```
# Import Required Libraries
import pandas as pd
import numpy as np

from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LogisticRegression
from sklearn.ensemble import RandomForestClassifier

from sklearn.metrics import classification_report, confusion_matrix, roc_auc_score

import matplotlib.pyplot as plt
import seaborn as sns
```

```
# Load Dataset
df = pd.read_csv("UCI_Credit_Card.csv")
print(df.shape)
df.head()
```

```
(30000, 25)
```

	ID	LIMIT_BAL	SEX	EDUCATION	MARRIAGE	AGE	PAY_0	PAY_2	PAY_3	PAY_4	...	BILL_AMT4	BILL_AMT5	BILL_AMT6	PAY_AMT1	PAY_AMT2	PA
0	1	20000.0	2	2	1	24	2	2	-1	-1	...	0.0	0.0	0.0	0.0	689.0	
1	2	120000.0	2	2	2	26	-1	2	0	0	...	3272.0	3455.0	3261.0	0.0	1000.0	
2	3	90000.0	2	2	2	34	0	0	0	0	...	14331.0	14948.0	15549.0	1518.0	1500.0	
3	4	50000.0	2	2	1	37	0	0	0	0	...	28314.0	28959.0	29547.0	2000.0	2019.0	
4	5	50000.0	1	2	1	57	-1	0	-1	0	...	20940.0	19146.0	19131.0	2000.0	36681.0	

5 rows × 25 columns

```
# Data Understanding
df.info()
df.describe()
df.isnull().sum()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 30000 entries, 0 to 29999
Data columns (total 25 columns):
 #   Column                      Non-Null Count  Dtype  
---  ------                      --------------  -----  
 0   ID                          30000 non-null  int64  
 1   LIMIT_BAL                   30000 non-null  float64
 2   SEX                         30000 non-null  int64  
 3   EDUCATION                   30000 non-null  int64  
 4   MARRIAGE                    30000 non-null  int64  
 5   AGE                         30000 non-null  int64  
 6   PAY_0                       30000 non-null  int64  
 7   PAY_2                       30000 non-null  int64  
 8   PAY_3                       30000 non-null  int64  
 9   PAY_4                       30000 non-null  int64  
 10  PAY_5                       30000 non-null  int64  
 11  PAY_6                       30000 non-null  int64  
 12  BILL_AMT1                   30000 non-null  float64
 13  BILL_AMT2                   30000 non-null  float64
 14  BILL_AMT3                   30000 non-null  float64
 15  BILL_AMT4                   30000 non-null  float64
 16  BILL_AMT5                   30000 non-null  float64
 17  BILL_AMT6                   30000 non-null  float64
 18  PAY_AMT1                    30000 non-null  float64
 19  PAY_AMT2                    30000 non-null  float64
 20  PAY_AMT3                    30000 non-null  float64
 21  PAY_AMT4                    30000 non-null  float64
 22  PAY_AMT5                    30000 non-null  float64
 23  PAY_AMT6                    30000 non-null  float64
 24  default.payment.next.month  30000 non-null  int64  
dtypes: float64(13), int64(12)
memory usage: 5.7 MB
```

	0
ID	0

```
# Define Features & Target
X = df.drop("default.payment.next.month", axis=1)
y = df["default.payment.next.month"]
```

EDUCATION	0

```
# Train-Test Split
X_train, X_test, y_train, y_test = train_test_split(
    X, y,
    test_size=0.25,
    random_state=42,
    stratify=y
)
```

PAY_4 0

```
# Feature Scaling (for Logistic Regression)
scaler = StandardScaler()

X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)
```

BILL_AMT2 0

```
# Training Model - Logistic Regression
lr = LogisticRegression(max_iter=1000)
lr.fit(X_train_scaled, y_train)
```

```
▾ LogisticRegression ⓘ ?
LogisticRegression(max_iter=1000)
```

```
# Training Model - Random Forest
rf = RandomForestClassifier(n_estimators=200, random_state=42)
rf.fit(X_train, y_train)
```

```
▾ RandomForestClassifier ⓘ ?
RandomForestClassifier(n_estimators=200, random_state=42)
```

default payment next month 0

```
# Model Evaluation
models = [("Logistic Regression", lr), ("Random Forest", rf)]

for name, model in models:
    if name == "Logistic Regression":
        y_pred = model.predict(X_test_scaled)
        y_prob = model.predict_proba(X_test_scaled)[:,1]
    else:
        y_pred = model.predict(X_test)
        y_prob = model.predict_proba(X_test)[:,1]
    print(f"\n=== {name} ===")
    print(classification_report(y_test, y_pred))
    print("ROC AUC:", roc_auc_score(y_test, y_prob))
    print(confusion_matrix(y_test, y_pred))
```

```

=== Logistic Regression ===
              precision    recall  f1-score   support

           0       0.82      0.97      0.89      5841
           1       0.70      0.24      0.36      1659

    accuracy                           0.81      7500
   macro avg       0.76      0.61      0.62      7500
weighted avg       0.79      0.81      0.77      7500

ROC AUC: 0.7157150937455593
[[5673  168]
 [1259  400]]

=== Random Forest ===
              precision    recall  f1-score   support

           0       0.84      0.94      0.89      5841
           1       0.66      0.37      0.48      1659

    accuracy                           0.82      7500
   macro avg       0.75      0.66      0.68      7500
weighted avg       0.80      0.82      0.80      7500

ROC AUC: 0.7597332423549973
[[5517  324]
 [1037  622]]
```

```
# Choosing Model
final_model = rf
```

```
# Credit Score Calculation
# Get probability of default
probability_of_default = final_model.predict_proba(X_test)[:, 1]

# Convert to credit score
credit_score = (1 - probability_of_default) * 850
```

```
credit_score[:10]
```

```
array([378.25, 476.  , 675.75, 501.5 , 692.75, 790.5 , 225.25, 709.75,
       760.75, 773.5 ])
```

```
# Create Credit Score Categories
def credit_category(score):
    if score >= 750:
        return "Low Risk"
    elif score >= 600:
        return "Medium Risk"
    else:
        return "High Risk"

credit_categories = [credit_category(score) for score in credit_score]
```

```
# Create Final Credit Score Output Table
results = X_test.copy()
results["Default_Probability"] = probability_of_default
results["Credit_Score"] = credit_score
results["Credit_Risk"] = credit_categories

results.head()
```

	ID	LIMIT_BAL	SEX	EDUCATION	MARRIAGE	AGE	PAY_0	PAY_2	PAY_3	PAY_4	...	BILL_AMT6	PAY_AMT1	PAY_AMT2	PAY_AMT3	PAY_AMT
16895	16896	50000.0	1	2	1	45	1	2	0	0	...	20058.0	0.0	2065.0	1376.0	701
6382	6383	80000.0	2	2	1	30	1	2	0	0	...	78710.0	0.0	3299.0	2699.0	3000
14305	14306	160000.0	1	3	1	42	1	-1	-1	-2	...	436.0	1564.0	0.0	0.0	872
15699	15700	20000.0	1	2	1	31	1	4	3	2	...	18062.0	0.0	0.0	0.0	1000
18485	18486	130000.0	2	2	2	26	0	0	0	2	...	131986.0	6000.0	12600.0	4900.0	5105

5 rows × 27 columns

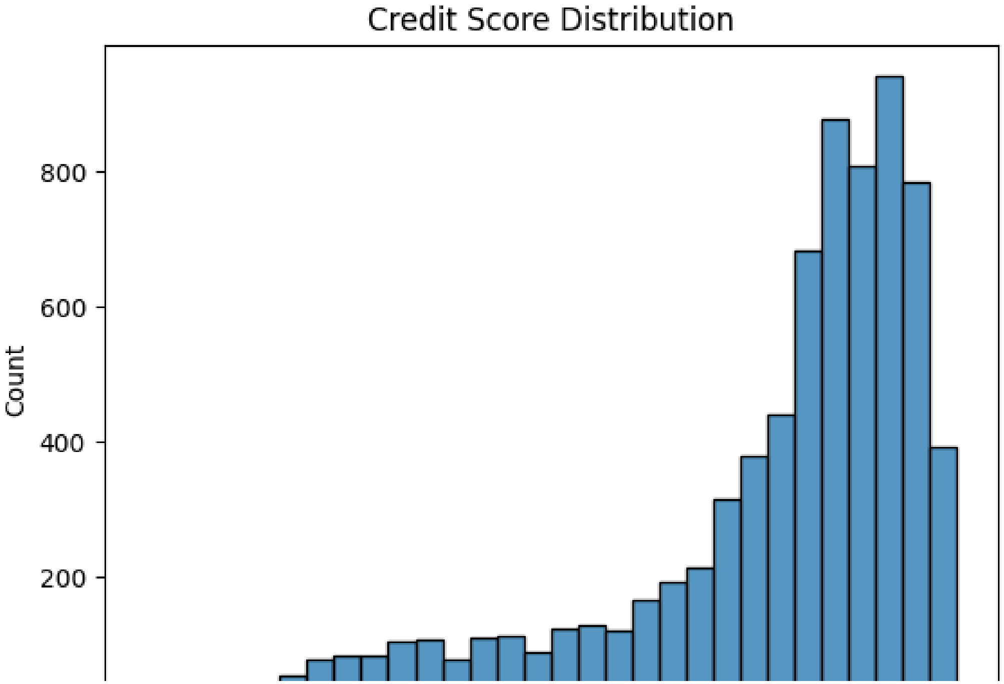
```
# Predict Credit Score for ONE New Customer
new_customer = X_test.iloc[[0]]
```

```
prob = final_model.predict_proba(new_customer)[0][1]
score = (1 - prob) * 850
risk = credit_category(score)

print("Default Probability:", round(prob, 2))
print("Credit Score:", int(score))
print("Risk Category:", risk)
```

```
Default Probability: 0.56
Credit Score: 378
Risk Category: High Risk
```

```
# Credit Score Distribution
plt.figure()
sns.histplot(credit_score, bins=30)
plt.title("Credit Score Distribution")
plt.show()
```


Credit Score Distribution
Count
800
600
400
200