2 : [2, 1]

Cluster # 9

Centroid: [ 8.00, 0.00 ]

Point # 7 : [8, 0]

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Number of CLusters, k = 10

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Initial Centroids: [[0, 8], [9, 2], [-6, 6], [5, 0], [8, 0], [2, 1], [7, 0], [4, 2], [-1, 2], [-3, 6]]

Epoch no.: 1

Distance Matrix ...

6.08 10.63 7.28 0.00 10.82 3.61 9.43 11.31 6.32 7.21

10.00 2.83 7.07 10.82 0.00 12.65 4.47 2.24 15.52 5.00

6.40 14.32 9.43 6.32 15.52 3.00 12.53 15.23 0.00 10.77

6.32 2.00 3.16 9.43 4.47 10.00 0.00 3.00 12.53 2.24

9.22 1.00 6.08 11.31 2.24 12.53 3.00 0.00 15.23 4.47

3.16 5.10 0.00 7.28 7.07 7.07 3.16 6.08 9.43 2.24

8.25 0.00 5.10 10.63 2.83 11.66 2.00 1.00 14.32 3.61

5.00 3.61 2.24 7.21 5.00 8.06 2.24 4.47 10.77 0.00

0.00 8.25 3.16 6.08 10.00 4.47 6.32 9.22 6.40 5.00

4.47 11.66 7.07 3.61 12.65 0.00 10.00 12.53 3.00 8.06

Cluster Assignment ...

[8, 6, 5, 0, 1, 9, 3, 4, 2, 7]

Sum of Squared Distance 0

[[0, 8]]

[[9, 2]]

[[-6, 6]]

[[5, 0]]

[[8, 0]]

[[2, 1]]

[[7, 0]]

[[4, 2]]

[[-1, 2]]

[[-3, 6]]

Updated Centroids ...

[[0.0, 8.0], [9.0, 2.0], [-6.0, 6.0], [5.0, 0.0], [8.0, 0.0], [2.0, 1.0], [7.0, 0.0], [4.0, 2.0], [-1.0, 2.0], [-3.0, 6.0]]

Final Cluster Formation ...

Cluster # 1

Centroid: [ 0.00, 8.00 ]

Point # 3 : [0, 8]

Cluster # 2

Centroid: [ 9.00, 2.00 ]

Point # 4 : [9, 2]

Cluster # 3

Centroid: [ -6.00, 6.00 ]

Point # 8 : [-6, 6]

Cluster # 4

Centroid: [ 5.00, 0.00 ]

Point # 6 : [5, 0]

Cluster # 5

Centroid: [ 8.00, 0.00 ]

Point # 7 : [8, 0]

Cluster # 6

Centroid: [ 2.00, 1.00 ]

Point # 2 : [2, 1]

Cluster # 7

Centroid: [ 7.00, 0.00 ]

Point # 1 : [7, 0]

Cluster # 8

Centroid: [ 4.00, 2.00 ]

Point # 9 : [4, 2]

Cluster # 9

Centroid: [ -1.00, 2.00 ]

Point # 0 : [-1, 2]

Cluster # 10

Centroid: [ -3.00, 6.00 ]

Point # 5 : [-3, 6]

k and SSE: ELbow ANalysis

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k = 2 : SSE = 79.66666666666667

k = 3 : SSE = 45.75

k = 4 : SSE = 38.66666666666667

k = 5 : SSE = 30.5

k = 6 : SSE = 11.666666666666668

k = 7 : SSE = 9.0

k = 8 : SSE = 4.666666666666666

k = 9 : SSE = 2.0

k = 10 : SSE = 0

