Q. Write a program to implement Support Vector Machine Algorithm to solve classification problem on two different datasets individually.

For Dataset: Nissan-data.csv

Importing necessary libraries

```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.svm import SVC
from sklearn.metrics import classification_report, confusion_matrix,
accuracy_score
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.preprocessing import StandardScaler, LabelEncoder
```

Importing first dataset and head of the df

```
df = pd.read_csv('nissan-dataset.csv')
df.head()

   id             full_name   age       gender           model    color  \
0   1        Dominic Applin  42.0         Male           Quest     Mauv
1   2           Lenee Eteen  54.0   Polygender         R'nessa   Orange
2   3        Kendal Esselin  37.0         Male  March / Micra     Teal
3   4  Nehemiah Marvelley  55.0         Male          Gloria    Green
4   5     Domenic McGeouch  21.0         Male          Avenir    Khaki

   performance        km  condition     price
0        299.0  509305.0   very bad  40394.91
1        109.0  965853.0        old   8687.90
2         52.0  380906.0        bad  44705.31
3        336.0  573171.0  very good  32889.88
4          2.0  809470.0        old   6949.22

df.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 10 columns):

 #    Column        Non-Null Count   Dtype
---   -------       --------------   -----
 0    id            10000 non-null   int64
 1    full_name     9157 non-null    object
 2    age           9154 non-null    float64
 3    gender        9144 non-null    object
 4    model         9130 non-null    object
 5    color         9139 non-null    object
 6   performance  9143 non-null   float64
 7   km           9141 non-null   float64
 8   condition    9151 non-null   object 
 9   price        9159 non-null   float64
dtypes: float64(4), int64(1), object(5)
memory usage: 781.4+ KB
```

```python
df.isnull().sum()
```

```
id               0
full_name      843
age            846
gender         856
model          870
color          861
performance    857
km             859
condition      849
price          841
dtype: int64
```

```python
df.dropna(inplace=True)
```

```python
df.isnull().sum()
```

```
id             0
full_name      0
age            0
gender         0
model          0
color          0
performance    0
km             0
condition      0
price          0
dtype: int64
```

```python
df.describe()
```

```
                 id          age  performance             km          price
count   9053.000000  9053.000000  9053.000000    9053.000000    9053.000000
mean    4983.303435    43.080305   197.822379  503871.380979   27361.050557
std     2905.407440    14.783407   112.850882  284898.768044   13463.534018
min        1.000000    18.000000     0.000000     808.000000    5000.250000
25%     2470.000000    31.000000   102.000000  258709.000000   15960.500000
50%     4969.000000    43.000000   196.000000  502308.000000   27328.560000
75%     7510.000000    56.000000   296.000000  749260.000000   38385.630000
max    10000.000000    69.000000   399.000000  999915.000000  215674.780000
```

```python
df['price'] = pd.to_numeric(df['price'], errors='coerce')
```

```python
median_price = df['price'].median()
df['high_price'] = (df['price'] > median_price).astype(int)
```

```python
df = df.drop(['id', 'full_name', 'price','gender'], axis=1)
```

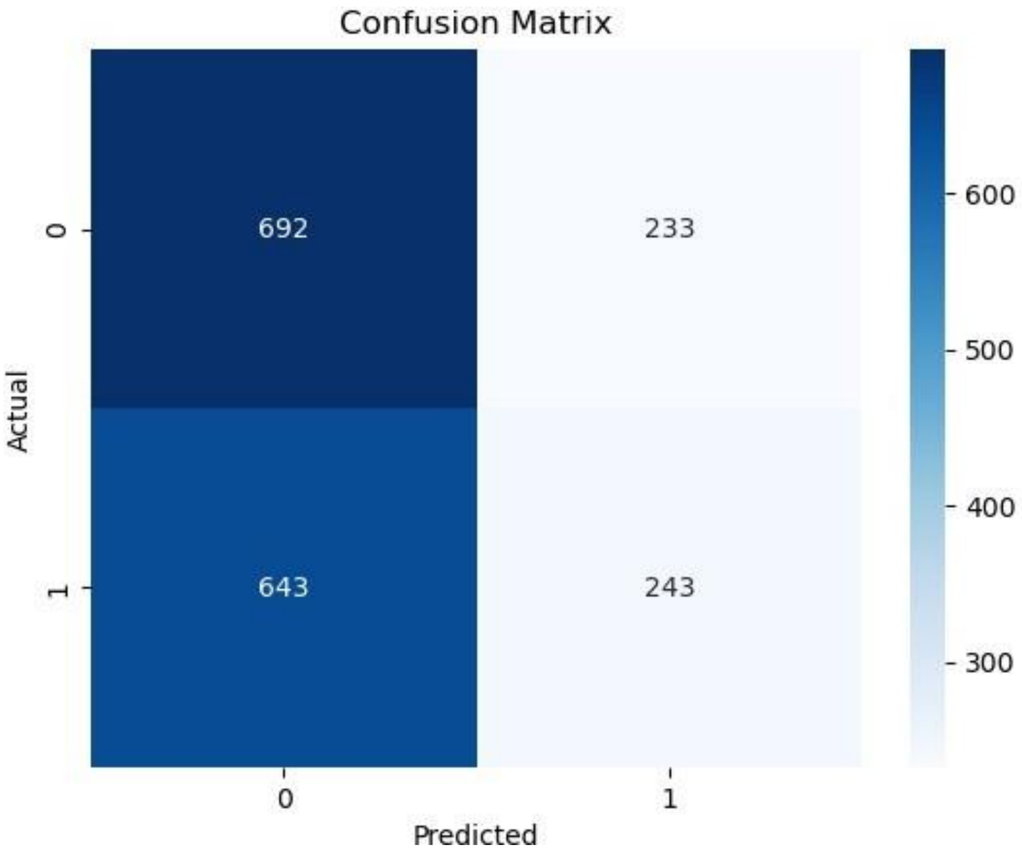
```python
df = pd.get_dummies(df, drop_first=True)
```

```python
X = df.drop('high_price', axis=1)
y = df['high_price']
```

```python
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,
random_state=42)

svm_model = SVC(kernel='linear')

svm_model.fit(X_train, y_train)

y_pred = svm_model.predict(X_test)

conf_matrix = confusion_matrix(y_test, y_pred)
class_report = classification_report(y_test, y_pred)
accuracy = accuracy_score(y_test, y_pred)

print("Confusion Matrix:")
print(conf_matrix)

print("\nClassification Report:")
print(class_report)

print("\nAccuracy Score:")
print(accuracy)
```

```
Confusion Matrix:
[[692 233]
 [643 243]]

Classification Report:
              precision    recall  f1-score   support

           0       0.52      0.75      0.61       925
           1       0.51      0.27      0.36       886

    accuracy                           0.52      1811
   macro avg       0.51      0.51      0.48      1811
weighted avg       0.51      0.52      0.49      1811


Accuracy Score:
0.5162893429044727
```

```python
sns.heatmap(conf_matrix, annot=True, fmt='d', cmap='Blues')
plt.title('Confusion Matrix')
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.show()
```



For dataset: Plant growth data

```
df1 = pd.read_csv('plant_growth_data.csv')
df1.head()

  Soil_Type  Sunlight_Hours Water_Frequency Fertilizer_Type  Temperature  \
0      loam        5.192294       bi-weekly        chemical    31.719602
1     sandy        4.033133          weekly         organic    28.919484
2      loam        8.892769       bi-weekly            none    23.179059
3      loam        8.241144       bi-weekly            none    18.465886
4     sandy        8.374043       bi-weekly         organic    18.128741

    Humidity  Growth_Milestone
0  61.591861                 0
1  52.422276                 1
2  44.660539                 0
3  46.433227                 0
4  63.625923                 0

df1.isnull().sum()

Soil_Type           0
Sunlight_Hours      0
Water_Frequency     0
Fertilizer_Type     0
Temperature         0
Humidity            0
Growth_Milestone    0
dtype: int64

df1.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 193 entries, 0 to 192
```

```
Data columns (total 7 columns):
 #   Column            Non-Null Count   Dtype
---  -------           ---------------  ---------
 0   Soil_Type         193 non-null     object
 1   Sunlight_Hours    193 non-null     float64
 2   Water_Frequency   193 non-null     object
 3   Fertilizer Type   193 non-null     object
 4   Temperature       193 non-null     float64
 5   Humidity          193 non-null     float64
 6   Growth_Milestone 193 non-null      int64
dtypes: float64(3), int64(1), object(3)
memory usage: 10.7+ KB
```

```
df1.describe()
```

```
       Sunlight_Hours  Temperature    Humidity  Growth_Milestone
count      193.000000   193.000000  193.000000        193.000000
mean         6.826484    25.076087   58.098927          0.497409
std          1.599509     5.354170   12.631799          0.501294
min          4.033133    15.200000   30.567682          0.000000
25%          5.477000    20.637095   49.300000          0.000000
50%          6.833290    25.912336   59.182806          0.000000
75%          8.241144    29.757938   69.100000          1.000000
max          9.913903    34.810103   79.648240          1.000000
```

```
label_encoders = {}
categorical_columns = ['Soil_Type', 'Water_Frequency', 'Fertilizer_Type']
for column in categorical_columns:
    le = LabelEncoder()
    df1[column] = le.fit_transform(df1[column])
    label_encoders[column] = le
```

```
df1.head()
```

```
   Soil_Type  Sunlight_Hours  Water_Frequency  Fertilizer_Type  Temperature  \
0          1        5.192294                0                0    31.719602
1          2        4.033133                2                2    28.919484
2          1        8.892769                0                1    23.179059
3          1        8.241144                0                1    18.465886
4          2        8.374043                0                2    18.128741

    Humidity  Growth_Milestone
0  61.591861                 0
1  52.422276                 1
2  44.660539                 0
3  46.433227                 0
4  63.625923                 0
```

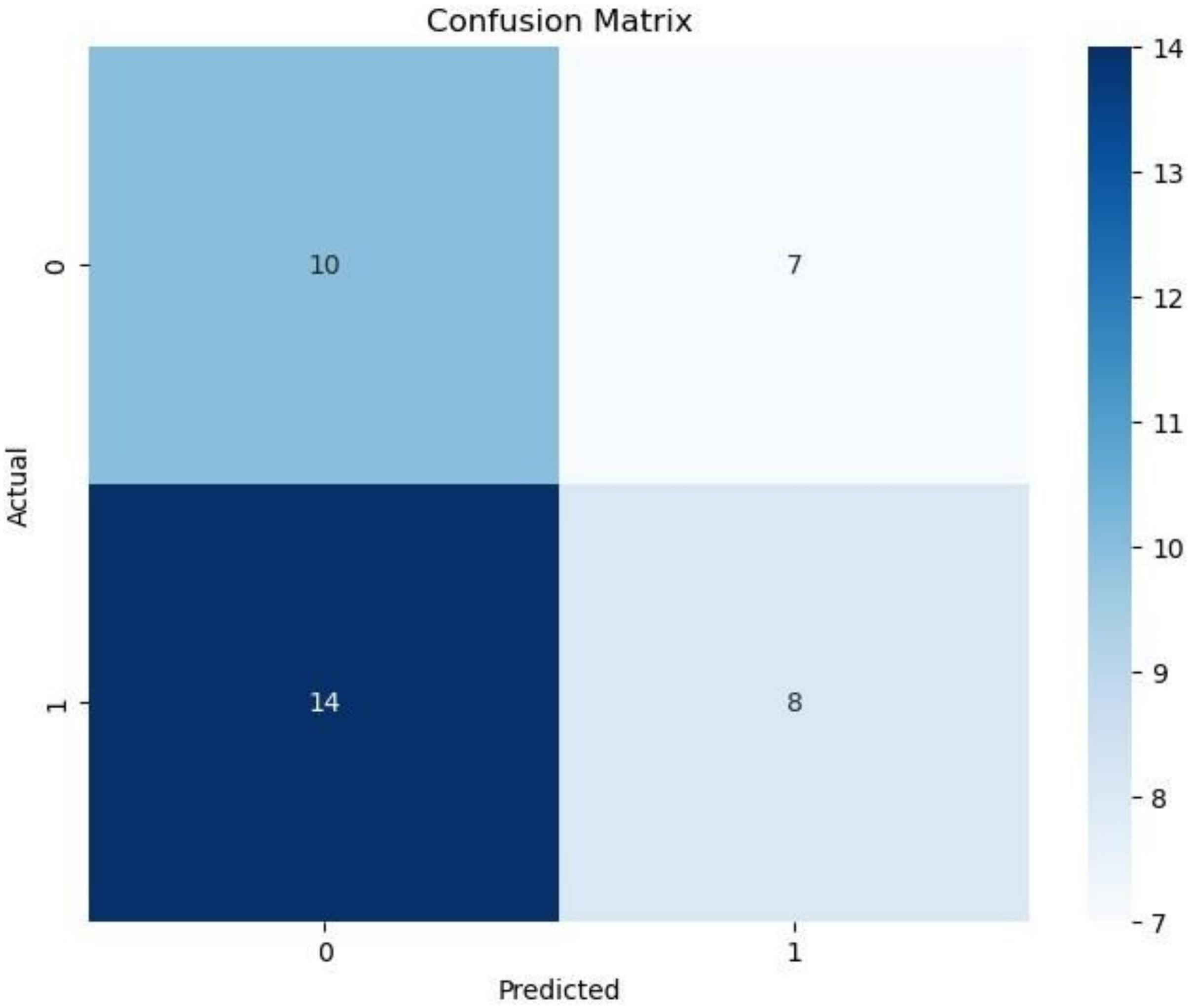
```
X = df1.drop('Growth_Milestone', axis=1)
y = df1['Growth_Milestone']
```

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,
random_state=42)
```

```
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
```

```
svm = SVC(kernel='linear')
svm.fit(X_train, y_train)
```

```
SVC(kernel='linear')

y_pred = svm.predict(X_test)

print("Classification Report:\n", classification_report(y_test, y_pred))

Classification Report:
               precision    recall  f1-score   support

           0       0.42      0.59      0.49        17
           1       0.53      0.36      0.43        22

    accuracy                           0.46        39
   macro avg       0.47      0.48      0.46        39
weighted avg       0.48      0.46      0.46        39


plt.figure(figsize=(8, 6))
sns.heatmap(confusion_matrix(y_test, y_pred), annot=True, fmt='d',
cmap='Blues')
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.title('Confusion Matrix')
plt.show()
```


Confusion Matrix
Actual
Predicted