In [1]:

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

In [2]:

```
train_df=pd.read_csv(r"C:\Users\smb06\Downloads\Mobile_Price_Classification_test.csv")
train_df
```

Out[2]:

```
       id  battery_power  blue  clock_speed  dual_sim  fc  four_g  int_memory  m_dep  mobile_wt  ...
  0     1           1043     1          1.8         1  14       0           5    0.1        193  ...
  1     2            841     1          0.5         1   4       1          61    0.8        191  ...
  2     3           1807     1          2.8         0   1       0          27    0.9        186  ...
  3     4           1546     0          0.5         1  18       1          25    0.5         96  ...
  4     5           1434     0          1.4         0  11       1          49    0.5        108  ...
...   ...            ...   ...          ...       ...  ...    ...         ...    ...        ...  ...
995   996           1700     1          1.9         0   0       1          54    0.5        170  ...
996   997            609     0          1.8         1   0       0          13    0.9        186  ...
997   998           1185     0          1.4         0   1       1           8    0.5         80  ...
998   999           1533     1          0.5         1   0       0          50    0.4        171  ...
999  1000           1270     1          0.5         0   4       1          35    0.1        140  ...

1000 rows × 21 columns
```

In [3]:

```
test_df=pd.read_csv(r"C:\Users\smb06\Downloads\Mobile_Price_Classification_train.csv")
test_df
```

Out[3]:

	battery_power	blue	clock_speed	dual_sim	fc	four_g	int_memory	m_dep	mobile_wt	n_cores
0	842	0	2.2	0	1	0	7	0.6	188	2
1	1021	1	0.5	1	0	1	53	0.7	136	3
2	563	1	0.5	1	2	1	41	0.9	145	5
3	615	1	2.5	0	0	0	10	0.8	131	6
4	1821	1	1.2	0	13	1	44	0.6	141	2
...	...	...	...	...	...	...	...	...	...	...
1995	794	1	0.5	1	0	1	2	0.8	106	6
1996	1965	1	2.6	1	0	0	39	0.2	187	4
1997	1911	0	0.9	1	1	1	36	0.7	108	8
1998	1512	0	0.9	0	4	1	46	0.1	145	5
1999	510	1	2.0	1	5	1	45	0.9	168	6

2000 rows × 21 columns

In [4]:

```
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 [5]:

```
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 [6]:

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

In [7]:

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

In [8]:

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

Out[8]:

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

In [9]:

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

Out[9]:

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

In [10]:

```
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_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 [11]:

```
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_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 [12]:

```
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    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 [13]:

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

In [14]:

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

In [15]:

```
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[15]:

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

In [16]:

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

Out[16]:

```
▾ RandomForestClassifier
RandomForestClassifier()
```

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 [17]:

```
rf = RandomForestClassifier()
```

In [18]:

```
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 [19]:

```
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[19]:

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

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

In [20]:

```
grid_search.best_score_
```

Out[20]:

```
0.5307142857142857
```

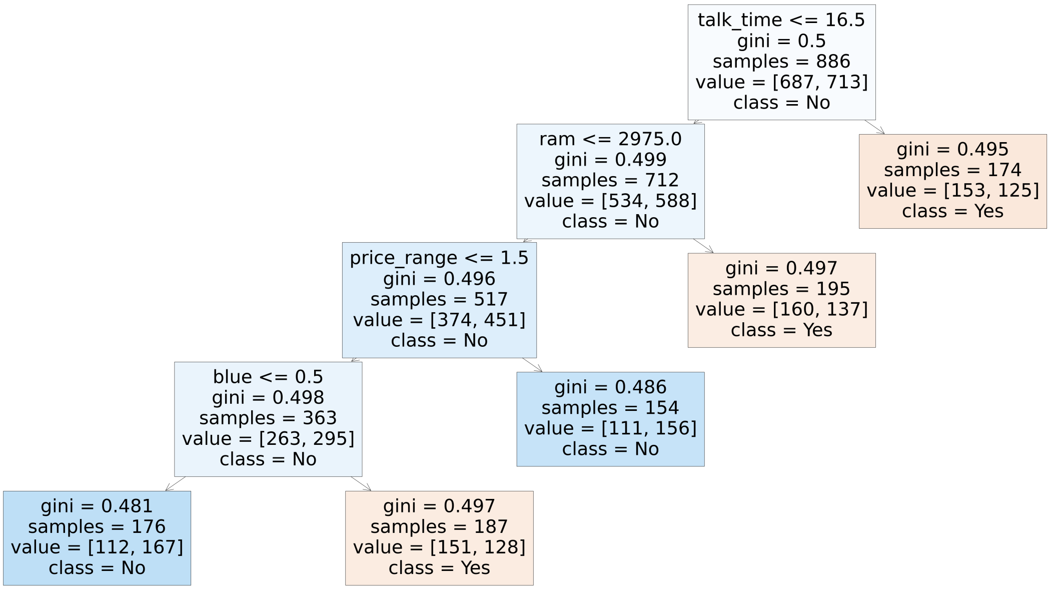
In [21]:

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

```
RandomForestClassifier(max_depth=5, min_samples_leaf=100, n_estimators=30)
```

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)
```

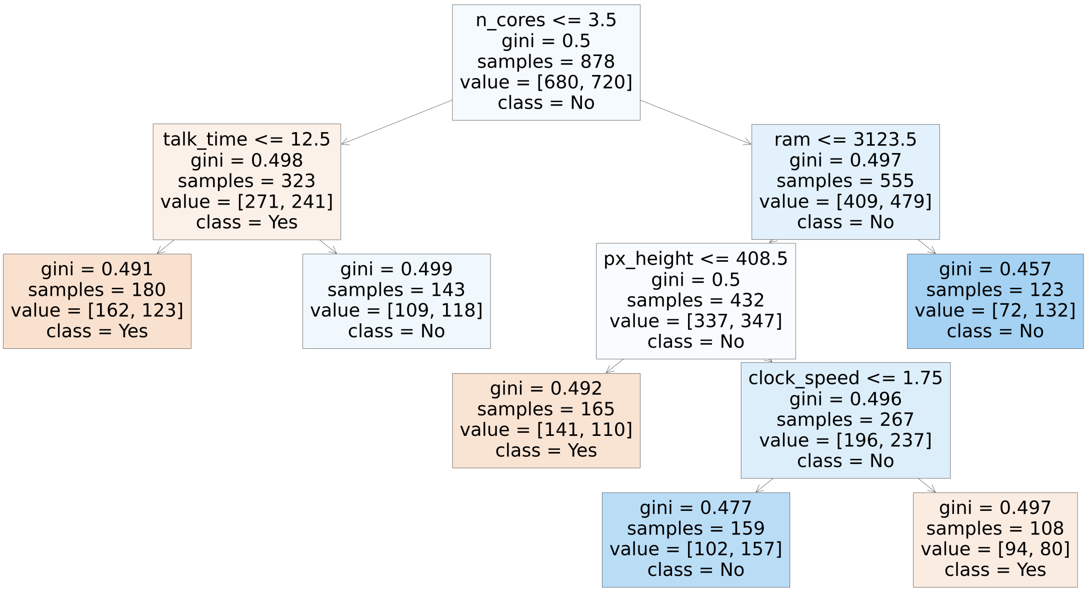


In [24]:

```
from sklearn.tree import plot_tree
plt.figure(figsize=(80,40))
plot_tree(rf_best.estimators_[7],feature_names=x.columns,class_names=["Yes","No"],filled=True)
```

Out[24]:

```
[Text(0.5, 0.9, 'n_cores <= 3.5\ngini = 0.5\nsamples = 878\nvalue = [680, 720]\ncla
ss = No'),
 Text(0.25, 0.7, 'talk_time <= 12.5\ngini = 0.498\nsamples = 323\nvalue = [271, 24
1]\nclass = Yes'),
 Text(0.125, 0.5, 'gini = 0.491\nsamples = 180\nvalue = [162, 123]\nclass = Yes'),
 Text(0.375, 0.5, 'gini = 0.499\nsamples = 143\nvalue = [109, 118]\nclass = No'),
 Text(0.75, 0.7, 'ram <= 3123.5\ngini = 0.497\nsamples = 555\nvalue = [409, 479]\nc
lass = No'),
 Text(0.625, 0.5, 'px_height <= 408.5\ngini = 0.5\nsamples = 432\nvalue = [337, 34
7]\nclass = No'),
 Text(0.5, 0.3, 'gini = 0.492\nsamples = 165\nvalue = [141, 110]\nclass = Yes'),
 Text(0.75, 0.3, 'clock_speed <= 1.75\ngini = 0.496\nsamples = 267\nvalue = [196, 2
37]\nclass = No'),
 Text(0.625, 0.1, 'gini = 0.477\nsamples = 159\nvalue = [102, 157]\nclass = No'),
 Text(0.875, 0.1, 'gini = 0.497\nsamples = 108\nvalue = [94, 80]\nclass = Yes'),
 Text(0.875, 0.5, 'gini = 0.457\nsamples = 123\nvalue = [72, 132]\nclass = No')]
```



In [25]:

```
rf_best.feature_importances_
```

Out[25]:

```
array([0.03334591, 0.01914167, 0.06293353, 0.00879701, 0.06890239,
       0.01881253, 0.06233112, 0.05192067, 0.07849322, 0.01252026,
       0.06905562, 0.14658583, 0.09846751, 0.05924079, 0.04058377,
       0.04552378, 0.08622158, 0.01038129, 0.00482762, 0.0219139 ])
```

In [26]:

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

Out[26]:

	Vername	Imp
11	px_height	0.146586
12	px_width	0.098468
16	talk_time	0.086222
8	mobile_wt	0.078493
10	pc	0.069056
4	fc	0.068902
2	clock_speed	0.062934
6	int_memory	0.062331
13	ram	0.059241
7	m_dep	0.051921
15	sc_w	0.045524
14	sc_h	0.040584
0	battery_power	0.033346
19	price_range	0.021914
1	blue	0.019142
5	four_g	0.018813
9	n_cores	0.012520
17	three_g	0.010381
3	dual_sim	0.008797
18	touch_screen	0.004828

In [ ]: