Lab 3

Import necessary libraries

```
import numpy as np

import pandas as pd

import matplotlib.pyplot as plt

import seaborn as sns

from sklearn.datasets import load_diabetes

from sklearn.model_selection import train_test_split

from sklearn.preprocessing import StandardScaler

from sklearn.linear_model import LogisticRegression

from sklearn.metrics import accuracy_score, classification_report, confusion_matrix, roc_curve, auc
```

Load the diabetes dataset

```
diabetes = load_diabetes()

X, y = diabetes.data, diabetes.target
```

Convert the target variable to binary (1 for diabetes, 0 for no diabetes)

```
y_binary = (y > np.median(y)).astype(int)

# Split the data into training and testing sets

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

Standardize features

```
scaler = StandardScaler()

X_train = scaler.fit_transform(X_train)

X_test = scaler.transform(X_test)
```

Train the Logistic Regression model

model = LogisticRegression()

model.fit(X_train, y_train)

Evaluate the model

y_pred = model.predict(X_test)

accuracy = accuracy_score(y_test, y_pred)

print("Accuracy: {:.2f}%".format(accuracy * 100))

<u>output:</u>

Accuracy: 73.03%

evaluate the model

print("Confusion Matrix:\n", confusion_matrix(y_test, y_pred))

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

<u>output:</u>

Confusion Matrix:

[[36 13]

[11 29]]

Classification Report:

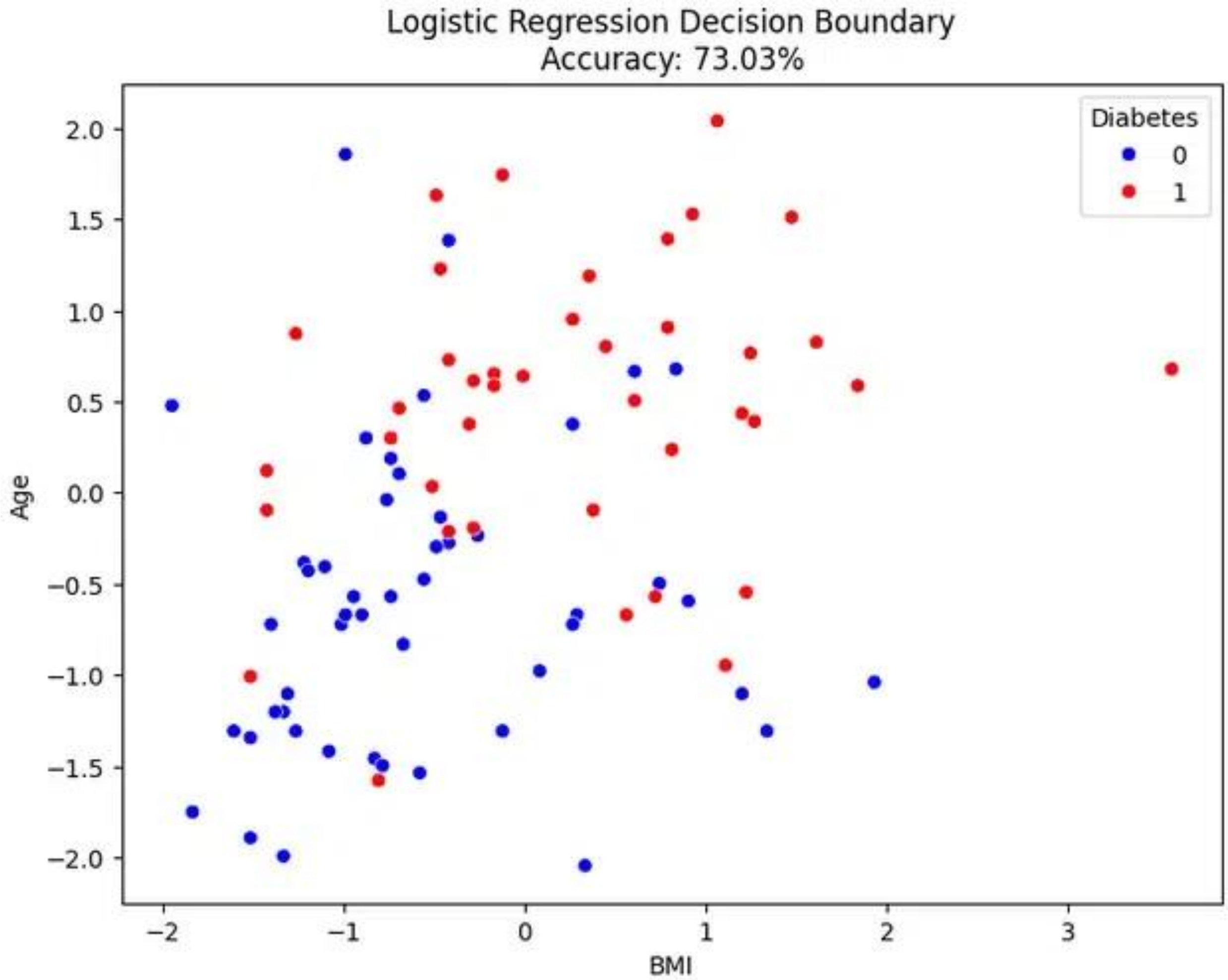
	precision	recall	f1-score	support
0	0.77	0.73	0.75	49
1	0.69	0.72	0.71	40

```
   accuracy                        0.73        89
  macro avg       0.73      0.73      0.73        89
weighted avg       0.73      0.73      0.73        89
```

Visualize the decision boundary with accuracy information

```
plt.figure(figsize=(8, 6))
sns.scatterplot(x=X_test[:, 2], y=X_test[:, 8], hue=y_test, palette={
            0: 'blue', 1: 'red'}, marker='o')
plt.xlabel("BMI")
plt.ylabel("Age")
plt.title("Logistic Regression Decision Boundary\nAccuracy: {:.2f}%".format(
   accuracy * 100))
plt.legend(title="Diabetes", loc="upper right")
plt.show()
```

output:



Plot ROC Curve

```
y_prob = model.predict_proba(X_test)[:, 1]

fpr, tpr, thresholds = roc_curve(y_test, y_prob)

roc_auc = auc(fpr, tpr)


plt.figure(figsize=(8, 6))

plt.plot(fpr, tpr, color='darkorange', lw=2,

        label=f'ROC Curve (AUC = {roc_auc:.2f})')

plt.plot([0, 1], [0, 1], color='navy', lw=2, linestyle='--', label='Random')

plt.xlabel('False Positive Rate')
```

```
plt.ylabel('True Positive Rate')
plt.title('Receiver Operating Characteristic (ROC) Curve\nAccuracy: {:.2f}%'.format(
    accuracy * 100))
plt.legend(loc="lower right")
plt.show()
```

output: