In [1]:

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

In [2]:

```
s=pd.read_csv(r"C:\Users\mouni\Downloads\Mobile_Price_Classification_test.csv")
s
```

Out[2]:

	id	battery_power	blue	clock_speed	dual_sim	fc	four_g	int_memory	m_dep	mobile_wt	...	pc	px_height	px_width	ram
0	1	1043	1	1.8	1	14	0	5	0.1	193	...	16	226	1412	3476
1	2	841	1	0.5	1	4	1	61	0.8	191	...	12	746	857	3895
2	3	1807	1	2.8	0	1	0	27	0.9	186	...	4	1270	1366	2396
3	4	1546	0	0.5	1	18	1	25	0.5	96	...	20	295	1752	3893
4	5	1434	0	1.4	0	11	1	49	0.5	108	...	18	749	810	1773
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
995	996	1700	1	1.9	0	0	1	54	0.5	170	...	17	644	913	2121
996	997	609	0	1.8	1	0	0	13	0.9	186	...	2	1152	1632	1933
997	998	1185	0	1.4	0	1	1	8	0.5	80	...	12	477	825	1223
998	999	1533	1	0.5	1	0	0	50	0.4	171	...	12	38	832	2509
999	1000	1270	1	0.5	0	4	1	35	0.1	140	...	19	457	608	2828

1000 rows × 21 columns

In [3]:

```
s.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 [4]:

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

In [5]:
```
s['dual_sim'].value_counts()
```

Out[5]:
```
dual_sim
1    517
0    483
Name: count, dtype: int64
```

In [6]:
```
m={"three_g":{"Yes":1,"No":0}}
s=s.replace(m)
print(s)
```

```
       id  battery_power  blue  clock_speed  dual_sim  fc  four_g  int_memory  \
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 [7]:
```
x=s.drop('wifi',axis=1)
y=s['wifi']
```

In [8]:
```
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[8]:
```
((700, 20), (300, 20))
```

In [9]:
```
from sklearn.ensemble import RandomForestClassifier
rfc=RandomForestClassifier()
rfc.fit(x_train,y_train)
```

Out[9]:
```
▾ RandomForestClassifier
RandomForestClassifier()
```

In [18]:

```
rf=RandomForestClassifier()
```

In [19]:

```
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 [20]:

```
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[20]:

```
GridSearchCV(cv=2, estimator=RandomForestClassifier(),
             param_grid={'max_depth': [2, 3, 5, 10, 20],
                         'min_samples_leaf': [5, 10, 20, 50, 100, 200],
                         'n_estimators': [10, 25, 30, 50, 100, 200]},
             scoring='accuracy')
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [21]:

```
grid_search.best_score_
```

Out[21]:

```
0.5642857142857143
```

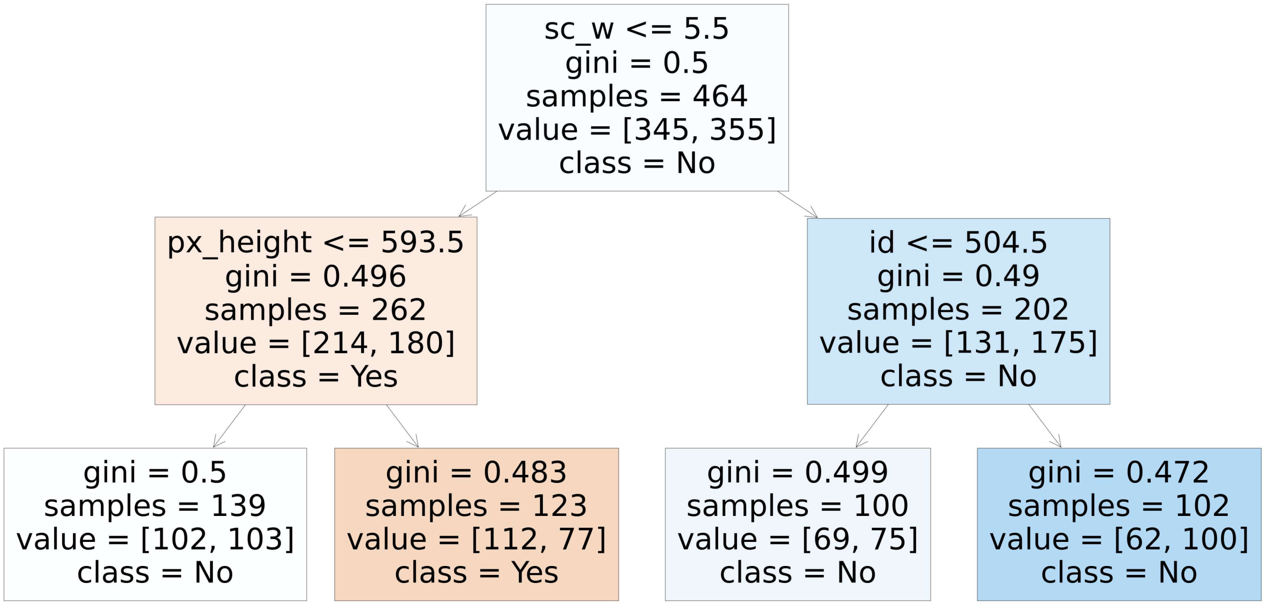
In [22]:

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

```
RandomForestClassifier(max_depth=3, min_samples_leaf=100)
```

In [23]:

```
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"],filled=True);
```



In [24]:

```
rf_best.feature_importances_
```

Out[24]:

```
array([0.06111629, 0.05959689, 0.01520499, 0.13406202, 0.00338616,
       0.10040493, 0.00861113, 0.06749342, 0.09568225, 0.07989498,
       0.01376784, 0.04871736, 0.04383924, 0.12822236, 0.04540978,
       0.02186786, 0.03412414, 0.03018371, 0.00430708, 0.00410758])
```

In [26]:
```
imp_s=pd.DataFrame({"Varname":x_train.columns,"IMP":rf_best.feature_importances_})
imp_s.sort_values(by="IMP",ascending=False)
```

Out[26]:

	Varname	IMP
3	clock_speed	0.134062
13	px_width	0.128222
5	fc	0.100405
8	m_dep	0.095682
9	mobile_wt	0.079895
7	int_memory	0.067493
0	id	0.061116
1	battery_power	0.059597
11	pc	0.048717
14	ram	0.045410
12	px_height	0.043839
16	sc_w	0.034124
17	talk_time	0.030184
15	sc_h	0.021868
2	blue	0.015205
10	n_cores	0.013768
6	four_g	0.008611
18	three_g	0.004307
19	touch_screen	0.004108
4	dual_sim	0.003386

In [6]:
```
#train data
```

In [21]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

In [22]:
```
m=pd.read_csv(r"C:\Users\mouni\Downloads\Mobile_Price_Classification_train.csv")
m
```

Out[22]:

	battery_power	blue	clock_speed	dual_sim	fc	four_g	int_memory	m_dep	mobile_wt	n_cores	...	px_height	px_width	ram
0	842	0	2.2	0	1	0	7	0.6	188	2	...	20	756	2549
1	1021	1	0.5	1	0	1	53	0.7	136	3	...	905	1988	2631
2	563	1	0.5	1	2	1	41	0.9	145	5	...	1263	1716	2603
3	615	1	2.5	0	0	0	10	0.8	131	6	...	1216	1786	2769
4	1821	1	1.2	0	13	1	44	0.6	141	2	...	1208	1212	1411
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1995	794	1	0.5	1	0	1	2	0.8	106	6	...	1222	1890	668
1996	1965	1	2.6	1	0	0	39	0.2	187	4	...	915	1965	2032
1997	1911	0	0.9	1	1	1	36	0.7	108	8	...	868	1632	3057
1998	1512	0	0.9	0	4	1	46	0.1	145	5	...	336	670	869
1999	510	1	2.0	1	5	1	45	0.9	168	6	...	483	754	3919

2000 rows × 21 columns

In [23]:

```
m.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: 328.2 KB
```

In [24]:

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

In [29]:

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

Out[29]:

```
dual_sim
1    1019
0     981
Name: count, dtype: int64
```

In [30]:
```
s={"three_g":{"Yes":1,"No":0}}
m=m.replace(s)
print(m)
```

```
      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    10   
1997    0.7        108        8  ...        868      1632  3057     9     1   
1998    0.1        145        5  ...        336       670   869    18    10   
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 [31]:
```
x=m.drop('wifi',axis=1)
y=m['wifi']
```

In [32]:
```
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[32]:
```
((1400, 20), (600, 20))
```

In [33]:
```
from sklearn.ensemble import RandomForestClassifier
rfc=RandomForestClassifier()
rfc.fit(x_train,y_train)
```

Out[33]:
```
▾ RandomForestClassifier
RandomForestClassifier()
```

In [34]:
```
rf=RandomForestClassifier()
```

In [35]:
```
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 [36]:

```
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[36]:

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

In [37]:

```
grid_search.best_score_
```

Out[37]:

```
0.5214285714285715
```

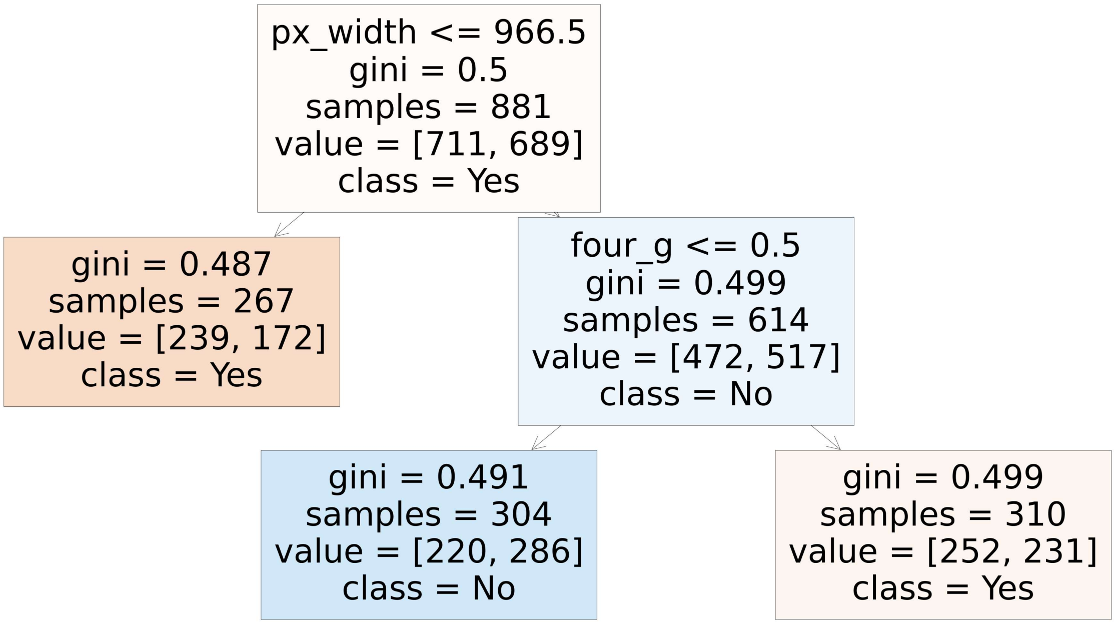
In [38]:

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

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

In [39]:

```
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"],filled=True);
```



In [40]:

```
rf_best.feature_importances_
```

Out[40]:

```
array([0.04083787, 0.        , 0.01928511, 0.03071182, 0.02853296,
       0.07426206, 0.        , 0.01540636, 0.        , 0.03717906,
       0.07146704, 0.20779773, 0.25742482, 0.0079048 , 0.02847548,
       0.        , 0.1528047 , 0.        , 0.02791019, 0.        ])
```

In [41]:

```
imp_s=pd.DataFrame({"Varname":x_train.columns,"IMP":rf_best.feature_importances_})
imp_s.sort_values(by="IMP",ascending=False)
```

Out[41]:

	Varname	IMP
12	px_width	0.257425
11	px_height	0.207798
16	talk_time	0.152805
5	four_g	0.074262
10	pc	0.071467
0	battery_power	0.040838
9	n_cores	0.037179
3	dual_sim	0.030712
4	fc	0.028533
14	sc_h	0.028475
18	touch_screen	0.027910
2	clock_speed	0.019285
7	m_dep	0.015406
13	ram	0.007905
6	int_memory	0.000000
8	mobile_wt	0.000000
1	blue	0.000000
15	sc_w	0.000000
17	three_g	0.000000
19	price_range	0.000000

In [ ]: