220962046_Week10

October 11, 2024

1 Lab 10

Q1

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

[2]:
```
df = pd.read_csv('Week10Q1.csv')
df
```

[2]:

	points	assists	rebounds
0	18.0	3.0	15
1	19.0	4.0	14
2	14.0	5.0	10
3	14.0	4.0	8
4	11.0	7.0	14
5	20.0	8.0	13
6	28.0	7.0	9
7	30.0	6.0	5
8	31.0	9.0	4
9	35.0	12.0	11
10	33.0	14.0	6
11	25.0	9.0	5
12	25.0	4.0	3
13	27.0	3.0	8
14	29.0	4.0	12
15	30.0	12.0	7
16	19.0	15.0	6
17	23.0	11.0	5

[3]:
```
def euclidean_distance(point, centroid):
    return np.sqrt(np.sum((point - centroid) ** 2))
def manhattan_distance(point, centroid):
    return np.sum(np.abs(point - centroid))
def minkowski_distance(point, centroid, p=3):
    return np.sum(np.abs(point - centroid) ** p) ** (1/p)
```

[4]:
```python
def assign_clusters(data, centroids, distance_metric):
    clusters = []
    for index, row in data.iterrows():
        if distance_metric == 1:
            distances = [euclidean_distance(row.values, centroid) for centroid␣
 ↪in centroids]
        elif distance_metric == 2:
            distances = [manhattan_distance(row.values, centroid) for centroid␣
 ↪in centroids]
        elif distance_metric == 3:
            distances = [minkowski_distance(row.values, centroid) for centroid␣
 ↪in centroids]
        else:
            raise ValueError("Unknown distance metric")
        clusters.append(np.argmin(distances))
    return np.array(clusters)
```

[5]:
```python
def kmeans(data, k, distance_metric, max_iterations=10):
    centroids = data.sample(n=k).values
    for _ in range(max_iterations):
        clusters = assign_clusters(data, centroids, distance_metric)
        centroids = np.array([data[clusters == i].mean().values for i in␣
 ↪range(k)])
    return clusters, centroids
```

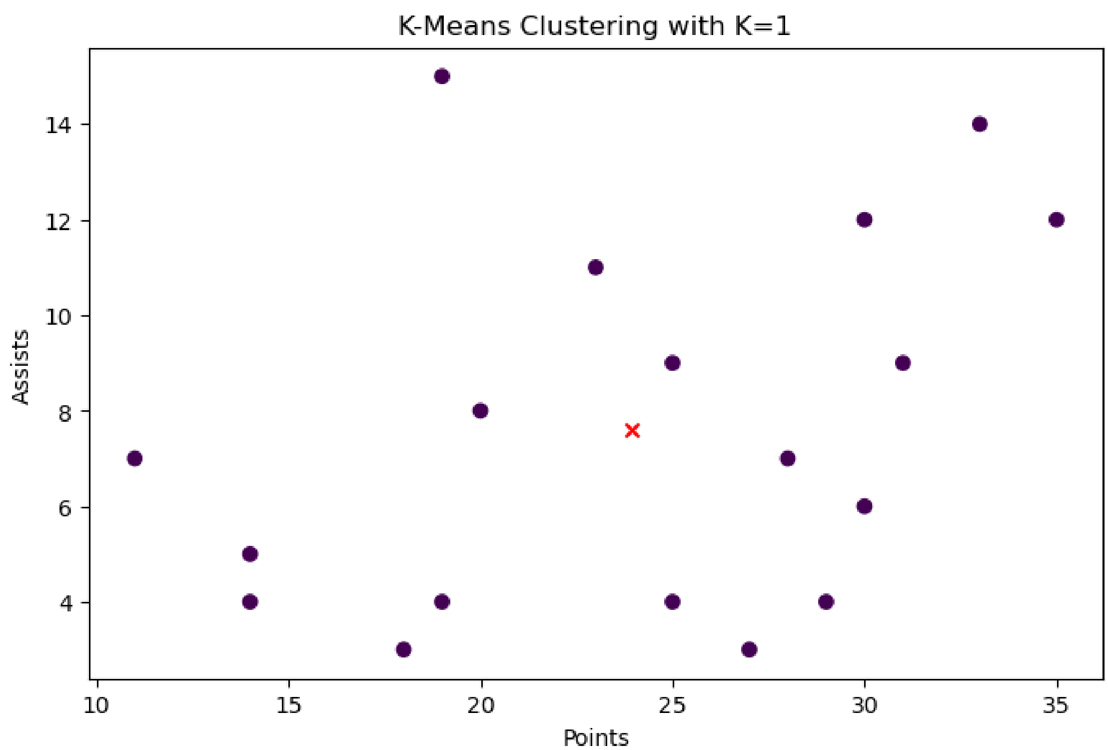
[6]:
```python
print("Welcome to K-Means Clustering!")
print("Choose a distance metric:")
print("1. Euclidean")
print("2. Manhattan")
print("3. Minkowski")
choice = int(input("Enter your choice (1, 2, or 3): "))
if choice == 1:
    print("Continuing with Euclidean Distance.")
elif choice == 2:
    print("Continuing with Manhattan Distance.")
elif choice == 3:
    print("Continuing with Minkowski Distance.")
else:
    print("Invalid Choice.")
```

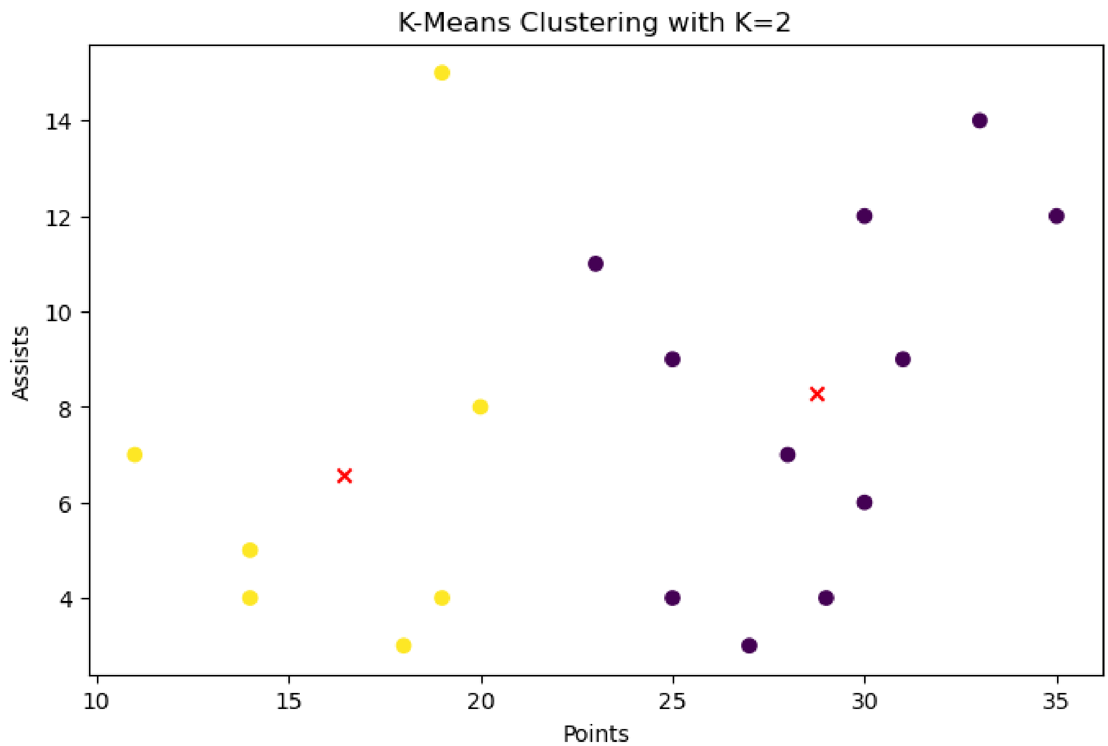
```
Welcome to K-Means Clustering!
Choose a distance metric:
1. Euclidean
2. Manhattan
3. Minkowski
Continuing with Minkowski Distance.
```

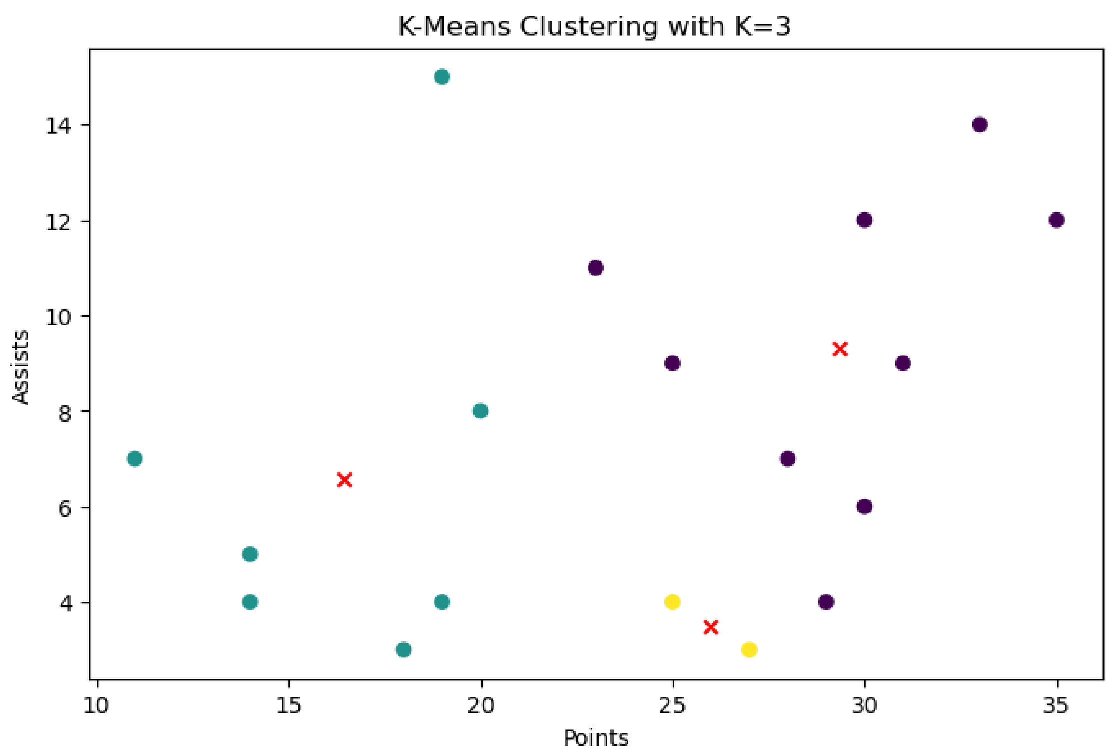
[7]:
```python
def compute_sse(data, clusters, centroids):
    sse = 0
    for i in range(len(centroids)):
        sse += np.sum((data[clusters == i] - centroids[i]) ** 2)
    return sse
```

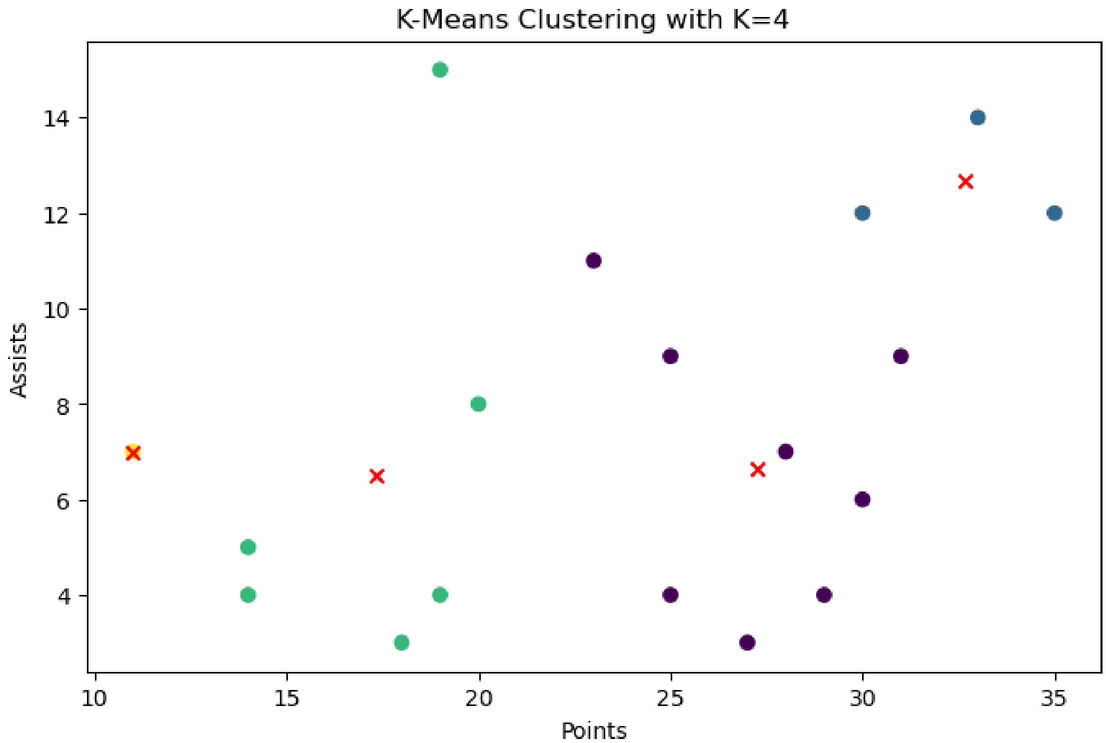
[8]:
```python
sse_values = []
```

[9]:
```python
sse_values = []
for k in range(1, 5):
    clusters, centroids = kmeans(df, k, choice)
    plt.figure(figsize=(8, 5))
    plt.scatter(df['points'], df['assists'], c=clusters, cmap='viridis',␣
 ↪marker='o')
    plt.scatter(centroids[:, 0], centroids[:, 1], c='red', marker='x')
    plt.title(f'K-Means Clustering with K={k}')
    plt.xlabel('Points')
    plt.ylabel('Assists')
    plt.show()
    sse = compute_sse(df.values, clusters, centroids)
    sse_values.append(sse)
```

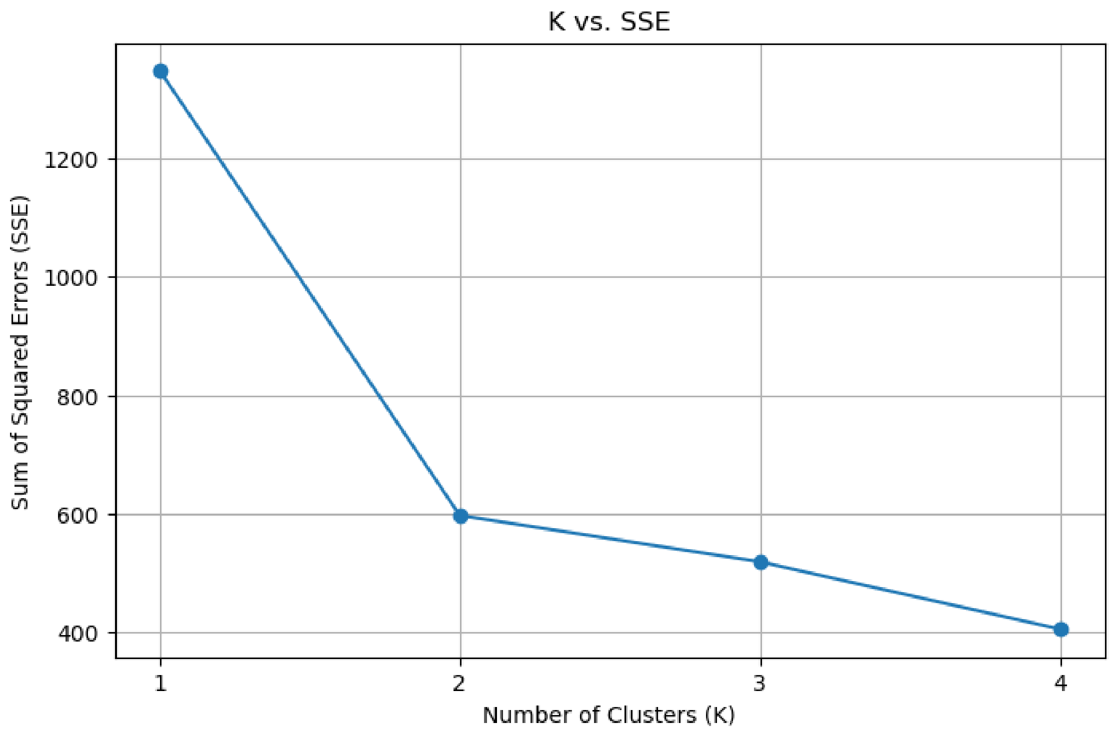



K-Means Clustering with K=2
Assists
Points
10
15
20
25
30
35
4
6
8
10
12
14


K-Means Clustering with K=3
Assists
Points
10
15
20
25
30
35
4
6
8
10
12
14



[10]:
```
plt.figure(figsize=(8, 5))
plt.plot(range(1, 5), sse_values, marker='o')
plt.title('K vs. SSE')
plt.xlabel('Number of Clusters (K)')
plt.ylabel('Sum of Squared Errors (SSE)')
plt.xticks(range(1, 5))
plt.grid()
plt.show()
```


K vs. SSE
Sum of Squared Errors (SSE)
1200
1000
800
600
400
1
2
3
4
Number of Clusters (K)

[ ]: