In [1]:

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

In [4]:

```
train_df=pd.read_csv(r"C:\Users\poorn\Downloads\test.csv")
train_df
```

Out[4]:

	id	battery_power	blue	clock_speed	dual_sim	fc	four_g	int_memory	m_dep	mc
0	1	1043	1	1.8	1	14	0	5	0.1	
1	2	841	1	0.5	1	4	1	61	0.8	
2	3	1807	1	2.8	0	1	0	27	0.9	
3	4	1546	0	0.5	1	18	1	25	0.5	
4	5	1434	0	1.4	0	11	1	49	0.5	
...	...	...	...	...	...	...	...	...	...	
995	996	1700	1	1.9	0	0	1	54	0.5	
996	997	609	0	1.8	1	0	0	13	0.9	
997	998	1185	0	1.4	0	1	1	8	0.5	
998	999	1533	1	0.5	1	0	0	50	0.4	
999	1000	1270	1	0.5	0	4	1	35	0.1	

1000 rows × 21 columns

In [5]:

```
test_df=pd.read_csv(r"C:\Users\poorn\Downloads\train.csv")
test_df
```

Out[5]:

	battery_power	blue	clock_speed	dual_sim	fc	four_g	int_memory	m_dep	mobile_w
0	842	0	2.2	0	1	0	7	0.6	18
1	1021	1	0.5	1	0	1	53	0.7	13
2	563	1	0.5	1	2	1	41	0.9	14
3	615	1	2.5	0	0	0	10	0.8	13
4	1821	1	1.2	0	13	1	44	0.6	14
...	...	...	...	...	...	...	...	...	
1995	794	1	0.5	1	0	1	2	0.8	10
1996	1965	1	2.6	1	0	0	39	0.2	18
1997	1911	0	0.9	1	1	1	36	0.7	10
1998	1512	0	0.9	0	4	1	46	0.1	14
1999	510	1	2.0	1	5	1	45	0.9	16

2000 rows × 21 columns

In [6]:

```
train_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 21 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   id             1000 non-null   int64  
 1   battery_power  1000 non-null   int64  
 2   blue           1000 non-null   int64  
 3   clock_speed    1000 non-null   float64
 4   dual_sim       1000 non-null   int64  
 5   fc             1000 non-null   int64  
 6   four_g         1000 non-null   int64  
 7   int_memory     1000 non-null   int64  
 8   m_dep          1000 non-null   float64
 9   mobile_wt      1000 non-null   int64  
 10  n_cores        1000 non-null   int64  
 11  pc             1000 non-null   int64  
 12  px_height      1000 non-null   int64  
 13  px_width       1000 non-null   int64  
 14  ram            1000 non-null   int64  
 15  sc_h           1000 non-null   int64  
 16  sc_w           1000 non-null   int64  
 17  talk_time      1000 non-null   int64  
 18  three_g        1000 non-null   int64  
 19  touch_screen   1000 non-null   int64  
 20  wifi           1000 non-null   int64  
dtypes: float64(2), int64(19)
memory usage: 164.2 KB
```

In [7]:

```
test_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2000 entries, 0 to 1999
Data columns (total 21 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   battery_power  2000 non-null   int64  
 1   blue           2000 non-null   int64  
 2   clock_speed    2000 non-null   float64
 3   dual_sim       2000 non-null   int64  
 4   fc             2000 non-null   int64  
 5   four_g         2000 non-null   int64  
 6   int_memory     2000 non-null   int64  
 7   m_dep          2000 non-null   float64
 8   mobile_wt      2000 non-null   int64  
 9   n_cores        2000 non-null   int64  
 10  pc             2000 non-null   int64  
 11  px_height      2000 non-null   int64  
 12  px_width       2000 non-null   int64  
 13  ram            2000 non-null   int64  
 14  sc_h           2000 non-null   int64  
 15  sc_w           2000 non-null   int64  
 16  talk_time      2000 non-null   int64  
 17  three_g        2000 non-null   int64  
 18  touch_screen   2000 non-null   int64  
 19  wifi           2000 non-null   int64  
 20  price_range    2000 non-null   int64  
dtypes: float64(2), int64(19)
memory usage: 328.3 KB
```

In [8]:

```
x=train_df.drop('wifi',axis=1)
y=train_df['wifi']
```

In [9]:

```
x=test_df.drop('wifi',axis=1)
y=test_df['wifi']
```

In [10]:

```
train_df['dual_sim'].value_counts()
```

Out[10]:

```
dual_sim
1    517
0    483
Name: count, dtype: int64
```

In [11]:

```
test_df['blue'].value_counts()
```

Out[11]:

```
blue
0    1010
1     990
Name: count, dtype: int64
```

In [12]:

```
T={"Home Owner":{"Yes":1,"No":0}}
train_df=train_df.replace(T)
print(train_df)
```

```
       id  battery_power  blue  clock_speed  dual_sim  fc  four_g  int_mem
ory
0       1           1043     1          1.8         1  14       0
5  \
1       2            841     1          0.5         1   4       1
61
2       3           1807     1          2.8         0   1       0
27
3       4           1546     0          0.5         1  18       1
25
4       5           1434     0          1.4         0  11       1
49
..    ...            ...   ...          ...       ...  ..     ...
...
995   996           1700     1          1.9         0   0       1
54
996   997            609     0          1.8         1   0       0
13
997   998           1185     0          1.4         0   1       1
8
998   999           1533     1          0.5         1   0       0
50
999  1000           1270     1          0.5         0   4       1
35

     m_dep  mobile_wt  ...  pc  px_height  px_width   ram  sc_h  sc_w  \
0      0.1        193  ...  16        226      1412  3476    12     7
1      0.8        191  ...  12        746       857  3895     6     0
2      0.9        186  ...   4       1270      1366  2396    17    10
3      0.5         96  ...  20        295      1752  3893    10     0
4      0.5        108  ...  18        749       810  1773    15     8
..     ...        ...  ...  ..        ...       ...   ...   ...   ...
995    0.5        170  ...  17        644       913  2121    14     8
996    0.9        186  ...   2       1152      1632  1933     8     1
997    0.5         80  ...  12        477       825  1223     5     0
998    0.4        171  ...  12         38       832  2509    15    11
999    0.1        140  ...  19        457       608  2828     9     2

     talk_time  three_g  touch_screen  wifi
0            2        0             1     0
1            7        1             0     0
2           10        0             1     1
3            7        1             1     0
4            7        1             0     1
..         ...      ...           ...   ...
995         15        1             1     0
996         19        0             1     1
997         14        1             0     0
998          6        0             1     0
999          3        1             0     1

[1000 rows x 21 columns]
```

In [13]:

```
T={"Home Owner":{"Yes":1,"No":0}}
train_df=train_df.replace(T)
print(train_df)
```

```
       id  battery_power  blue  clock_speed  dual_sim  fc  four_g  int_mem
ory
0       1           1043     1          1.8         1  14       0
5  \
1       2            841     1          0.5         1   4       1
61
2       3           1807     1          2.8         0   1       0
27
3       4           1546     0          0.5         1  18       1
25
4       5           1434     0          1.4         0  11       1
49
..    ...            ...   ...          ...       ...  ..     ...
...
995   996           1700     1          1.9         0   0       1
54
996   997            609     0          1.8         1   0       0
13
997   998           1185     0          1.4         0   1       1
8
998   999           1533     1          0.5         1   0       0
50
999  1000           1270     1          0.5         0   4       1
35

     m_dep  mobile_wt  ...  pc  px_height  px_width   ram  sc_h  sc_w
0      0.1        193  ...  16        226      1412  3476    12     7  \
1      0.8        191  ...  12        746       857  3895     6     0
2      0.9        186  ...   4       1270      1366  2396    17    10
3      0.5         96  ...  20        295      1752  3893    10     0
4      0.5        108  ...  18        749       810  1773    15     8
..     ...        ...  ...  ..        ...       ...   ...   ...   ...
995    0.5        170  ...  17        644       913  2121    14     8
996    0.9        186  ...   2       1152      1632  1933     8     1
997    0.5         80  ...  12        477       825  1223     5     0
998    0.4        171  ...  12         38       832  2509    15    11
999    0.1        140  ...  19        457       608  2828     9     2

     talk_time  three_g  touch_screen  wifi
0            2        0             1     0
1            7        1             0     0
2           10        0             1     1
3            7        1             1     0
4            7        1             0     1
..         ...      ...           ...   ...
995         15        1             1     0
996         19        0             1     1
997         14        1             0     0
998          6        0             1     0
999          3        1             0     1

[1000 rows x 21 columns]
```

In [14]:

```
T={"Home Owner":{"Yes":1,"No":0}}
test_df=test_df.replace(T)
print(test_df)
```

```
      battery_power  blue  clock_speed  dual_sim  fc  four_g  int_memory
0               842     0          2.2         0   1       0           7
\
1              1021     1          0.5         1   0       1          53
2               563     1          0.5         1   2       1          41
3               615     1          2.5         0   0       0          10
4              1821     1          1.2         0  13       1          44
...             ...   ...          ...       ...  ..     ...         ...
1995            794     1          0.5         1   0       1           2
1996           1965     1          2.6         1   0       0          39
1997           1911     0          0.9         1   1       1          36
1998           1512     0          0.9         0   4       1          46
1999            510     1          2.0         1   5       1          45

      m_dep  mobile_wt  n_cores  ...  px_height  px_width   ram  sc_h  sc_
w
0       0.6        188        2  ...         20        756  2549     9
7  \
1       0.7        136        3  ...        905       1988  2631    17
3
2       0.9        145        5  ...       1263       1716  2603    11
2
3       0.8        131        6  ...       1216       1786  2769    16
8
4       0.6        141        2  ...       1208       1212  1411     8
2
...     ...        ...      ...  ...        ...        ...   ...   ...
...
1995    0.8        106        6  ...       1222       1890   668    13
4
1996    0.2        187        4  ...        915       1965  2032    11    1
0
1997    0.7        108        8  ...        868       1632  3057     9
1
1998    0.1        145        5  ...        336        670   869    18    1
0
1999    0.9        168        6  ...        483        754  3919    19
4

      talk_time  three_g  touch_screen  wifi  price_range
0            19        0             0     1            1
1             7        1             1     0            2
2             9        1             1     0            2
3            11        1             0     0            2
4            15        1             1     0            1
...         ...      ...           ...   ...          ...
1995         19        1             1     0            0
1996         16        1             1     1            2
1997          5        1             1     0            3
1998         19        1             1     1            0
1999          2        1             1     1            3

[2000 rows x 21 columns]
```

In [15]:

```
x=train_df.drop('wifi',axis=1)
y=train_df['wifi']
```

In [16]:

```
x=test_df.drop('wifi',axis=1)
y=test_df['wifi']
```

In [17]:

```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test = train_test_split(x,y,train_size=0.7,random_state=42)
x_train.shape,x_test.shape
```

Out[17]:

```
((1400, 20), (600, 20))
```

In [18]:

```
from sklearn.ensemble import RandomForestClassifier
rfc = RandomForestClassifier()
rfc.fit(x_train,y_train)
```

Out[18]:

```
▾ RandomForestClassifier

RandomForestClassifier()
```

In a jupyter environment,please return this cell to show the HTML representation or

In [19]:

```
rf = RandomForestClassifier()
```

In [20]:

```
params = {'max_depth': [2,3,5,10,20],
'min_samples_leaf': [5,10,20,50,100,200],
'n_estimators': [10,25,30,50,100,200]}
```

In [21]:

```
from sklearn.model_selection import GridSearchCV
grid_search = GridSearchCV(estimator=rf,param_grid=params,cv = 2, scoring='accuracy')
grid_search.fit(x_train,y_train)
```

Out[21]:

```
▸ GridSearchCV
▸ estimator: RandomForestClassifier
    ▸ RandomForestClassifier
```

In a jupyter environment,please rerun this cell to show the HTML representation or

In [23]:

```
grid_search.best_score_
```

Out[23]:

```
0.5249999999999999
```

In [24]:

```
rf_best = grid_search.best_estimator_
print(rf_best)
```

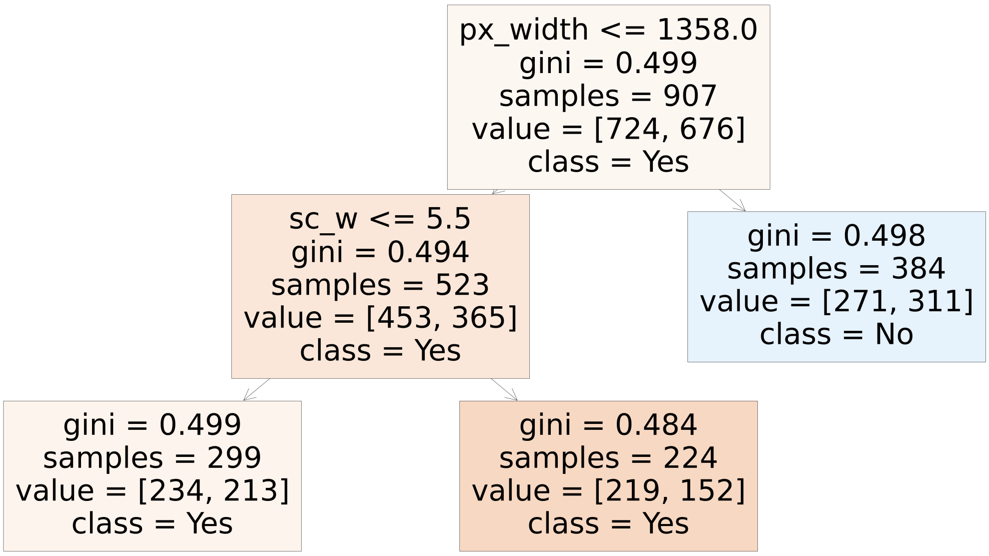
```
RandomForestClassifier(max_depth=10, min_samples_leaf=200, n_estimators=2
5)
```

In [27]:

```
from sklearn.tree import plot_tree
plt.figure(figsize=(80,40))
plot_tree(rf_best.estimators_[5], feature_names = x.columns,class_names=['Yes',"No"],fil
```

Out[27]:

```
[Text(0.6, 0.8333333333333334, 'px_width <= 1358.0\ngini = 0.499\nsamples
= 907\nvalue = [724, 676]\nclass = Yes'),
 Text(0.4, 0.5, 'sc_w <= 5.5\ngini = 0.494\nsamples = 523\nvalue = [453, 3
65]\nclass = Yes'),
 Text(0.2, 0.16666666666666666, 'gini = 0.499\nsamples = 299\nvalue = [23
4, 213]\nclass = Yes'),
 Text(0.6, 0.16666666666666666, 'gini = 0.484\nsamples = 224\nvalue = [21
9, 152]\nclass = Yes'),
 Text(0.8, 0.5, 'gini = 0.498\nsamples = 384\nvalue = [271, 311]\nclass =
No')]
```

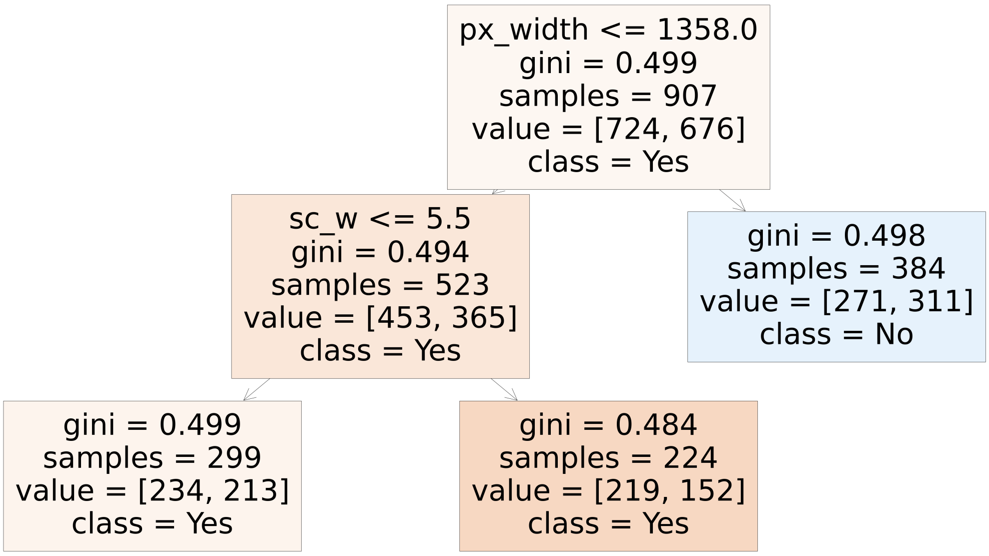


In [28]:

```
from sklearn.tree import plot_tree
plt.figure(figsize=(80,40))
plot_tree(rf_best.estimators_[5], feature_names = x.columns,class_names=['Yes',"No"],fil
```

Out[28]:

```
[Text(0.6, 0.8333333333333334, 'px_width <= 1358.0\ngini = 0.499\nsamples
= 907\nvalue = [724, 676]\nclass = Yes'),
 Text(0.4, 0.5, 'sc_w <= 5.5\ngini = 0.494\nsamples = 523\nvalue = [453, 3
65]\nclass = Yes'),
 Text(0.2, 0.16666666666666666, 'gini = 0.499\nsamples = 299\nvalue = [23
4, 213]\nclass = Yes'),
 Text(0.6, 0.16666666666666666, 'gini = 0.484\nsamples = 224\nvalue = [21
9, 152]\nclass = Yes'),
 Text(0.8, 0.5, 'gini = 0.498\nsamples = 384\nvalue = [271, 311]\nclass =
No')]
```



In [29]:

```
rf_best.feature_importances_
```

Out[29]:

```
array([0.02475867, 0.        , 0.03013278, 0.01426141, 0.01822027,
       0.        , 0.01232766, 0.06114952, 0.03368426, 0.02091575,
       0.08832281, 0.17423659, 0.24921247, 0.06521139, 0.        ,
       0.0437792 , 0.13098155, 0.        , 0.        , 0.03280566])
```

In [31]:

```
imp_df = pd.DataFrame({"Vername": x_train.columns,"Imp": rf_best.feature_importances_})
imp_df.sort_values(by="Imp", ascending=False)
```

Out[31]:

	Vername	Imp
12	px_width	0.249212
11	px_height	0.174237
16	talk_time	0.130982
10	pc	0.088323
13	ram	0.065211
7	m_dep	0.061150
15	sc_w	0.043779
8	mobile_wt	0.033684
19	price_range	0.032806
2	clock_speed	0.030133
0	battery_power	0.024759
9	n_cores	0.020916
4	fc	0.018220
3	dual_sim	0.014261
6	int_memory	0.012328
1	blue	0.000000
5	four_g	0.000000
14	sc_h	0.000000
17	three_g	0.000000
18	touch_screen	0.000000

In [ ]: