Assignment - 6 K Means Clustering

In [31]:

```
import pandas as pd
import numpy as np
from sklearn.datasets import load_wine
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt
```

In [32]:

```
wine = load_wine()
wine_data = pd.DataFrame(wine.data, columns=wine.feature_names)
```

In [33]:

```
print(wine_data)
```

```
     alcohol  malic_acid   ash  alcalinity_of_ash  magnesium  total_phenols  \
0      14.23        1.71  2.43               15.6      127.0           2.80
1      13.20        1.78  2.14               11.2      100.0           2.65
2      13.16        2.36  2.67               18.6      101.0           2.80
3      14.37        1.95  2.50               16.8      113.0           3.85
4      13.24        2.59  2.87               21.0      118.0           2.80
..       ...         ...   ...                ...        ...            ...
173    13.71        5.65  2.45               20.5       95.0           1.68
174    13.40        3.91  2.48               23.0      102.0           1.80
175    13.27        4.28  2.26               20.0      120.0           1.59
176    13.17        2.59  2.37               20.0      120.0           1.65
177    14.13        4.10  2.74               24.5       96.0           2.05

     flavanoids  nonflavanoid_phenols  proanthocyanins  color_intensity   hue  \
0          3.06                  0.28             2.29             5.64  1.04
1          2.76                  0.26             1.28             4.38  1.05
2          3.24                  0.30             2.81             5.68  1.03
3          3.49                  0.24             2.18             7.80  0.86
4          2.69                  0.39             1.82             4.32  1.04
..          ...                   ...              ...              ...   ...
173        0.61                  0.52             1.06             7.70  0.64
174        0.75                  0.43             1.41             7.30  0.70
175        0.69                  0.43             1.35            10.20  0.59
176        0.68                  0.53             1.46             9.30  0.60
177        0.76                  0.56             1.35             9.20  0.61

     od280/od315_of_diluted_wines  proline
0                            3.92   1065.0
1                            3.40   1050.0
2                            3.17   1185.0
3                            3.45   1480.0
4                            2.93    735.0
..                            ...      ...
173                          1.74    740.0
174                          1.56    750.0
175                          1.56    835.0
176                          1.62    840.0
177                          1.60    560.0

[178 rows x 13 columns]
```

In [34]:

```
from sklearn.metrics import silhouette_score

silhouette_scores = []
for k in range(2, 11):
        kmeans = KMeans(n_clusters=k)
        kmeans.fit(wine_data)
        silhouette_scores.append(silhouette_score(wine_data, kmeans.labels_))
```

```
l:\Prodigy Internship\.venv\lib\site-packages\sklearn\cluster\_kmeans.py:1416: FutureWarning: The default
value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress t
he warning
  super()._check_params_vs_input(X, default_n_init=10)
l:\Prodigy Internship\.venv\lib\site-packages\sklearn\cluster\_kmeans.py:1416: FutureWarning: The default
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l:\Prodigy Internship\.venv\lib\site-packages\sklearn\cluster\_kmeans.py:1416: FutureWarning: The default
```

```
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```
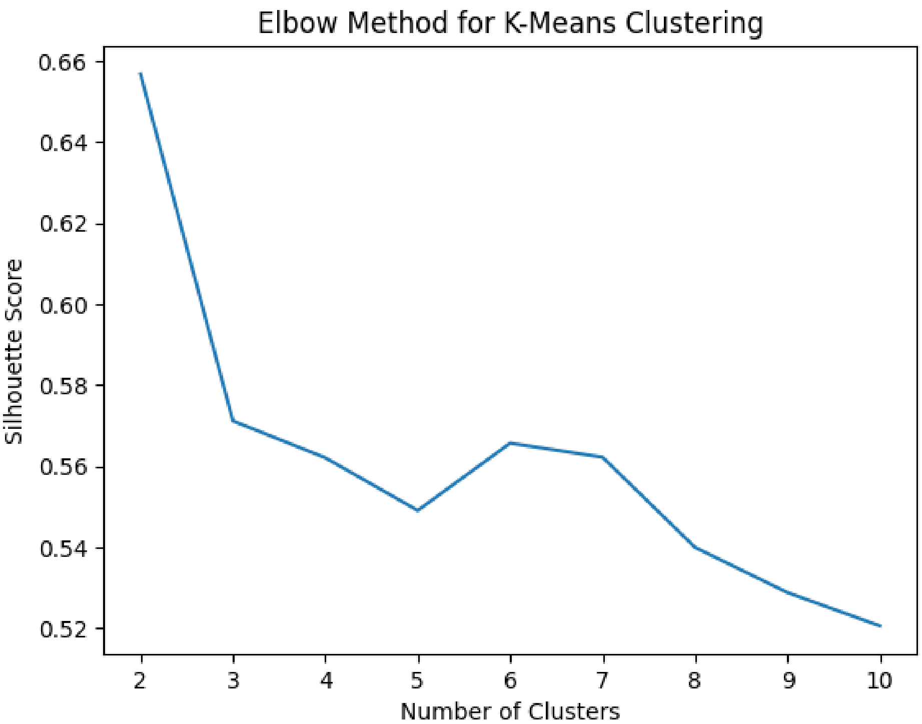

In [35]:

```
plt.plot(range(2, 11), silhouette_scores)
plt.xlabel("Number of Clusters")
plt.ylabel("Silhouette Score")
plt.title("Elbow Method for K-Means Clustering")
plt.show()
```



In [36]:

```
# Perform K-Means clustering with 7 clusters
kmeans = KMeans(n_clusters=7, random_state=42)
kmeans.fit(wine_data)
```

```
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```

Out[36]:

```
▾ KMeans
KMeans(n_clusters=7, random_state=42)
```

In [37]:

```
cluster_labels = kmeans.labels_
cluster_centers = kmeans.cluster_centers_
```

In [38]:

```
# Extract the first two features for visualization (assuming informative)
features_to_plot = [0, 1]
```

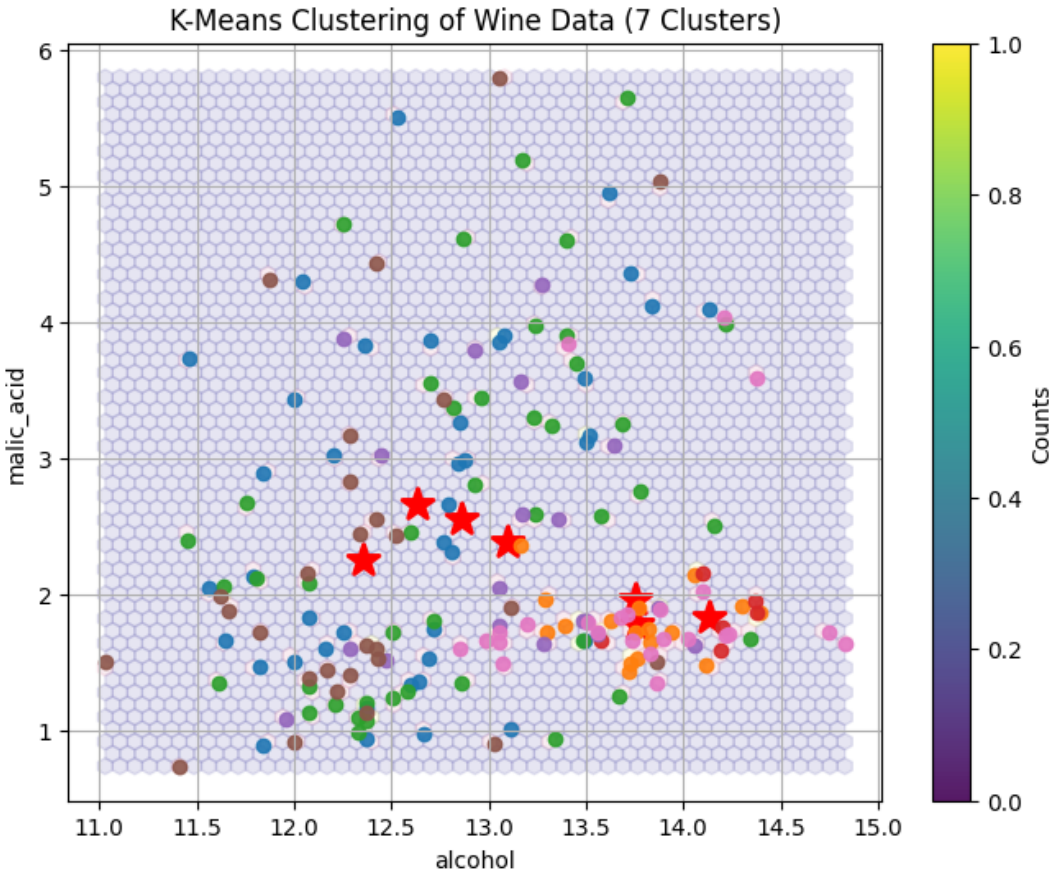
In [41]:

```
plt.figure(figsize=(8, 6))
plt.hexbin(wine_data.iloc[:, features_to_plot[0]], wine_data.iloc[:, features_to_plot[1]],
           gridsize=50, cmap='plasma', alpha=0.1)

cluster_centers = kmeans.cluster_centers_
plt.scatter(cluster_centers[:, features_to_plot[0]], cluster_centers[:, features_to_plot[1]],
           marker='*', c='red', s=200, linewidths=2)

for cluster_label in range(7):
    cluster_data = wine_data[cluster_labels == cluster_label]
    plt.scatter(cluster_data.iloc[:, features_to_plot[0]], cluster_data.iloc[:, features_to_plot[1]],
                label=f'Cluster {cluster_label}', alpha=0.9)

plt.xlabel(wine.feature_names[features_to_plot[0]])
plt.ylabel(wine.feature_names[features_to_plot[1]])
plt.title('K-Means Clustering of Wine Data (7 Clusters)')
plt.colorbar(label='Counts')
plt.grid(True)
plt.show()
```



In [ ]:

```
```