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

loan_df=pd.read_csv("loan_data.csv")

loan_df.head()
```

```
   person_age person_gender person_education  person_income
person_emp_exp  \
0        22.0        female           Master        71948.0
0
1        21.0        female      High School        12282.0
0
2        25.0        female      High School        12438.0
3
3        23.0        female         Bachelor        79753.0
0
4        24.0          male           Master        66135.0
1

  person_home_ownership  loan_amnt loan_intent  loan_int_rate  \
0                  RENT    35000.0    PERSONAL          16.02
1                   OWN     1000.0   EDUCATION          11.14
2              MORTGAGE     5500.0     MEDICAL          12.87
3                  RENT    35000.0     MEDICAL          15.23
4                  RENT    35000.0     MEDICAL          14.27

   loan_percent_income  cb_person_cred_hist_length  credit_score  \
0                 0.49                         3.0           561
1                 0.08                         2.0           504
2                 0.44                         3.0           635
3                 0.44                         2.0           675
4                 0.53                         4.0           586

  previous_loan_defaults_on_file  loan_status
0                             No            1
1                            Yes            0
2                             No            1
3                             No            1
4                             No            1
```

```python
loan_df.isnull().sum()
```

```
person_age                        0
person_gender                     0
person_education                  0
person_income                     0
person_emp_exp                    0
person_home_ownership             0
```

```
loan_amnt                         0
loan_intent                       0
loan_int_rate                     0
loan_percent_income               0
cb_person_cred_hist_length        0
credit_score                      0
previous_loan_defaults_on_file    0
loan_status                       0
dtype: int64
```

```
loan_df.duplicated().sum()
```

```
0
```

```
loan_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 45000 entries, 0 to 44999
Data columns (total 14 columns):
 #   Column                          Non-Null Count  Dtype
---  ------                          --------------  -----
 0   person_age                      45000 non-null  float64
 1   person_gender                   45000 non-null  object
 2   person_education                45000 non-null  object
 3   person_income                   45000 non-null  float64
 4   person_emp_exp                  45000 non-null  int64
 5   person_home_ownership           45000 non-null  object
 6   loan_amnt                       45000 non-null  float64
 7   loan_intent                     45000 non-null  object
 8   loan_int_rate                   45000 non-null  float64
 9   loan_percent_income             45000 non-null  float64
 10  cb_person_cred_hist_length      45000 non-null  float64
 11  credit_score                    45000 non-null  int64
 12  previous_loan_defaults_on_file  45000 non-null  object
 13  loan_status                     45000 non-null  int64
dtypes: float64(6), int64(3), object(5)
memory usage: 4.8+ MB
```

```
from sklearn.preprocessing import LabelEncoder
```

```
enc=LabelEncoder()
```

```
loan_df['person_gender']=enc.fit_transform(loan_df['person_gender'])
```

```
loan_df['person_education'].unique()
```

```
array(['Master', 'High School', 'Bachelor', 'Associate', 'Doctorate'],
      dtype=object)
```

```
from sklearn.preprocessing import OrdinalEncoder
edu=['High School','Bachelor','Master','Associate','Doctorate']
ord=OrdinalEncoder(categories=[edu])

loan_df['person_education']=ord.fit_transform(loan_df[['person_educati
on']])

loan_df.head()
```

```
   person_age  person_gender  person_education  person_income
person_emp_exp  \
0        22.0              0               2.0        71948.0
0
1        21.0              0               0.0        12282.0
0
2        25.0              0               0.0        12438.0
3
3        23.0              0               1.0        79753.0
0
4        24.0              1               2.0        66135.0
1

   loan_amnt loan_intent  loan_int_rate  loan_percent_income  \
0    35000.0    PERSONAL          16.02                 0.49
1     1000.0   EDUCATION          11.14                 0.08
2     5500.0     MEDICAL          12.87                 0.44
3    35000.0     MEDICAL          15.23                 0.44
4    35000.0     MEDICAL          14.27                 0.53

   cb_person_cred_hist_length  credit_score
previous_loan_defaults_on_file  \
0                         3.0           561
No
1                         2.0           504
Yes
2                         3.0           635
No
3                         2.0           675
No
4                         4.0           586
No

   loan_status  person_home_ownership_MORTGAGE
person_home_ownership_OTHER  \
0            1                           False
False
1            0                           False
False
2            1                            True
False
```

```
3            1                            False
False
4            1                            False
False

   person_home_ownership_OWN  person_home_ownership_RENT
0                      False                        True
1                       True                       False
2                      False                       False
3                      False                        True
4                      False                        True

loan_df['person_home_ownership_MORTGAGE']=enc.fit_transform(loan_df['p
erson_home_ownership_MORTGAGE'])
loan_df['person_home_ownership_OTHER']=enc.fit_transform(loan_df['pers
on_home_ownership_OTHER'])
loan_df['person_home_ownership_OWN']=enc.fit_transform(loan_df['person
_home_ownership_OWN'])
loan_df['person_home_ownership_RENT']=enc.fit_transform(loan_df['perso
n_home_ownership_RENT'])

loan_df['previous_loan_defaults_on_file']=enc.fit_transform(loan_df['p
revious_loan_defaults_on_file'])

loan_df['loan_intent']=enc.fit_transform(loan_df['loan_intent'])

loan_df.head()

   person_age  person_gender  person_education  person_income
person_emp_exp  \
0        22.0              0               2.0        71948.0
0
1        21.0              0               0.0        12282.0
0
2        25.0              0               0.0        12438.0
3
3        23.0              0               1.0        79753.0
0
4        24.0              1               2.0        66135.0
1

   loan_amnt  loan_intent  loan_int_rate  loan_percent_income  \
0    35000.0            4          16.02                 0.49
1     1000.0            1          11.14                 0.08
2     5500.0            3          12.87                 0.44
3    35000.0            3          15.23                 0.44
4    35000.0            3          14.27                 0.53

   cb_person_cred_hist_length  credit_score
previous_loan_defaults_on_file  \
0                         3.0           561
```

```
0
1                         2.0           504
1
2                         3.0           635
0
3                         2.0           675
0
4                         4.0           586
0

   loan_status  person_home_ownership_MORTGAGE
person_home_ownership_OTHER  \
0            1                               0
0
1            0                               0
0
2            1                               1
0
3            1                               0
0
4            1                               0
0

   person_home_ownership_OWN  person_home_ownership_RENT
0                          0                           1
1                          1                           0
2                          0                           0
3                          0                           1
4                          0                           1
```

```
loan_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 45000 entries, 0 to 44999
Data columns (total 17 columns):
 #   Column                          Non-Null Count  Dtype
---  ------                          --------------  -----
 0   person_age                      45000 non-null  float64
 1   person_gender                   45000 non-null  int32
 2   person_education                45000 non-null  float64
 3   person_income                   45000 non-null  float64
 4   person_emp_exp                  45000 non-null  int64
 5   loan_amnt                       45000 non-null  float64
 6   loan_intent                     45000 non-null  int32
 7   loan_int_rate                   45000 non-null  float64
 8   loan_percent_income             45000 non-null  float64
 9   cb_person_cred_hist_length      45000 non-null  float64
 10  credit_score                    45000 non-null  int64
 11  previous_loan_defaults_on_file  45000 non-null  int32
 12  loan_status                     45000 non-null  int64
 13  person_home_ownership_MORTGAGE  45000 non-null  int64
 14  person_home_ownership_OTHER     45000 non-null  int64
 15  person_home_ownership_OWN       45000 non-null  int64
 16  person_home_ownership_RENT      45000 non-null  int64
dtypes: float64(7), int32(3), int64(7)
memory usage: 5.3 MB
```

```
x=loan_df.drop(columns=['loan_status'],axis=1)
y=loan_df['loan_status']
```

```
from sklearn.model_selection import train_test_split
```

```
xtrain,xtest,ytrain,ytest=train_test_split(x,y,test_size=0.2,random_st
ate=42)
```

```
xtrain.shape,ytrain.shape
```

```
((36000, 16), (36000,))
```

```
from sklearn.linear_model import LogisticRegression
```

```
model=LogisticRegression()
```

```
model.fit(xtrain,ytrain)
```

```
C:\Users\giridharanks\anaconda3\Lib\site-packages\sklearn\
linear_model\_logistic.py:469: ConvergenceWarning: lbfgs failed to
converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as
shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:

https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
  n_iter_i = _check_optimize_result(

LogisticRegression()
```

```
ypred=model.predict(xtest)
```

```
from sklearn import metrics
```

```
cm=metrics.confusion_matrix(ytest,ypred)
```

```
cm
```

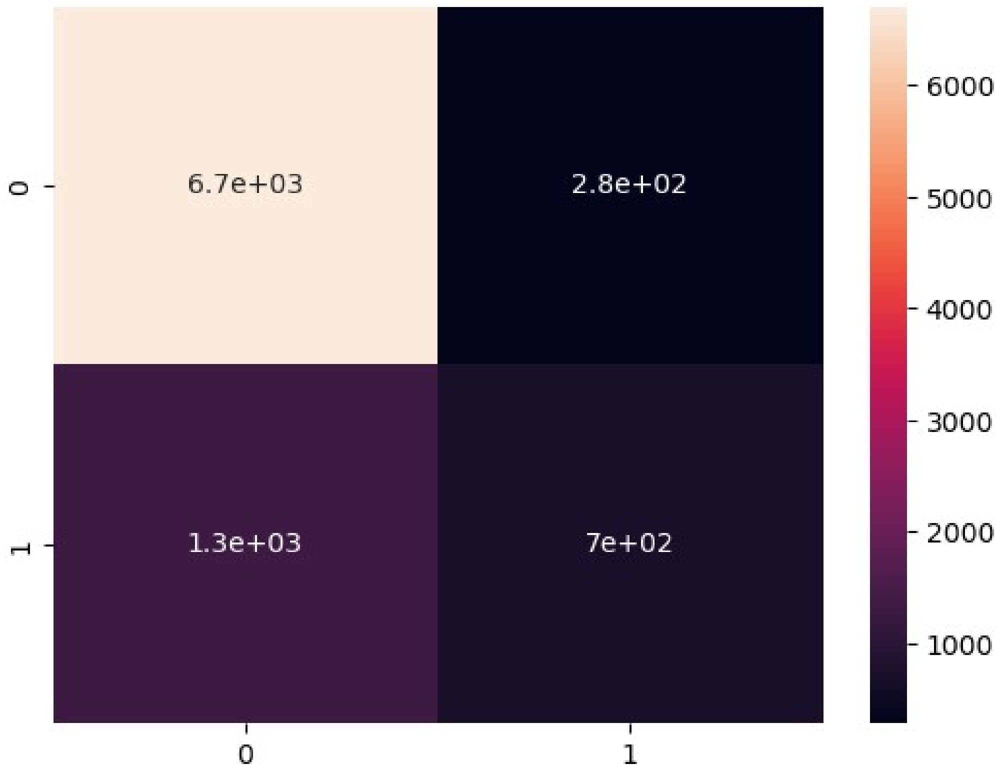
```
array([[6709,  281],
       [1309,  701]], dtype=int64)
```

```
acc=metrics.accuracy_score(ytest,ypred)
```

```
print("Accurracy:",acc*100,"%")
```

```
Accurracy: 82.33333333333334 %
```

```
sns.heatmap(data=cm,annot=True)
plt.show()
```



6.7e+03
2.8e+02
1.3e+03
7e+02
0
1
0
1
6000
5000
4000
3000
2000
1000