Car Evaluation Model using KNN

Importing Libraries

In [1]:

```
import numpy
import pandas
from keras.utils import np_utils
import matplotlib.pyplot as plt
from keras.utils import to_categorical
```

In [2]:

```
from sklearn.preprocessing import LabelEncoder
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import accuracy_score
```

load dataset

In [3]:

```
dataframe = pandas.read_csv(r"../DATASET/car_evaluation.csv")
```

Assign names to Columns

In [4]:

```
dataframe.columns = ['buying','maint','doors','persons','lug_boot','safety','classes']
```

Encode Data

In [5]:

```
dataframe.buying.replace(
    ('vhigh','high','med','low'),
    (1,2,3,4),
    inplace=True
)


dataframe.maint.replace(
    ('vhigh','high','med','low'),
    (1,2,3,4),
    inplace=True
)


dataframe.doors.replace(
    ('2','3','4','5more'),
    (1,2,3,4),
    inplace=True
)

dataframe.persons.replace(
    ('2','4','more'),
    (1,2,3),
    inplace=True
)


dataframe.lug_boot.replace(
    ('small','med','big'),
    (1,2,3),
    inplace=True
)


dataframe.safety.replace(
    ('low','med','high'),
    (1,2,3),
    inplace=True
)


dataframe.classes.replace(
    ('unacc','acc','good','vgood'),
    (1,2,3,4),
    inplace=True
)
```

View first 5 records

In [6]:

```
print("dataframe.head: ", dataframe.head())
```

```
dataframe.head:     buying  maint  doors  persons  lug_boot  safety  class
es
0       1      1      1        1         1       2        1
1       1      1      1        1         1       3        1
2       1      1      1        1         2       1        1
3       1      1      1        1         2       2        1
4       1      1      1        1         2       3        1
```

Description

In [7]:

```
print("dataframe.describe: ", dataframe.describe())
```

```
dataframe.describe:              buying        maint        doors      per
sons     lug_boot  \
count  1727.000000  1727.000000  1727.000000  1727.000000  1727.000000
mean      2.500869     2.500869     2.500869     2.000579     2.000579
std       1.118098     1.118098     1.118098     0.816615     0.816615
min       1.000000     1.000000     1.000000     1.000000     1.000000
25%       2.000000     2.000000     2.000000     1.000000     1.000000
50%       3.000000     3.000000     3.000000     2.000000     2.000000
75%       3.500000     3.500000     3.500000     3.000000     3.000000
max       4.000000     4.000000     4.000000     3.000000     3.000000

            safety      classes
count  1727.000000  1727.000000
mean      2.000579     1.415171
std       0.816615     0.740847
min       1.000000     1.000000
25%       1.000000     1.000000
50%       2.000000     1.000000
75%       3.000000     2.000000
max       3.000000     4.000000
```

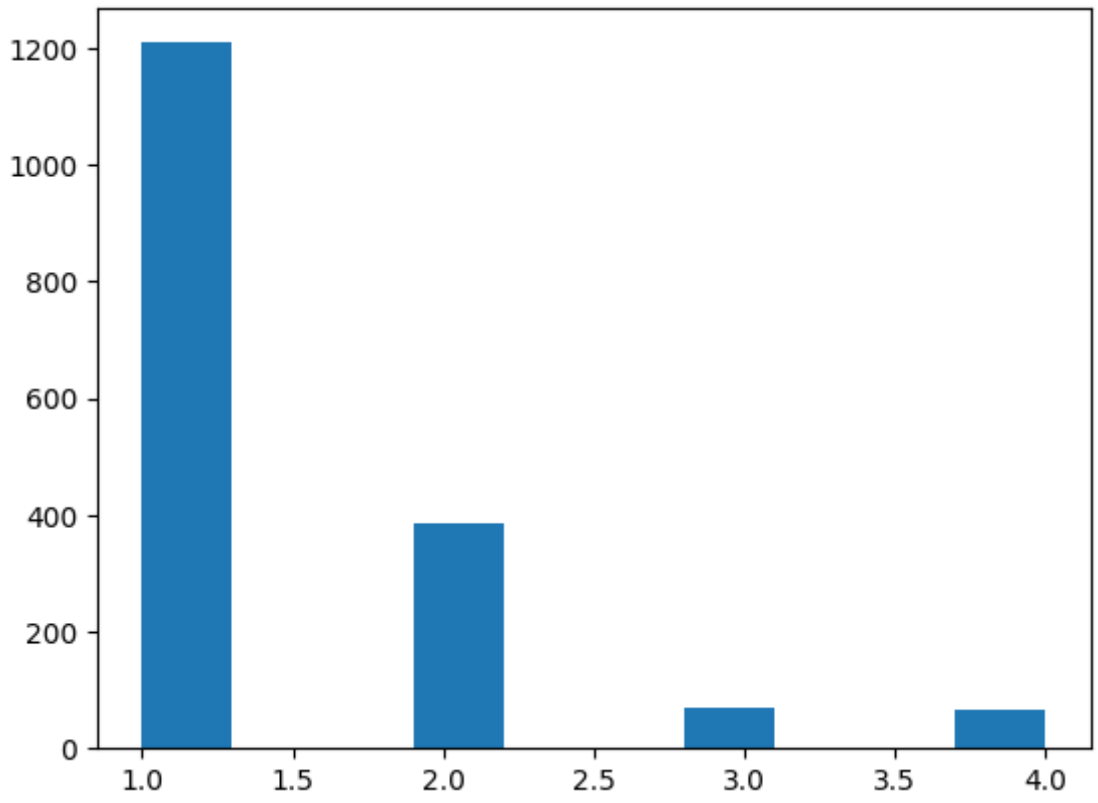
Plotting Histogram

In [8]:

```
plt.hist((dataframe.classes))
```

Out[8]:

```
(array([1209.,    0.,    0.,  384.,    0.,    0.,   69.,    0.,    0.,
          65.]),
 array([1. , 1.3, 1.6, 1.9, 2.2, 2.5, 2.8, 3.1, 3.4, 3.7, 4. ]),
 <BarContainer object of 10 artists>)
```

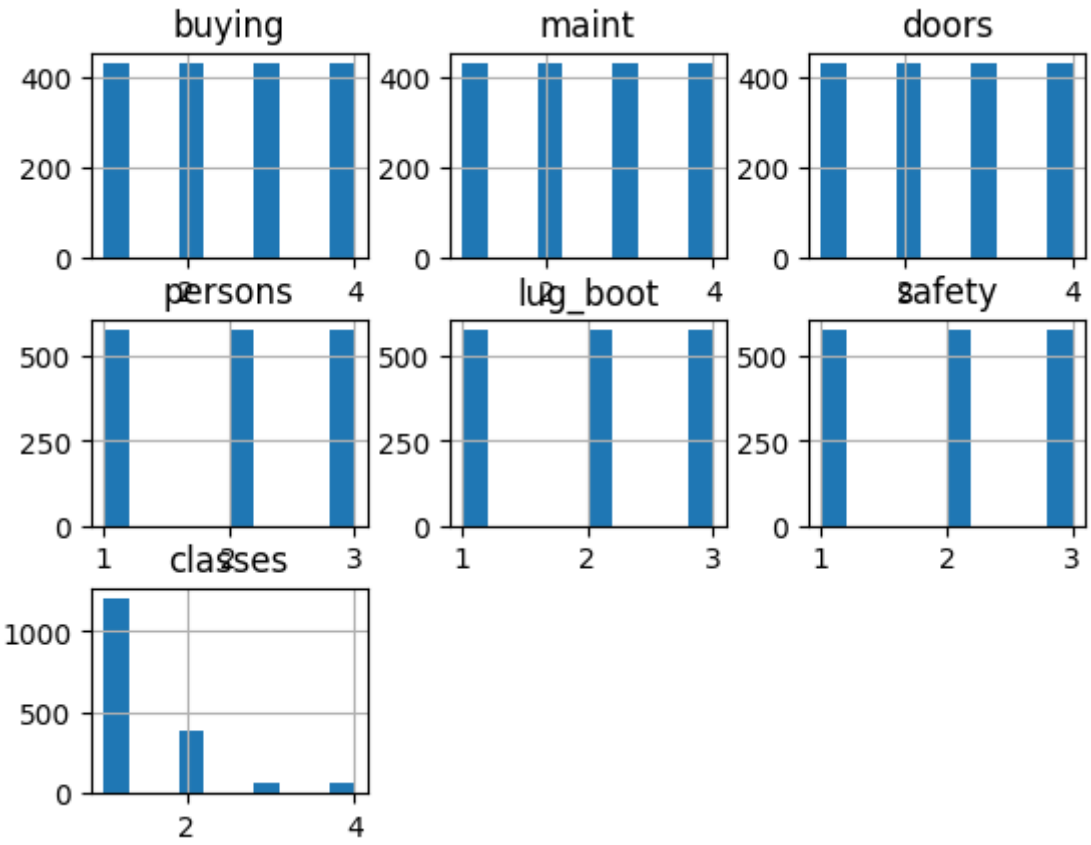


In [9]:

```
dataframe.hist()
```

Out[9]:

```
array([[<AxesSubplot:title={'center':'buying'}>,
        <AxesSubplot:title={'center':'maint'}>,
        <AxesSubplot:title={'center':'doors'}>],
       [<AxesSubplot:title={'center':'persons'}>,
        <AxesSubplot:title={'center':'lug_boot'}>,
        <AxesSubplot:title={'center':'safety'}>],
       [<AxesSubplot:title={'center':'classes'}>, <AxesSubplot:>,
        <AxesSubplot:>]], dtype=object)
```



Training

In [10]:

```
max_accuracy = 0
min_accuracy = 200

loops = 30

knn = 0

predictions = []

for i in range(loops):

    dataset = dataframe.values


    X = dataset[:,0:6]
    Y = numpy.asarray(dataset[:,6], dtype="S6")


    # Split Data to Train and Test
    X_Train, X_Test, Y_Train, Y_Test = train_test_split(X, Y, test_size=0.2)

    # create model
    knn = KNeighborsClassifier()

    knn.fit(X_Train, Y_Train)

    predictions = knn.predict(X_Test)

    score = accuracy_score(Y_Test, predictions)

    max_accuracy = max(max_accuracy, score)
    min_accuracy = min(min_accuracy, score)

    print(score)
```

```
0.9161849710982659
0.9161849710982659
0.9132947976878613
0.9046242774566474
0.9335260115606936
0.9277456647398844
0.9335260115606936
0.9075144508670521
0.9393063583815029
0.9190751445086706
0.9161849710982659
0.9132947976878613
0.9046242774566474
0.9075144508670521
0.9219653179190751
0.9190751445086706
0.9248554913294798
0.9335260115606936
0.9421965317919075
0.9421965317919075
0.9075144508670521
0.8988439306358381
0.9335260115606936
0.930635838150289
0.9075144508670521
0.9219653179190751
0.9364161849710982
0.9219653179190751
0.9277456647398844
0.9190751445086706
```

In [11]:

```
print("max_accuracy : ", max_accuracy)
print("min_accuracy : ", min_accuracy)
```

```
max_accuracy :  0.9421965317919075
min_accuracy :  0.8988439306358381
```

In [12]:

```
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(Y_Test, predictions)
print('Confusion matrix\n\n', cm)
```

```
Confusion matrix

 [[240   2   0   0]
 [  9  66   1   0]
 [  2   7   7   0]
 [  0   4   3   5]]
```

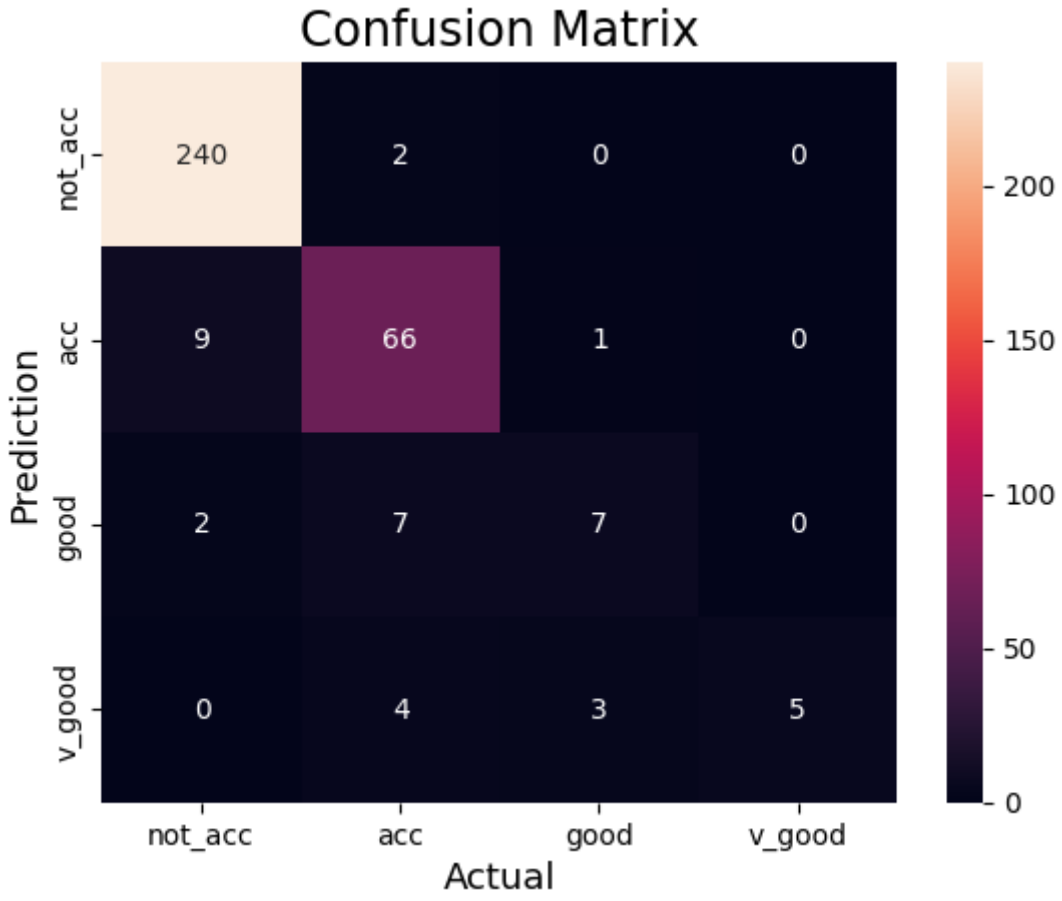
Plot the confusion matrix.

In [13]:

```
import seaborn as sns
import matplotlib.pyplot as plt


sns.heatmap(cm,
            annot=True,
            fmt='g',
            xticklabels=['not_acc','acc', 'good', 'v_good'],
            yticklabels=['not_acc','acc', 'good', 'v_good'])


plt.ylabel('Prediction',fontsize=13)
plt.xlabel('Actual',fontsize=13)
plt.title('Confusion Matrix',fontsize=17)
plt.show()
```



In [14]:

```
from sklearn.metrics import classification_report
print(classification_report(Y_Test, predictions))
```

```
              precision    recall  f1-score   support

        b'1'       0.96      0.99      0.97       242
        b'2'       0.84      0.87      0.85        76
        b'3'       0.64      0.44      0.52        16
        b'4'       1.00      0.42      0.59        12

    accuracy                           0.92       346
   macro avg       0.86      0.68      0.73       346
weighted avg       0.92      0.92      0.91       346
```

Predictions

In [15]:

```
buying = 4
maint = 4
doors = 4
persons = 3
lug_boot = 2
safety = 2

knn.predict([[buying, maint, doors, persons, lug_boot, safety]])
```

Out[15]:

```
array([b'3'], dtype='|S6')
```

Saving the model

In [16]:

```
import pickle

with open('model_pickle','wb') as file:
    pickle.dump(knn,file)
```