In [220]:
```
# importing Libraries
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn import svm
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
from sklearn.impute import SimpleImputer
from sklearn.preprocessing import StandardScaler
```

In [179]:
```
#Datasets
loan=pd.read_csv('bankloan.csv')
```

In [180]:
```
loan.head()
```

Out[180]:

	Loan_ID	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	Coapplica
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 [181]:
```
loan.tail()
```

Out[181]:

	Loan_ID	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	Coappli
609	LP002978	Female	No	0	Graduate	No	2900	
610	LP002979	Male	Yes	3+	Graduate	No	4106	
611	LP002983	Male	Yes	1	Graduate	No	8072	
612	LP002984	Male	Yes	2	Graduate	No	7583	
613	LP002990	Female	No	0	Graduate	Yes	4583	

In [182]:
```
loan.shape
```

Out[182]: (614, 13)

In [183]:
```
loan.columns
```

Out[183]:
```
Index(['Loan_ID', 'Gender', 'Married', 'Dependents', 'Education',
       'Self_Employed', 'ApplicantIncome', 'CoapplicantIncome', 'LoanAmount',
       'Loan_Amount_Term', 'Credit_History', 'Property_Area', 'Loan_Status'],
      dtype='object')
```

In [184]:
```
loan.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 614 entries, 0 to 613
Data columns (total 13 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   Loan_ID            614 non-null    object 
 1   Gender             601 non-null    object 
 2   Married            611 non-null    object 
 3   Dependents         599 non-null    object 
 4   Education          614 non-null    object 
 5   Self_Employed      582 non-null    object 
 6   ApplicantIncome    614 non-null    int64  
 7   CoapplicantIncome  614 non-null    float64
 8   LoanAmount         592 non-null    float64
 9   Loan_Amount_Term   600 non-null    float64
 10  Credit_History     564 non-null    float64
 11  Property_Area      614 non-null    object 
 12  Loan_Status        614 non-null    object 
dtypes: float64(4), int64(1), object(8)
memory usage: 62.5+ KB
```

In [185]:
```
loan.describe().transpose()
```

Out[185]:

	count	mean	std	min	25%	50%	75%	max
ApplicantIncome	614.0	5403.459283	6109.041673	150.0	2877.5	3812.5	5795.00	81000.0
CoapplicantIncome	614.0	1621.245798	2926.248369	0.0	0.0	1188.5	2297.25	41667.0
LoanAmount	592.0	146.412162	85.587325	9.0	100.0	128.0	168.00	700.0
Loan_Amount_Term	600.0	342.000000	65.120410	12.0	360.0	360.0	360.00	480.0
Credit_History	564.0	0.842199	0.364878	0.0	1.0	1.0	1.00	1.0

Checking values of different columns

In [186]:
```
loan['Dependents'].value_counts()
```

Out[186]:
```
0     345
1     102
2     101
3+     51
Name: Dependents, dtype: int64
```

In [187]:
```
loan['Education'].value_counts()
```

Out[187]:
```
Graduate        480
Not Graduate    134
Name: Education, dtype: int64
```

In [188]:
```
loan['Self_Employed'].value_counts()
```

Out[188]:
```
No     500
Yes     82
Name: Self_Employed, dtype: int64
```

In [189]:
```
#Checking Null Values
nullv=loan.isnull().sum()
print(nullv)
print("\nTotal Null Values: ",nullv.sum())
```

```
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

Total Null Values:  149
```

In [190]:
```
#Imputing Missing values with mean for continuous variable
loan['LoanAmount'].fillna(loan['LoanAmount'].mean(), inplace=True)
loan['Loan_Amount_Term'].fillna(loan['Loan_Amount_Term'].mean(), inplace=True)
loan['ApplicantIncome'].fillna(loan['ApplicantIncome'].mean(), inplace=True)
loan['CoapplicantIncome'].fillna(loan['CoapplicantIncome'].mean(), inplace=True)

#Imputing Missing values with mode for categorical variables
loan['Gender'].fillna(loan['Gender'].mode()[0], inplace=True)
loan['Married'].fillna(loan['Married'].mode()[0], inplace=True)
loan['Dependents'].fillna(loan['Dependents'].mode()[0], inplace=True)
loan['Self_Employed'].fillna(loan['Self_Employed'].mode()[0], inplace=True)
loan['Loan_Amount_Term'].fillna(loan['Loan_Amount_Term'].mode()[0], inplace=True)
loan['Credit_History'].fillna(loan['Credit_History'].mode()[0], inplace=True)
```

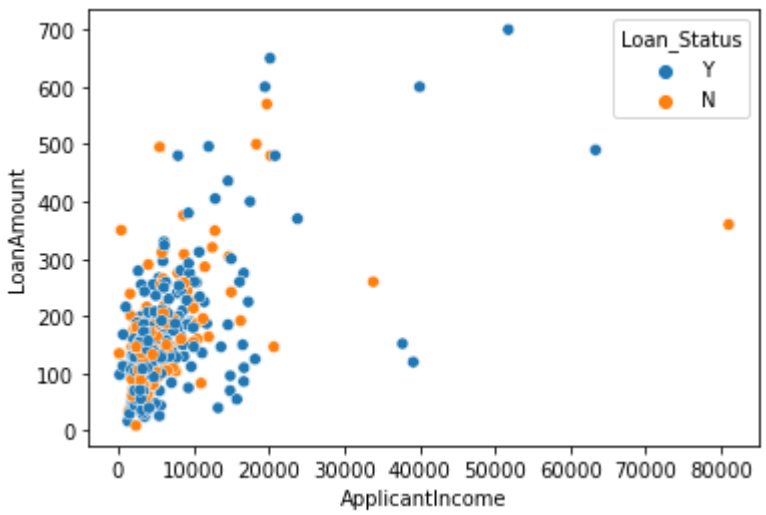
In [191]:
```
loan.shape
```

Out[191]:
```
(614, 13)
```

Data Visualizations

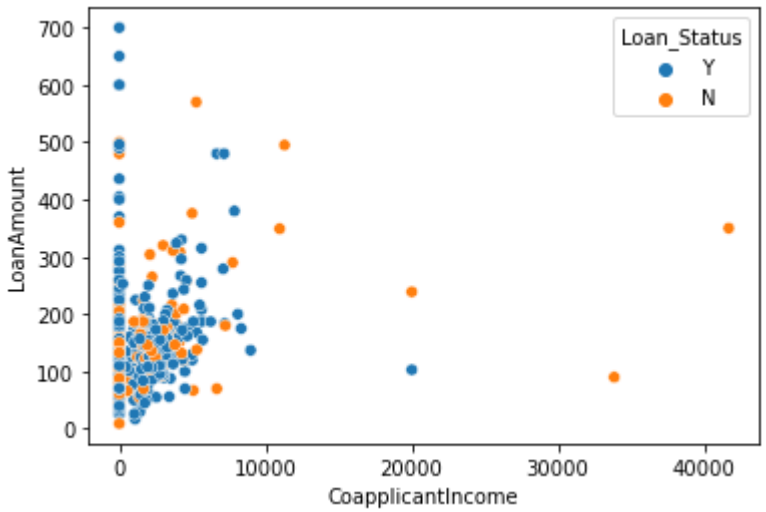
In [192]:
```
sns.scatterplot(y='LoanAmount',x='ApplicantIncome',hue='Loan_Status',data=loan)
```

Out[192]:
```
<AxesSubplot:xlabel='ApplicantIncome', ylabel='LoanAmount'>
```



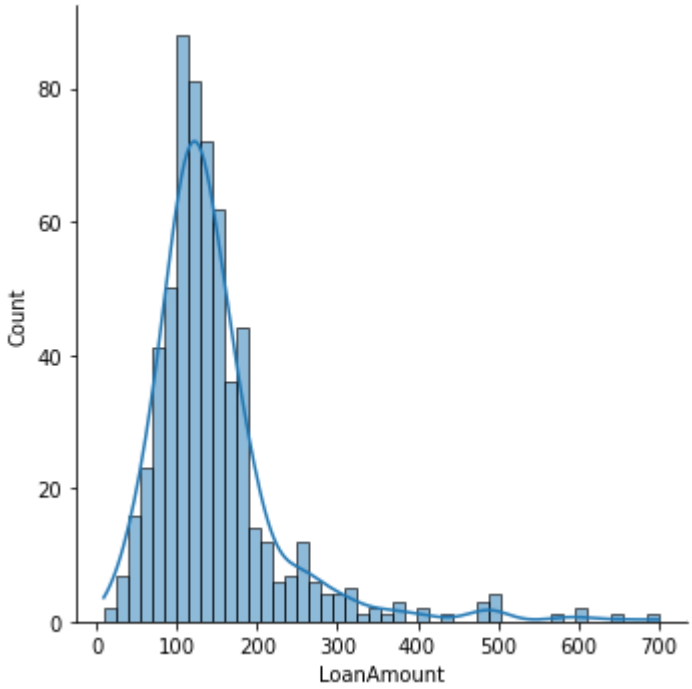
In [193]:
```
sns.scatterplot(y='LoanAmount',x='CoapplicantIncome',hue='Loan_Status',data=loan)
```

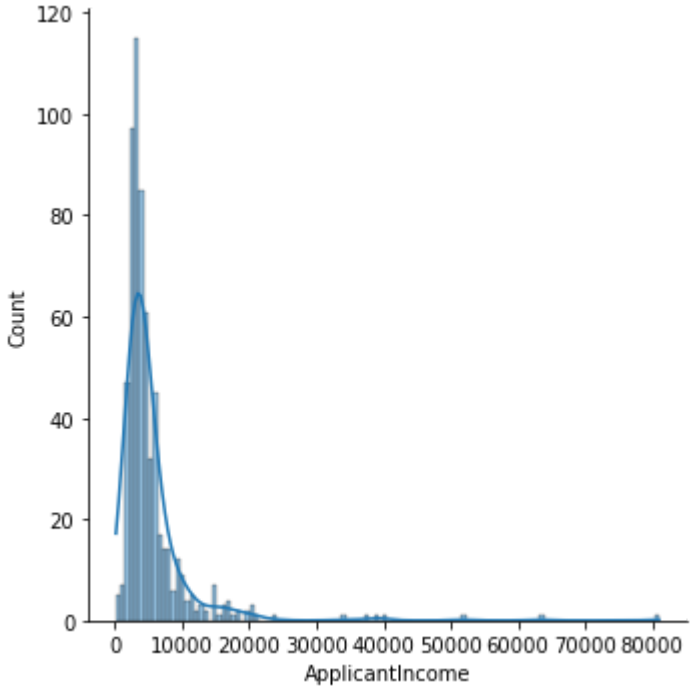
Out[193]:
```
<AxesSubplot:xlabel='CoapplicantIncome', ylabel='LoanAmount'>
```



In [194]:
```
sns.displot(x='LoanAmount',data= loan, kde=True)
sns.displot(x='ApplicantIncome',data= loan, kde=True)
```

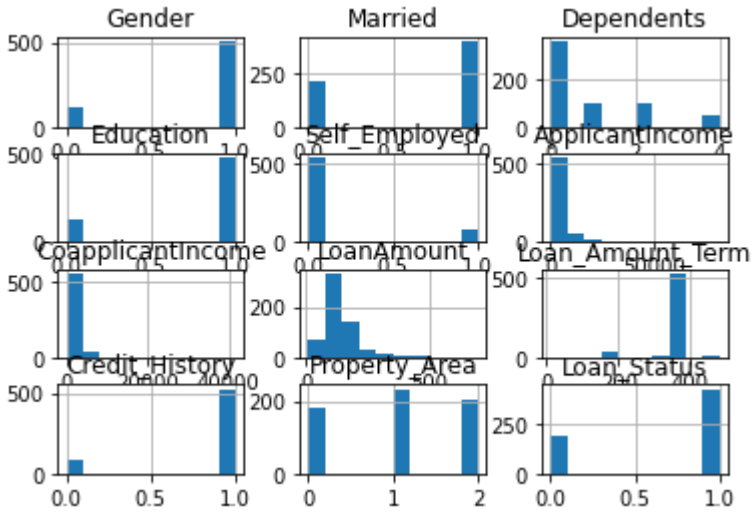
Out[194]: <seaborn.axisgrid.FacetGrid at 0x1d36cc464c0>





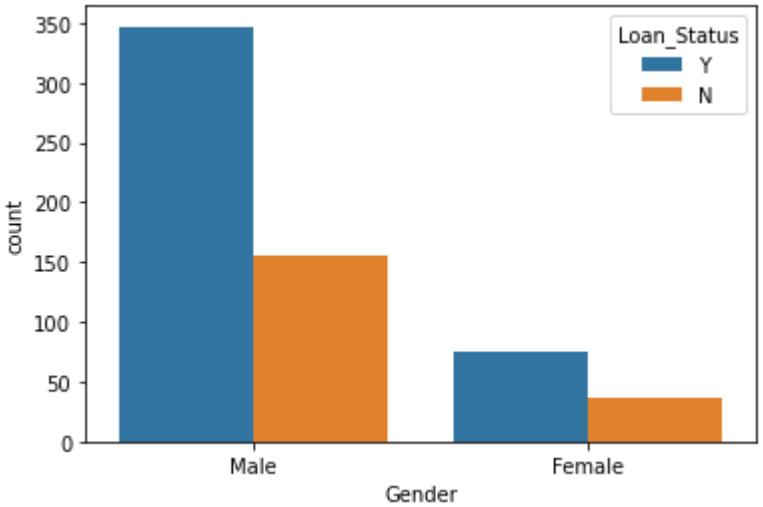
In [225]:
```
plt.figure(figsize=(16,15))
loan.hist();
```

```
<Figure size 1152x1080 with 0 Axes>
```



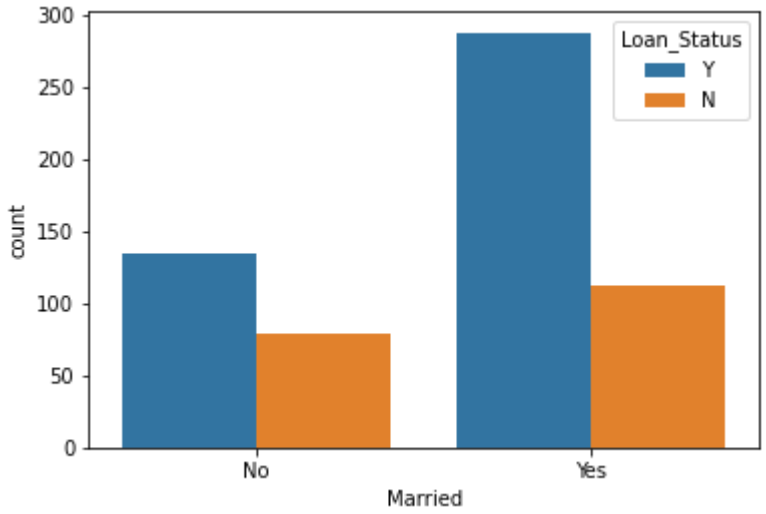
In [196]:
```
sns.countplot(x='Gender',hue='Loan_Status',data=loan)
```

Out[196]:
```
<AxesSubplot:xlabel='Gender', ylabel='count'>
```



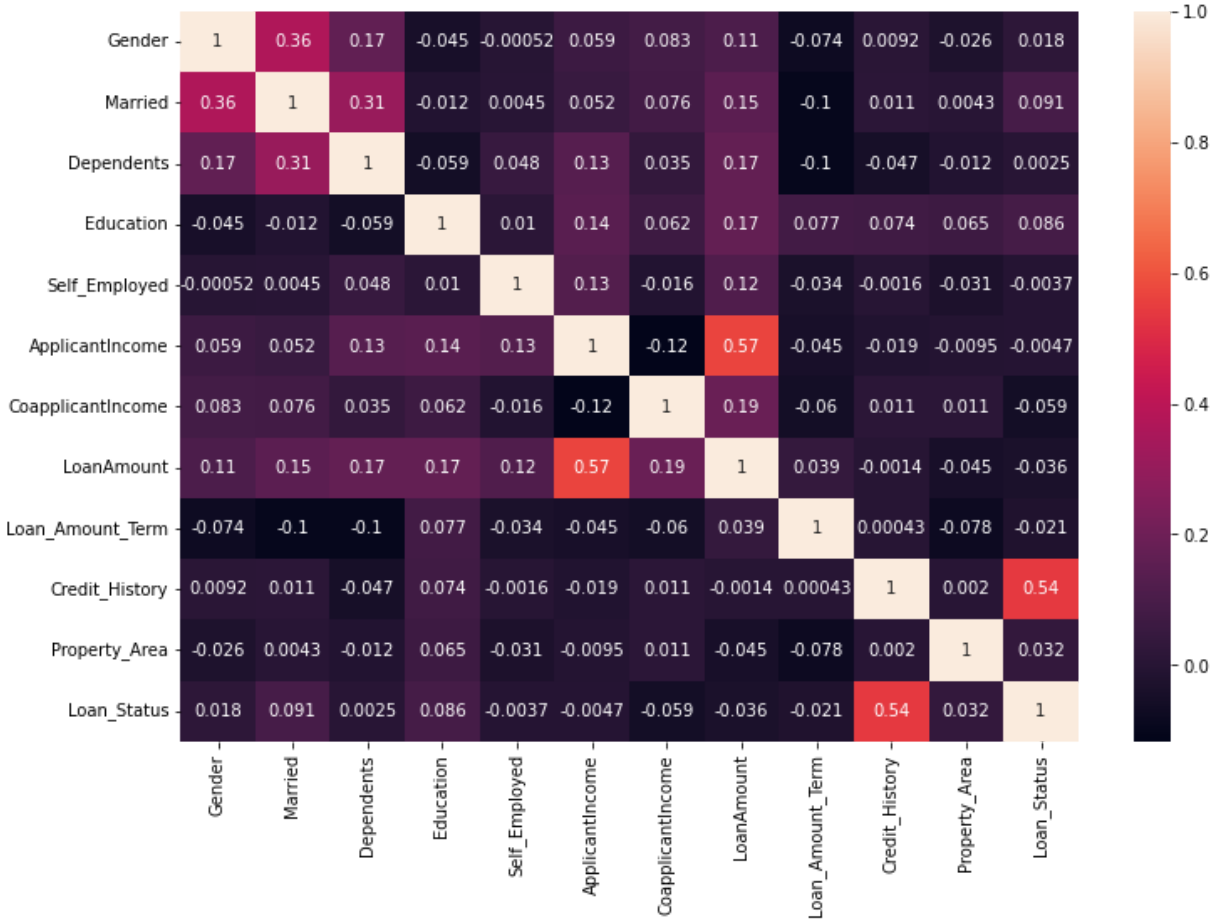
In [197]:
```
sns.countplot(x='Married',hue='Loan_Status',data=loan)
```

Out[197]:
```
<AxesSubplot:xlabel='Married', ylabel='count'>
```



In [221]:
```
# Correlation
plt.figure(figsize=(12,8))
corr=loan.corr()
sns.heatmap(corr,annot=True)
```

Out[221]: <AxesSubplot:>



In [198]:
```
# convert categorical columns to numerical values
loan = loan.replace(to_replace='3+', value=4)

loan.replace({'Loan_Status':{'N':0,'Y':1},'Married':{'No':0,'Yes':1},'Gender':{'M
                      'Property_Area':{'Rural':0,'Semiurban':1,'Urban':2},'Educat
```

In [199]:
```
loan.head()
```

Out[199]:

	Loan_ID	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	Coapplica
0	LP001002	1	0	0	1	0	5849	
1	LP001003	1	1	1	1	0	4583	
2	LP001005	1	1	0	1	1	3000	
3	LP001006	1	1	0	0	0	2583	
4	LP001008	1	0	0	1	0	6000	

In [200]:
```
loan['Dependents']=loan['Dependents'].astype(int)
```

In [201]:
```
loan.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 614 entries, 0 to 613
Data columns (total 13 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   Loan_ID            614 non-null    object 
 1   Gender             614 non-null    int64  
 2   Married            614 non-null    int64  
 3   Dependents         614 non-null    int32  
 4   Education          614 non-null    int64  
 5   Self_Employed      614 non-null    int64  
 6   ApplicantIncome    614 non-null    int64  
 7   CoapplicantIncome  614 non-null    float64
 8   LoanAmount         614 non-null    float64
 9   Loan_Amount_Term   614 non-null    float64
 10  Credit_History     614 non-null    float64
 11  Property_Area      614 non-null    int64  
 12  Loan_Status        614 non-null    int64  
dtypes: float64(4), int32(1), int64(7), object(1)
memory usage: 60.1+ KB
```

Seprating Data and Label

In [202]:
```
X=loan.drop(columns=['Loan_ID','Loan_Status'],axis=1)
y=loan['Loan_Status']
```

In [203]:
```
print('X= ',X.shape)
print('y= ',y.shape)
```

```
X=  (614, 11)
y=  (614,)
```

In [204]:
```
# Splitting data into train test split
```

In [205]:
```
X_train, X_test, Y_train, Y_test= train_test_split(X,y,test_size=0.1,stratify=y)
```

In [206]:
```
print(X_train.shape, X_test.shape, Y_train.shape, Y_test.shape)
```

```
(552, 11) (62, 11) (552,) (62,)
```

In [207]:
```
scale= StandardScaler()
X_train= scale.fit_transform(X_train)
X_test= scale.transform(X_test)
```

Traning the Mode using SVM

In [208]:
```
classifier= svm.SVC(kernel='linear')
```

In [209]:
```
classifier.fit(X_train,Y_train)
```

Out[209]:
```
SVC(kernel='linear')
```

In [210]:
```
X_train_pred=classifier.predict(X_train)
Train_Accu=accuracy_score(X_train_pred,Y_train)
```

In [211]:
```
print('Accuracy: ',Train_Accu )
```

```
Accuracy:  0.8097826086956522
```

In [212]:
```
X_test_pred=classifier.predict(X_test)
Test_Accu=accuracy_score(X_test_pred,Y_test)
```

In [213]:
```
print('Accuracy: ',Test_Accu )
```

```
Accuracy:  0.8064516129032258
```

In [ ]:
```

```