ML ASSIGNMENT: DECISION TREES WITH GRID SEARCH CROSS VALIDATION

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IMPORTS

In [1]:

```
import os
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
```

In [2]:

```
loc = 'Downloads/car_evaluation.csv'
df = pd.read_csv(loc, header = None)
df.head()
```

Out[2]:

	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 [3]:

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

In [4]:

```
df.head()
```

Out[4]:

	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 [5]:

```
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 [6]:

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

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

In [7]:

```
df.shape
```

Out[7]:

```
(1728, 7)
```

SPLITTING THE DATA

In [8]:

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

In [9]:

```
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 [10]:

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

GINI INDEX

In [11]:

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

In [12]:

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

Out[12]:

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

In [13]:

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

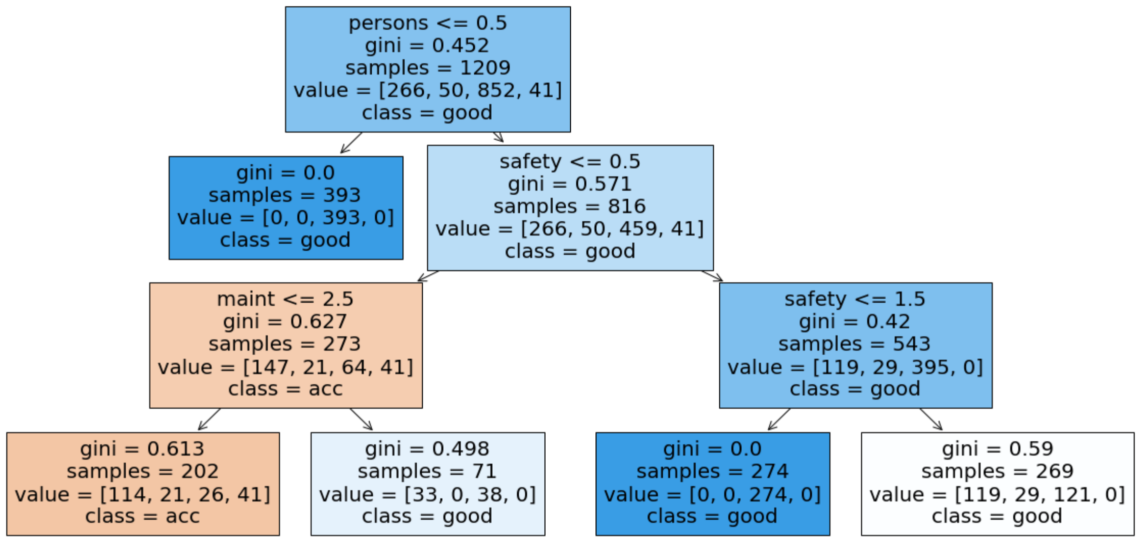
In [14]:

```
from sklearn.metrics import accuracy_score
print(f'Model with gini index gives an accuracy of: {accuracy_score(y_test, y_pred)}')
```

```
Model with gini index gives an accuracy of: 0.7572254335260116
```

In [15]:

```
from sklearn import tree
##resize tthis pls
plt.figure(figsize = (20,10))
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 [16]:

```
##CHECKING 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
```

ENTROPY

In [17]:

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

Out[17]:

```
DecisionTreeClassifier(criterion='entropy', max_depth=3, random_state=42)
```

In [18]:

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

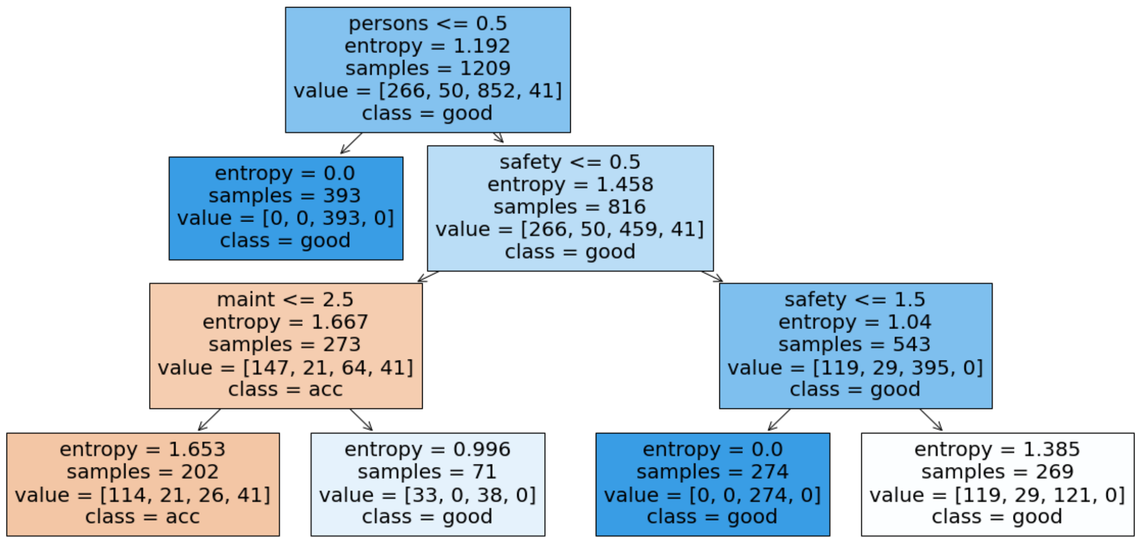
In [19]:

```
from sklearn.metrics import accuracy_score
print(f'Model with gini index gives an accuracy of: {accuracy_score(y_test, y_pred)}')
```

```
Model with gini index gives an accuracy of: 0.7572254335260116
```

In [22]:

```
plt.figure(figsize=(20,10))
tree.plot_tree(clf_entropy,
               feature_names=['buying', 'maint', 'doors', 'persons', 'lug_boot', 'safet
y'],
               class_names= list(set(y_train)),
               filled = True)
plt.show()
```



In [23]:

```
# Check for underfitting
print(f'Training set score: {clf_entropy.score(X_train,y_train)}')
print(f'Test set score: {clf_entropy.score(X_test,y_test)}')
```

```
Training set score: 0.7775020678246485
Test set score: 0.7572254335260116
```

In [24]:

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

In [25]:

```
print(cm)
```

```
[[ 44   0  74   0]
 [  9   0  10   0]
 [  9   0 349   0]
 [ 24   0   0   0]]
```

In [26]:

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

```
              precision    recall  f1-score   support

         acc       0.51      0.37      0.43       118
        good       0.00      0.00      0.00        19
       unacc       0.81      0.97      0.88       358
       vgood       0.00      0.00      0.00        24

    accuracy                           0.76       519
   macro avg       0.33      0.34      0.33       519
weighted avg       0.67      0.76      0.71       519



C:\Users\AVANI\anaconda3\lib\site-packages\sklearn\metrics\_classificatio
n.py:1221: UndefinedMetricWarning: Precision and F-score are ill-defined a
nd being set to 0.0 in labels with no predicted samples. Use `zero_divisio
n` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

In [ ]:

```

```