In [2]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn import svm
```

In [5]:
```
df = pd. read_csv ("loan.csv")
```

In [6]:
```
df.head()
```

Out[6]:

	Loan_ID	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	CoapplicantI
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 [7]:
```
df.info()
```

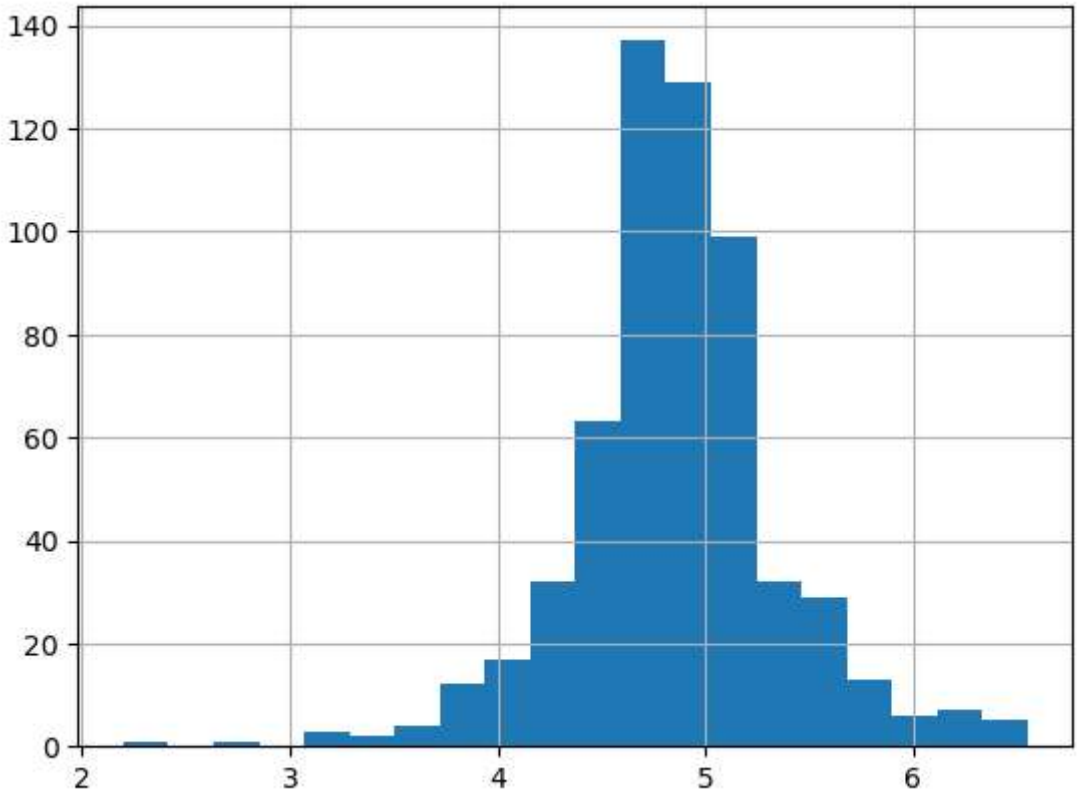
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 614 entries, 0 to 613
Data columns (total 13 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   Loan_ID            614 non-null    object 
 1   Gender             601 non-null    object 
 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 [8]:
```
df.isnull().sum()
```

Out[8]:
```
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
```

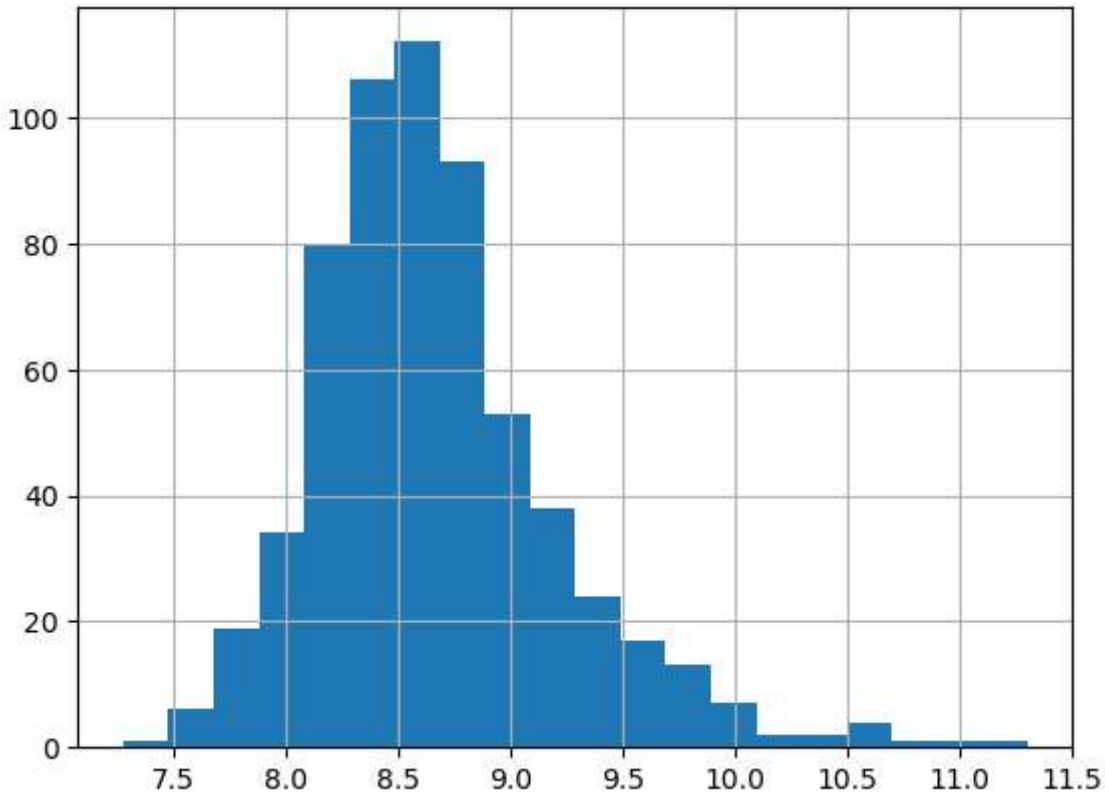
In [9]:
```
df ['loanAmount_log'] = np.log(df [ 'LoanAmount'])
df['loanAmount_log'].hist (bins=20)
```

Out[9]:
```
<Axes: >
```



In [12]:
```
df ['TotalIncome'] = df ['ApplicantIncome'] + df ['CoapplicantIncome']
df ['TotalIncome_log'] = np.log(df ['TotalIncome'])
df['TotalIncome_log'].hist (bins=20)
```

Out[12]:
```
<Axes: >
```



In [13]:
```
df.isnull().sum()
```

Out[13]:
```
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
loanAmount_log       22
TotalIncome           0
TotalIncome_log       0
dtype: int64
```

In [19]:
```
df['Gender'].fillna(df['Gender' ].mode() [0], inplace = True)
df['Married'].fillna(df['Married'].mode() [0], inplace = True)
df ['Self_Employed'].fillna(df ['Self_Employed'].mode() [0], inplace = True)
df ['Dependents'].fillna(df ['Dependents'].mode() [0], inplace = True)

df. LoanAmount = df. LoanAmount.fillna(df. LoanAmount.mean())
df.loanAmount_log = df.loanAmount_log.fillna(df.loanAmount_log.mean())
df ['Loan_Amount_Term'].fillna(df ['Loan_Amount_Term' ].mode() [0], inplace = True)
df['Credit_History'].fillna(df['Credit_History'].mode()[0], inplace=True)


df.isnull().sum()
```

Out[19]:
```
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
loanAmount_log       0
TotalIncome          0
TotalIncome_log      0
dtype: int64
```

In [21]:
```
X= df.iloc[:,np.r_[1:5,9:11, 13:15]].values
y= df.iloc[:,12].values
X
```

Out[21]:
```
array([['Male', 'No', '0', ..., 1.0, 4.857444178729352, 5849.0],
       ['Male', 'Yes', '1', ..., 1.0, 4.852030263919617, 6091.0],
       ['Male', 'Yes', '0', ..., 1.0, 4.189654742026425, 3000.0],
       ...,
       ['Male', 'Yes', '1', ..., 1.0, 5.53338948872752, 8312.0],
       ['Male', 'Yes', '2', ..., 1.0, 5.231108616854587, 7583.0],
       ['Female', 'No', '0', ..., 0.0, 4.890349128221754, 4583.0]],
      dtype=object)
```

In [22]:
```
df.head(20)
```

Out[22]:

	Loan_ID	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	Coapplican
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	
5	LP001011	Male	Yes	2	Graduate	Yes	5417	
6	LP001013	Male	Yes	0	Not Graduate	No	2333	
7	LP001014	Male	Yes	3+	Graduate	No	3036	
8	LP001018	Male	Yes	2	Graduate	No	4006	
9	LP001020	Male	Yes	1	Graduate	No	12841	
10	LP001024	Male	Yes	2	Graduate	No	3200	
11	LP001027	Male	Yes	2	Graduate	No	2500	
12	LP001028	Male	Yes	2	Graduate	No	3073	
13	LP001029	Male	No	0	Graduate	No	1853	
14	LP001030	Male	Yes	2	Graduate	No	1299	
15	LP001032	Male	No	0	Graduate	No	4950	
16	LP001034	Male	No	1	Not Graduate	No	3596	
17	LP001036	Female	No	0	Graduate	No	3510	
18	LP001038	Male	Yes	0	Not Graduate	No	4887	
19	LP001041	Male	Yes	0	Graduate	No	2600	

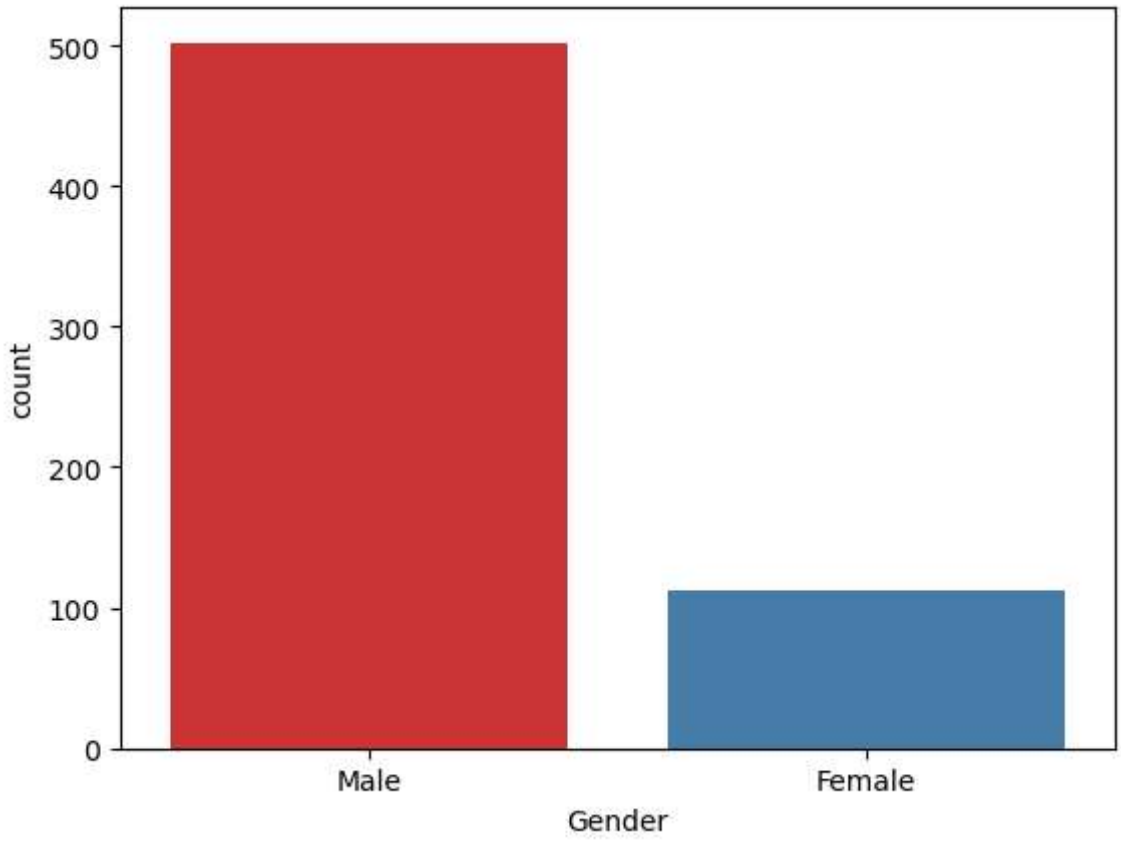
In [23]:
```
print("per of missing gender is %2f%%" % ((df [ 'Gender'].isnull().sum()/df.shape [0])
```

```
per of missing gender is 0.000000%
```

In [24]:
```
print("number of people who take loan as group by gender:")
print (df [ 'Gender'].value_counts())
sns.countplot (x='Gender', data=df, palette = 'Set1')
```

```
number of people who take loan as group by gender:
Male      502
Female    112
Name: Gender, dtype: int64
```

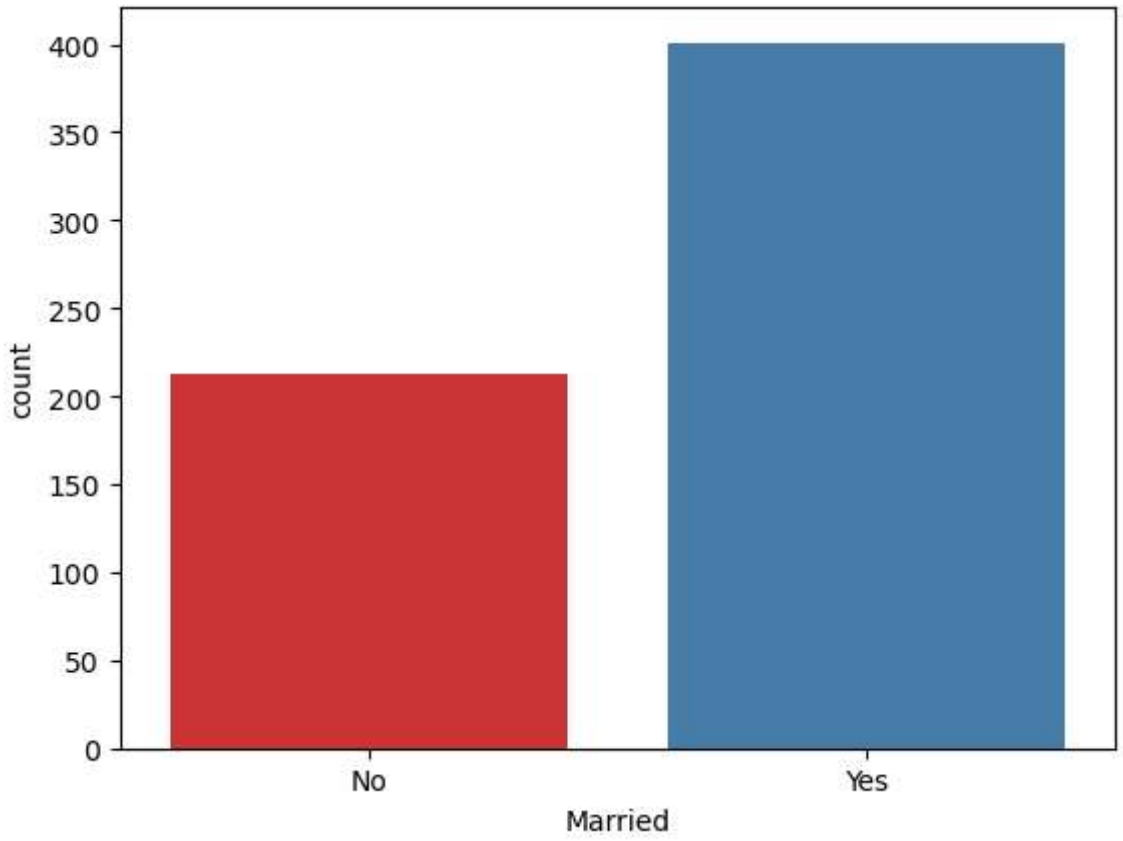
Out[24]:
```
<Axes: xlabel='Gender', ylabel='count'>
```



In [25]:
```
print("number of people who take loan as group by Marital Status:")
print (df [ 'Married'].value_counts())
sns.countplot (x='Married', data=df, palette = 'Set1')
```

```
number of people who take loan as group by Marital Status:
Yes    401
No     213
Name: Married, dtype: int64
```

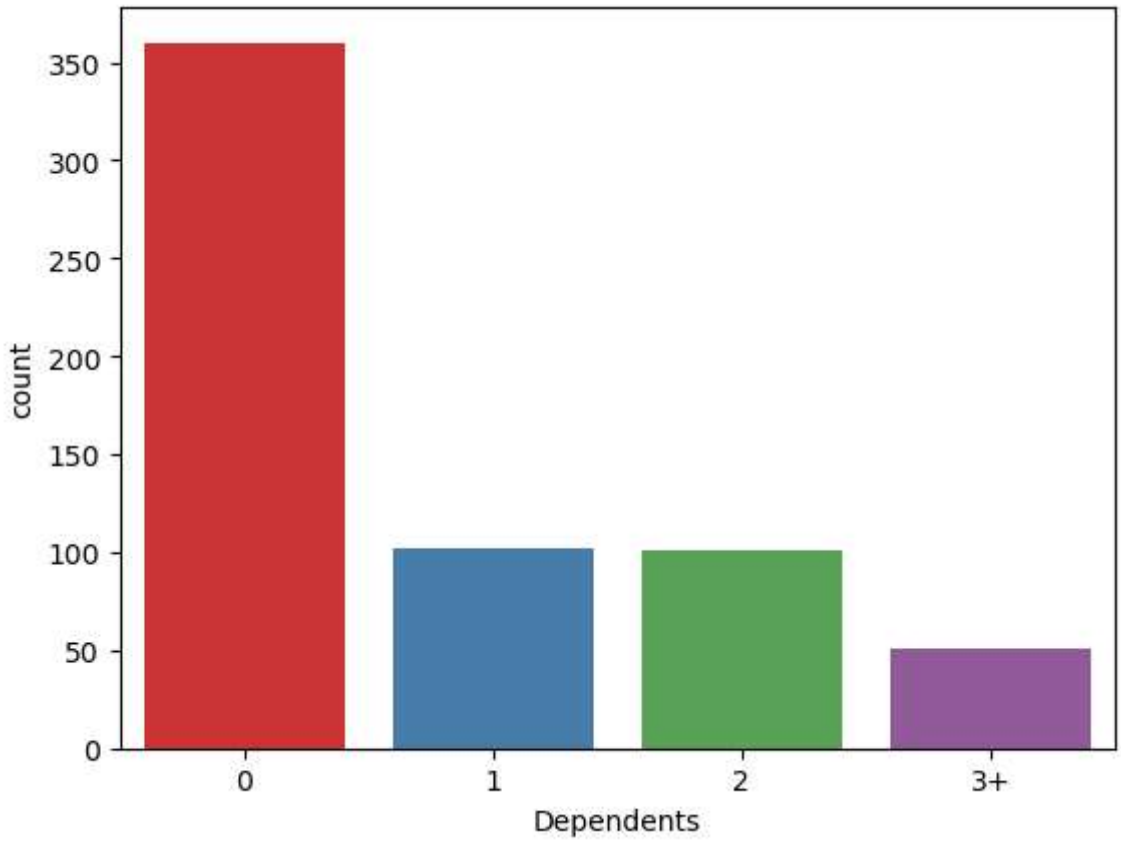
Out[25]:
```
<Axes: xlabel='Married', ylabel='count'>
```



In [26]:
```
print("number of people who take loan as group by Dependents:")
print (df [ 'Dependents'].value_counts())
sns.countplot (x='Dependents', data=df, palette = 'Set1')
```

```
number of people who take loan as group by Dependents:
0     360
1     102
2     101
3+     51
Name: Dependents, dtype: int64
```

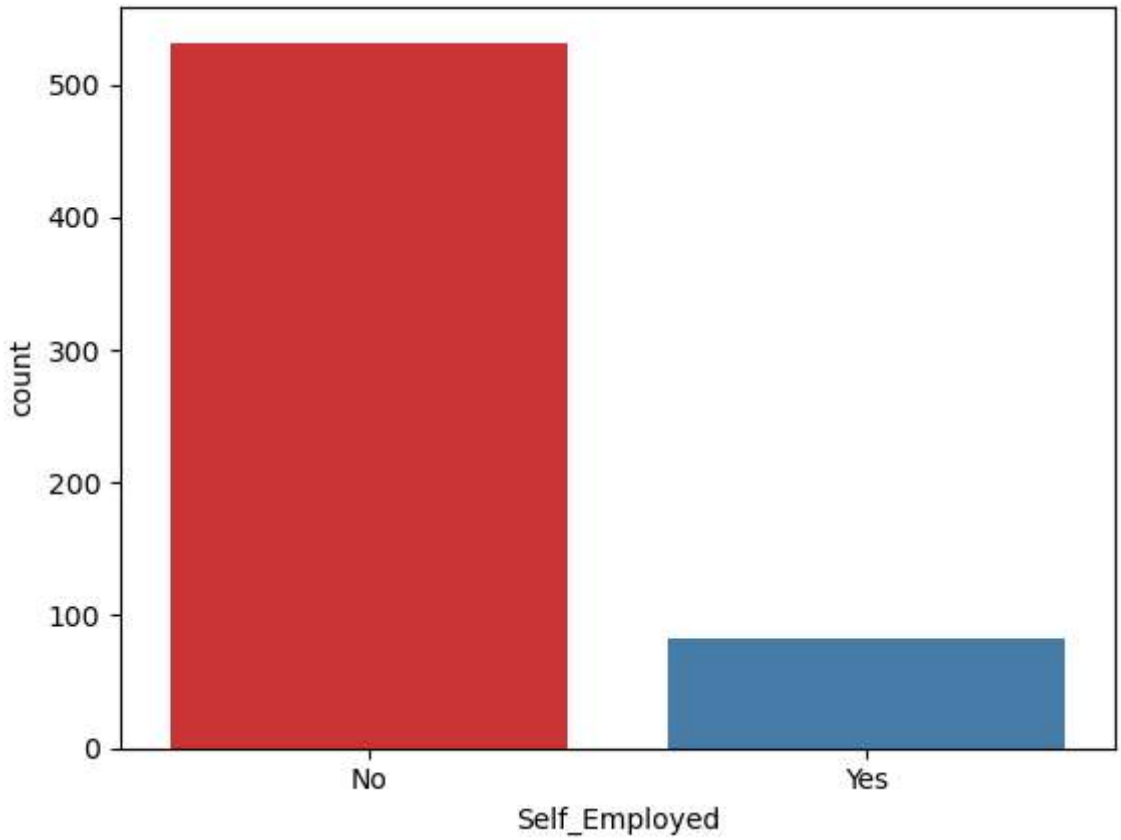
Out[26]:
```
<Axes: xlabel='Dependents', ylabel='count'>
```



In [27]:
```
print("number of people who take loan as group by Self_Employed:")
print (df [ 'Self_Employed'].value_counts())
sns.countplot (x='Self_Employed', data=df, palette = 'Set1')
```

```
number of people who take loan as group by Self_Employed:
No     532
Yes     82
Name: Self_Employed, dtype: int64
```

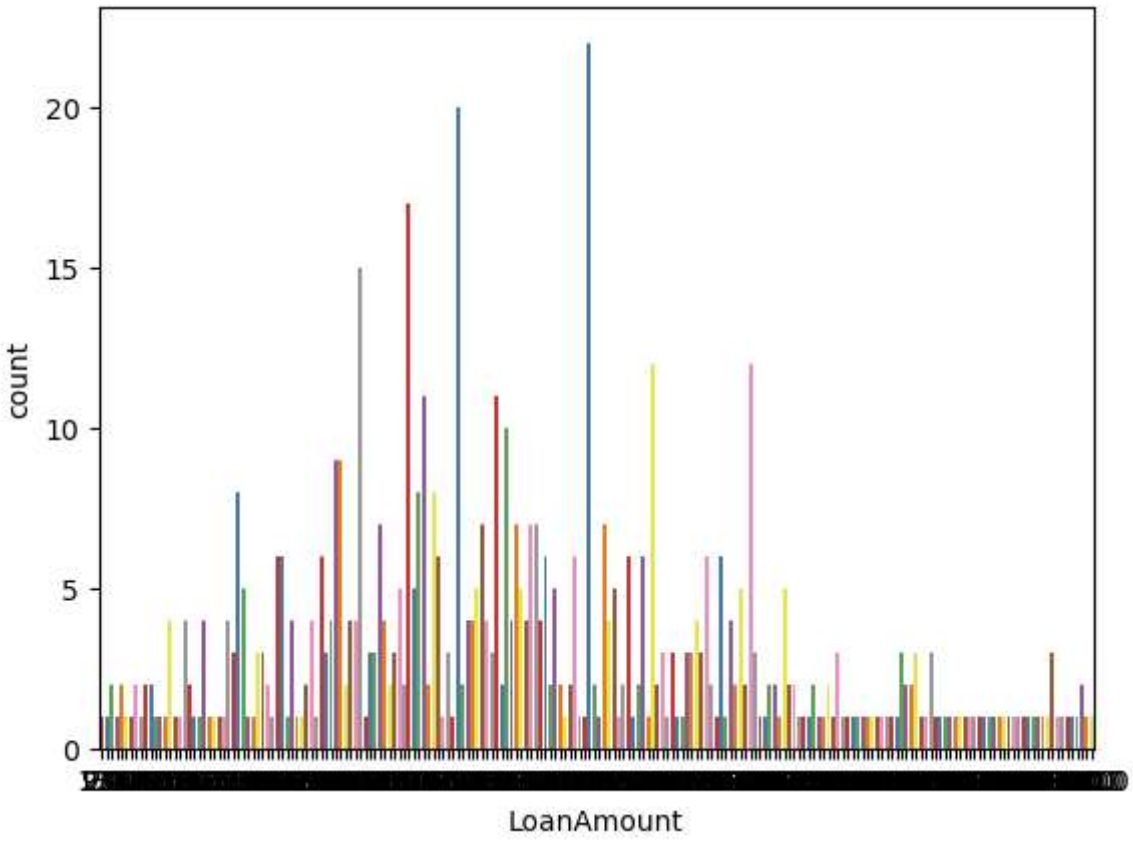
Out[27]:
```
<Axes: xlabel='Self_Employed', ylabel='count'>
```



In [28]:
```
print("number of people who take loan as group by LoanAmount:")
print (df [ 'LoanAmount'].value_counts())
sns.countplot (x='LoanAmount', data=df, palette = 'Set1')
```

```
number of people who take loan as group by LoanAmount:
146.412162    22
120.000000    20
110.000000    17
100.000000    15
160.000000    12
              ..
240.000000     1
214.000000     1
59.000000      1
166.000000     1
253.000000     1
Name: LoanAmount, Length: 204, dtype: int64
```

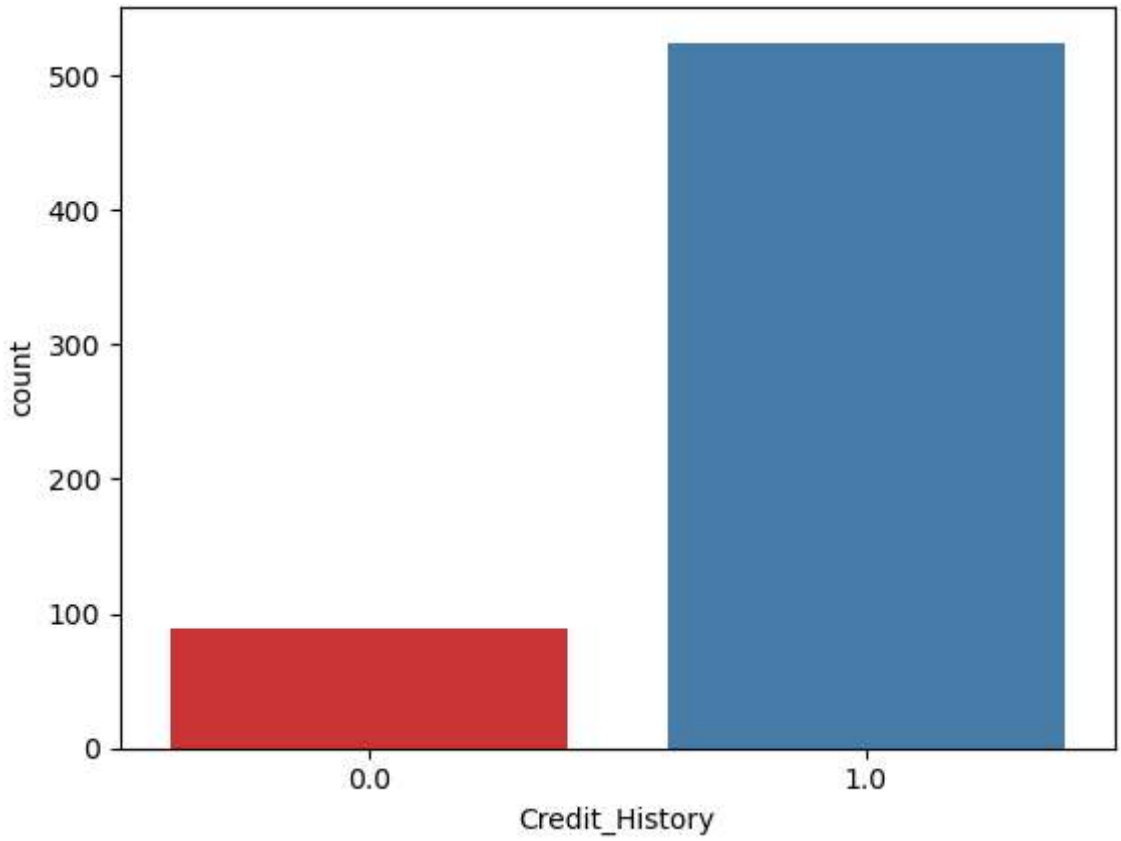
Out[28]: <Axes: xlabel='LoanAmount', ylabel='count'>



In [29]:
```
print("number of people who take loan as group by Credit_History:")
print (df [ 'Credit_History'].value_counts())
sns.countplot (x='Credit_History', data=df, palette = 'Set1')
```

```
number of people who take loan as group by Credit_History:
1.0    525
0.0     89
Name: Credit_History, dtype: int64
```

Out[29]:
```
<Axes: xlabel='Credit_History', ylabel='count'>
```



In [34]:
```
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_stat


from sklearn.preprocessing import LabelEncoder
LabelEncoder_x = LabelEncoder ()
```

In [44]:
```
for i in range(0, 5):

    X_train[:,i] = LabelEncoder_x.fit_transform (X_train[:,i])
    X_train[:,7] = LabelEncoder_x.fit_transform (X_train[:,7])


X_train
```

Out[44]:
```
array([[1, 1, 0, ..., 1.0, 4.875197323201151, 267],
       [1, 0, 1, ..., 1.0, 5.278114659230517, 407],
       [1, 1, 0, ..., 0.0, 5.003946305945459, 249],
       ...,
       [1, 1, 3, ..., 1.0, 5.298317366548036, 363],
       [1, 1, 0, ..., 1.0, 5.075173815233827, 273],
       [0, 1, 0, ..., 1.0, 5.204006687076795, 301]], dtype=object)
```

In [45]:
```
Labelencoder_y=LabelEncoder ()
y_train = Labelencoder_y.fit_transform(y_train)
y_train
```

Out[45]:
```
array([1, 0, 0, 1, 1, 0, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1,
       0, 1, 1, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 0, 1, 0, 1, 1, 1,
       1, 0, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 1, 0,
       1, 1, 1, 1, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0, 0, 1, 1, 1, 1, 1, 1,
       1, 1, 0, 1, 0, 1, 0, 1, 1, 1, 1, 0, 0, 1, 1, 1, 0, 1, 1, 0, 0, 0,
       1, 1, 1, 0, 1, 0, 0, 1, 0, 0, 0, 1, 1, 1, 1, 1, 0, 0, 0, 0, 1, 1,
       0, 1, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0,
       0, 1, 0, 1, 0, 0, 0, 1, 0, 1, 1, 1, 1, 1, 0, 0, 1, 0, 1, 1, 1, 1,
       0, 0, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 0, 1, 1,
       0, 1, 1, 1, 0, 1, 1, 1, 0, 1, 0, 1, 0, 1, 1, 0, 0, 0, 1, 0, 1, 1,
       1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 0, 1, 1, 1, 1, 1, 1,
       1, 1, 0, 0, 1, 0, 1, 1, 1, 0, 1, 1, 0, 1, 0, 1, 0, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0, 1, 0, 1, 1,
       1, 1, 1, 0, 1, 0, 1, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1, 0, 0, 1, 1, 1,
       1, 1, 1, 0, 1, 1, 1, 0, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 1, 1,
       1, 0, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 1, 0, 0, 0,
       1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1,
       1, 0, 1, 0, 1, 1, 1, 0, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1,
       1, 1, 0, 1, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0,
       1, 1, 0, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1,
       1, 1, 1, 1, 1, 0, 1, 0, 1, 0, 0, 1, 1, 1, 0, 1, 1, 0, 0, 0, 0, 1,
       1, 1, 1, 0, 1, 0, 1])
```

In [47]:
```
for i in range(0,5):
    X_test[:,i] = LabelEncoder_x.fit_transform (X_test[:,i])
    X_test[:,7] = LabelEncoder_x.fit_transform (X_test[:,7])

X_test
```

Out[47]:
```
array([[1, 0, 0, 0, 5, 1.0, 4.430816798843313, 85],
       [0, 0, 0, 0, 5, 1.0, 4.718498871295094, 28],
       [1, 1, 0, 0, 5, 1.0, 5.780743515792329, 104],
       [1, 1, 0, 0, 5, 1.0, 4.700480365792417, 80],
       [1, 1, 2, 0, 5, 1.0, 4.574710978503383, 22],
       [1, 1, 0, 1, 3, 0.0, 5.10594547390058, 70],
       [1, 1, 3, 0, 3, 1.0, 5.056245805348308, 77],
       [1, 0, 0, 0, 5, 1.0, 6.003887067106539, 114],
       [1, 0, 0, 0, 5, 0.0, 4.820281565605037, 53],
       [1, 1, 0, 0, 5, 1.0, 4.852030263919617, 55],
       [0, 0, 0, 0, 5, 1.0, 4.430816798843313, 4],
       [1, 1, 1, 0, 5, 1.0, 4.553876891600541, 2],
       [0, 0, 0, 0, 5, 1.0, 5.634789603169249, 96],
       [1, 1, 2, 0, 5, 1.0, 5.4638318050256105, 97],
       [1, 1, 0, 0, 5, 1.0, 4.564348191467836, 117],
       [1, 1, 1, 0, 5, 1.0, 4.204692619390966, 22],
       [1, 0, 1, 1, 5, 1.0, 5.247024072160486, 32],
       [1, 0, 0, 1, 5, 1.0, 4.882801922586371, 25],
       [0, 0, 0, 0, 5, 1.0, 4.532599493153256, 1],
       [1, 1, 0, 1, 5, 0.0, 5.198497031265826, 44],
       [0, 1, 0, 0, 5, 0.0, 4.787491742782046, 71],
       [1, 1, 0, 0, 5, 1.0, 4.962844630259907, 43],
       [1, 1, 2, 0, 5, 1.0, 4.68213122712422, 91],
       [1, 1, 2, 0, 5, 1.0, 5.10594547390058, 111],
       [1, 1, 0, 0, 5, 1.0, 4.060443010546419, 35],
       [1, 1, 1, 0, 5, 1.0, 5.521460917862246, 94],
       [1, 0, 0, 0, 5, 1.0, 5.231108616854587, 98],
       [1, 1, 0, 0, 5, 1.0, 5.231108616854587, 110],
       [1, 1, 3, 0, 5, 0.0, 4.852030263919617, 41],
       [0, 0, 0, 0, 5, 0.0, 4.634728988229636, 50],
       [1, 1, 0, 0, 5, 1.0, 5.429345628954441, 99],
       [1, 0, 0, 1, 5, 1.0, 3.871201010907891, 46],
       [1, 1, 1, 1, 5, 1.0, 4.499809670330265, 52],
       [1, 1, 0, 0, 5, 1.0, 5.19295685089021, 102],
       [1, 1, 0, 0, 5, 1.0, 4.857444178729352, 95],
       [0, 1, 0, 1, 5, 0.0, 5.181783550292085, 57],
       [1, 1, 0, 0, 5, 1.0, 5.147494476813453, 65],
       [1, 0, 0, 1, 5, 1.0, 4.836281906951478, 39],
       [1, 1, 0, 0, 5, 1.0, 4.852030263919617, 75],
       [1, 1, 2, 1, 5, 1.0, 4.68213122712422, 24],
       [0, 0, 0, 0, 5, 1.0, 4.382026634673881, 9],
       [1, 1, 3, 0, 5, 0.0, 4.812184355372417, 68],
       [1, 1, 2, 0, 2, 1.0, 2.833213344056216, 0],
       [1, 1, 1, 1, 5, 1.0, 5.062595033026967, 67],
       [1, 0, 0, 0, 5, 1.0, 4.330733340286331, 21],
       [1, 0, 0, 0, 5, 1.0, 5.231108616854587, 113],
       [1, 1, 1, 0, 5, 1.0, 4.7535901911063645, 18],
       [0, 0, 0, 0, 5, 1.0, 4.74493212836325, 37],
       [1, 1, 1, 0, 5, 1.0, 4.852030263919617, 72],
       [1, 0, 0, 0, 5, 1.0, 4.941642422609304, 78],
       [1, 1, 3, 1, 5, 1.0, 4.30406509320417, 8],
       [1, 1, 0, 0, 5, 1.0, 4.867534450455582, 84],
       [1, 1, 0, 1, 5, 1.0, 4.672828834461906, 31],
       [1, 0, 0, 0, 5, 1.0, 4.857444178729352, 61],
       [1, 1, 0, 0, 5, 1.0, 4.718498871295094, 19],
       [1, 1, 0, 0, 5, 1.0, 5.556828061699537, 107],
       [1, 1, 0, 0, 5, 1.0, 4.553876891600541, 34],
       [1, 0, 0, 1, 5, 1.0, 4.890349128221754, 74],
       [1, 1, 2, 0, 5, 1.0, 5.123963979403259, 62],
       [1, 0, 0, 0, 5, 1.0, 4.787491742782046, 27],
```

```
[0, 0, 0, 0, 5, 0.0, 4.919980925828125, 108],
[0, 0, 0, 0, 5, 1.0, 5.365976015021851, 103],
[1, 1, 0, 1, 5, 1.0, 4.74493212836325, 38],
[0, 0, 0, 0, 5, 0.0, 4.330733340286331, 13],
[1, 1, 2, 0, 5, 1.0, 4.890349128221754, 69],
[1, 1, 1, 0, 5, 1.0, 5.752572638825633, 112],
[1, 1, 0, 0, 5, 1.0, 5.075173815233827, 73],
[1, 0, 0, 0, 5, 1.0, 4.912654885736052, 47],
[1, 1, 0, 0, 5, 1.0, 5.204006687076795, 81],
[1, 0, 0, 1, 5, 1.0, 4.564348191467836, 60],
[1, 0, 0, 0, 5, 1.0, 4.204692619390966, 83],
[0, 1, 0, 0, 5, 1.0, 4.867534450455582, 5],
[1, 1, 2, 1, 5, 1.0, 5.056245805348308, 58],
[1, 1, 1, 1, 3, 1.0, 4.919980925828125, 79],
[0, 1, 0, 0, 5, 1.0, 4.969813299576001, 54],
[1, 1, 0, 1, 4, 1.0, 4.820281565605037, 56],
[1, 0, 0, 0, 5, 1.0, 4.499809670330265, 120],
[1, 0, 3, 0, 5, 1.0, 5.768320995793772, 118],
[1, 1, 2, 0, 5, 1.0, 4.718498871295094, 101],
[0, 0, 0, 0, 5, 0.0, 4.7535901911063645, 26],
[0, 0, 0, 0, 6, 1.0, 4.727387818712341, 33],
[1, 1, 1, 0, 5, 1.0, 6.214608098422191, 119],
[0, 0, 0, 0, 5, 1.0, 5.267858159063328, 89],
[1, 1, 2, 0, 5, 1.0, 5.231108616854587, 92],
[1, 0, 0, 0, 6, 1.0, 4.2626798770413155, 6],
[1, 1, 0, 0, 0, 1.0, 4.709530201312334, 90],
[1, 1, 0, 0, 5, 1.0, 4.700480365792417, 45],
[1, 1, 2, 0, 5, 1.0, 5.298317366548036, 109],
[1, 0, 1, 0, 3, 1.0, 4.727387818712341, 17],
[1, 1, 1, 0, 5, 1.0, 4.6443908991413725, 36],
[0, 1, 0, 1, 5, 1.0, 4.605170185988092, 16],
[1, 0, 0, 0, 5, 1.0, 4.30406509320417, 7],
[1, 1, 1, 0, 1, 1.0, 5.147494476813453, 88],
[1, 1, 3, 0, 4, 0.0, 5.19295685089021, 87],
[0, 0, 0, 0, 5, 1.0, 4.2626798770413155, 3],
[1, 0, 0, 1, 3, 0.0, 4.836281906951478, 59],
[1, 0, 0, 0, 3, 1.0, 5.1647859739235145, 82],
[1, 0, 0, 0, 5, 1.0, 4.969813299576001, 66],
[1, 1, 2, 1, 5, 1.0, 4.394449154672439, 51],
[1, 1, 1, 0, 5, 1.0, 5.231108616854587, 100],
[1, 1, 0, 0, 5, 1.0, 5.351858133476067, 93],
[1, 1, 0, 0, 5, 1.0, 4.605170185988092, 15],
[1, 1, 2, 0, 5, 1.0, 4.787491742782046, 106],
[1, 0, 0, 0, 3, 1.0, 4.787491742782046, 105],
[1, 1, 3, 0, 5, 1.0, 4.852030263919617, 64],
[1, 0, 0, 0, 5, 1.0, 4.8283137373023015, 49],
[1, 0, 0, 1, 5, 1.0, 4.6443908991413725, 42],
[0, 0, 0, 0, 5, 1.0, 4.477336814478207, 10],
[1, 1, 0, 1, 5, 1.0, 4.553876891600541, 20],
[1, 1, 3, 1, 3, 1.0, 4.394449154672439, 14],
[1, 0, 0, 0, 5, 1.0, 5.298317366548036, 76],
[0, 0, 0, 0, 5, 1.0, 4.90527477843843, 11],
[1, 0, 0, 0, 6, 1.0, 4.727387818712341, 18],
[1, 1, 2, 0, 5, 1.0, 4.248495242049359, 23],
[1, 1, 0, 1, 5, 0.0, 5.303304908059076, 63],
[1, 1, 0, 0, 3, 0.0, 4.499809670330265, 48],
[0, 0, 0, 0, 5, 1.0, 4.430816798843313, 30],
[1, 0, 0, 0, 5, 1.0, 4.897839799950911, 29],
[1, 1, 2, 0, 5, 1.0, 5.170483995038151, 86],
[1, 1, 3, 0, 5, 1.0, 4.867534450455582, 115],
```

```
       [1, 1, 0, 0, 5, 1.0, 6.077642243349034, 116],
       [1, 1, 3, 1, 3, 0.0, 4.248495242049359, 40],
       [1, 1, 1, 0, 5, 1.0, 4.564348191467836, 12]], dtype=object)
```

In [48]:
```
Labelencoder_y=LabelEncoder ()
y_test= Labelencoder_y.fit_transform(y_test)
y_test
```

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

In [51]:
```
from sklearn.preprocessing import StandardScaler
ss = StandardScaler()
X_train = ss.fit_transform (X_train)
x_test= ss.fit_transform (X_test)
```

In [54]:
```
from sklearn.ensemble import RandomForestClassifier

rf_clf = RandomForestClassifier ()
rf_clf.fit (X_train, y_train)
```

Out[54]:
```
▾ RandomForestClassifier

RandomForestClassifier()
```

In [55]:
```
from sklearn import metrics

y_pred = rf_clf.predict(x_test)
print("acc of random forest clf is", metrics.accuracy_score(y_pred, y_test))
y_pred
```

```
acc of random forest clf is 0.7804878048780488
```

Out[55]:
```
array([1, 1, 0, 1, 1, 0, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 1,
       1, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 0, 1,
       1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 0, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1])
```

In [61]:
```
from sklearn.naive_bayes import GaussianNB

nb_clf = GaussianNB()
nb_clf.fit(X_train, y_train)
```

Out[61]:
```
▾ GaussianNB

GaussianNB()
```

In [60]:
```
y_pred = nb_clf.predict(X_test)
print('acc of naive bayes is', metrics.accuracy_score(y_pred, y_test))
```

```
acc of naive bayes is 0.2764227642276423
```

In [62]:
```
y_pred = nb_clf.predict(X_test)
print('acc of GaussianNB is %', metrics.accuracy_score(y_pred, y_test))
```

```
acc of GaussianNB is 0.2764227642276423
```

In [63]:
```
print('acc of GaussianNB is', metrics.accuracy_score(y_pred, y_test))
```

```
acc of GaussianNB is 0.2764227642276423
```

In [64]:
```
print('acc of GaussianNB is %', metrics.accuracy_score(y_pred, y_test))
```

```
acc of GaussianNB is % 0.2764227642276423
```

In [65]:
```
y_pred = nb_clf.predict(X_test)
print('acc of GaussianNB is %', metrics.accuracy_score(y_pred, y_test))
```

```
acc of GaussianNB is % 0.2764227642276423
```

In [68]:
```
y_pred = nb_classifier.predict(X_test)
print("acc of GaussianNB is %", metrics.accuracy_score(y_pred, y_test))
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[68], line 1
----> 1 y_pred = nb_classifier.predict(X_test)
      2 print("acc of GaussianNB is %", metrics.accuracy_score(y_pred, y_test))

NameError: name 'nb_classifier' is not defined
```

In [69]:
```
from sklearn.naive_bayes import GaussianNB

nb_classifier = GaussianNB()
nb_classifier.fit(X_train, y_train)
```

Out[69]:
```
GaussianNB()
```

In [70]:
```
y_pred = nb_classifier.predict(X_test)
print("acc of GaussianNB is %", metrics.accuracy_score(y_pred, y_test))
```

```
acc of GaussianNB is % 0.2764227642276423
```

In [71]:
```
y_pred
```

Out[71]:
```
array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
```

In [77]:
```
from sklearn.tree import DecisionTreeClassifier
dt_clf = DecisionTreeClassifier()
dt_clf.fit(X_train, y_train)
```

Out[77]:
```
DecisionTreeClassifier()
```

In [79]:
```
y_pred = dt_clf.predict(X_test)
print("acc of DT is", metrics.accurac(y_score, y_test))
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[79], line 2
      1 y_pred = dt_clf.predict(X_test)
----> 2 print("acc of DT is", metrics.accurac(y_score, y_test))

AttributeError: module 'sklearn.metrics' has no attribute 'accurac'
```

In [80]:
```
y_pred = dt_clf.predict(X_test)
print("acc of DT is", metrics.accuracy_score(y_pred, y_test))
```

```
acc of DT is 0.7154471544715447
```

In [81]:
```
y_pred
```

Out[81]:
```
array([1, 1, 1, 1, 1, 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, 1, 1, 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, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1])
```

In [83]:
```
from sklearn.neighbors import KNeighborsClassifier
kn_clf = KNeighborsClassifier()
kn_clf.fit(X_train, y_train)
```

Out[83]:
```
KNeighborsClassifier
KNeighborsClassifier()
```

In [84]:
```
y_pred= kn_clf.predict(X_test)
print("acc of KN is", metrics.accuracy_score(y_pred, y_test))
```

```
acc of KN is 0.5528455284552846
```

In [ ]: