Importing the Requires Libraries

In [1]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
import warnings
warnings.filterwarnings('ignore')

from sklearn.preprocessing import LabelEncoder
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import confusion_matrix
```

Uploading and Reading the Train_Data

In [2]:
```
dt = pd.read_csv("train.csv")
dt.head()
```

Out[2]:

	Loan_ID	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	Coapplicant
0	LP001002	Male	No	0	Graduate	No	5849	
1	LP001003	Male	Yes	1	Graduate	No	4583	
2	LP001005	Male	Yes	0	Graduate	Yes	3000	
3	LP001006	Male	Yes	0	Not Graduate	No	2583	
4	LP001008	Male	No	0	Graduate	No	6000	

In [3]:
```
#checking the shape of the dataset
dt.shape
```

Out[3]:
```
(614, 13)
```

In [4]:
```
#summary statistics of the dataset
dt.describe()
```

Out[4]:

	ApplicantIncome	CoapplicantIncome	LoanAmount	Loan_Amount_Term	Credit_History
count	614.000000	614.000000	592.000000	600.00000	564.000000
mean	5403.459283	1621.245798	146.412162	342.00000	0.842199
std	6109.041673	2926.248369	85.587325	65.12041	0.364878
min	150.000000	0.000000	9.000000	12.00000	0.000000
25%	2877.500000	0.000000	100.000000	360.00000	1.000000
50%	3812.500000	1188.500000	128.000000	360.00000	1.000000
75%	5795.000000	2297.250000	168.000000	360.00000	1.000000
max	81000.000000	41667.000000	700.000000	480.00000	1.000000

In [5]:

```
dt.describe()
```

Out[5]:

	ApplicantIncome	CoapplicantIncome	LoanAmount	Loan_Amount_Term	Credit_History
count	614.000000	614.000000	592.000000	600.00000	564.000000
mean	5403.459283	1621.245798	146.412162	342.00000	0.842199
std	6109.041673	2926.248369	85.587325	65.12041	0.364878
min	150.000000	0.000000	9.000000	12.00000	0.000000
25%	2877.500000	0.000000	100.000000	360.00000	1.000000
50%	3812.500000	1188.500000	128.000000	360.00000	1.000000
75%	5795.000000	2297.250000	168.000000	360.00000	1.000000
max	81000.000000	41667.000000	700.000000	480.00000	1.000000

In [6]:

```
#checking the missing the values
dt.isnull().sum()
```

Out[6]:

```
Loan_ID               0
Gender               13
Married               3
Dependents           15
Education             0
Self_Employed        32
ApplicantIncome       0
CoapplicantIncome     0
LoanAmount           22
Loan_Amount_Term     14
Credit_History       50
Property_Area         0
Loan_Status           0
dtype: int64
```

Droping the column with missing data for numerical and categorical variable

In [7]:
```
# fill the missing values for numerical terms
dt['LoanAmount'] = dt['LoanAmount'].fillna(dt['LoanAmount'].mean())
dt['Loan_Amount_Term'] = dt['Loan_Amount_Term'].fillna(dt['Loan_Amount_Term'].mean())
dt['Credit_History'] = dt['Credit_History'].fillna(dt['Credit_History'].mean())
dt['CoapplicantIncome'] = dt['CoapplicantIncome'].fillna(dt['CoapplicantIncome'].mean(
```

In [8]:
```
# fill the missing values for categorical terms
dt['Gender'] = dt["Gender"].fillna(dt['Gender'].mode()[0])
dt['Married'] = dt["Married"].fillna(dt['Married'].mode()[0])
dt['Dependents'] = dt["Dependents"].fillna(dt['Dependents'].mode()[0])
dt['Self_Employed'] = dt["Self_Employed"].fillna(dt['Self_Employed'].mode()[0])
```

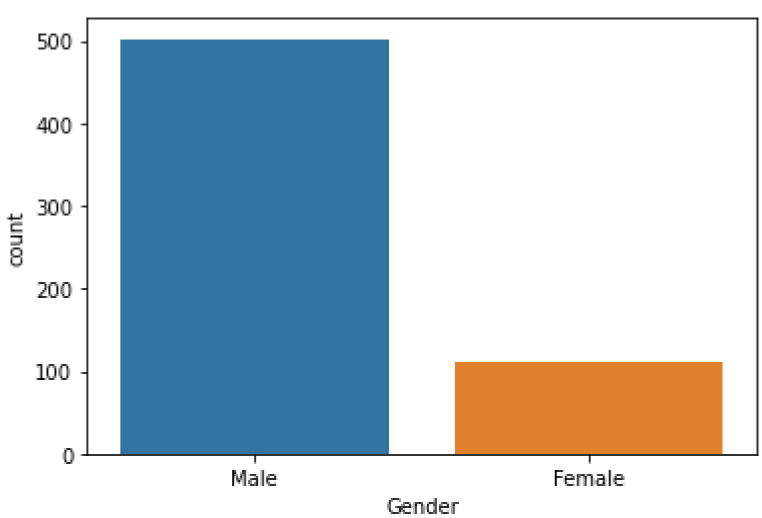
In [9]:
```
#checking the missing values
dt.isnull().sum()
```

Out[9]:
```
Loan_ID              0
Gender               0
Married              0
Dependents           0
Education            0
Self_Employed        0
ApplicantIncome      0
CoapplicantIncome    0
LoanAmount           0
Loan_Amount_Term     0
Credit_History       0
Property_Area        0
Loan_Status          0
dtype: int64
```

Visualization of the categorical attributes columns

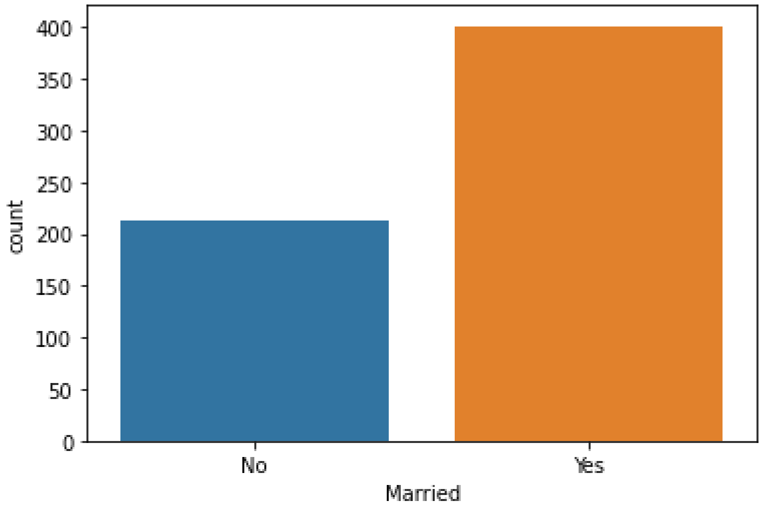
In [10]:
```
# categorical attributes visualization
sns.countplot(dt['Gender'])
```

Out[10]:
```
<AxesSubplot:xlabel='Gender', ylabel='count'>
```



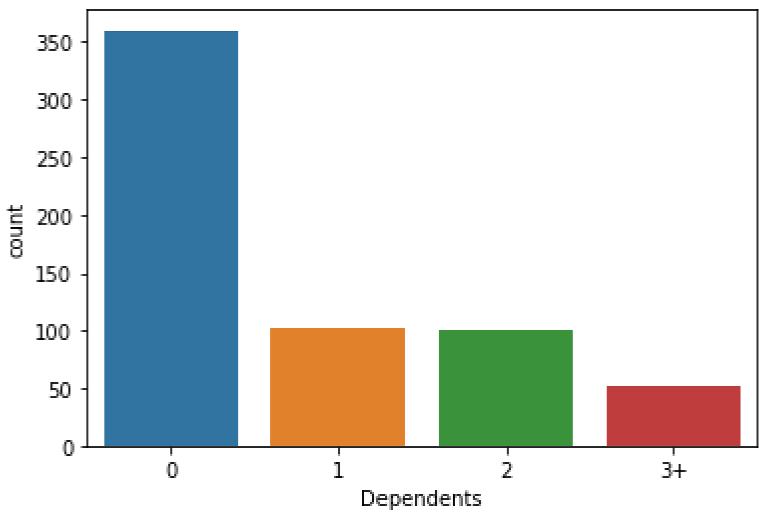
In [11]:
```
#visualization for the married column on categorical attributes
sns.countplot(dt['Married'])
```

Out[11]: <AxesSubplot:xlabel='Married', ylabel='count'>



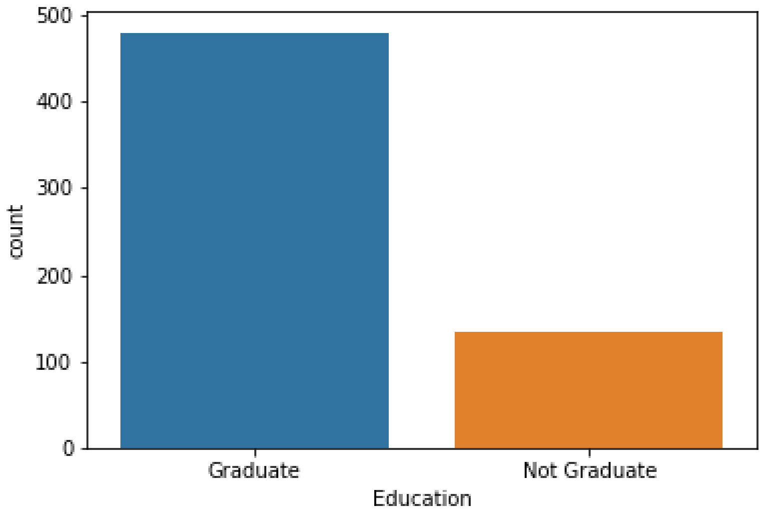
In [12]:
```
#visualization for the Dependent column
sns.countplot(dt['Dependents'])
```

Out[12]: <AxesSubplot:xlabel='Dependents', ylabel='count'>



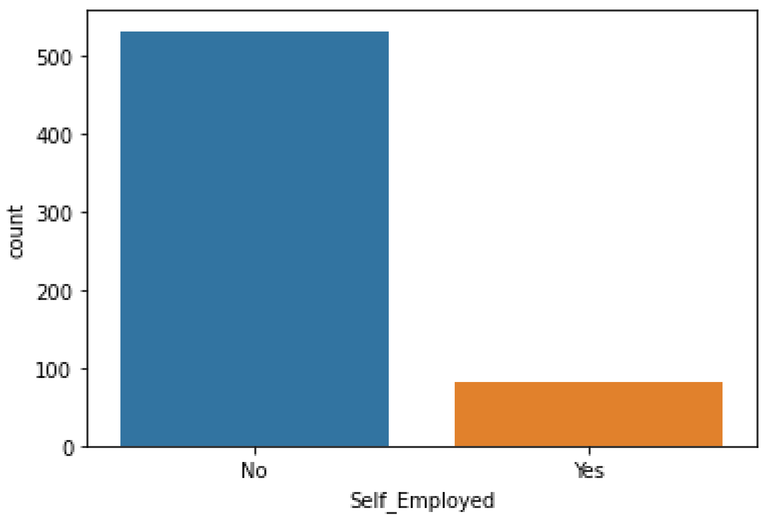
In [13]:
```
#visualization for the Education column
sns.countplot(dt['Education'])
```

Out[13]: <AxesSubplot:xlabel='Education', ylabel='count'>



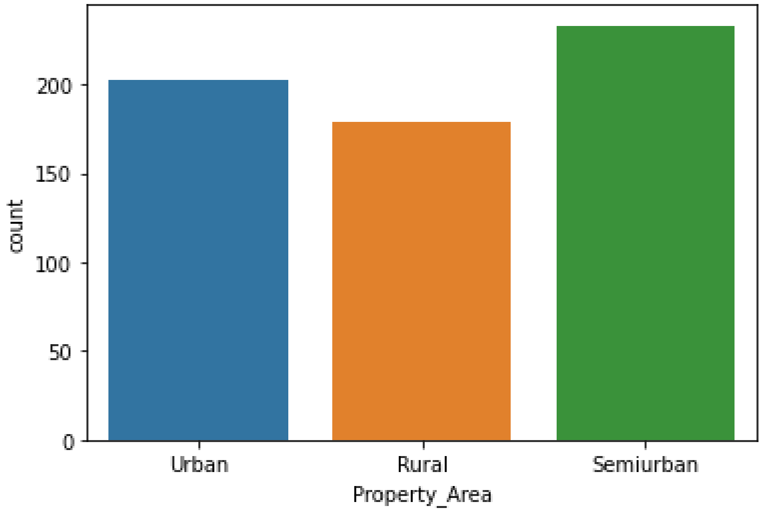
In [14]:
```
#visualization for the Self_Employed column
sns.countplot(dt['Self_Employed'])
```

Out[14]: <AxesSubplot:xlabel='Self_Employed', ylabel='count'>



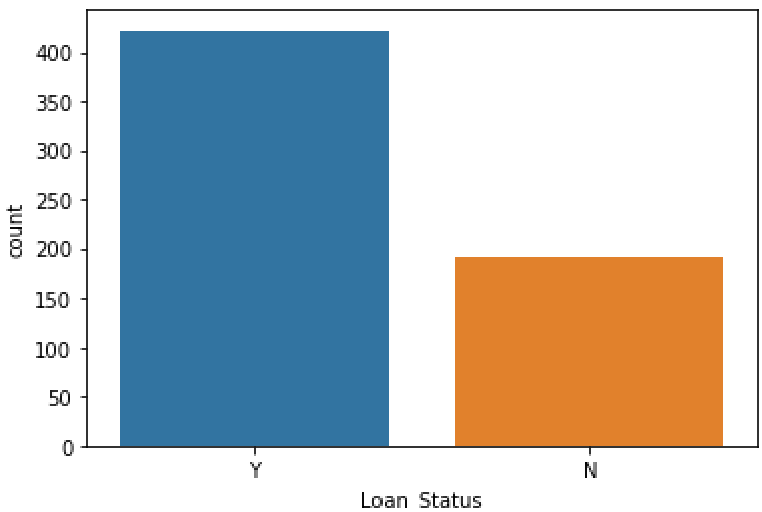
In [15]:
```
#visualization for the Property_Area column
sns.countplot(dt['Property_Area'])
```

Out[15]: <AxesSubplot:xlabel='Property_Area', ylabel='count'>



In [16]:
```
#visualization for the Loan_Status column
sns.countplot(dt['Loan_Status'])
```

Out[16]: <AxesSubplot:xlabel='Loan_Status', ylabel='count'>



In [17]:
```
#checking the some head of he data
dt.head()
```

Out[17]:

	Loan_ID	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	Coapplicant
0	LP001002	Male	No	0	Graduate	No	5849	
1	LP001003	Male	Yes	1	Graduate	No	4583	
2	LP001005	Male	Yes	0	Graduate	Yes	3000	
3	LP001006	Male	Yes	0	Not Graduate	No	2583	
4	LP001008	Male	No	0	Graduate	No	6000	

In [18]:
```
#dropping the columns
cols = ['CoapplicantIncome', 'Loan_Amount_Term', 'Loan_ID', 'CoapplicantIncome']
dt = dt.drop(columns=cols, axis=1)
```

```
In [19]: dt.head()
```

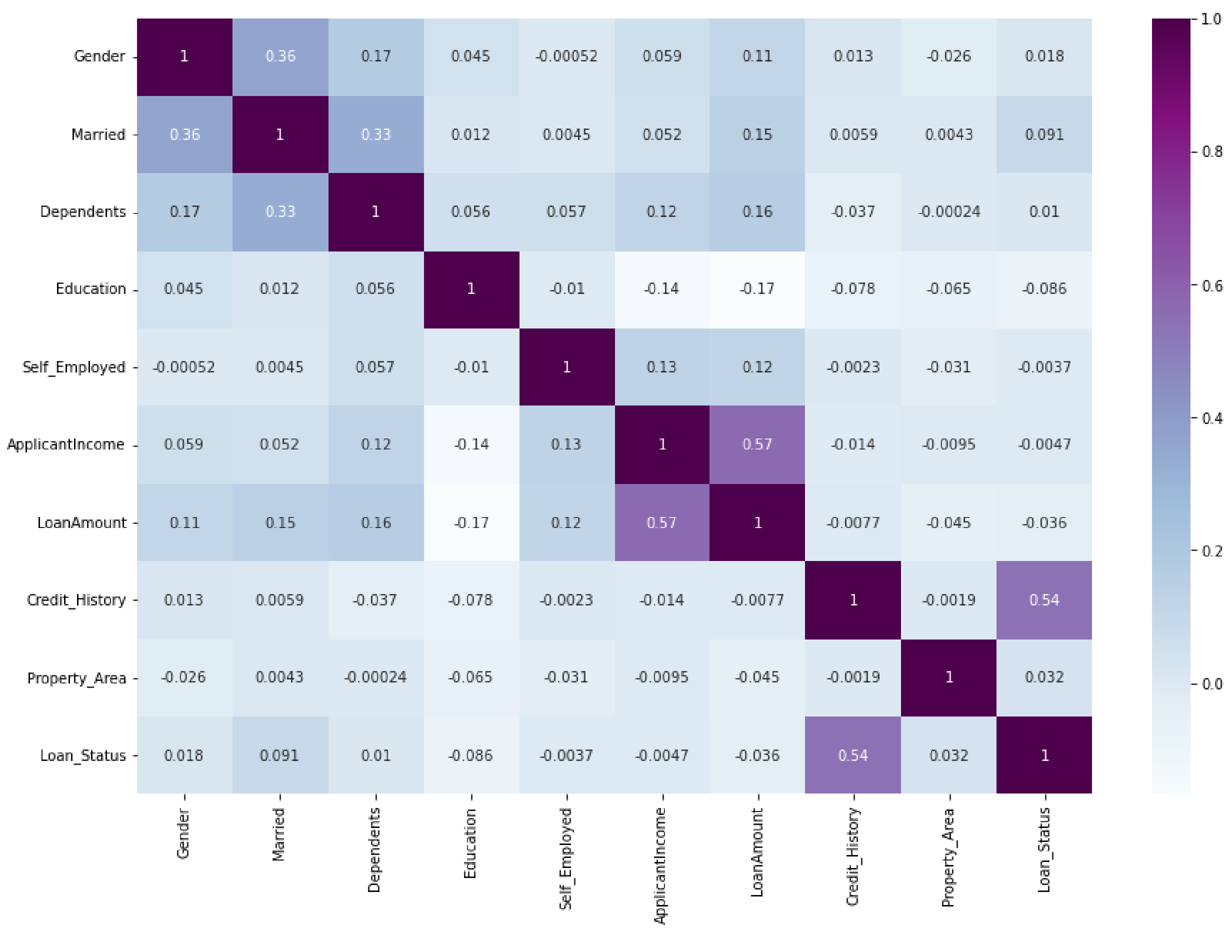
Out[19]:

	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	LoanAmount	Credit_H
0	Male	No	0	Graduate	No	5849	146.412162	
1	Male	Yes	1	Graduate	No	4583	128.000000	
2	Male	Yes	0	Graduate	Yes	3000	66.000000	
3	Male	Yes	0	Not Graduate	No	2583	120.000000	
4	Male	No	0	Graduate	No	6000	141.000000	

```
In [20]: #applying the labelencoder
from sklearn.preprocessing import LabelEncoder
cols = ['Gender',"Married","Education",'Self_Employed',"Property_Area","Loan_Status",'
le = LabelEncoder()
for col in cols:
    dt[col] = le.fit_transform(dt[col])
```

```
In [21]: #correlation of the data
corr = dt.corr()
plt.figure(figsize=(15,10))
sns.heatmap(corr, annot = True, cmap="BuPu")
```

Out[21]: <AxesSubplot:>



In [22]:
```
#dropping the Loan_status columns for looking the target columns
X = dt.drop(columns=['Loan_Status'], axis=1)
y = dt['Loan_Status']
```

In [23]:
```
X
```

Out[23]:

	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	LoanAmount	Credit
0	1	0	0	0	0	5849	146.412162	
1	1	1	1	0	0	4583	128.000000	
2	1	1	0	0	1	3000	66.000000	
3	1	1	0	1	0	2583	120.000000	
4	1	0	0	0	0	6000	141.000000	
...	...	...	...	...	...	...	...	
609	0	0	0	0	0	2900	71.000000	
610	1	1	3	0	0	4106	40.000000	
611	1	1	1	0	0	8072	253.000000	
612	1	1	2	0	0	7583	187.000000	
613	0	0	0	0	1	4583	133.000000	

614 rows × 9 columns

In [24]:
```
y
```

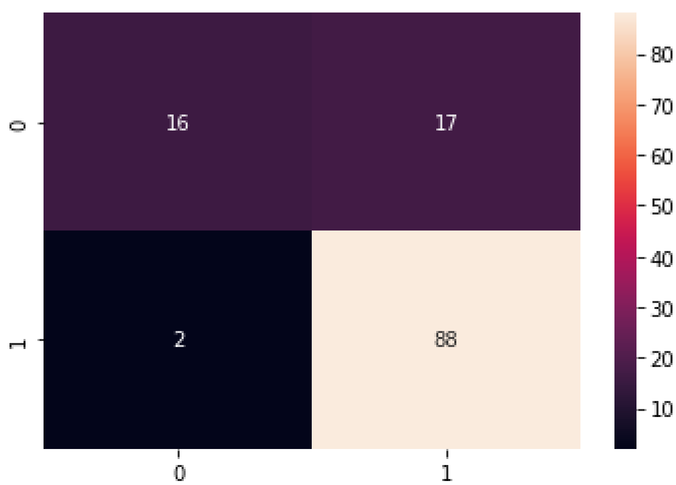
Out[24]:
```
0      1
1      0
2      1
3      1
4      1
      ..
609    1
610    1
611    1
612    1
613    0
Name: Loan_Status, Length: 614, dtype: int32
```

Splitting the dataset in to the training set and test set

In [25]:
```
#splitting the dataset in to the training set and test set
from sklearn.model_selection import train_test_split
x_train,x_test, y_train, y_test = train_test_split(X, y,test_size=0.2, random_state=0)
```

In [26]:
```
#applying the Logistic regression algorithm
from sklearn.linear_model import LogisticRegression
model = LogisticRegression()
```

In [27]:
```
model.fit(x_train, y_train)
```
Out[27]:
```
LogisticRegression()
```
In [28]:
```
#printing the model accuracy
print("Accuracy is", model.score(x_test, y_test)*100)
```
```
Accuracy is 84.5528455284553
```
Model prediction

In [29]:
```
#predicting the test set results
y_pred = model.predict(x_test)
```
In [30]:
```
#importing confusion_matrix
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_test, y_pred)
cm
```
Out[30]:
```
array([[16, 17],
       [ 2, 88]], dtype=int64)
```
In [31]:
```
import seaborn as sns
sns.heatmap(cm, annot=True)
```
Out[31]:
```
<AxesSubplot:>
```


In [32]:
```
#importing and applying the classification_report
from sklearn.metrics import classification_report
# Predicting the values of test data
#y_pred = classifier.predict(x_test)
print('Classification report - \n', classification_report(y_test, y_pred))
```

```
Classification report -
               precision    recall  f1-score   support

           0       0.89      0.48      0.63        33
           1       0.84      0.98      0.90        90

    accuracy                           0.85       123
   macro avg       0.86      0.73      0.77       123
weighted avg       0.85      0.85      0.83       123
```

In [33]:
```
#importing DecisionTreeClassifier
from sklearn.tree import DecisionTreeClassifier
DTModel = DecisionTreeClassifier()
DTModel.fit(x_train, y_train)
print("Accuracy is", DTModel.score(x_test, y_test)*100)
```

```
Accuracy is 66.66666666666666
```

In [34]:
```
#predicting the test set results
y_predDT = DTModel.predict(x_test)
```

In [35]:
```
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_test, y_predDT)
cm
```

Out[35]:
```
array([[17, 16],
       [25, 65]], dtype=int64)
```

In [36]:
```
from sklearn.metrics import classification_report
# Predicting the values of test data
#y_pred = classifier.predict(x_test)
print('Classification report - \n', classification_report(y_test, y_predDT))
```

```
Classification report -
               precision    recall  f1-score   support

           0       0.40      0.52      0.45        33
           1       0.80      0.72      0.76        90

    accuracy                           0.67       123
   macro avg       0.60      0.62      0.61       123
weighted avg       0.70      0.67      0.68       123
```

In [37]:
```
from sklearn.ensemble import RandomForestClassifier,ExtraTreesClassifier
RFModel = RandomForestClassifier()

RFModel.fit(x_train, y_train)
print("Accuracy is", RFModel.score(x_test, y_test)*100)
```

```
Accuracy is 78.04878048780488
```

In [38]:
```
#predicting the test set results
y_predRF = RFModel.predict(x_test)
```

In [39]:
```
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_test, y_predRF)
cm
```

Out[39]:
```
array([[14, 19],
       [ 8, 82]], dtype=int64)
```

In [40]:
```
from sklearn.metrics import classification_report
# Predicting the values of test data
#y_pred = classifier.predict(x_test)
print('Classification report - \n', classification_report(y_test, y_predRF))
```

```
Classification report -
               precision    recall  f1-score   support

           0       0.64      0.42      0.51        33
           1       0.81      0.91      0.86        90

    accuracy                           0.78       123
   macro avg       0.72      0.67      0.68       123
weighted avg       0.76      0.78      0.76       123
```

Importing the test dataset

In [41]:
```
#Importing the test dataset
dt1 = pd.read_csv("test.csv")
dt1
```

Out[41]:

	Loan_ID	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	Coapplica
0	LP001015	Male	Yes	0	Graduate	No	5720	
1	LP001022	Male	Yes	1	Graduate	No	3076	
2	LP001031	Male	Yes	2	Graduate	No	5000	
3	LP001035	Male	Yes	2	Graduate	No	2340	
4	LP001051	Male	No	0	Not Graduate	No	3276	
...	...	...	...	...	...	...	...	
362	LP002971	Male	Yes	3+	Not Graduate	Yes	4009	
363	LP002975	Male	Yes	0	Graduate	No	4158	
364	LP002980	Male	No	0	Graduate	No	3250	
365	LP002986	Male	Yes	0	Graduate	No	5000	
366	LP002989	Male	No	0	Graduate	Yes	9200	

367 rows × 12 columns

In [42]:
```
# fill the missing values for numerical terms
dt1['LoanAmount'] = dt1['LoanAmount'].fillna(dt1['LoanAmount'].mean())
dt1['Loan_Amount_Term'] = dt1['Loan_Amount_Term'].fillna(dt1['Loan_Amount_Term'].mean(
dt1['Credit_History'] = dt1['Credit_History'].fillna(dt1['Credit_History'].mean())
dt1['CoapplicantIncome'] = dt1['CoapplicantIncome'].fillna(dt1['CoapplicantIncome'].me
```

In [43]:
```
# fill the missing values for categorical terms
dt1['Gender'] = dt1["Gender"].fillna(dt1['Gender'].mode()[0])
dt1['Married'] = dt1["Married"].fillna(dt1['Married'].mode()[0])
dt1['Dependents'] = dt1["Dependents"].fillna(dt1['Dependents'].mode()[0])
dt1['Self_Employed'] = dt1["Self_Employed"].fillna(dt1['Self_Employed'].mode()[0])
```

In [44]:
```
dt1.isnull().sum()
```

Out[44]:
```
Loan_ID              0
Gender               0
Married              0
Dependents           0
Education            0
Self_Employed        0
ApplicantIncome      0
CoapplicantIncome    0
LoanAmount           0
Loan_Amount_Term     0
Credit_History       0
Property_Area        0
dtype: int64
```

In [45]:
```
cols = ['CoapplicantIncome', 'Loan_Amount_Term', 'Loan_ID', 'CoapplicantIncome']
dt1 = dt1.drop(columns=cols, axis=1)
```

In [46]:
```
from sklearn.preprocessing import LabelEncoder
cols = ['Gender',"Married","Education",'Self_Employed',"Property_Area","Dependents"]
le = LabelEncoder()
for col in cols:
    dt1[col] = le.fit_transform(dt1[col])
```

In [47]:
```
new_pred=model.predict(dt1)
```

In [48]:
```
new_pred
```

Out[48]:
```
array([1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1,
       0, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 0, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 1, 1, 1, 0, 0, 1, 0, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0,
       1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 0, 0, 1, 0, 1, 1, 1, 1, 0, 0, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 1, 1, 0, 1,
       0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0,
       1, 0, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 0, 1, 0, 1, 1, 1, 1, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1,
       1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1])
```

In [49]:
```
prediction=pd.DataFrame(new_pred, columns=['Predictions']).to_csv("predictionLoad.csv'
```

By comparison the LogisticRegression perform more than the 2 alrogrithm for this model.