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J021

In [2]:

```
import os
print(os.getcwd())
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
```

C:\Users\User-1

In [3]:

```
df = pd.read_csv('car_evaluation.csv', header = None)
```

In [4]:

```
df.head()
```

Out[4]:

	0	1	2	3	4	5	6
0	vhigh	vhigh	2	2	small	low	unacc
1	vhigh	vhigh	2	2	small	med	unacc
2	vhigh	vhigh	2	2	small	high	unacc
3	vhigh	vhigh	2	2	med	low	unacc
4	vhigh	vhigh	2	2	med	med	unacc

In [5]:

```
col_names = ['buying', 'maint', 'doors', 'persons', 'lug_boot', 'safety', 'class']
df.columns = col_names
col_names
```

Out[5]:

```
['buying', 'maint', 'doors', 'persons', 'lug_boot', 'safety', 'class']
```

In [6]:

```
df.head()
```

Out[6]:

	buying	maint	doors	persons	lug_boot	safety	class
0	vhigh	vhigh	2	2	small	low	unacc
1	vhigh	vhigh	2	2	small	med	unacc
2	vhigh	vhigh	2	2	small	high	unacc
3	vhigh	vhigh	2	2	med	low	unacc
4	vhigh	vhigh	2	2	med	med	unacc

In [7]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1728 entries, 0 to 1727
Data columns (total 7 columns):
#   Column      Non-Null Count  Dtype
---  -
0   buying      1728 non-null   object
1   maint       1728 non-null   object
2   doors       1728 non-null   object
3   persons     1728 non-null   object
4   lug_boot    1728 non-null   object
5   safety      1728 non-null   object
6   class       1728 non-null   object
dtypes: object(7)
memory usage: 94.6+ KB
```

In [8]:

```
for i in col_names:  
    print(df[i].value_counts())
```

```
med      432  
vhigh    432  
high     432  
low      432  
Name: buying, dtype: int64  
med      432  
vhigh    432  
high     432  
low      432  
Name: maint, dtype: int64  
3        432  
5more    432  
2        432  
4        432  
Name: doors, dtype: int64  
more     576  
2        576  
4        576  
Name: persons, dtype: int64  
med      576  
big      576  
small    576  
Name: lug_boot, dtype: int64  
med      576  
high     576  
low      576  
Name: safety, dtype: int64  
unacc    1210  
acc      384  
good      69  
vgood     65  
Name: class, dtype: int64
```

In [9]:

```
df.shape
```

Out[9]:

```
(1728, 7)
```

In [10]:

```
X = df.drop(['class'],axis = 1)  
y = df['class']
```

In [11]:

```
from sklearn.model_selection import train_test_split  
X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.3,random_state=42)
```

In [12]:

```
from sklearn.preprocessing import OrdinalEncoder
enc = OrdinalEncoder()
X_train = enc.fit_transform(X_train)
X_test = enc.transform(X_test)
```

Gini index as criterion

In [13]:

```
from sklearn.tree import DecisionTreeClassifier
```

In [14]:

```
clf_gini = DecisionTreeClassifier(criterion='gini', max_depth=3, random_state=42)
clf_gini.fit(X_train, y_train)
```

Out[14]:

```
DecisionTreeClassifier(max_depth=3, random_state=42)
```

In [15]:

```
y_pred = clf_gini.predict(X_test)
```

Grid Search Cv

In [48]:

```
from sklearn.model_selection import GridSearchCV
option=['gini','entropy']
weight_option=['auto','sqrt','log2']
param_grid = {'criterion': option , 'max_features':[2,3,4,5,6] , 'max_depth':[4,5,6,7] , 'min_samples_split':2}
grid=GridSearchCV(clf_gini,param_grid,cv=3,scoring='accuracy')
grid.fit(X_train,y_train)
print(grid.best_score_)
print(grid.best_params_)
```

```
0.9247311827956989
```

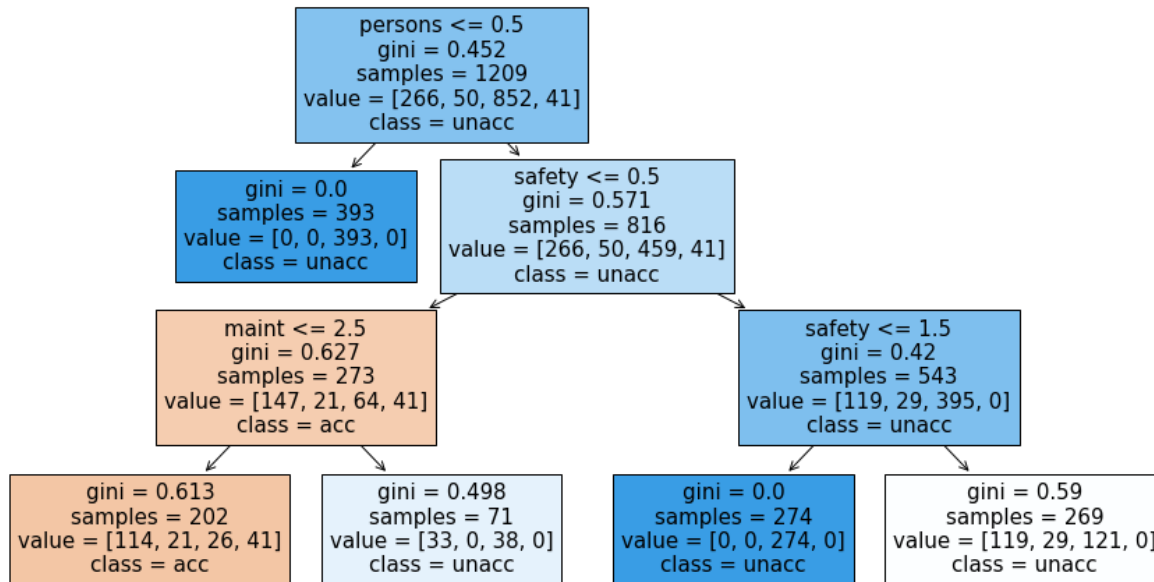
```
{'criterion': 'gini', 'max_depth': 7, 'max_features': 6, 'min_samples_split': 2}
```

In [49]:

```

from sklearn import tree
plt.figure(figsize=(15,8))
tree.plot_tree(clf_gini,
               feature_names=['buying', 'maint', 'doors', 'persons', 'lug_boot', 'safety'],
               class_names= list(set(y_train)),
               filled = True)
plt.show()

```



In [50]:

```

# Check for underfitting

print(f'Training set score: {clf_gini.score(X_train,y_train)}')
print(f'Test set score: {clf_gini.score(X_test,y_test)}')

```

Training set score: 0.7775020678246485

Test set score: 0.7572254335260116

Model after grid search

In [51]:

```
dtc = DecisionTreeClassifier(criterion='gini', max_depth=7,max_features = 6)
dtc.fit(X_train, y_train)
```

Out[51]:

```
DecisionTreeClassifier(max_depth=7, max_features=6)
```

In [61]:

```
y_pred = dtc.predict(X_test)
```

In [53]:

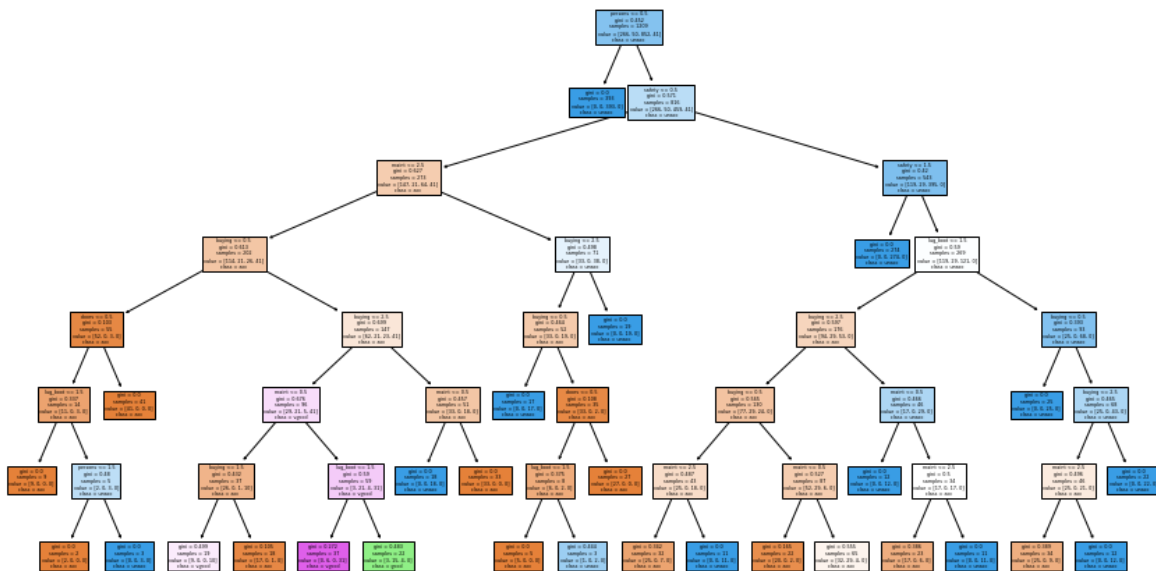
```
print(f'Training set score: {dtc.score(X_train,y_train)}')
print(f'Test set score: {dtc.score(X_test,y_test)}')
```

Training set score: 0.9330024813895782

Test set score: 0.9344894026974951

In [54]:

```
from sklearn import tree
plt.figure(figsize=(15,8))
tree.plot_tree(dtc,
               feature_names=['buying', 'maint', 'doors', 'persons', 'lug_boot', 'safety'],
               class_names=list(set(y_train)),
               filled = True)
plt.show()
```



Cross validation

In [55]:

```
from sklearn.model_selection import cross_val_score
score=cross_val_score(dtc,X_train,y_train,cv=10,scoring='accuracy')
score.mean()
```

Out[55]:

0.920564738292011

In [57]:

```
from sklearn.model_selection import cross_val_score
score=cross_val_score(dtc,X_test,y_test,cv=10,scoring='accuracy')
score.mean()
```

Out[57]:

0.8978883861236803

In [62]:

```
from sklearn.metrics import confusion_matrix, classification_report
cm = confusion_matrix(y_test, y_pred)
```

In [63]:

```
print(cm)
```

```
[[109  4  1  4]
 [ 10  6  0  3]
 [ 11  0 346  1]
 [  0  0  0 24]]
```

In [64]:

```
print(classification_report(y_test, y_pred))
```

	precision	recall	f1-score	support
acc	0.84	0.92	0.88	118
good	0.60	0.32	0.41	19
unacc	1.00	0.97	0.98	358
vgood	0.75	1.00	0.86	24
accuracy			0.93	519
macro avg	0.80	0.80	0.78	519
weighted avg	0.94	0.93	0.93	519

In []:

