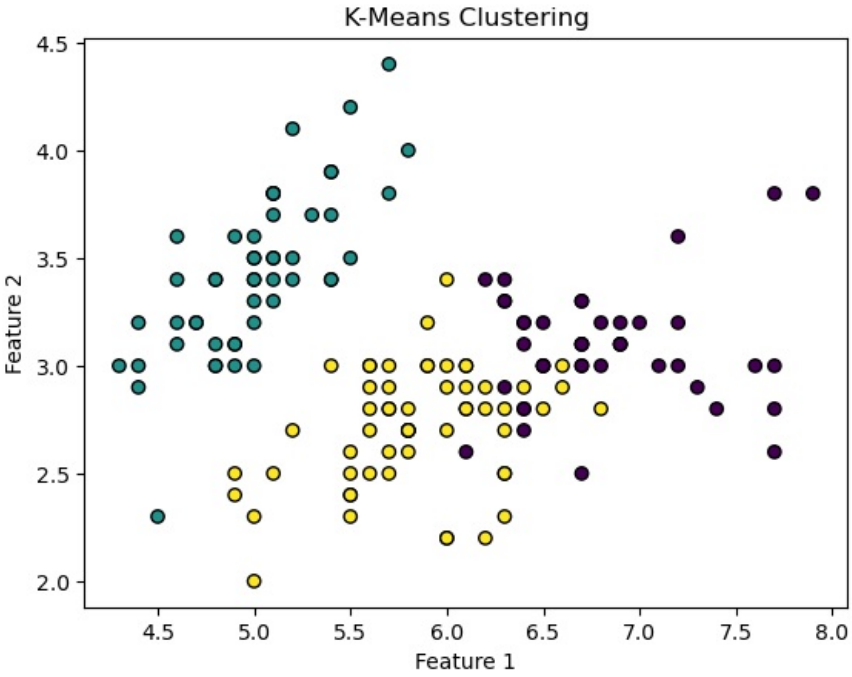
In [5]:
```
pip install pandas numpy matplotlib scikit-learn
```

```
Requirement already satisfied: pandas in c:\users\user\anaconda3\lib\site-packages (2.2.3)
Requirement already satisfied: numpy in c:\users\user\anaconda3\lib\site-packages (2.1.3)
Requirement already satisfied: matplotlib in c:\users\user\anaconda3\lib\site-packages (3.10.0)
Requirement already satisfied: scikit-learn in c:\users\user\anaconda3\lib\site-packages (1.6.1)
Requirement already satisfied: python-dateutil>=2.8.2 in c:\users\user\anaconda3\lib\site-packages (from pandas)
(2.9.0.post0)
Requirement already satisfied: pytz>=2020.1 in c:\users\user\anaconda3\lib\site-packages (from pandas) (2024.1)
Requirement already satisfied: tzdata>=2022.7 in c:\users\user\anaconda3\lib\site-packages (from pandas) (2025.2
)
Requirement already satisfied: contourpy>=1.0.1 in c:\users\user\anaconda3\lib\site-packages (from matplotlib) (
1.3.1)
Requirement already satisfied: cycler>=0.10 in c:\users\user\anaconda3\lib\site-packages (from matplotlib) (0.11
.0)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\user\anaconda3\lib\site-packages (from matplotlib)
(4.55.3)
Requirement already satisfied: kiwisolver>=1.3.1 in c:\users\user\anaconda3\lib\site-packages (from matplotlib)
(1.4.8)
Requirement already satisfied: packaging>=20.0 in c:\users\user\anaconda3\lib\site-packages (from matplotlib) (2
4.2)
Requirement already satisfied: pillow>=8 in c:\users\user\anaconda3\lib\site-packages (from matplotlib) (11.1.0)
Requirement already satisfied: pyparsing>=2.3.1 in c:\users\user\anaconda3\lib\site-packages (from matplotlib) (
3.2.0)
Requirement already satisfied: scipy>=1.6.0 in c:\users\user\anaconda3\lib\site-packages (from scikit-learn) (1.
15.3)
Requirement already satisfied: joblib>=1.2.0 in c:\users\user\anaconda3\lib\site-packages (from scikit-learn) (1
.4.2)
Requirement already satisfied: threadpoolctl>=3.1.0 in c:\users\user\anaconda3\lib\site-packages (from scikit-le
arn) (3.5.0)
Requirement already satisfied: six>=1.5 in c:\users\user\anaconda3\lib\site-packages (from python-dateutil>=2.8.
2->pandas) (1.17.0)
Note: you may need to restart the kernel to use updated packages.
```

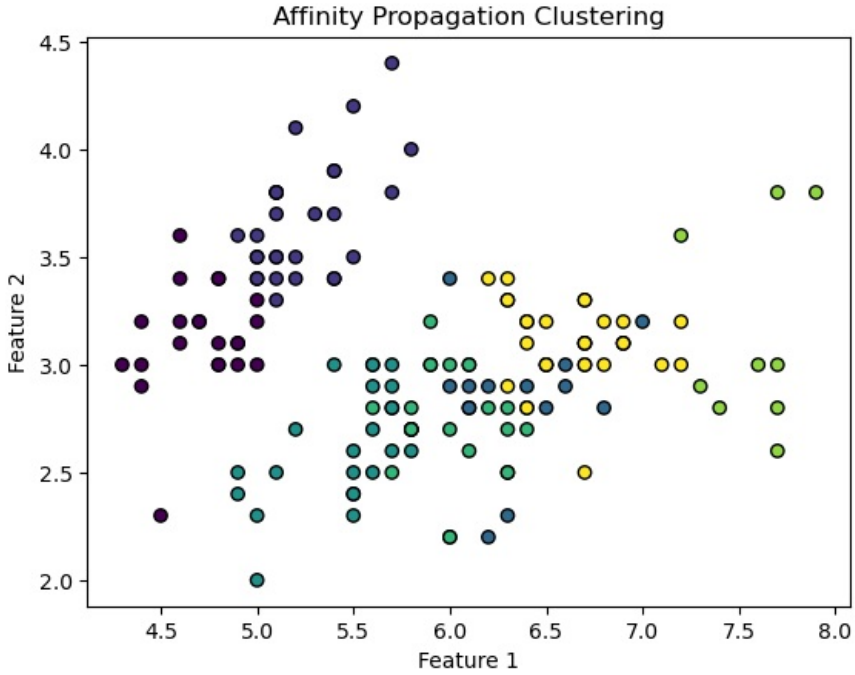
In [6]:
```python
# Import libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans, AffinityPropagation, Birch
from sklearn.metrics import silhouette_score, davies_bouldin_score, calinski_harabasz_score
from sklearn.datasets import load_iris

# Load Iris dataset
iris = load_iris()
data = pd.DataFrame(data=np.c_[iris['data'], iris['target']], columns=iris['feature_names'] + ['target'])

# Select relevant features for clustering
selected_features = ['sepal length (cm)', 'sepal width (cm)', 'petal length (cm)', 'petal width (cm)']
X = data[selected_features]

# K-means clustering function
def kmeans_clustering(X, n_clusters=3):
    model = KMeans(n_clusters=n_clusters, random_state=42)
    labels = model.fit_predict(X)
    return labels

# Affinity Propagation clustering function
def affinity_propagation_clustering(X):
    model = AffinityPropagation()
    labels = model.fit_predict(X)
    return labels

# Birch clustering function
def birch_clustering(X, n_clusters=3):
    model = Birch(n_clusters=n_clusters)
    labels = model.fit_predict(X)
    return labels

# Function to evaluate clustering metrics
def evaluate_clustering(X, labels, algorithm):
    silhouette = silhouette_score(X, labels)
    db_index = davies_bouldin_score(X, labels)
    ch_index = calinski_harabasz_score(X, labels)

    print(f'Evaluation Metrics for {algorithm}:')
    print(f'Silhouette Score: {silhouette}')
    print(f'Davies-Bouldin Index: {db_index}')
    print(f'Calinski-Harabasz Index: {ch_index}\n')

# Function to plot clusters
def plot_clusters(X, labels, algorithm):
    plt.scatter(X.iloc[:, 0], X.iloc[:, 1], c=labels, cmap='viridis', marker='o', edgecolors='k')
```

```
    plt.title(f'{algorithm} Clustering')
    plt.xlabel('Feature 1')
    plt.ylabel('Feature 2')
    plt.show()

# Apply K-means clustering
kmeans_labels = kmeans_clustering(X)
evaluate_clustering(X, kmeans_labels, 'K-Means Clustering')
plot_clusters(X, kmeans_labels, 'K-Means')

# Apply Affinity Propagation clustering
affinity_labels = affinity_propagation_clustering(X)
evaluate_clustering(X, affinity_labels, 'Affinity Propagation')
plot_clusters(X, affinity_labels, 'Affinity Propagation')

# Apply Birch clustering
birch_labels = birch_clustering(X)
evaluate_clustering(X, birch_labels, 'Birch Clustering')
plot_clusters(X, birch_labels, 'Birch')
```

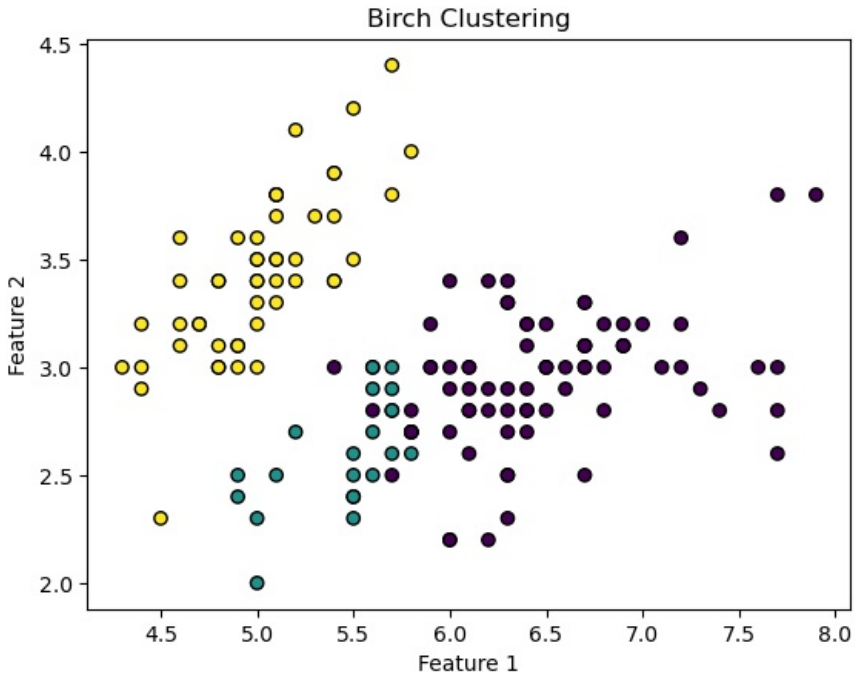
```
C:\Users\User\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1419: UserWarning: KMeans is known to have a memory leak on Windows with MKL, when there are less chunks than available threads. You can avoid it by setting the environment variable OMP_NUM_THREADS=1.
  warnings.warn(
Evaluation Metrics for K-Means Clustering:
Silhouette Score: 0.5511916046195919
Davies-Bouldin Index: 0.6660385791628491
Calinski-Harabasz Index: 561.5937320156642
```




```
Evaluation Metrics for Affinity Propagation:
Silhouette Score: 0.3474081937055608
Davies-Bouldin Index: 0.985397223305653
Calinski-Harabasz Index: 443.79711286686637
```




```
Evaluation Metrics for Birch Clustering:
Silhouette Score: 0.5019524848046079
Davies-Bouldin Index: 0.6258305924331681
Calinski-Harabasz Index: 458.47251055625765
```



In [ ]: