DataSet: Pima Indians Diabetes Dataset

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder, StandardScaler
from sklearn.metrics import classification_report, confusion_matr
from sklearn.metrics import ConfusionMatrixDisplay
from sklearn.model_selection import learning_curve
```

```
from sklearn.linear_model import LogisticRegression
from sklearn.neighbors import KNeighborsClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.svm import SVC
```

```
df = pd.read_csv("/content/drive/MyDrive/Dataset/Pima Indians Dia
```

```
display(df.head())
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	Dia
0	6	148	72	35	0	33.6	
1	1	85	66	29	0	26.6	
2	8	183	64	0	0	23.3	
3	1	89	66	23	94	28.1	
4	0	137	40	35	168	43.1	

```
print(df.shape)
```

```
(768, 9)
```

```
print(df.columns.tolist())
```

```
['Pregnancies', 'Glucose', 'BloodPressure', 'SkinThickness', 'Insulin'
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 768 entries, 0 to 767
Data columns (total 9 columns):
 #   Column                    Non-Null Count  Dtype  
---  ------                    --------------  -----  
 0   Pregnancies               768 non-null    int64  
 1   Glucose                   768 non-null    int64  
 2   BloodPressure             768 non-null    int64  
 3   SkinThickness             768 non-null    int64  
 4   Insulin                   768 non-null    int64  
 5   BMI                       768 non-null    float64
 6   DiabetesPedigreeFunction  768 non-null    float64
 7   Age                       768 non-null    int64  
 8   Outcome                   768 non-null    int64  
dtypes: float64(2), int64(7)
memory usage: 54.1 KB
```

```
display(df.describe())
```

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin
count	768.000000	768.000000	768.000000	768.000000	768.000000
mean	3.845052	120.894531	69.105469	20.536458	79.799479
std	3.369578	31.972618	19.355807	15.952218	115.244002
min	0.000000	0.000000	0.000000	0.000000	0.000000
25%	1.000000	99.000000	62.000000	0.000000	0.000000
50%	3.000000	117.000000	72.000000	23.000000	30.500000
75%	6.000000	140.250000	80.000000	32.000000	127.250000
max	17.000000	199.000000	122.000000	99.000000	846.000000

```
print((df == 0).sum())
```

```
Pregnancies                 111
Glucose                       5
BloodPressure                35
SkinThickness               227
Insulin                     374
BMI                          11
DiabetesPedigreeFunction      0
Age                           0
Outcome                     500
dtype: int64
```

```
zero_to_nan_cols = ["Glucose", "BloodPressure", "SkinThickness", 

```

```
df[zero_to_nan_cols] = df[zero_to_nan_cols].replace(0, np.nan)
```

```
print(df.isnull().sum())
```

```
Pregnancies                   0
Glucose                       5
```

```
BloodPressure                35
SkinThickness               227
Insulin                     374
BMI                          11
DiabetesPedigreeFunction      0
Age                           0
Outcome                       0
dtype: int64
```

```python
df.fillna(df.median(), inplace=True)
```

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

```
Pregnancies                 0
Glucose                     0
BloodPressure               0
SkinThickness               0
Insulin                     0
BMI                         0
DiabetesPedigreeFunction    0
Age                         0
Outcome                     0
dtype: int64
```

```python
before_rows = df.shape[0]
df.drop_duplicates(inplace=True)
after_rows = df.shape[0]
```

```python
print(f"\nRows Before Removing Duplicates: {before_rows}")
print(f"Rows After Removing Duplicates: {after_rows}")
```

```

Rows Before Removing Duplicates: 768
Rows After Removing Duplicates: 768
```

```python
print(df["Outcome"].unique())
```

```
[1 0]
```

```python
le = LabelEncoder()
df["Outcome"] = le.fit_transform(df["Outcome"])
```

```python

print("\nUnique values in Outcome after encoding:")
print(df["Outcome"].unique())
```

```

Unique values in Outcome after encoding:
[1 0]
```

```python
X = df.drop("Outcome", axis=1)
y = df["Outcome"]
```

```
print("\nFeature Matrix (X) Shape:", X.shape)
print("Target Vector (y) Shape:", y.shape)
```

```

Feature Matrix (X) Shape: (768, 8)
Target Vector (y) Shape: (768,)
```

```
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)

print("\nFeature Scaling Completed.")
```

```

Feature Scaling Completed.
```

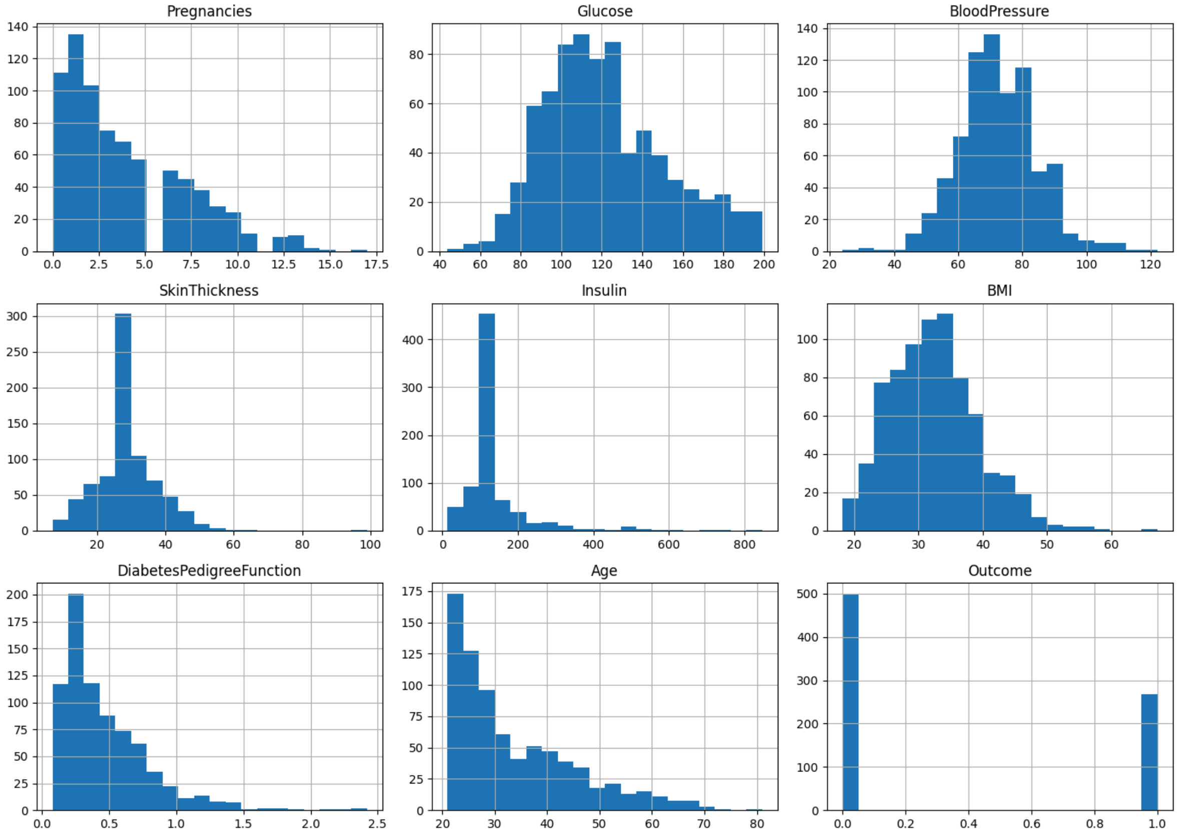
```
X_train, X_test, y_train, y_test = train_test_split(
    X_scaled, y, test_size=0.20, random_state=42
)
```

```
print("\nTraining Set Shape:", X_train.shape)
print("Testing Set Shape:", X_test.shape)
```

```

Training Set Shape: (614, 8)
Testing Set Shape: (154, 8)
```

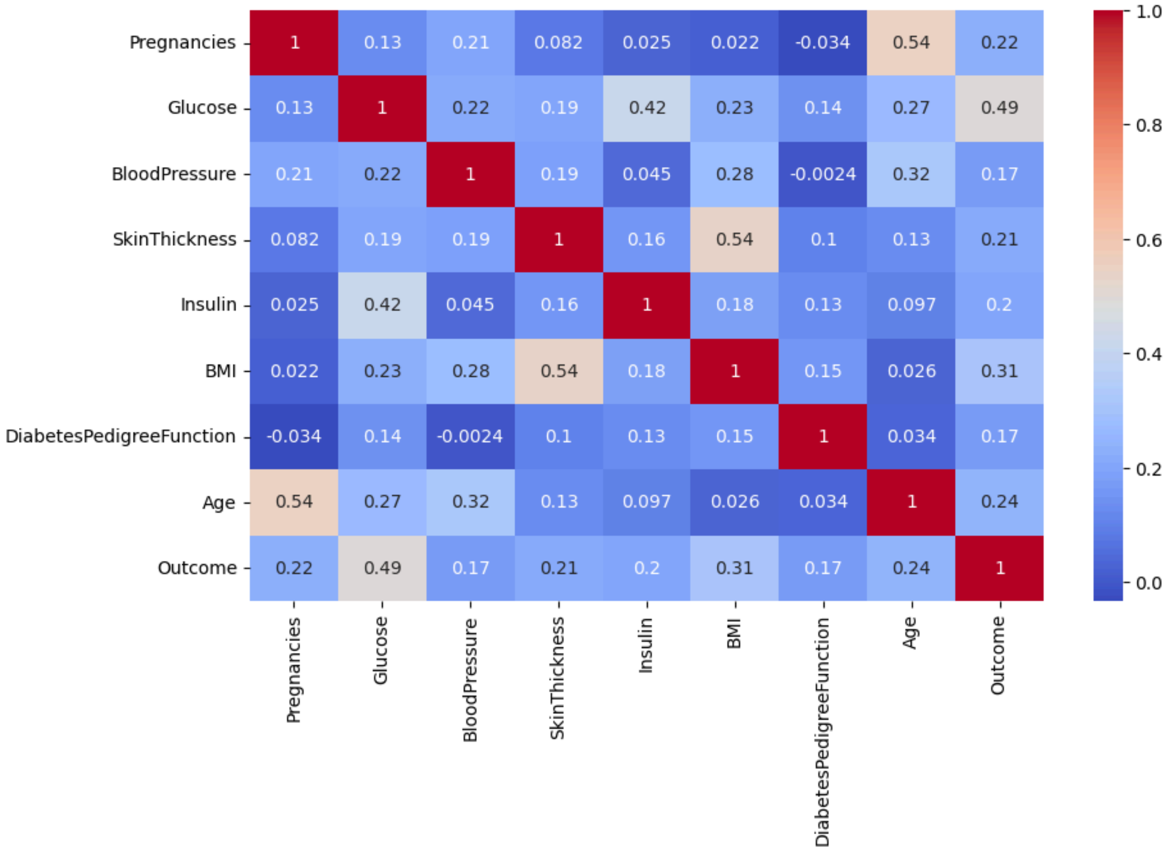
```
print("\nGenerating Histograms...")
df.hist(figsize=(14, 10), bins=20)
plt.tight_layout()
plt.show()
```

```
Generating Histograms...
```



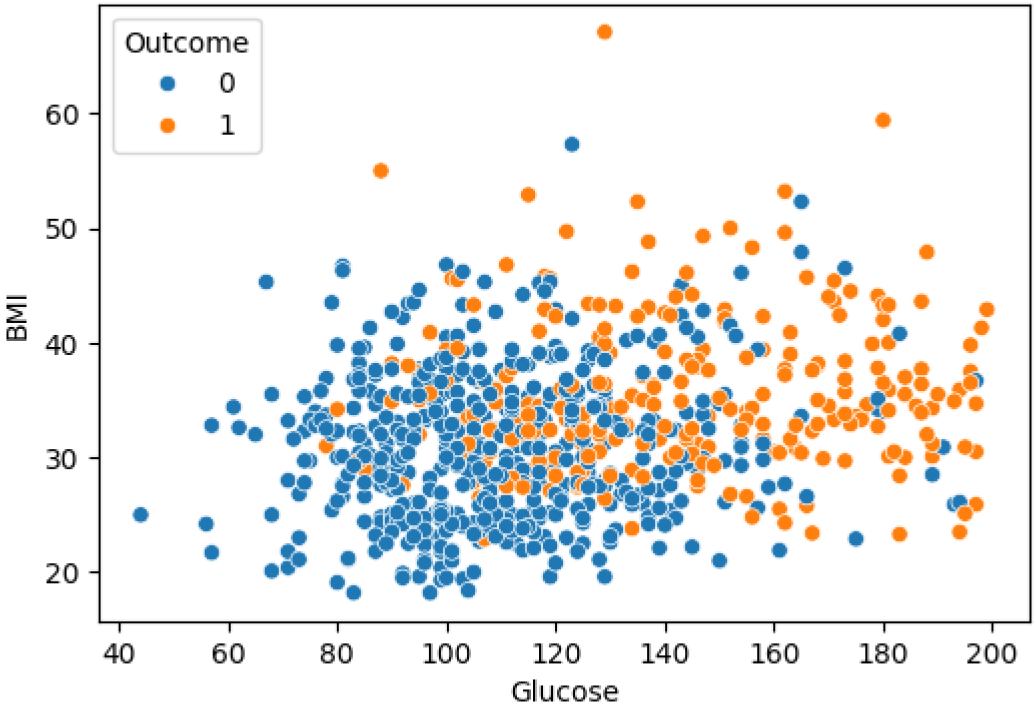
```python
print("\nCorrelation Heatmap:")
plt.figure(figsize=(10, 6))
sns.heatmap(df.corr(), annot=True, cmap="coolwarm")
plt.show()
```

```
Correlation Heatmap:
```

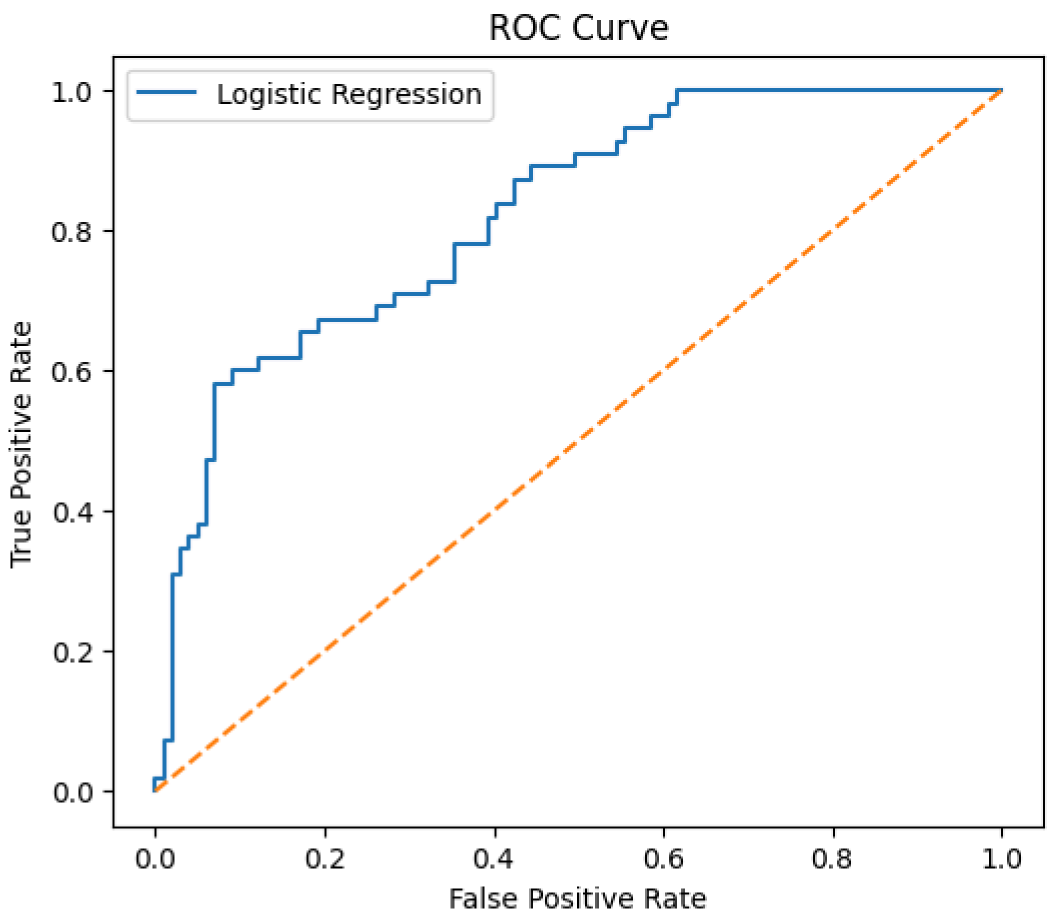


```python
print("\nScatter Plot: Glucose vs BMI")
plt.figure(figsize=(6, 4))
sns.scatterplot(x=df["Glucose"], y=df["BMI"], hue=df["Outcome"])
plt.show()
```

```
Scatter Plot: Glucose vs BMI
```



```
plt.figure(figsize=(6, 5))
plt.plot(fpr, tpr, label="Logistic Regression")
plt.plot([0, 1], [0, 1], linestyle="--")
plt.xlabel("False Positive Rate")
plt.ylabel("True Positive Rate")
plt.title("ROC Curve")
plt.legend()
plt.show()
```

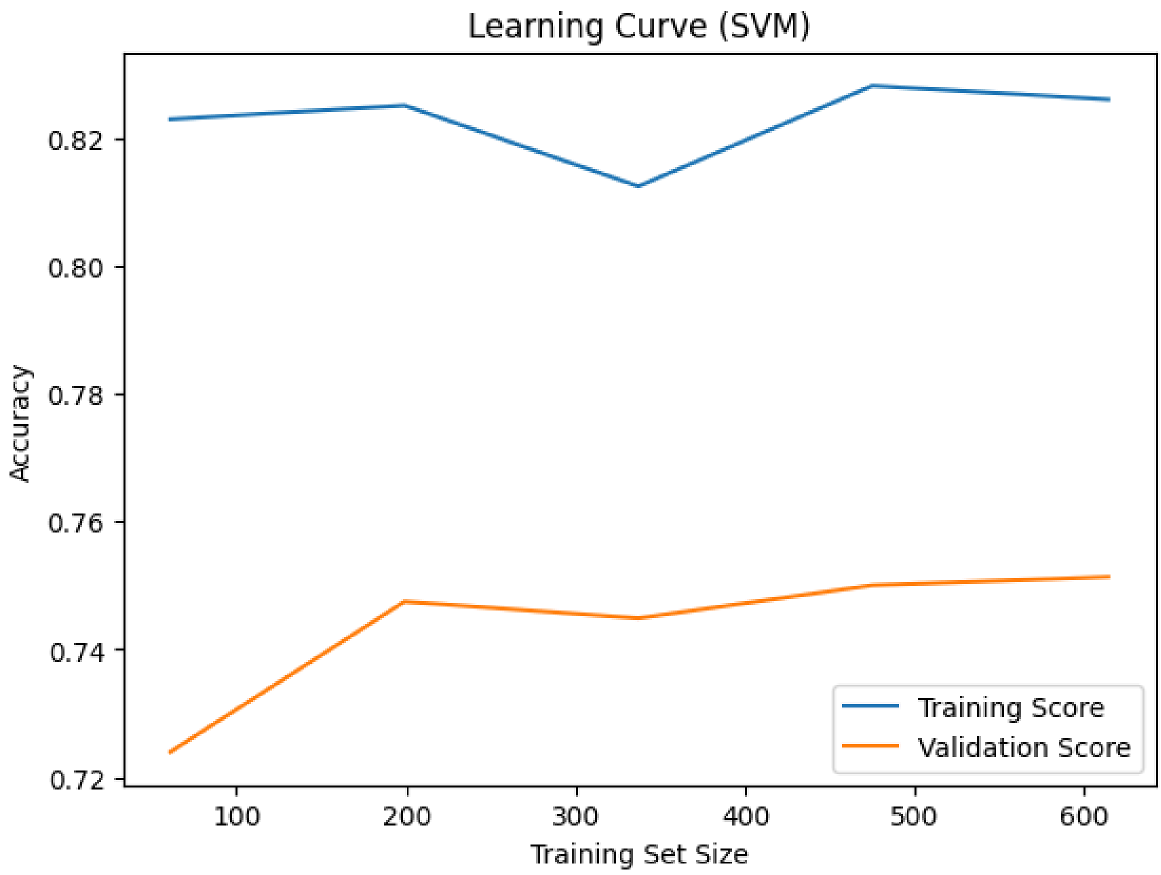


```
print("\nGenerating Learning Curve for SVM...")

train_sizes, train_scores, test_scores = learning_curve(
    SVC(), X_scaled, y, cv=5, scoring='accuracy'
)
```

```
Generating Learning Curve for SVM...
```

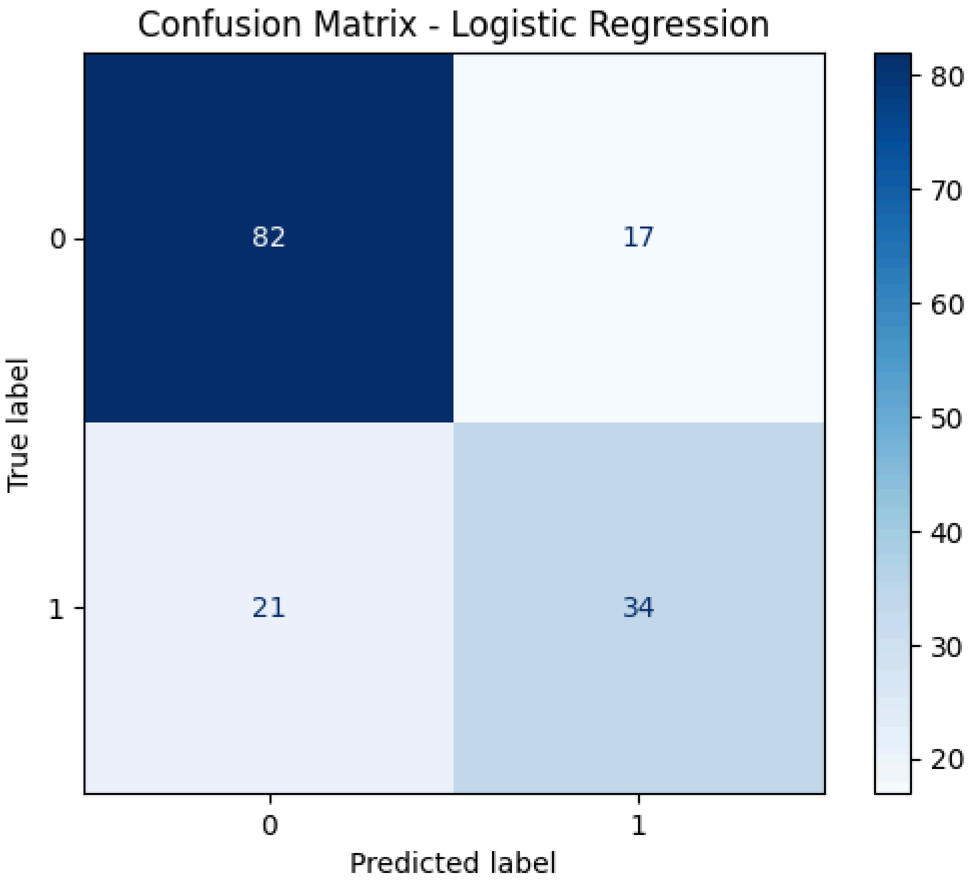
```
train_mean = train_scores.mean(axis=1)
test_mean = test_scores.mean(axis=1)
```

```
plt.figure(figsize=(7, 5))
plt.plot(train_sizes, train_mean, label="Training Score")
plt.plot(train_sizes, test_mean, label="Validation Score")
plt.xlabel("Training Set Size")
plt.ylabel("Accuracy")
plt.title("Learning Curve (SVM)")
plt.legend()
plt.show()
```



```
log_model = LogisticRegression(max_iter=300)
log_model.fit(X_train, y_train)

y_pred_log = log_model.predict(X_test)

print("Confusion Matrix - Logistic Regression:")
cm_log = confusion_matrix(y_test, y_pred_log)
print(cm_log)

disp = ConfusionMatrixDisplay(confusion_matrix=cm_log)
disp.plot(cmap="Blues")
plt.title("Confusion Matrix - Logistic Regression")
plt.show()

print("\nClassification Report - Logistic Regression:")
print(classification_report(y_test, y_pred_log))

```

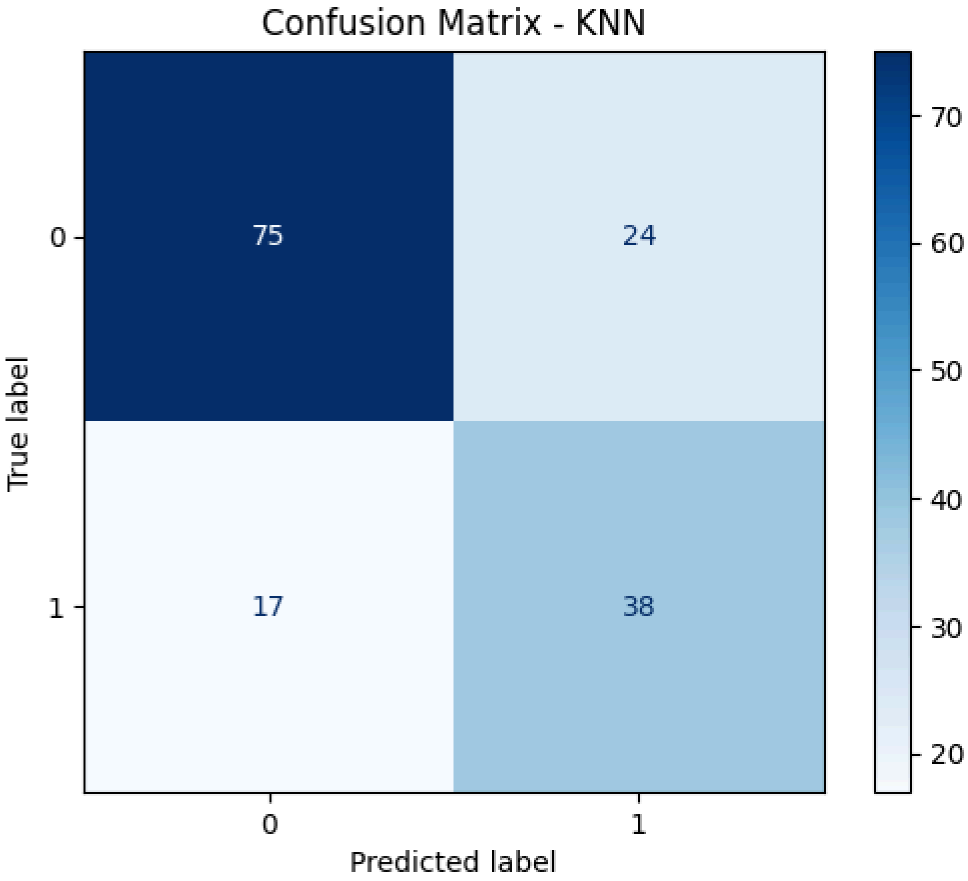
```
Confusion Matrix - Logistic Regression:
[[82 17]
 [21 34]]
```



```
Classification Report - Logistic Regression:
              precision    recall  f1-score   support

           0       0.80      0.83      0.81        99
           1       0.67      0.62      0.64        55

    accuracy                           0.75       154
   macro avg       0.73      0.72      0.73       154
weighted avg       0.75      0.75      0.75       154
```

```
knn_model = KNeighborsClassifier()
knn_model.fit(X_train, y_train)

y_pred_knn = knn_model.predict(X_test)

print("Confusion Matrix - KNN:")
cm_knn = confusion_matrix(y_test, y_pred_knn)
print(cm_knn)

disp = ConfusionMatrixDisplay(confusion_matrix=cm_knn)
disp.plot(cmap="Blues")
plt.title("Confusion Matrix - KNN")
plt.show()

print("\nClassification Report - KNN:")
print(classification_report(y_test, y_pred_knn))

```

```
Confusion Matrix - KNN:
[[75 24]
 [17 38]]
```

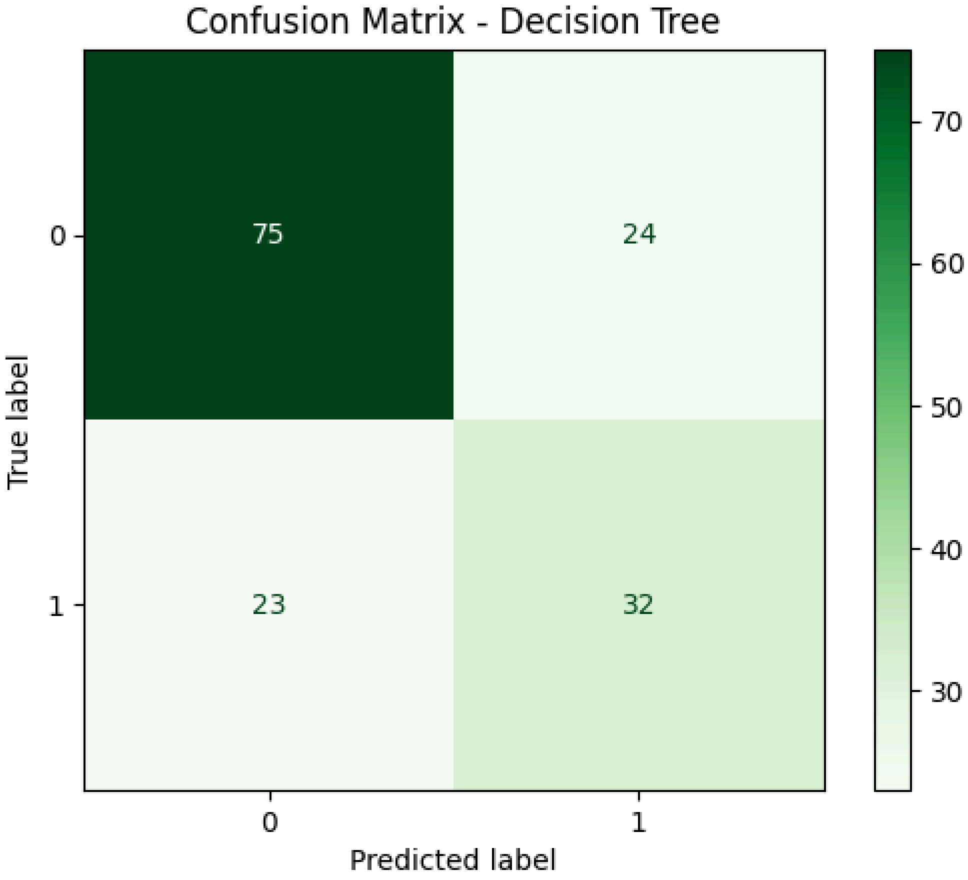


```
Classification Report - KNN:
              precision    recall  f1-score   support

           0       0.82      0.76      0.79        99
           1       0.61      0.69      0.65        55

    accuracy                           0.73       154
   macro avg       0.71      0.72      0.72       154
weighted avg       0.74      0.73      0.74       154
```

```
dt_model = DecisionTreeClassifier()
dt_model.fit(X_train, y_train)

y_pred_dt = dt_model.predict(X_test)

print("Confusion Matrix - Decision Tree:")
cm_dt = confusion_matrix(y_test, y_pred_dt)
print(cm_dt)

disp = ConfusionMatrixDisplay(confusion_matrix=cm_dt)
disp.plot(cmap="Greens")
plt.title("Confusion Matrix - Decision Tree")
plt.show()
```

```python

print("\nClassification Report – Decision Tree:")
print(classification_report(y_test, y_pred_dt))
```

```
Confusion Matrix – Decision Tree:
[[75 24]
 [23 32]]
```

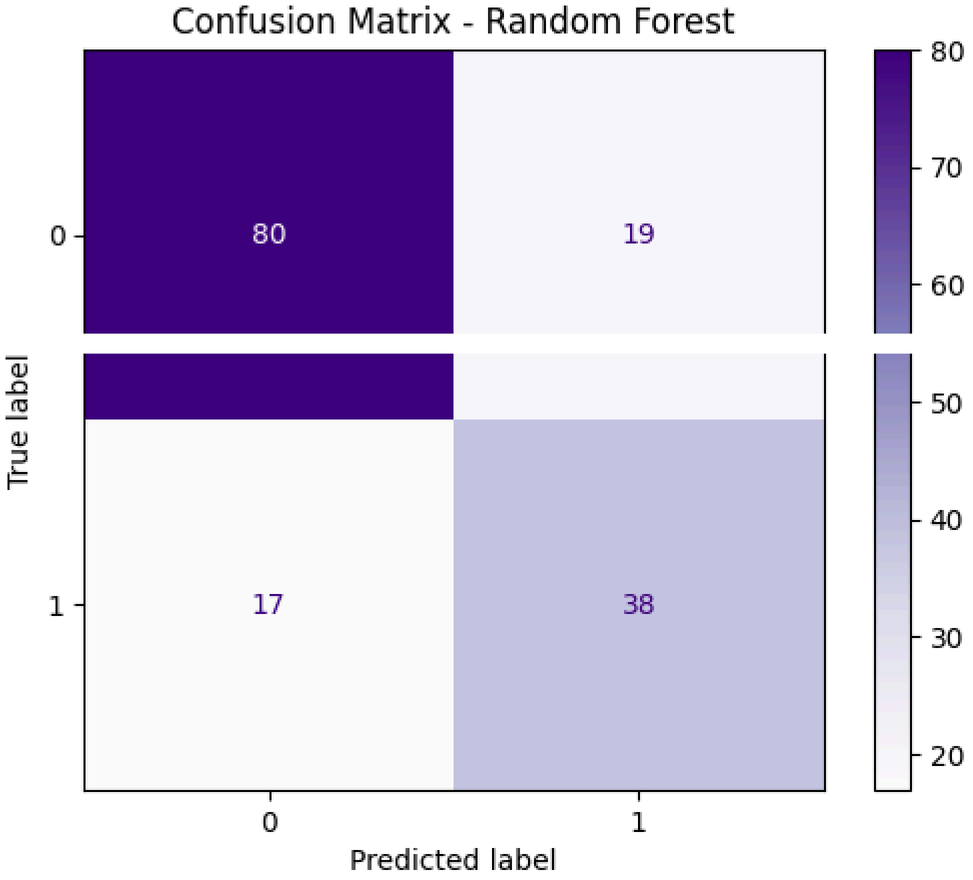


```
Classification Report – Decision Tree:
              precision    recall  f1-score   support

           0       0.77      0.76      0.76        99
           1       0.57      0.58      0.58        55

    accuracy                           0.69       154
   macro avg       0.67      0.67      0.67       154
weighted avg       0.70      0.69      0.70       154
```

```python

rf_model = RandomForestClassifier()
rf_model.fit(X_train, y_train)

y_pred_rf = rf_model.predict(X_test)

print("Confusion Matrix – Random Forest:")
cm_rf = confusion_matrix(y_test, y_pred_rf)
print(cm_rf)

disp = ConfusionMatrixDisplay(confusion_matrix=cm_rf)
disp.plot(cmap="Purples")
```

```
plt.title("Confusion Matrix - Random Forest")
plt.show()

print("\nClassification Report - Random Forest:")
```

```
Confusion Matrix - Random Forest:
[[80 19]
 [17 38]]
```



```
Classification Report - Random Forest:
              precision    recall  f1-score   support

           0       0.82      0.81      0.82        99
           1       0.67      0.69      0.68        55

    accuracy                           0.77       154
```