logistic_regression.py

```python
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 StandardScaler
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import confusion_matrix, classification_report, roc_auc_score, roc_curve

# Step 1: Load dataset
df = pd.read_csv("data.csv")

# Step 2: Drop unnecessary columns
df.drop(['id', 'Unnamed: 32'], axis=1, inplace=True)

# Step 3: Encode target column ('diagnosis': M=1, B=0)
df['diagnosis'] = df['diagnosis'].map({'M': 1, 'B': 0})

# Step 4: Handle missing values
df.fillna(df.mean(numeric_only=True), inplace=True)

# Step 5: Split into features and target
X = df.drop('diagnosis', axis=1)
y = df['diagnosis']

# Step 6: Train/test split
X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.2, random_state=42)

# Step 7: Scale the features
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)

# Step 8: Train logistic regression model
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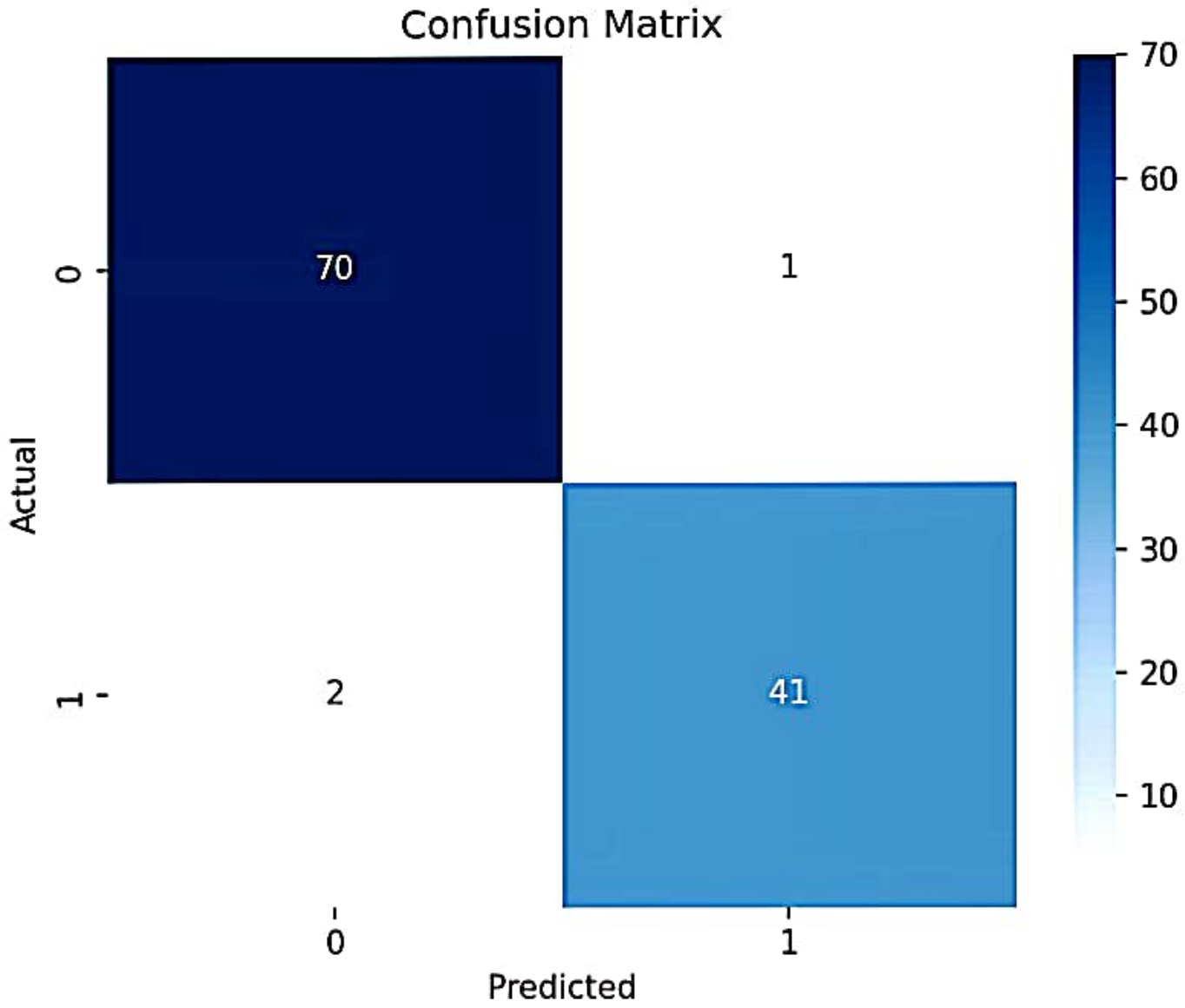
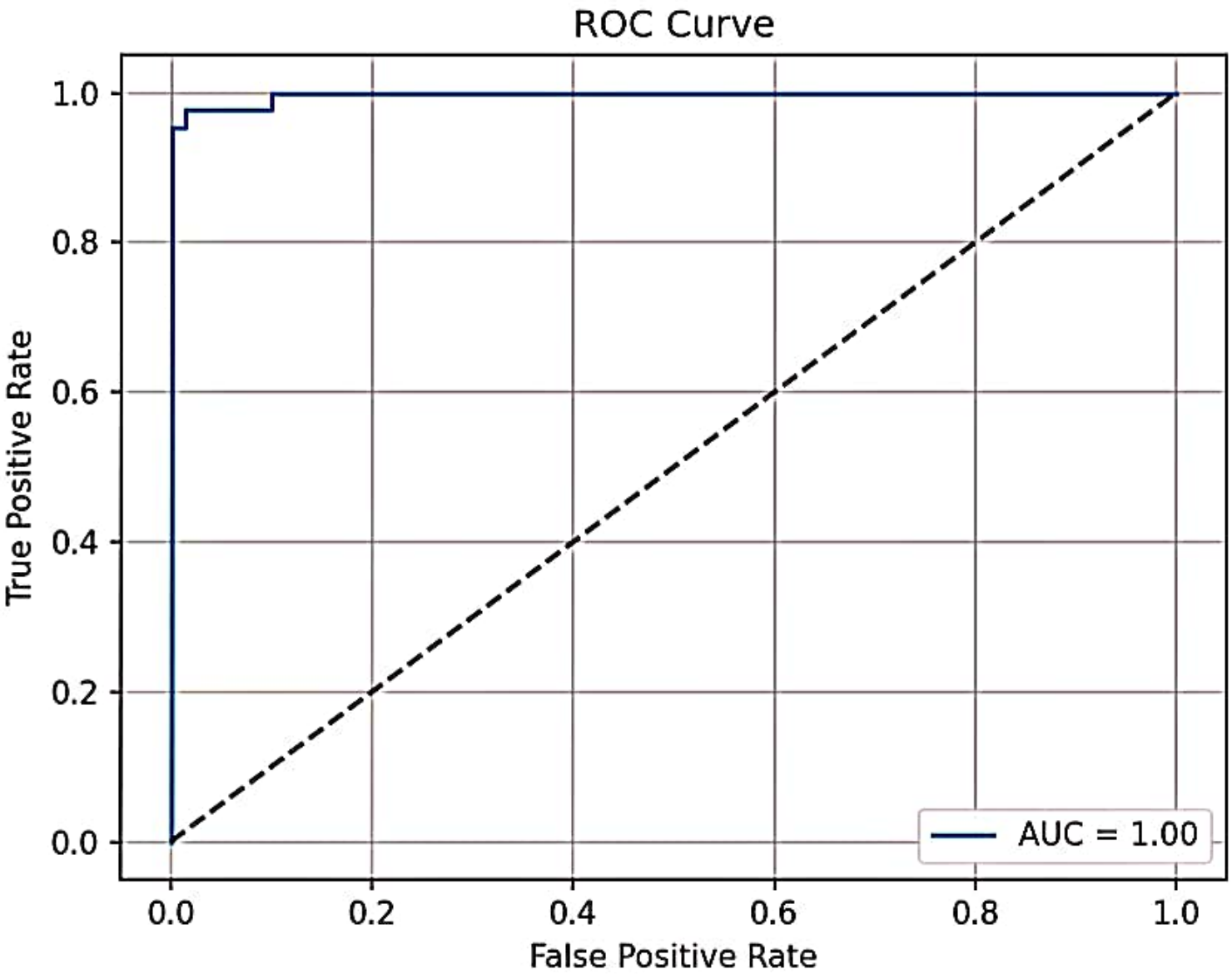
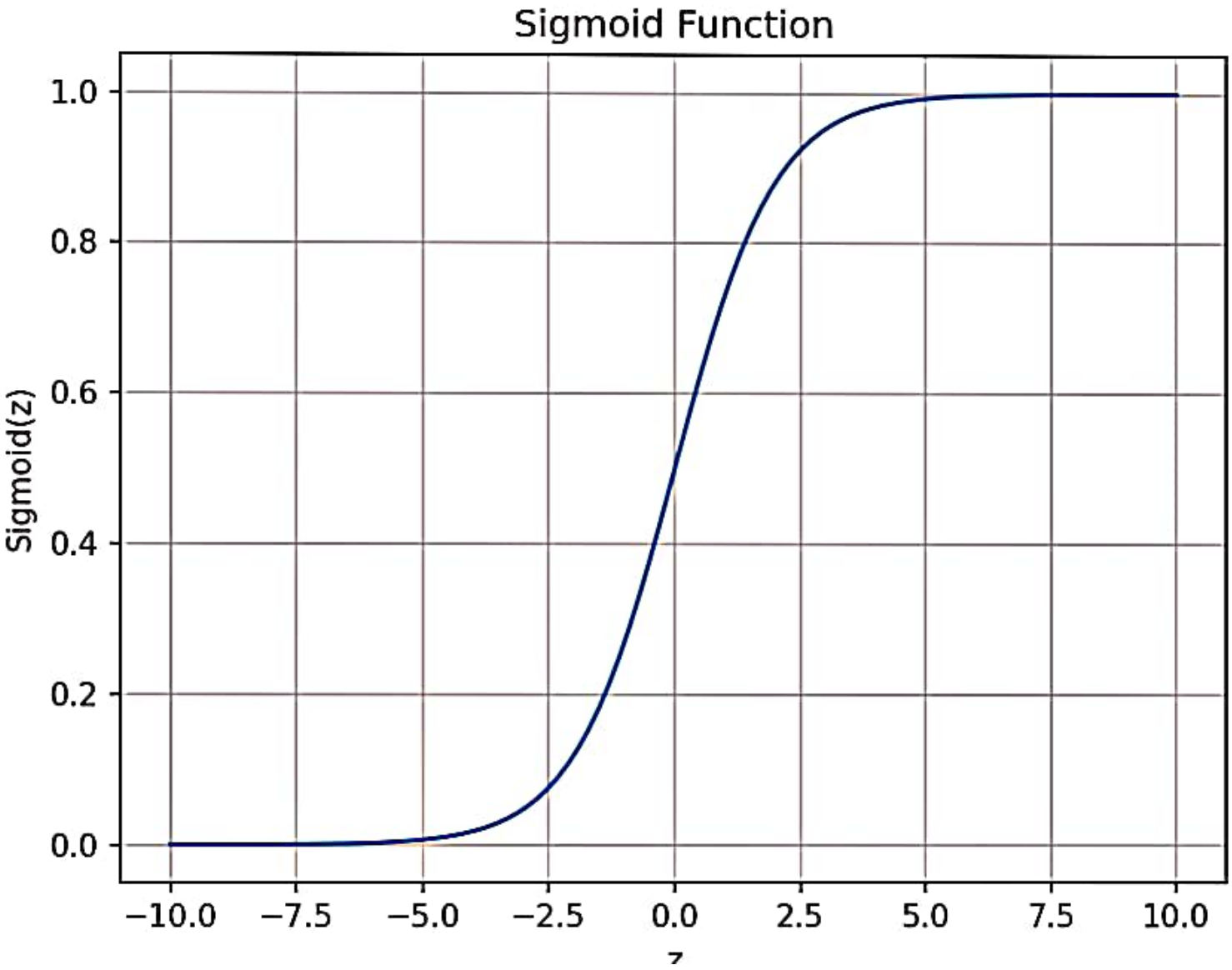
```python
model = LogisticRegression()
model.fit(X_train_scaled, y_train)

# Step 9: Make predictions
y_pred = model.predict(X_test_scaled)
y_proba = model.predict_proba(X_test_scaled)[:, 1]

# Step 10: Confusion Matrix
cm = confusion_matrix(y_test, y_pred)
print("\nConfusion Matrix:\n", cm)
sns.heatmap(cm, annot=True, fmt='d', cmap='Blues')
plt.title("Confusion Matrix")
plt.xlabel("Predicted")
plt.ylabel("Actual")
plt.show()

# Step 11: Classification Report & ROC-AUC
print("\nClassification Report:\n", classification_report(y_test, y_pred))
roc_auc = roc_auc_score(y_test, y_proba)
print("ROC AUC Score:", roc_auc)

# Step 12: ROC Curve
fpr, tpr, thresholds = roc_curve(y_test, y_proba)
plt.plot(fpr, tpr, label=f"AUC = {roc_auc:.2f}")
plt.plot([0, 1], [0, 1], 'k--')
plt.xlabel("False Positive Rate")
plt.ylabel("True Positive Rate")
plt.title("ROC Curve")
plt.legend()
plt.grid(True)
plt.show()

# Step 13: Sigmoid Function
def sigmoid(z):
    return 1 / (1 + np.exp(-z))
```

```python
z = np.linspace(-10, 10, 100)
plt.plot(z, sigmoid(z))
plt.title("Sigmoid Function")
plt.xlabel("z")
plt.ylabel("Sigmoid(z)")
plt.grid(True)
plt.show()

# Step 14: Pause if running from file
input("\n Execution complete. Press Enter to exit...")
```

```
[Running] python -u "d:\titanic-preprossesing\logistic_regression.py"

Confusion Matrix:
[[70  1]
 [ 2 41]]

Classification Report:
              precision    recall  f1-score   support

           0       0.97      0.99      0.98        71
           1       0.98      0.95      0.96        43

    accuracy                           0.97       114
   macro avg       0.97      0.97      0.97       114
weighted avg       0.97      0.97      0.97       114

ROC AUC Score: 0.997379626596791

Execution complete. Press Enter to exit...
```


Confusion Matrix
70
1
2
41
0
1
Actual
0
1
Predicted
70
60
50
40
30
20
10


ROC Curve
True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0
AUC = 1.00


Sigmoid Function
Sigmoid(z)
1.0
0.8
0.6
0.4
0.2
0.0
−10.0
−7.5
−5.0
−2.5
0.0
2.5
5.0
7.5
10.0
z