```
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Course: BIL570 / BIL470
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Exploratory Data Analysis (EDA)

In [1]:

```
import pandas as pd
from sklearn.utils import shuffle
import seaborn as sns
import matplotlib.pyplot as plt
import numpy as np

from sklearn.metrics import confusion_matrix, classification_report, roc_curve, roc_
from sklearn.metrics import accuracy_score, precision_score

from dt import DecisionTreeClassifier
```

In [2]:

```
# Veri setini yükleme
data = pd.read_csv('iris.csv')

# Veri setinin başlığını kontrol etme
print(data.head())
```

```
   Id  SepalLengthCm  SepalWidthCm  PetalLengthCm  PetalWidthCm      Speci
es
0   1            5.1           3.5            1.4           0.2  Iris-seto
sa
1   2            4.9           3.0            1.4           0.2  Iris-seto
sa
2   3            4.7           3.2            1.3           0.2  Iris-seto
sa
3   4            4.6           3.1            1.5           0.2  Iris-seto
sa
4   5            5.0           3.6            1.4           0.2  Iris-seto
sa
```

In [3]:

```
# Tür adlarını tam sayılara dönüştürme
data['Species'] = data['Species'].map({'Iris-setosa': 0, 'Iris-versicolor': 1, 'Iris

# Sonuçları kontrol etme
print(data.head())
```

```
   Id  SepalLengthCm  SepalWidthCm  PetalLengthCm  PetalWidthCm  Species
0   1            5.1           3.5            1.4           0.2        0
1   2            4.9           3.0            1.4           0.2        0
2   3            4.7           3.2            1.3           0.2        0
3   4            4.6           3.1            1.5           0.2        0
4   5            5.0           3.6            1.4           0.2        0
```

In [4]:

```
# Veri setinin özeti
print(data.describe())
```

```
               Id  SepalLengthCm  SepalWidthCm  PetalLengthCm  PetalWidthC
m  \
count  150.000000     150.000000    150.000000     150.000000    150.00000
0
mean    75.500000       5.843333      3.054000       3.758667      1.19866
7
std     43.445368       0.828066      0.433594       1.764420      0.76316
1
min      1.000000       4.300000      2.000000       1.000000      0.10000
0
25%     38.250000       5.100000      2.800000       1.600000      0.30000
0
50%     75.500000       5.800000      3.000000       4.350000      1.30000
0
75%    112.750000       6.400000      3.300000       5.100000      1.80000
0
max    150.000000       7.900000      4.400000       6.900000      2.50000
0

          Species
count  150.000000
mean     1.000000
std      0.819232
min      0.000000
25%      0.000000
50%      1.000000
75%      2.000000
max      2.000000
```

In [5]:

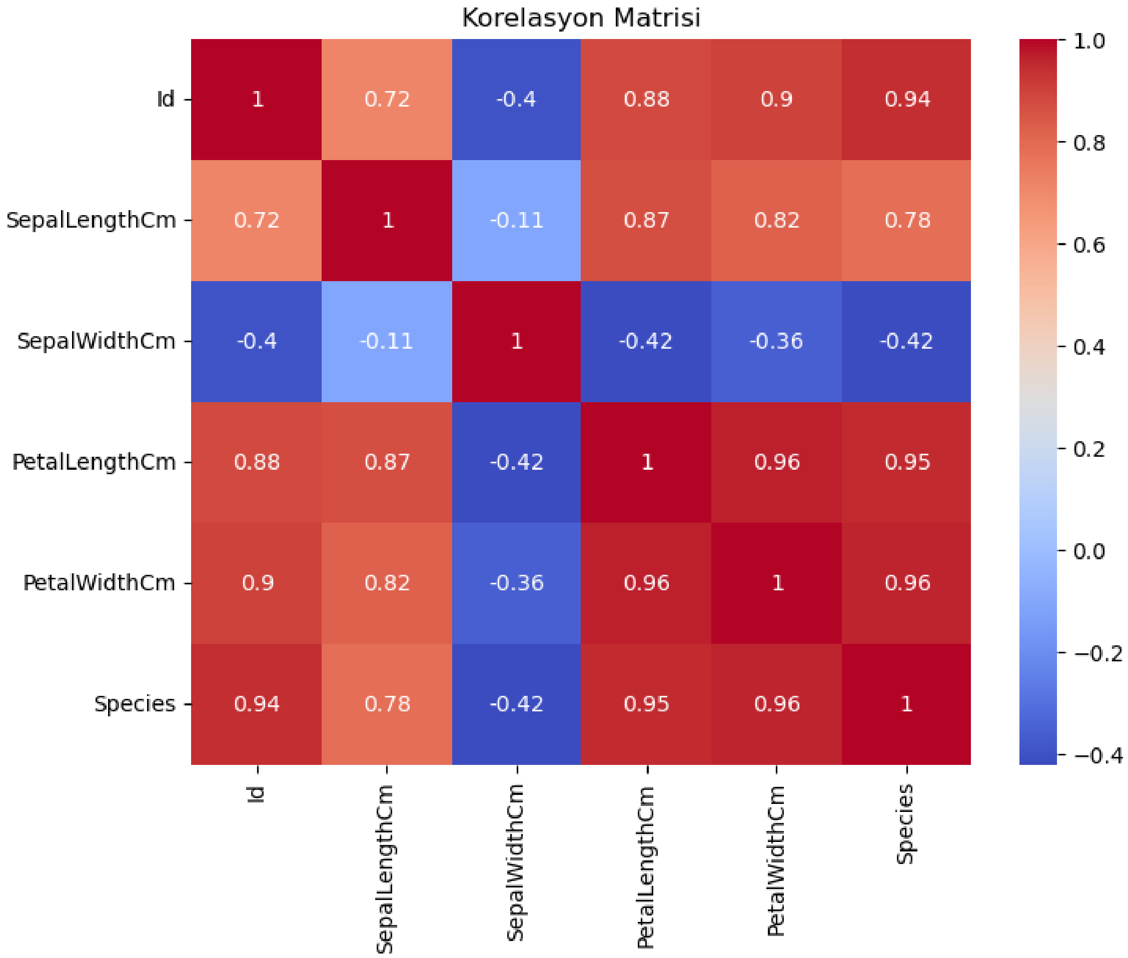
```
# Veri setinin karıştırılması
data = shuffle(data)
print(data.head())
```

```
      Id  SepalLengthCm  SepalWidthCm  PetalLengthCm  PetalWidthCm  Specie
s
107  108            7.3           2.9            6.3           1.8
2
101  102            5.8           2.7            5.1           1.9
2
59    60            5.2           2.7            3.9           1.4
1
126  127            6.2           2.8            4.8           1.8
2
44    45            5.1           3.8            1.9           0.4
0
```

In [6]:

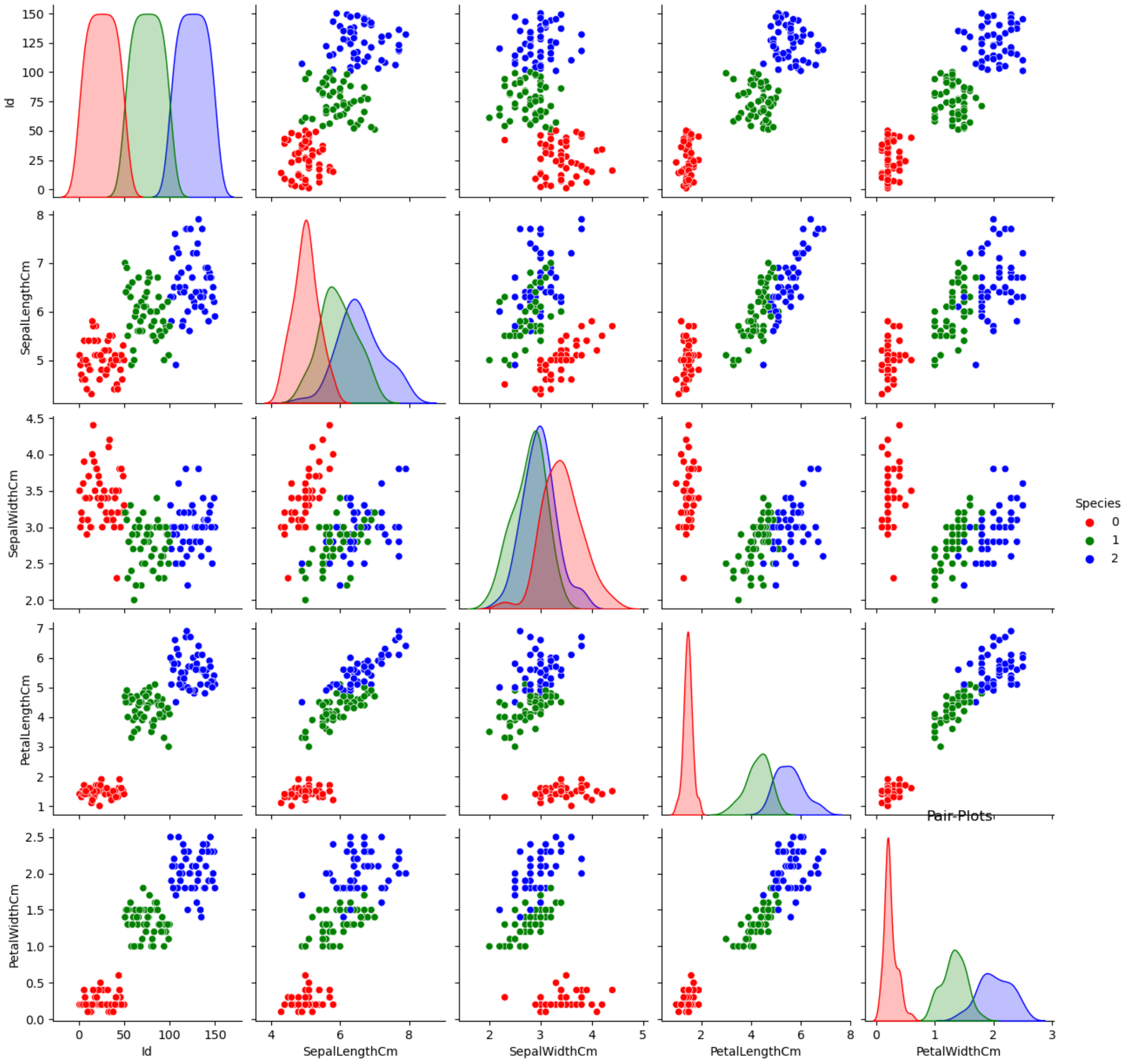
```
# Korelasyon matrisi
correlation_matrix = data.corr()

# Korelasyon matrisini görselleştirme
plt.figure(figsize=(8, 6))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm')
plt.title('Korelasyon Matrisi')
plt.show()
```



In [7]:

```
# Öznitelikler için pair-plots
custom_palette = ['red', 'green', 'blue']
sns.pairplot(data, hue='Species', palette=custom_palette)
plt.title('Pair-Plots')
plt.show()
```



Veriyi eğitim ve test setlerine ayırma

In [8]:

```
X = data.iloc[:, :-1].values
y = data.iloc[:, -1].values

train_size = int(0.8 * len(X))
X_train, X_test = X[:train_size], X[train_size:]
y_train, y_test = y[:train_size], y[train_size:]
```

DecisionTreeClassifier'ı eğitme

In [9]:

```
classifier = DecisionTreeClassifier(max_depth=5)
classifier.fit(X_train.tolist(), y_train.tolist())
```

Test seti üzerinde sınıflandırma

In [10]:

```
predictions = classifier.predict(X_test.tolist())
```

Sonuçları değerlendirme

In [11]:

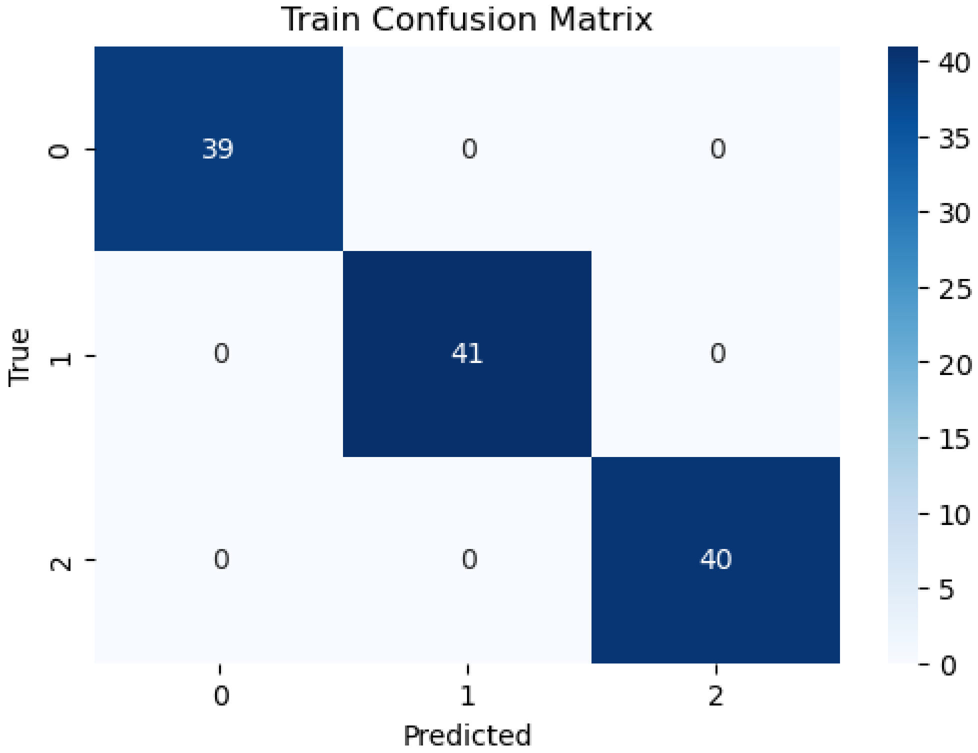
```
accuracy = sum(predictions == y_test) / len(y_test)
print("Accuracy:", accuracy)
```

```
Accuracy: 0.9666666666666667
```

Confusion Matrix

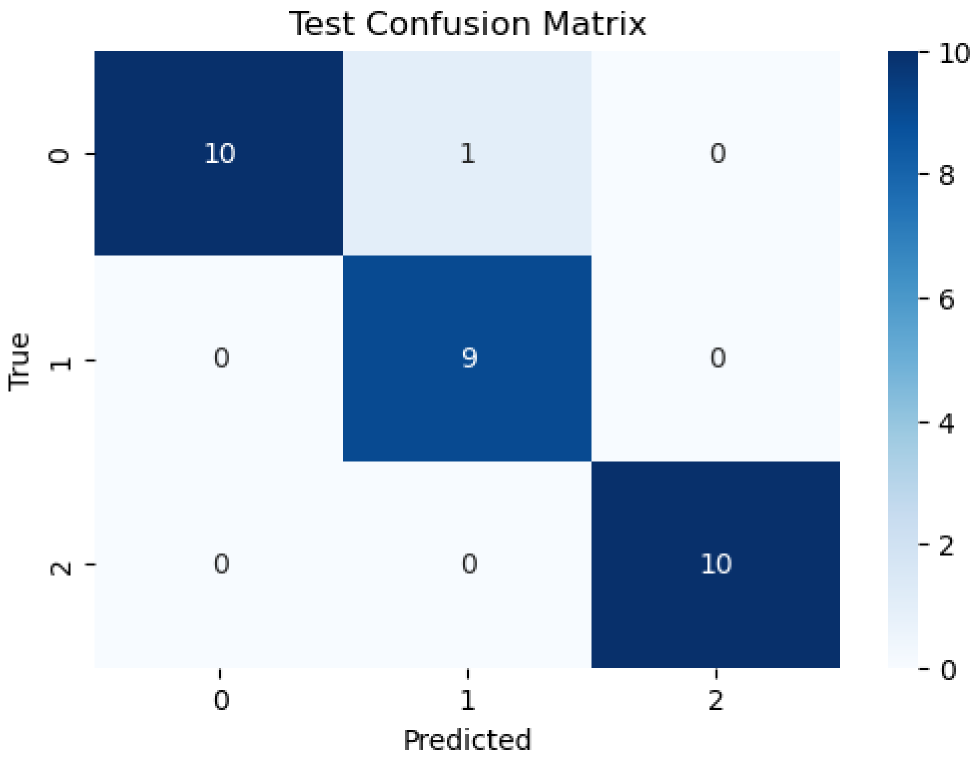
In [12]:

```python
# Training set evaluation
train_predictions = classifier.predict(X_train.tolist())
train_confusion_matrix = confusion_matrix(y_train.tolist(), train_predictions)
plt.figure(figsize=(6, 4))
plt.title('Train Confusion Matrix')
sns.heatmap(train_confusion_matrix, annot=True, cmap='Blues', fmt='g')
plt.xlabel('Predicted')
plt.ylabel('True')
plt.show()
```



In [13]:

```python
# Test set evaluation
test_predictions = classifier.predict(X_test.tolist())
test_confusion_matrix = confusion_matrix(y_test.tolist(), test_predictions)
plt.figure(figsize=(6, 4))
plt.title('Test Confusion Matrix')
sns.heatmap(test_confusion_matrix, annot=True, cmap='Blues', fmt='g')
plt.xlabel('Predicted')
plt.ylabel('True')
plt.show()
```



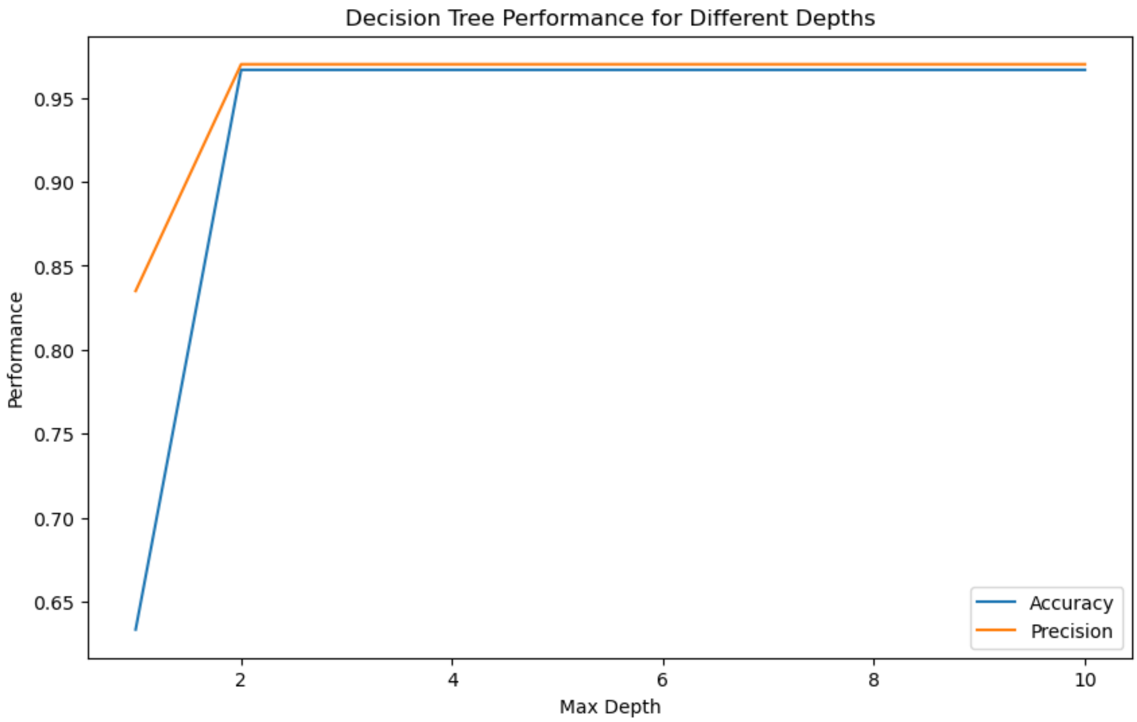
In [14]:

```
# Accuracy
train_accuracy = np.mean(train_predictions == y_train) * 100
test_accuracy = np.mean(test_predictions == y_test) * 100
print("\nAccuracy (Train set):", train_accuracy)
print("Accuracy (Test set):", test_accuracy)

# F1-Score
train_f1_score = classification_report(y_train, train_predictions, output_dict=True)
test_f1_score = classification_report(y_test, test_predictions, output_dict=True)['w
print("\nF1-Score (Train set):", train_f1_score)
print("F1-Score (Test set):", test_f1_score)

# Precision
train_precision = classification_report(y_train, train_predictions, output_dict=True
test_precision = classification_report(y_test, test_predictions, output_dict=True)['
print("\nPrecision (Train set):", train_precision)
print("Precision (Test set):", test_precision)

# Recall
train_recall = classification_report(y_train, train_predictions, output_dict=True)['
test_recall = classification_report(y_test, test_predictions, output_dict=True)['wei
print("\nRecall (Train set):", train_recall)
print("Recall (Test set):", test_recall)
```

```

Accuracy (Train set): 100.0
Accuracy (Test set): 96.66666666666667

F1-Score (Train set): 1.0
F1-Score (Test set): 0.966750208855472

Precision (Train set): 1.0
Precision (Test set): 0.9700000000000001

Recall (Train set): 1.0
Recall (Test set): 0.9666666666666667
```

In [15]:

```python
L = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
accuracies = []
precisions = []

for depth in L:
    # DecisionTreeClassifier'ı eğitme
    classifier = DecisionTreeClassifier(max_depth=depth)
    classifier.fit(X_train.tolist(), y_train.tolist())

    # Test seti üzerinde sınıflandırma
    predictions = classifier.predict(X_test.tolist())

    # Accuracy
    accuracy = accuracy_score(y_test, predictions)
    accuracies.append(accuracy)

    # Precision
    precision = precision_score(y_test, predictions, average='weighted', zero_divisi
    precisions.append(precision)

plt.figure(figsize=(10, 6))
plt.plot(L, accuracies, label='Accuracy')
plt.plot(L, precisions, label='Precision')
plt.xlabel('Max Depth')
plt.ylabel('Performance')
plt.title('Decision Tree Performance for Different Depths')
plt.legend()
plt.show()

best_accuracy = max(accuracies)
best_accuracy_index = accuracies.index(best_accuracy)
best_precision = precisions[best_accuracy_index]
best_depth = L[best_accuracy_index]

print("Best Depth:", best_depth)
print("Best Accuracy:", best_accuracy)
print("Corresponding Precision:", best_precision)
```



```
Best Depth: 2
Best Accuracy: 0.9666666666666667
Corresponding Precision: 0.9700000000000001
```

```
Bu verilere göre, Decision Tree Classifier modeli 2 derinlik seviyesinde en iyi sonuçları verdi. Yani, modelin en doğru tahminleri ve hassas sonuçları bu derinlik seviyesinde elde edildi.

Modelin daha derin olması ise overfit riskini artırabilir ve genel başarıyı olumsuz etkileyebilir. Dolayısıyla, 2 derinlik seviyesi, modelin dengeli ve iyi bir şekilde genellemesini sağlamıştır.

Ancak, daha fazla deney yapmak ve farklı veri setlerinde modelin performansını test etmek için daha fazla çalışma gerekmektedir.
```