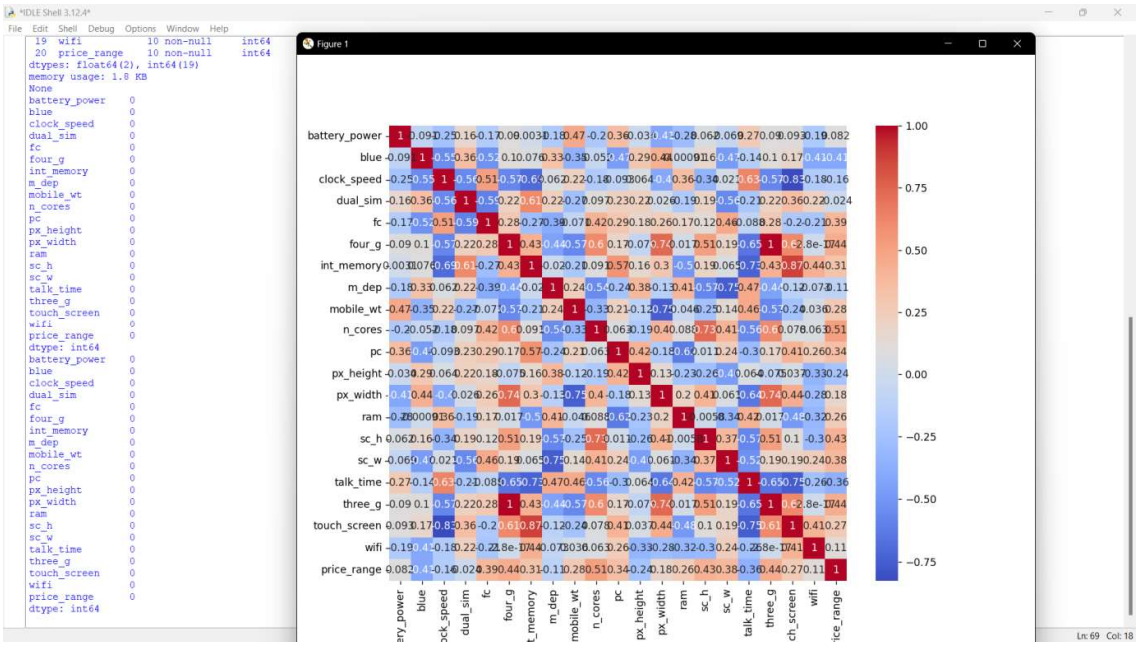
Machine learning day 1

#1

```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.naive_bayes import GaussianNB
from sklearn.metrics import accuracy_score

# Step 1: Reading the dataset
data = pd.DataFrame({
    'battery_power': [842, 1021, 563, 615, 1821, 1859, 1821, 1954, 1445, 509],
    'blue': [0, 1, 1, 0, 0, 1, 1, 0, 1, 1],
    'clock_speed': [2.2, 0.5, 0.5, 2.5, 1.2, 0.5, 1.0, 0.5, 1.7, 0.5],
    'dual_sim': [0, 1, 1, 0, 1, 0, 1, 1, 1, 1],
    'fc': [1, 0, 2, 13, 3, 4, 0, 3, 0, 0],
    'four_g': [0, 1, 1, 1, 1, 1, 1, 1, 0, 1],
    'int_memory': [7, 53, 41, 10, 44, 22, 4, 53, 22, 46],
    'm_dep': [0.6, 0.7, 0.9, 0.2, 0.5, 0.3, 0.4, 0.1, 0.8, 0.1],
    'mobile_wt': [188, 136, 145, 131, 141, 164, 139, 187, 174, 93],
    'n_cores': [2, 3, 5, 6, 2, 3, 5, 6, 2, 5],
    'pc': [2, 6, 6, 9, 14, 7, 0, 16, 10, 6],
    'px_height': [20, 905, 1263, 1216, 1208, 1004, 381, 512, 1988, 754],
    'px_width': [756, 1988, 1716, 1786, 1215, 1654, 1366, 1028, 858, 1784],
    'ram': [2549, 2631, 2603, 2769, 1411, 1067, 3220, 700, 1099, 513],
    'sc_h': [9, 17, 11, 16, 8, 13, 17, 19, 11, 16],
    'sc_w': [7, 3, 2, 8, 2, 8, 1, 10, 0, 7],
    'talk_time': [19, 7, 9, 11, 15, 10, 18, 5, 19, 2],
    'three_g': [0, 1, 1, 1, 1, 1, 1, 1, 0, 1],
    'touch_screen': [0, 1, 1, 0, 1, 1, 0, 1, 0, 1],
    'wifi': [1, 0, 1, 0, 1, 0, 0, 1, 0, 1],
```

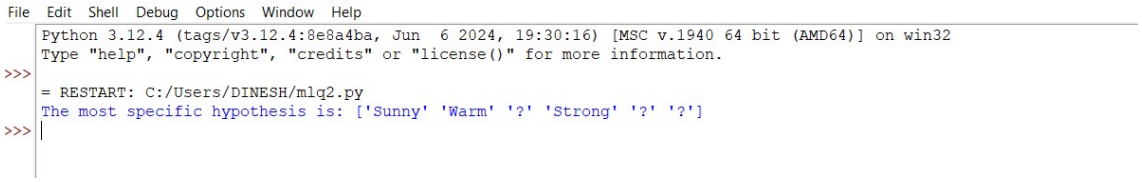
```
    'price_range': [1, 2, 2, 2, 1, 1, 1, 3, 0, 0]
})

# Step 2: Printing the first five rows
print(data.head())

# Step 3: Basic statistical computations
print(data.describe())

# Step 4: Identifying columns and their data types
print(data.info())

# Step 5: Detecting and handling null values
print(data.isnull().sum())

# Replacing null values with mode
for column in data.columns:
    if data[column].isnull().sum() > 0:
        mode_value = data[column].mode()[0]
        data[column].fillna(mode_value, inplace=True)

print(data.isnull().sum())

# Step 6: Exploring the dataset using a heatmap
plt.figure(figsize=(10, 8))
sns.heatmap(data.corr(), annot=True, cmap='coolwarm')
plt.show()

# Step 7: Splitting the data into training and testing sets
X = data.drop('price_range', axis=1)
y = data['price_range']
```

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

# Step 8: Fitting the Naive Bayes Classifier model
model = GaussianNB()
model.fit(X_train, y_train)

# Step 9: Predicting with the model
y_pred = model.predict(X_test)

# Step 10: Finding the accuracy of the model
accuracy = accuracy_score(y_test, y_pred)
print(f'Accuracy of the Naive Bayes Classifier: {accuracy:.2f}')
#output
```




```
#02
import pandas as pd

data = {
```

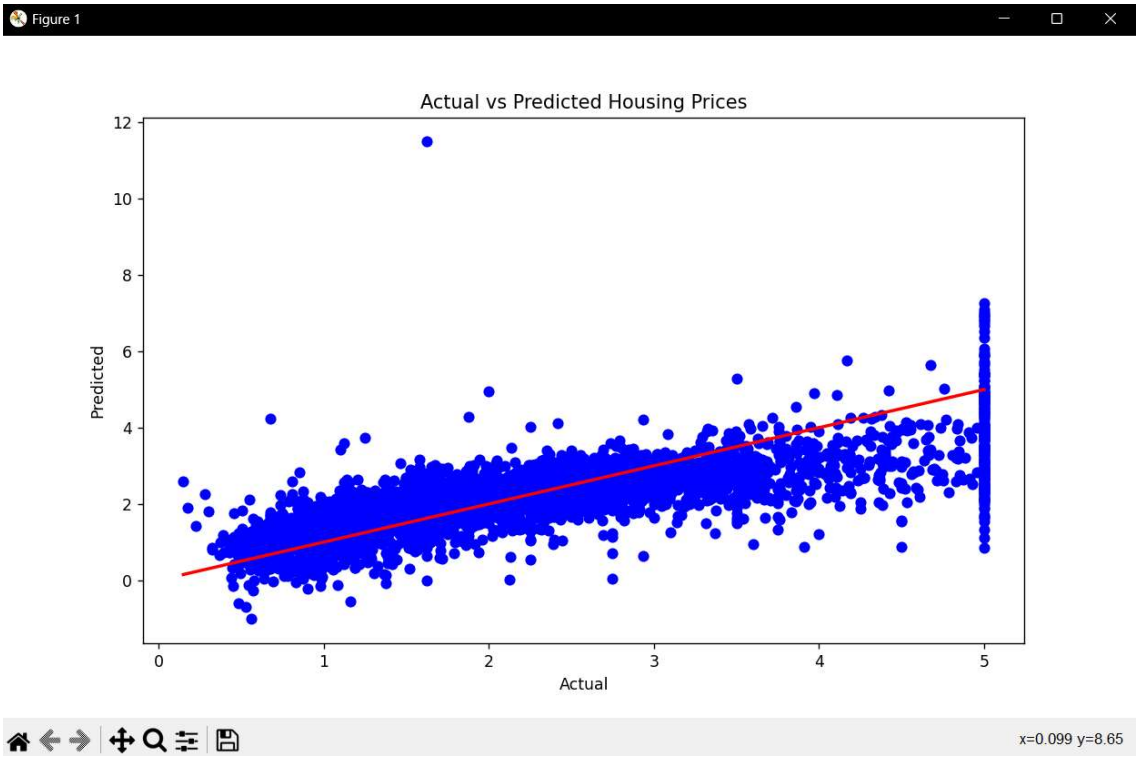
```
    'Sky': ['Sunny', 'Sunny', 'Rainy', 'Sunny'],
    'Air Temp': ['Warm', 'Warm', 'Cold', 'Warm'],
    'Humidity': ['Normal', 'High', 'High', 'High'],
    'Wind': ['Strong', 'Strong', 'Strong', 'Strong'],
    'Water': ['Warm', 'Warm', 'Warm', 'Cool'],
    'Forecast': ['Same', 'Same', 'Change', 'Change'],
    'Enjoy Sport': ['Yes', 'Yes', 'No', 'Yes']
}
df = pd.DataFrame(data)

def find_s_algorithm(dataframe):
    features = dataframe.iloc[:, :-1].values
    target = dataframe.iloc[:, -1].values
    hypothesis = None
    for i in range(len(target)):
        if target[i] == 'Yes':
            hypothesis = features[i].copy()
            break
    for i in range(len(features)):
        if target[i] == 'Yes':
            for j in range(len(hypothesis)):
                if hypothesis[j] != features[i][j]:
                    hypothesis[j] = '?'

    return hypothesis
hypothesis = find_s_algorithm(df)
print('The most specific hypothesis is:', hypothesis)
#output
```



#03

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.datasets import fetch_california_housing
from sklearn.metrics import mean_squared_error, r2_score
# Step 1: Load the dataset
housing = fetch_california_housing()
X = pd.DataFrame(housing.data, columns=housing.feature_names)
y = pd.Series(housing.target)
# Step 2: Split the dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
# Step 3: Train the Linear Regression model
model = LinearRegression()
model.fit(X_train, y_train)
# Step 4: Make predictions
y_pred = model.predict(X_test)
# Step 5: Evaluate the model's performance
mse = mean_squared_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print(f'Mean Squared Error: {mse:.2f}')
print(f'R^2 Score: {r2:.2f}')
```

```
plt.figure(figsize=(10, 6))
plt.scatter(y_test, y_pred, color='blue')
plt.plot([min(y_test), max(y_test)], [min(y_test), max(y_test)], color='red', linewidth=2)
plt.xlabel('Actual')
plt.ylabel('Predicted')
plt.title('Actual vs Predicted Housing Prices')
plt.show()
#output
```

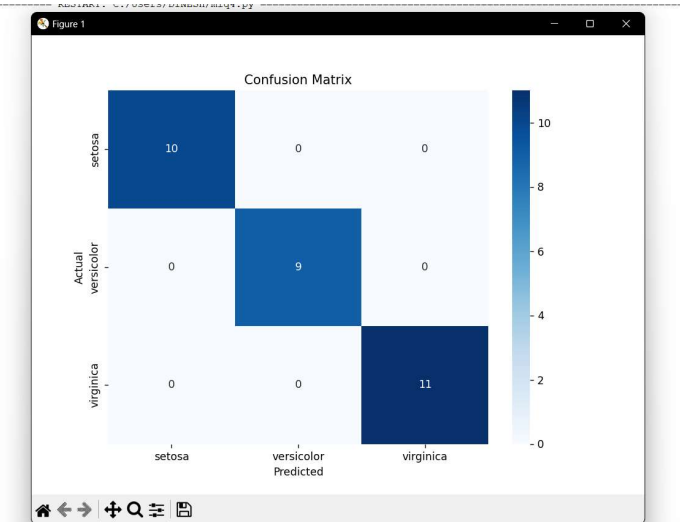



```
#04
import pandas as pd
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import accuracy_score, classification_report, confusion_matrix
import seaborn as sns
import matplotlib.pyplot as plt
```

```
# Step 1: Load the Iris dataset
iris = load_iris()
X = pd.DataFrame(iris.data, columns=iris.feature_names)
y = pd.Series(iris.target)

# Step 2: Split the dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Step 3: Train the KNN model
knn = KNeighborsClassifier(n_neighbors=3)
knn.fit(X_train, y_train)

# Step 4: Make predictions
y_pred = knn.predict(X_test)

# Step 5: Evaluate the model's performance
accuracy = accuracy_score(y_test, y_pred)
print(f'Accuracy: {accuracy:.2f}')
print('Classification Report:')
print(classification_report(y_test, y_pred))

# Step 6: Visualize the results
conf_matrix = confusion_matrix(y_test, y_pred)
plt.figure(figsize=(8, 6))
sns.heatmap(conf_matrix, annot=True, fmt='d', cmap='Blues', xticklabels=iris.target_names,
yticklabels=iris.target_names)
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.title('Confusion Matrix')
plt.show()
```

#output

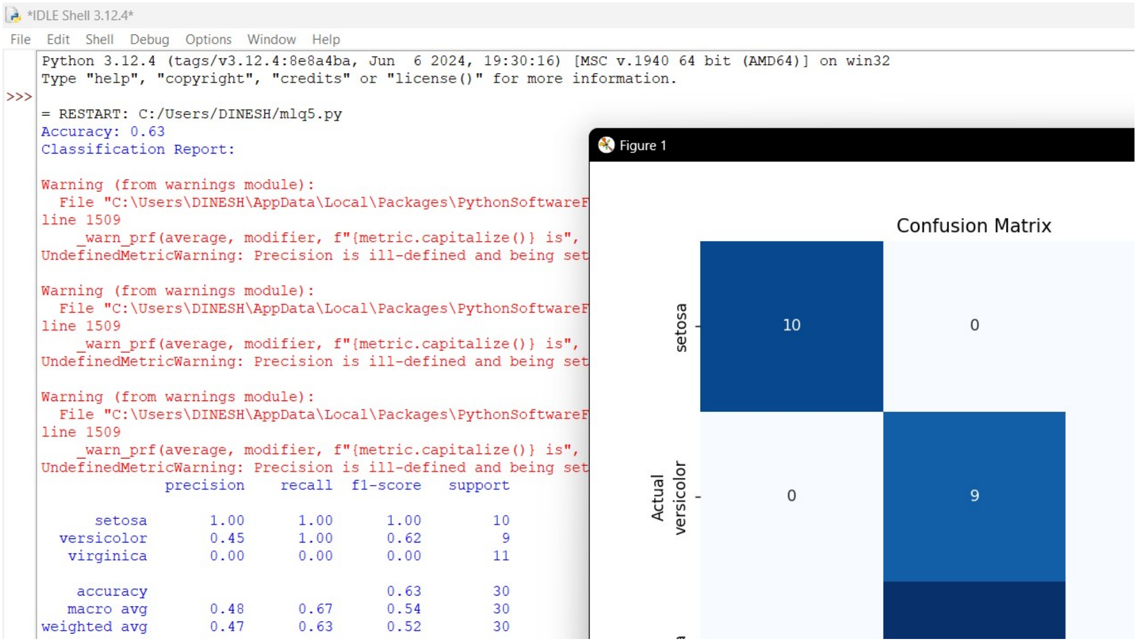
```
Accuracy: 1.00
Classification Report:
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        10
           1       1.00      1.00      1.00         9
           2       1.00      1.00      1.00        11

    accuracy                           1.00        30
   macro avg       1.00      1.00      1.00        30
weighted avg       1.00      1.00      1.00        30
```



#05

```
import numpy as np
import pandas as pd
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
from sklearn.linear_model import Perceptron
from sklearn.metrics import accuracy_score, classification_report, confusion_matrix
import seaborn as sns
import matplotlib.pyplot as plt

# Step 1: Load the Iris dataset
iris = load_iris()
X = pd.DataFrame(iris.data, columns=iris.feature_names)
y = pd.Series(iris.target)

# Step 2: Split the dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Step 3: Train the Perceptron model using One-vs-Rest (OvR) strategy
```

```
perceptron = Perceptron(max_iter=1000, tol=1e-3, random_state=42)
perceptron.fit(X_train, y_train)

# Step 4: Make predictions
y_pred = perceptron.predict(X_test)

# Step 5: Evaluate the model's performance
accuracy = accuracy_score(y_test, y_pred)
print(f'Accuracy: {accuracy:.2f}')
print('Classification Report:')
print(classification_report(y_test, y_pred, target_names=iris.target_names))

# Step 6: Visualize the results
# Confusion matrix
conf_matrix = confusion_matrix(y_test, y_pred)
plt.figure(figsize=(8, 6))
sns.heatmap(conf_matrix, annot=True, fmt='d', cmap='Blues', xticklabels=iris.target_names,
yticklabels=iris.target_names)
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.title('Confusion Matrix')
plt.show()
```



#06

```
import pandas as pd


# Step 1: Load the training data from a CSV file
data = {
    'Sky': ['Sunny', 'Sunny', 'Rainy', 'Sunny'],
    'Air Temp': ['Warm', 'Warm', 'Cold', 'Warm'],
    'Humidity': ['Normal', 'High', 'High', 'High'],
    'Wind': ['Strong', 'Strong', 'Strong', 'Strong'],
    'Water': ['Warm', 'Warm', 'Warm', 'Cool'],
    'Forecast': ['Same', 'Same', 'Change', 'Change'],
    'Enjoy Sport': ['Yes', 'Yes', 'No', 'Yes']
}
df = pd.DataFrame(data)


# Convert the dataframe to a list of lists
examples = df.values.tolist()
```

```
# Step 2: Initialize the general (G) and specific (S) hypotheses
def initialize_hypotheses(examples):
    specific_h = examples[0][:-1].copy()
    general_h = [['?' for _ in range(len(specific_h))] for _ in range(len(specific_h))]
    return specific_h, general_h

def consistent(hypothesis, example):
    for h, e in zip(hypothesis, example):
        if h != '?' and h != e:
            return False
    return True

def candidate_elimination(examples):
    specific_h, general_h = initialize_hypotheses(examples)
    print(f"Initial Specific Hypothesis: {specific_h}")
    print(f"Initial General Hypothesis: {general_h}")

    for i, example in enumerate(examples):
        if example[-1] == 'Yes':
            for j in range(len(specific_h)):
                if not consistent(specific_h, example[:-1]):
                    specific_h[j] = '?' if specific_h[j] != example[j] else specific_h[j]
            for g in general_h:
                if not consistent(g, example[:-1]):
                    general_h.remove(g)
        else:
            new_general_h = []
            for g in general_h:
                for j in range(len(specific_h)):
                    if g[j] == '?':
                        for value in df.iloc[:, j].unique():
```

```
                    if value != specific_h[j]:
                        new_g = g.copy()
                        new_g[j] = value
                        if consistent(new_g, specific_h):
                            new_general_h.append(new_g)
            general_h = new_general_h.copy()

        print(f"\nExample {i + 1} processed")
        print(f"Specific Hypothesis: {specific_h}")
        print(f"General Hypothesis: {general_h}")

    return specific_h, general_h

# Step 3: Apply the Candidate-Elimination algorithm to the dataset
specific_h, general_h = candidate_elimination(examples)

# Step 4: Output the final version space
print("\nFinal Version Space:")
print(f"Specific Hypothesis: {specific_h}")
print(f"General Hypothesis: {general_h}")
#output
```

#07

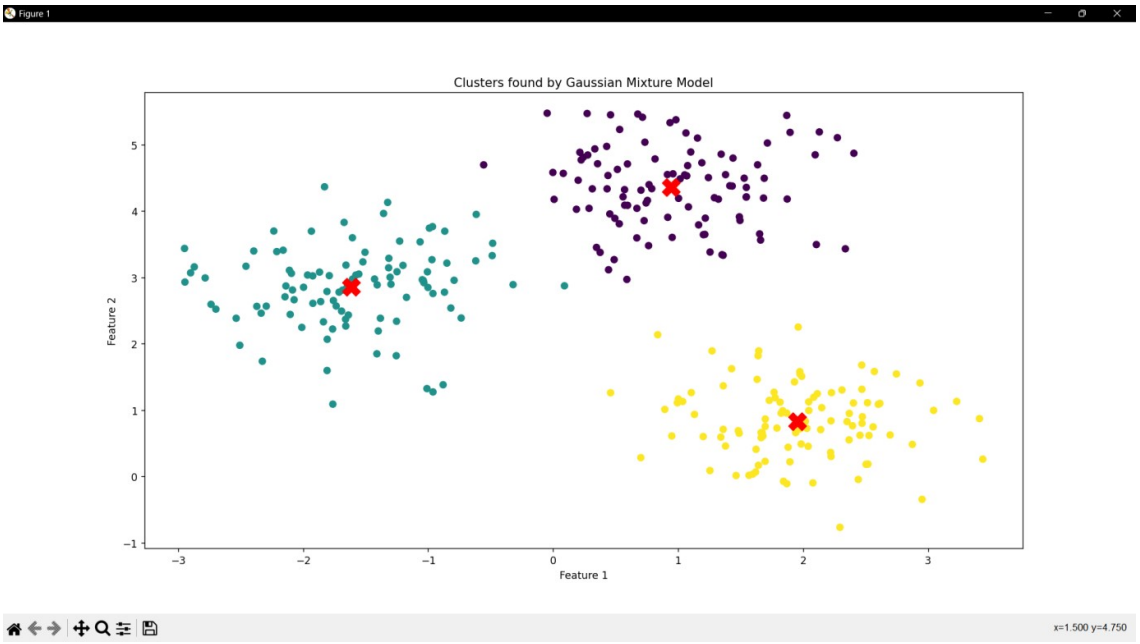
```
import pandas as pd
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score, classification_report, confusion_matrix
import seaborn as sns
import matplotlib.pyplot as plt

# Step 1: Load the Iris dataset
iris = load_iris()
X = pd.DataFrame(iris.data, columns=iris.feature_names)
y = pd.Series(iris.target)

# Step 2: Split the dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Step 3: Train the Logistic Regression model
```

```
log_reg = LogisticRegression(max_iter=200)
log_reg.fit(X_train, y_train)

# Step 4: Make predictions
y_pred = log_reg.predict(X_test)

# Step 5: Evaluate the model's performance
accuracy = accuracy_score(y_test, y_pred)
print(f'Accuracy: {accuracy:.2f}')
print('Classification Report:')
print(classification_report(y_test, y_pred, target_names=iris.target_names))

# Step 6: Visualize the results
# Confusion matrix
conf_matrix = confusion_matrix(y_test, y_pred)
plt.figure(figsize=(8, 6))
sns.heatmap(conf_matrix, annot=True, fmt='d', cmap='Blues', xticklabels=iris.target_names,
yticklabels=iris.target_names)
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.title('Confusion Matrix')
plt.show()
```

#08

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.mixture import GaussianMixture
from sklearn.datasets import make_blobs
import seaborn as sns

# Step 1: Generate a synthetic dataset
X, y_true = make_blobs(n_samples=300, centers=3, cluster_std=0.60, random_state=0)

# Step 2: Initialize the Gaussian Mixture Model
gmm = GaussianMixture(n_components=3, random_state=42)

# Step 3: Fit the model using the EM algorithm
gmm.fit(X)

# Step 4: Predict cluster assignments
```

```
y_gmm = gmm.predict(X)

# Step 5: Visualize the results
plt.figure(figsize=(10, 6))
plt.scatter(X[:, 0], X[:, 1], c=y_gmm, s=40, cmap='viridis')
plt.scatter(gmm.means_[:, 0], gmm.means_[:, 1], s=300, c='red', marker='X')  # Cluster centers
plt.title('Clusters found by Gaussian Mixture Model')
plt.xlabel('Feature 1')
plt.ylabel('Feature 2')
plt.show()

# Print the parameters of the Gaussian Mixture Model
print('Means of the components:')
print(gmm.means_)
print('\nCovariances of the components:')
print(gmm.covariances_)
#output
```



#09

```
import pandas as pd

# Step 1: Create the dataset
data = {
    'Origin': ['Japan', 'Japan', 'Japan', 'USA', 'Japan'],
    'Manufacturer': ['Honda', 'Toyota', 'Toyota', 'Chrysler', 'Honda'],
    'Color': ['Blue', 'Green', 'Blue', 'Red', 'White'],
    'Decade': [1980, 1970, 1990, 1980, 1980],
    'Type': ['Economy', 'Sports', 'Economy', 'Economy', 'Economy'],
    'Example Type': ['Positive', 'Negative', 'Positive', 'Negative', 'Positive']
}

df = pd.DataFrame(data)

# Step 2: Initialize the most specific hypothesis
hypothesis = ['Ø', 'Ø', 'Ø', 'Ø', 'Ø']

# Step 3: Find-S Algorithm
for index, row in df.iterrows():
    if row['Example Type'] == 'Positive':
        for i in range(len(hypothesis)):
            if hypothesis[i] == 'Ø':
                hypothesis[i] = row[i]
elif hypothesis[i] != row[i]:
                hypothesis[i] = '?'

# Step 4: Output the most specific hypothesis
print("The most specific hypothesis is:", hypothesis)

#output
```

```
= RESTART: C:/Users/DINESH/mlq9.py
The most specific hypothesis is: ['Japan', 'Honda', '?', 1980, 'Economy']
```

#10

```
import pandas as pd

# Define the dataset
data = {
    'Origin': ['Japan', 'Japan', 'Japan', 'USA', 'Japan'],
    'Manufacturer': ['Honda', 'Toyota', 'Toyota', 'Chrysler', 'Honda'],
    'Color': ['Blue', 'Green', 'Blue', 'Red', 'White'],
    'Decade': ['1980', '1970', '1990', '1980', '1980'],
    'Type': ['Economy', 'Sports', 'Economy', 'Economy', 'Economy'],
    'Example Type': ['Positive', 'Negative', 'Positive', 'Negative', 'Positive']
}

# Create a DataFrame
df = pd.DataFrame(data)

# Function to implement Find-S algorithm
def find_s_algorithm(df):
    # Initialize the most specific hypothesis
    hypothesis = ['φ'] * (df.shape[1] - 1)

    # Iterate through the dataset
    for i in range(df.shape[0]):
        if df.iloc[i]['Example Type'] == 'Positive':
            if hypothesis == ['φ'] * (df.shape[1] - 1):
                hypothesis = list(df.iloc[i][:-1])
            else:
                for j in range(len(hypothesis)):
```

```
            if hypothesis[j] != df.iloc[i, j]:
                hypothesis[j] = '?'
    return hypothesis

# Apply the Find-S algorithm to the dataset
hypothesis = find_s_algorithm(df)

# Output the most specific hypothesis
print("The most specific hypothesis is:", hypothesis)
#output
#output
```

```
= RESTART: C:/Users/DINESH/mlq10.py
The most specific hypothesis is: ['Japan', '?', '?', '?', 'Economy']
```