Data Mining (Δ02): Exercise Set 2: 2.2 - 7Clusters Dataset (K-Means - Silhouette)

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In [1]:

```
#general
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt


#classifiers
from sklearn.cluster import KMeans
from sklearn.metrics import silhouette_score

#to ignore warnings
import warnings
warnings.filterwarnings('ignore')
```

In [2]:

```
data = []
# read the file line by line
with open(r'C:\Users\Nefeli\Desktop\dm_msc\DM_Homework2_2024\clustering\7clusters.txt',
    for line in file:
        # Strip whitespace, split (by space)
        clean_line = line.strip().split()
        data.append((float(clean_line[0]), float(clean_line[1])))

# Create DataFrame from the list
main_df = pd.DataFrame(data, columns=['x', 'y'])
```

In [3]:

```
#range of k values to test
k = range(2, 11)

silhouette_scores = []

# get silhouette for each different k
for k_i in k:
    kmeans = KMeans(n_clusters=k_i, random_state=42)
    labels = kmeans.fit_predict(main_df)
    silhouette_avg = silhouette_score(main_df, labels)
    silhouette_scores.append(silhouette_avg)
    print("k = {} ----- Silhouette Score = {}".format(k_i,silhouette_avg))

# get best k (highest silhouette score)
best_k = k[np.argmax(silhouette_scores)]
print("Optimal number of clusters: {}".format(best_k))
```

```
k = 2 ----- Silhouette Score = 0.48696257114049535
k = 3 ----- Silhouette Score = 0.5106857584174717
k = 4 ----- Silhouette Score = 0.5600784275159115
k = 5 ----- Silhouette Score = 0.5762451809818667
k = 6 ----- Silhouette Score = 0.5695476563612936
k = 7 ----- Silhouette Score = 0.5786682874311846
```

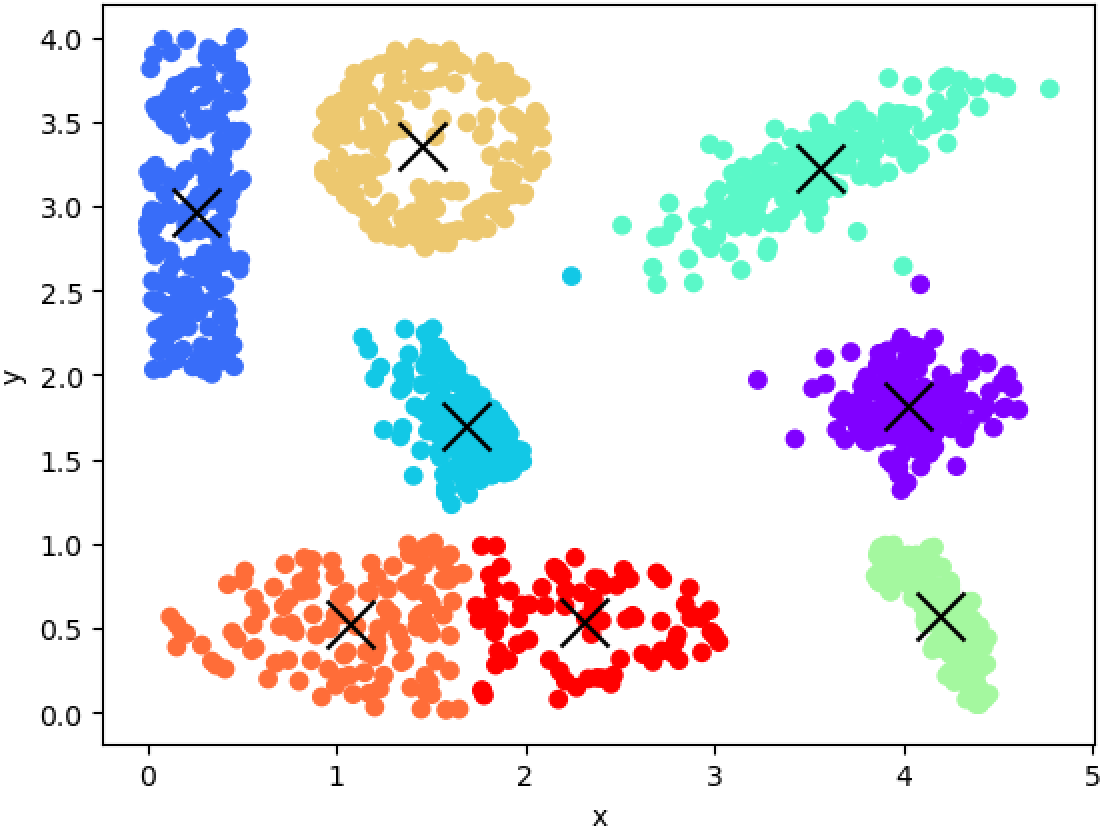
```
k = 8 ----- Silhouette Score = 0.6037426703909804
k = 9 ----- Silhouette Score = 0.6017911273196738
k = 10 ----- Silhouette Score = 0.5806289482553522
Optimal number of clusters: 8
```

In [4]:

```python
kmeans = KMeans(n_clusters=best_k)
kmeans.fit(main_df)

# get centroids and labels
centroids = kmeans.cluster_centers_
labels = kmeans.labels_


plt.scatter(main_df['x'], main_df['y'], c=labels, cmap='rainbow')
plt.scatter(centroids[:, 0], centroids[:, 1], s=300, c='black', marker='x')
plt.xlabel('x')
plt.ylabel('y')
plt.show()
```



The optimal number of clusters does not match the number of clusters expected from visual inspection of the data. According to the Silhouette method's results, the number of clusters is actually 8. The visually perceived single "big" oval cluster at the bottom of the plot is actually two different clusters that are very close together.

In [ ]: