02-09-2023

In [342]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [382]:
```
from sklearn.linear_model import LogisticRegression
a=pd.read_csv(r"C:\USERS\user\Downloads\C8_loan-train.csv")
a
```

```
  1  LP001003    Male   Yes    1  Graduate       No   4583   150
  2  LP001005    Male   Yes    0  Graduate       Yes  3000
  3  LP001006    Male   Yes    0  Not Graduate   No   2583   235
  4  LP001008    Male   No     0  Graduate       No   6000
...       ...     ...   ...  ...       ...       ...   ...
609  LP002978  Female   No     0  Graduate       No   2900
610  LP002979    Male   Yes   3+  Graduate       No   4106
611  LP002983    Male   Yes    1  Graduate       No   8072   24
612  LP002984    Male   Yes    2  Graduate       No   7583
613  LP002990  Female   No     0  Graduate       Yes  4583

614 rows × 13 columns
```

In [383]:
```
a=a.head(60)
a
```

```
Gender Married Dependents Education     Self_Employed ApplicantIncome CoapplicantIncome LoanAmount Loan_Amount_
Male   No      0          Graduate      No            5849            0.0               NaN
Male   Yes     1          Graduate      No            4583            1508.0            128.0
Male   Yes     0          Graduate      Yes           3000            0.0               66.0
Male   Yes     0          Not Graduate  No            2583            2358.0            120.0
Male   No      0          Graduate      No            6000            0.0               141.0
Male   Yes     2          Graduate      Yes           5417            4196.0            267.0
Male   Yes     0          Not Graduate  No            2333            1516.0            95.0
Male   Yes     3+         Graduate      No            3036            2504.0            158.0
Male   Yes     2          Graduate      No            4006            1526.0            168.0
Male   Yes     1          Graduate      No            12841           10968.0           349.0
```

In [384]:
```
from sklearn.linear_model import LogisticRegression
```

In [385]:
```
a.columns
```

Out[385]:
```
Index(['Loan_ID', 'Gender', 'Married', 'Dependents', 'Education',
       'Self_Employed', 'ApplicantIncome', 'CoapplicantIncome', 'LoanAmount',
       'Loan_Amount_Term', 'Credit_History', 'Property_Area', 'Loan_Status'],
      dtype='object')
```

In [409]:
```
b=a[['ApplicantIncome', 'CoapplicantIncome']]
b
```

Out[409]:

	ApplicantIncome	CoapplicantIncome
0	5849	0.0
1	4583	1508.0
2	3000	0.0
3	2583	2358.0
4	6000	0.0
5	5417	4196.0
6	2333	1516.0
7	3036	2504.0
8	4006	1526.0
9	12841	10968.0
10	3200	700.0
11	2500	1840.0
12	3073	8106.0
13	1853	2840.0
14	1299	1086.0
15	4950	0.0
16	3596	0.0
17	3510	0.0
18	4887	0.0
19	2600	3500.0
20	7660	0.0
21	5955	5625.0
22	2600	1911.0
23	3365	1917.0
24	3717	2925.0
25	9560	0.0
26	2799	2253.0
27	4226	1040.0
28	1442	0.0
29	3750	2083.0
30	4166	3369.0
31	3167	0.0
32	4692	0.0
33	3500	1667.0
34	12500	3000.0
35	2275	2067.0
36	1828	1330.0
37	3667	1459.0
38	4166	7210.0

	ApplicantIncome	CoapplicantIncome
39	3748	1668.0
40	3600	0.0
41	1800	1213.0
42	2400	0.0
43	3941	2336.0
44	4695	0.0
45	3410	0.0
46	5649	0.0
47	5821	0.0
48	2645	3440.0
49	4000	2275.0
50	1928	1644.0
51	3086	0.0
52	4230	0.0
53	4616	0.0
54	11500	0.0
55	2708	1167.0
56	2132	1591.0
57	3366	2200.0
58	8080	2250.0
59	3357	2859.0

In [410]:
```
c=b.iloc[:,0:5]
d=b.iloc[:,-1]
```

In [411]:
```
c.shape
```

Out[411]:
```
(60, 2)
```

In [412]:
```
d.shape
```

Out[412]:
```
(60,)
```

In [413]:
```
from sklearn.preprocessing import StandardScaler
fs=StandardScaler().fit_transform(c)
fs
```

```
Out[413]: array([[ 0.67433211, -0.82097989],
                 [ 0.15206627, -0.1008207 ],
                 [-0.5009723 , -0.82097989],
                 [-0.67299826,  0.30510458],
                 [ 0.73662448, -0.82097989],
                 [ 0.49611817,  1.18285829],
                 [-0.77613132, -0.09700022],
                 [-0.48612114,  0.37482822],
                 [-0.08596485, -0.09222463],
                 [ 3.55875768,  4.41688885],
                 [-0.41846585, -0.48668849],
                 [-0.70723843,  0.05772894],
                 [-0.47085745,  3.05011456],
                 [-0.97414681,  0.53528809],
                 [-1.20268968, -0.30235066],
                 [ 0.30346561, -0.82097989],
                 [-0.25510307, -0.82097989],
                 [-0.29058085, -0.82097989],
                 [ 0.27747607, -0.82097989],
                 [-0.66598521,  0.85047713],
                 [ 1.42142804, -0.82097989],
                 [ 0.71806053,  1.86529032],
                 [-0.66598521,  0.09163564],
                 [-0.35039803,  0.094501  ],
                 [-0.20518667,  0.57588062],
                 [ 2.20523933, -0.82097989],
                 [-0.58389129,  0.25496087],
                 [ 0.00479225, -0.32431838],
                 [-1.14369757, -0.82097989],
                 [-0.19157311,  0.17377581],
                 [-0.01995969,  0.78791688],
                 [-0.43207942, -0.82097989],
                 [ 0.19703228, -0.82097989],
                 [-0.29470617, -0.02488879],
                 [ 3.41808418,  0.61169755],
                 [-0.80005819,  0.16613487],
                 [-0.98446011, -0.18582622],
                 [-0.22581328, -0.12422109],
                 [-0.01995969,  2.62222157],
                 [-0.19239817, -0.02441123],
                 [-0.25345295, -0.82097989],
                 [-0.99601102, -0.24170064],
                 [-0.74849166, -0.82097989],
                 [-0.11277944,  0.29459828],
                 [ 0.19826988, -0.82097989],
                 [-0.33183408, -0.82097989],
                 [ 0.59182566, -0.82097989],
                 [ 0.66278121, -0.82097989],
                 [-0.64742126,  0.82182358],
                 [-0.08844004,  0.26546717],
                 [-0.94320689, -0.03587265],
                 [-0.46549453, -0.82097989],
                 [ 0.00644238, -0.82097989],
                 [ 0.16567983, -0.82097989],
                 [ 3.00555192, -0.82097989],
                 [-0.62143172, -0.26366836],
                 [-0.85905031, -0.06118329],
                 [-0.3499855 ,  0.22965023],
                 [ 1.59469159,  0.25352819],
                 [-0.35369829,  0.54436171]])
```

In [414]:
```
logr=LogisticRegression()
logr.fit(fs,d)
```
Out[414]:
```
LogisticRegression()
```

In [417]:
```
e=[[777,55]]
```

In [418]:
```
prediction=logr.predict(e)
prediction
```
Out[418]:
```
array([3000.])
```

In [419]:
```
logr.classes_
```
Out[419]:
```
array([    0.,   700.,  1040.,  1086.,  1167.,  1213.,  1330.,  1459.,
        1508.,  1516.,  1526.,  1591.,  1644.,  1667.,  1668.,  1840.,
        1911.,  1917.,  2067.,  2083.,  2200.,  2250.,  2253.,  2275.,
        2336.,  2358.,  2504.,  2840.,  2859.,  2925.,  3000.,  3369.,
        3440.,  3500.,  4196.,  5625.,  7210.,  8106., 10968.])
```

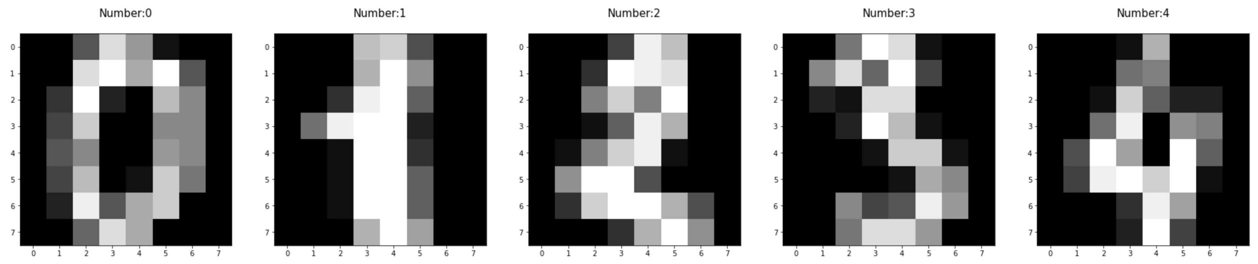
In [420]:
```
logr.predict_proba(e)[0][0]
```
Out[420]:
```
8.794009433362316e-302
```

In [421]:
```
import re
from sklearn.datasets import load_digits
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [422]:
```
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import train_test_split
```

In [423]:
```
digits=load_digits()
digits
```
```
  'pixel_1_4',
  'pixel_1_5',
  'pixel_1_6',
  'pixel_1_7',
  'pixel_2_0',
  'pixel_2_1',
  'pixel_2_2',
  'pixel_2_3',
  'pixel_2_4',
  'pixel_2_5',
  'pixel_2_6',
  'pixel_2_7',
  'pixel_3_0',
  'pixel_3_1',
  'pixel_3_2',
  'pixel_3_3',
  'pixel_3_4',
  'pixel_3_5',
  'pixel_3_6',
```

In [424]:
```
plt.figure(figsize=(50,25))
for index,(image,label) in enumerate(zip(digits.data[0:8],digits.target[0:5])):
    plt.subplot(1,8,index+1)
    plt.imshow(np.reshape(image,(8,8)),cmap=plt.cm.gray)
    plt.title('Number:%i\n'%label,fontsize=15)
```



In [429]:
```
x_train,x_test,y_train,y_test=train_test_split(digits.data,digits.target,test_size=0
```

In [430]:
```
print(x_train.shape)
print(x_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(736, 64)
(1061, 64)
(736,)
(1061,)
```

In [431]:
```
logre=LogisticRegression(max_iter=10000)
logre.fit(x_train,y_train)

```

Out[431]:
```
LogisticRegression(max_iter=10000)
```

In [432]:
```
print(logre.predict(x_test))
```

```
[7 2 8 ... 6 2 2]
```

In [433]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [434]:
```
a=pd.read_csv(r"C:\USERS\user\Downloads\C8_loan-train.csv")
```

In [435]:
```
a=a.head(60)
a
```

```
32  LP001097    Male   No    1   Graduate      Yes    4692     0
33  LP001098    Male   Yes   0   Graduate      No     3500  1667
34  LP001100    Male   No   3+   Graduate      No    12500  3000
35  LP001106    Male   Yes   0   Graduate      No     2275  2067
36  LP001109    Male   Yes   0   Graduate      No     1828  1330
37  LP001112  Female   Yes   0   Graduate      No     3667  1459
38  LP001114    Male   No    0   Graduate      No     4166  7210
39  LP001116    Male   No    0        Not      No     3748  1668
                                 Graduate
40  LP001119    Male   No    0   Graduate      No     3600     0
41  LP001120    Male   No    0   Graduate      No     1800  1213
42  LP001123    Male   Yes   0   Graduate      No     2400     0
43  LP001131    Male   Yes   0   Graduate      No     3941  2336
```

In [437]:
```
b=a[[ 'ApplicantIncome', 'CoapplicantIncome','Loan_Status']]
b
```

Out[437]:

	ApplicantIncome	CoapplicantIncome	Loan_Status
0	5849	0.0	Y
1	4583	1508.0	N
2	3000	0.0	Y
3	2583	2358.0	Y
4	6000	0.0	Y
5	5417	4196.0	Y
6	2333	1516.0	Y
7	3036	2504.0	N
8	4006	1526.0	Y
9	12841	10968.0	N
10	3200	700.0	Y
11	2500	1840.0	Y
12	3073	8106.0	Y
13	1853	2840.0	N
14	1299	1086.0	Y
15	4950	0.0	Y
16	3596	0.0	Y
17	3510	0.0	N
18	4887	0.0	N
19	2600	3500.0	Y
20	7660	0.0	N
21	5955	5625.0	Y
22	2600	1911.0	N
23	3365	1917.0	N
24	3717	2925.0	N
25	9560	0.0	Y
26	2799	2253.0	Y
27	4226	1040.0	Y
28	1442	0.0	N
29	3750	2083.0	Y
30	4166	3369.0	N
31	3167	0.0	N
32	4692	0.0	N
33	3500	1667.0	Y
34	12500	3000.0	N
35	2275	2067.0	Y
36	1828	1330.0	N
37	3667	1459.0	Y
38	4166	7210.0	Y

	ApplicantIncome	CoapplicantIncome	Loan_Status
39	3748	1668.0	Y
40	3600	0.0	N
41	1800	1213.0	Y
42	2400	0.0	Y
43	3941	2336.0	Y
44	4695	0.0	Y
45	3410	0.0	Y
46	5649	0.0	Y
47	5821	0.0	Y
48	2645	3440.0	N
49	4000	2275.0	Y
50	1928	1644.0	Y
51	3086	0.0	Y
52	4230	0.0	N
53	4616	0.0	N
54	11500	0.0	N
55	2708	1167.0	Y
56	2132	1591.0	Y
57	3366	2200.0	N
58	8080	2250.0	Y
59	3357	2859.0	Y

In [439]:
```
b['Loan_Status'].value_counts()
```

Out[439]:
```
Y    38
N    22
Name: Loan_Status, dtype: int64
```

In [440]:
```
x=b.drop('Loan_Status',axis=1)
y=b['Loan_Status']
print(b)
```

```
    ApplicantIncome  CoapplicantIncome Loan_Status
0              5849                0.0           Y
1              4583             1508.0           N
2              3000                0.0           Y
3              2583             2358.0           Y
4              6000                0.0           Y
5              5417             4196.0           Y
6              2333             1516.0           Y
7              3036             2504.0           N
8              4006             1526.0           Y
9             12841            10968.0           N
10             3200              700.0           Y
11             2500             1840.0           Y
12             3073             8106.0           Y
13             1853             2840.0           N
14             1299             1086.0           Y
15             4950                0.0           Y
16             3596                0.0           Y
17             3510                0.0           N
18             4887                0.0           N
19             2600             3500.0           Y
20             7660                0.0           N
21             5955             5625.0           Y
22             2600             1911.0           N
23             3365             1917.0           N
24             3717             2925.0           N
25             9560                0.0           Y
26             2799             2253.0           Y
27             4226             1040.0           Y
28             1442                0.0           N
29             3750             2083.0           Y
30             4166             3369.0           N
31             3167                0.0           N
32             4692                0.0           N
33             3500             1667.0           Y
34            12500             3000.0           N
35             2275             2067.0           Y
36             1828             1330.0           N
37             3667             1459.0           Y
38             4166             7210.0           Y
39             3748             1668.0           Y
40             3600                0.0           N
41             1800             1213.0           Y
42             2400                0.0           Y
43             3941             2336.0           Y
44             4695                0.0           Y
45             3410                0.0           Y
46             5649                0.0           Y
47             5821                0.0           Y
48             2645             3440.0           N
49             4000             2275.0           Y
50             1928             1644.0           Y
51             3086                0.0           Y
52             4230                0.0           N
53             4616                0.0           N
54            11500                0.0           N
55             2708             1167.0           Y
56             2132             1591.0           Y
57             3366             2200.0           N
58             8080             2250.0           Y
59             3357             2859.0           Y
```

In [441]:
```
g1={"Loan_Status":{'g1':1}}
a=a.replace(g1)
print(a)
```

```
     Loan_ID  Gender Married Dependents     Education Self_Employed  \
0   LP001002    Male      No          0      Graduate            No
1   LP001003    Male     Yes          1      Graduate            No
2   LP001005    Male     Yes          0      Graduate           Yes
3   LP001006    Male     Yes          0  Not Graduate            No
4   LP001008    Male      No          0      Graduate            No
5   LP001011    Male     Yes          2      Graduate           Yes
6   LP001013    Male     Yes          0  Not Graduate            No
7   LP001014    Male     Yes         3+      Graduate            No
8   LP001018    Male     Yes          2      Graduate            No
9   LP001020    Male     Yes          1      Graduate            No
10  LP001024    Male     Yes          2      Graduate            No
11  LP001027    Male     Yes          2      Graduate           NaN
12  LP001028    Male     Yes          2      Graduate            No
13  LP001029    Male      No          0      Graduate            No
14  LP001030    Male     Yes          2      Graduate            No
15  LP001032    Male      No          0      Graduate            No
16  LP001034    Male      No          1  Not Graduate            No
17  LP001036  Female      No          0      Graduate            No
```

In [442]:
```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,train_size=0.70)
```

In [443]:
```
from sklearn.ensemble import RandomForestClassifier
```

In [444]:
```
rfc=RandomForestClassifier()
rfc.fit(x_train,y_train)
```

Out[444]:
```
RandomForestClassifier()
```

In [445]:
```
parameters={'max_depth':[1,2,3,4,5],
            'min_samples_leaf':[5,10,15,20,25],
            'n_estimators':[10,20,30,40,50]}
```

In [446]:
```
from sklearn.model_selection import GridSearchCV
```

In [447]:
```
grid_search=GridSearchCV(estimator=rfc,param_grid=parameters,cv=2,scoring="accuracy"
grid_search.fit(x_train,y_train)
```

Out[447]:
```
GridSearchCV(cv=2, estimator=RandomForestClassifier(),
             param_grid={'max_depth': [1, 2, 3, 4, 5],
                         'min_samples_leaf': [5, 10, 15, 20, 25],
                         'n_estimators': [10, 20, 30, 40, 50]},
             scoring='accuracy')
```

In [448]:
```
grid_search.best_score_
```

Out[448]:
```
0.6190476190476191
```

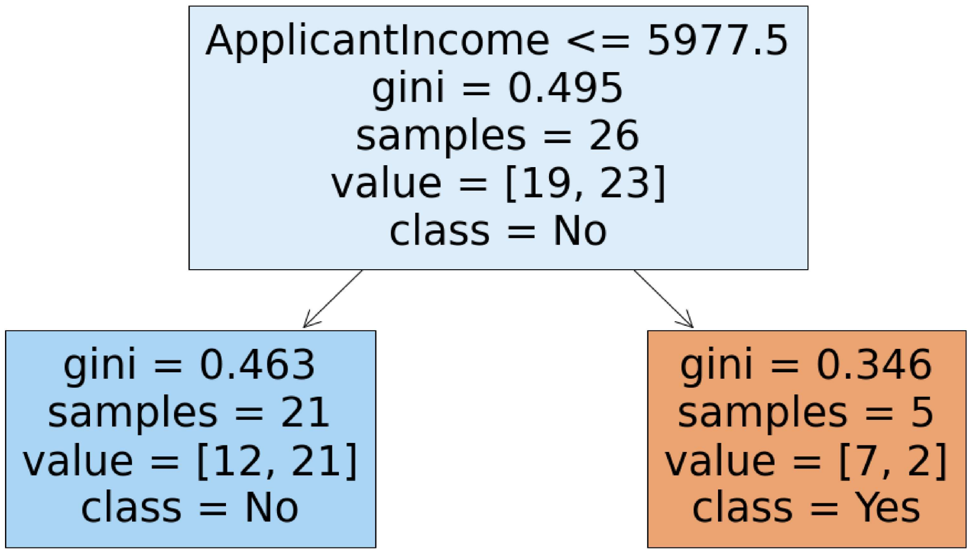
In [449]:
```
rfc_best=grid_search.best_estimator_
```

In [450]:
```
from sklearn.tree import plot_tree
```

In [451]:
```
plt.figure(figsize=(20,10))
plot_tree(rfc_best.estimators_[5],feature_names=x.columns,class_names=['Yes','No'],f

```

Out[451]:
```
[Text(558.0, 407.70000000000005, 'ApplicantIncome <= 5977.5\ngini = 0.495\nsamples = 26
\nvalue = [19, 23]\nclass = No'),
 Text(279.0, 135.89999999999998, 'gini = 0.463\nsamples = 21\nvalue = [12, 21]\nclass =
No'),
 Text(837.0, 135.89999999999998, 'gini = 0.346\nsamples = 5\nvalue = [7, 2]\nclass = Ye
s')]
```


ApplicantIncome <= 5977.5
gini = 0.495
samples = 26
value = [19, 23]
class = No
gini = 0.463
samples = 21
value = [12, 21]
class = No
gini = 0.346
samples = 5
value = [7, 2]
class = Yes