Car Evaluation Model using KNN

Importing Libraries

In [56]:

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

In [57]:

```
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 [58]:

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

Assign names to Columns

In [59]:

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

Encode Data

In [60]:

```
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 [61]:

```
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 [62]:

```
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
```

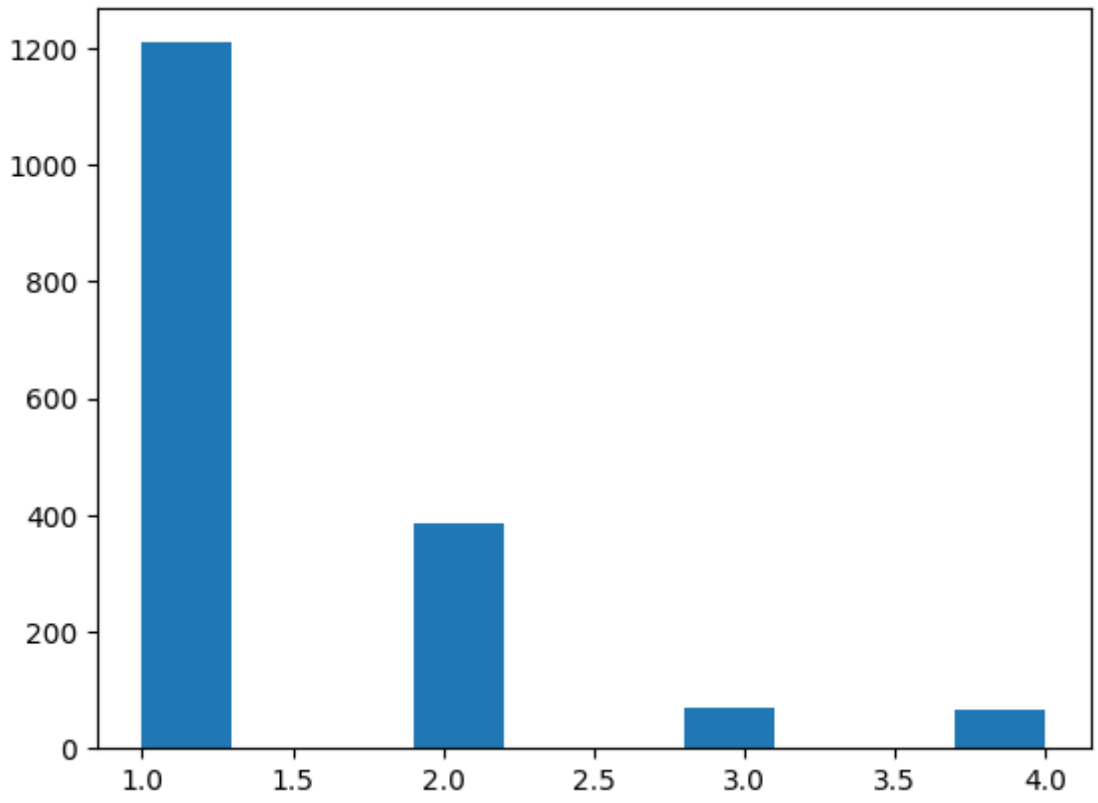
Plotting Histogram

In [63]:

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

Out[63]:

```
(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>)
```

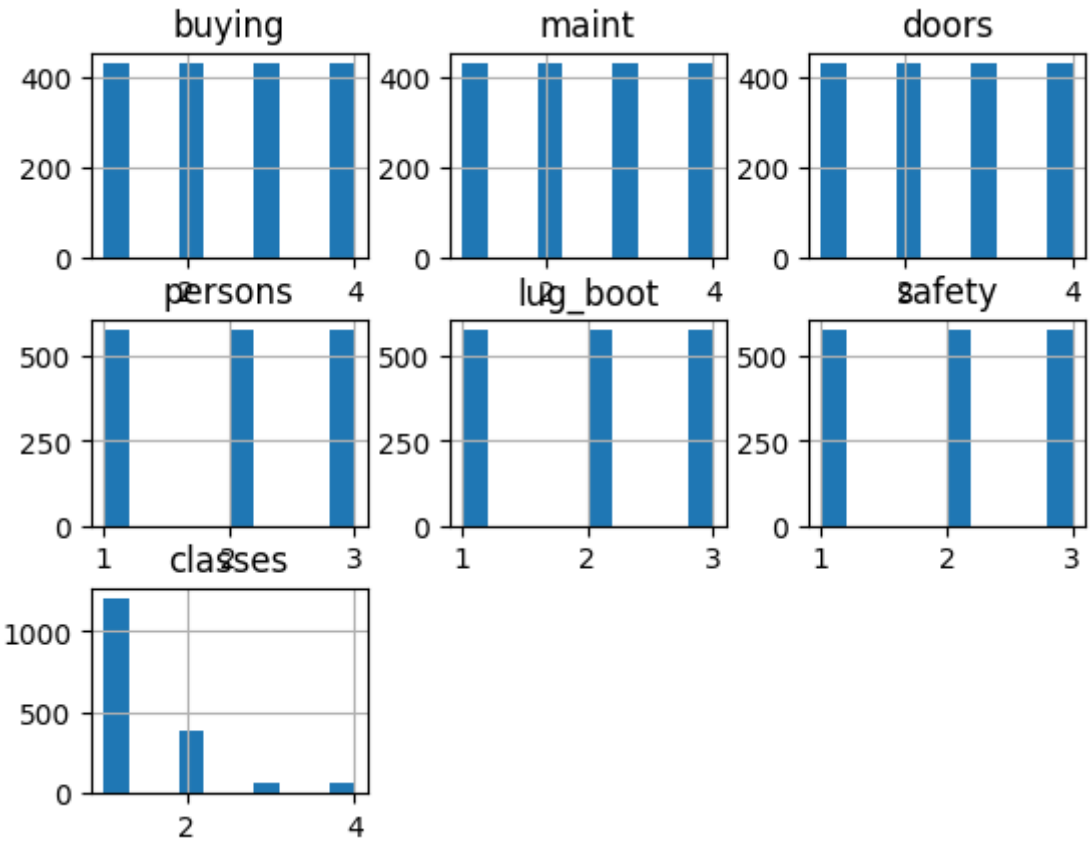


In [64]:

```
dataframe.hist()
```

Out[64]:

```
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 [65]:

```
max_accuracy = 0
min_accuracy = 200

loops = 30

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)
```

```
0.9450867052023122
0.9219653179190751
0.9450867052023122
0.8988439306358381
0.9364161849710982
0.930635838150289
0.9161849710982659
0.9075144508670521
0.9682080924855492
0.9161849710982659
0.9450867052023122
0.9479768786127167
0.9190751445086706
0.9335260115606936
0.9479768786127167
0.9450867052023122
0.9161849710982659
0.9132947976878613
0.9190751445086706
0.9335260115606936
0.9190751445086706
0.9393063583815029
0.9104046242774566
0.9075144508670521
0.9190751445086706
0.9161849710982659
0.9335260115606936
0.9508670520231214
0.9219653179190751
0.9393063583815029
```

In [66]:

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

```
max_accuracy :  0.9682080924855492
min_accuracy :  0.8988439306358381
```

In [67]:

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

```
Confusion matrix

 [[255   0   0   0]
 [ 11  62   0   0]
 [  2   4   4   0]
 [  0   2   2   4]]
```

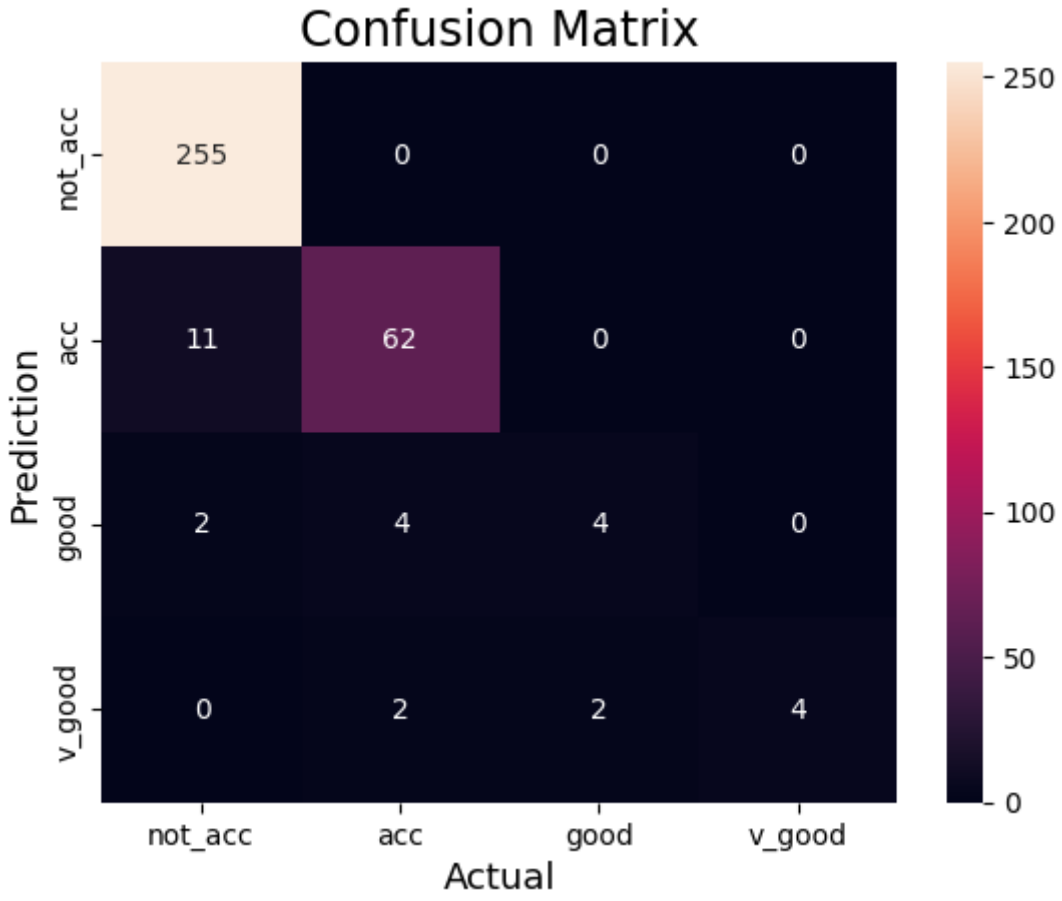
Plot the confusion matrix.

In [68]:

```
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 [69]:

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

```
              precision    recall  f1-score   support

        b'1'       0.95      1.00      0.98       255
        b'2'       0.91      0.85      0.88        73
        b'3'       0.67      0.40      0.50        10
        b'4'       1.00      0.50      0.67         8

    accuracy                           0.94       346
   macro avg       0.88      0.69      0.76       346
weighted avg       0.94      0.94      0.93       346
```

In [ ]:

```

```