Importing the Dependencies

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score
```

Data Collection

In [2]:
```
# loading the dataset to a Pandas DataFrame
wine_dataset = pd.read_csv('B:\MY COMPUTER (HOME)\2 IT\Practice works\Datasets\winequal
```

In [3]:
```
# number of rows & columns in the dataset
wine_dataset.shape
```

Out[3]: (1599, 12)

In [4]:
```
# first 5 rows of the dataset
wine_dataset.head()
```

Out[4]:

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates	alcohol	quality
0	7.4	0.70	0.00	1.9	0.076	11.0	34.0	0.9978	3.51	0.56	9.4	5
1	7.8	0.88	0.00	2.6	0.098	25.0	67.0	0.9968	3.20	0.68	9.8	5
2	7.8	0.76	0.04	2.3	0.092	15.0	54.0	0.9970	3.26	0.65	9.8	5
3	11.2	0.28	0.56	1.9	0.075	17.0	60.0	0.9980	3.16	0.58	9.8	6
4	7.4	0.70	0.00	1.9	0.076	11.0	34.0	0.9978	3.51	0.56	9.4	5

In [5]:
```
# checking for missing values
wine_dataset.isnull().sum()
```

Out[5]:
```
fixed acidity           0
volatile acidity        0
citric acid             0
residual sugar          0
chlorides               0
free sulfur dioxide     0
total sulfur dioxide    0
density                 0
pH                      0
sulphates               0
alcohol                 0
quality                 0
dtype: int64
```

Data Analysis and Visulaization

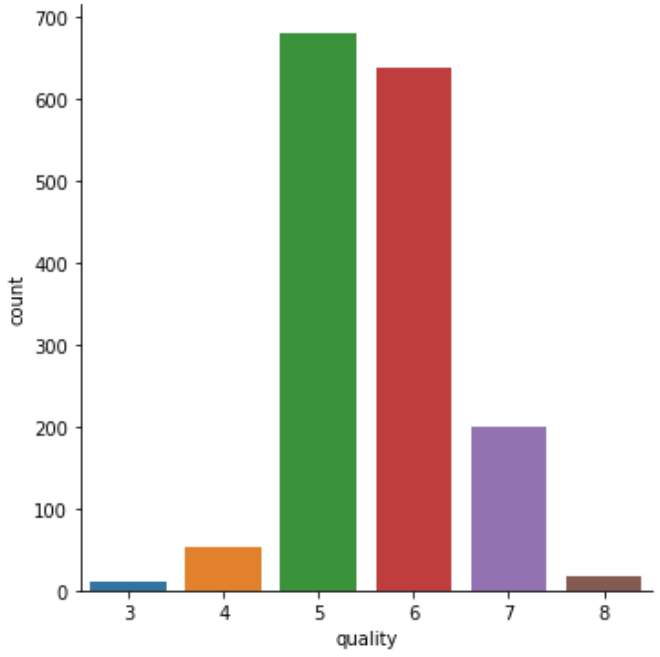
In [6]:
```
# statistical measures of the dataset
wine_dataset.describe()
```

Out[6]:

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	dens
count	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.0000
mean	8.319637	0.527821	0.270976	2.538806	0.087467	15.874922	46.467792	0.9967
std	1.741096	0.179060	0.194801	1.409928	0.047065	10.460157	32.895324	0.0018
min	4.600000	0.120000	0.000000	0.900000	0.012000	1.000000	6.000000	0.9900
25%	7.100000	0.390000	0.090000	1.900000	0.070000	7.000000	22.000000	0.9956
50%	7.900000	0.520000	0.260000	2.200000	0.079000	14.000000	38.000000	0.9967
75%	9.200000	0.640000	0.420000	2.600000	0.090000	21.000000	62.000000	0.9978
max	15.900000	1.580000	1.000000	15.500000	0.611000	72.000000	289.000000	1.0036

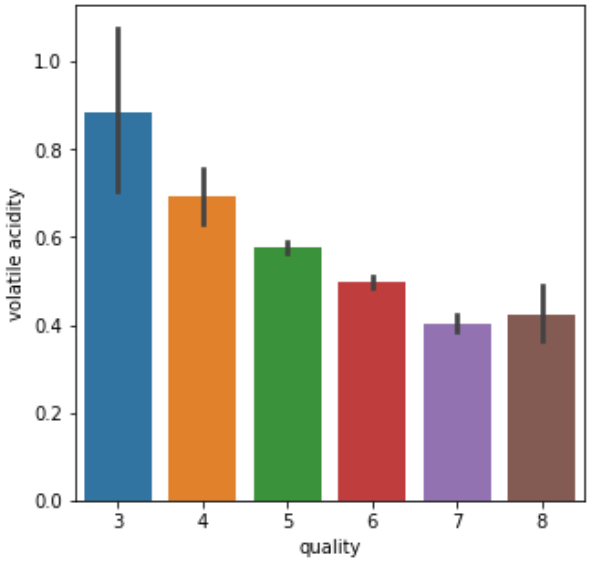
In [7]:
```
# number of values for each quality
sns.catplot(x='quality', data = wine_dataset, kind = 'count')
```

Out[7]: <seaborn.axisgrid.FacetGrid at 0x7fb106addb50>



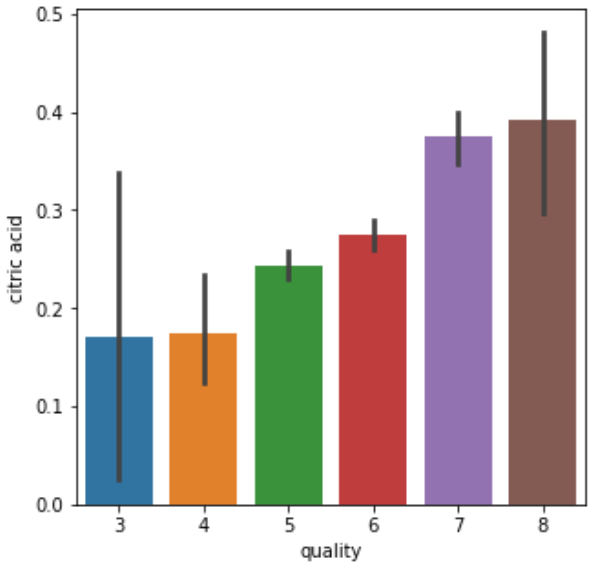
In [8]:
```
# volatile acidity vs Quality
plot = plt.figure(figsize=(5,5))
sns.barplot(x='quality', y = 'volatile acidity', data = wine_dataset)
```

Out[8]: <matplotlib.axes._subplots.AxesSubplot at 0x7fb10649bbd0>



In [9]:
```
# citric acid vs Quality
plot = plt.figure(figsize=(5,5))
sns.barplot(x='quality', y = 'citric acid', data = wine_dataset)
```

Out[9]: <matplotlib.axes._subplots.AxesSubplot at 0x7fb106506a10>



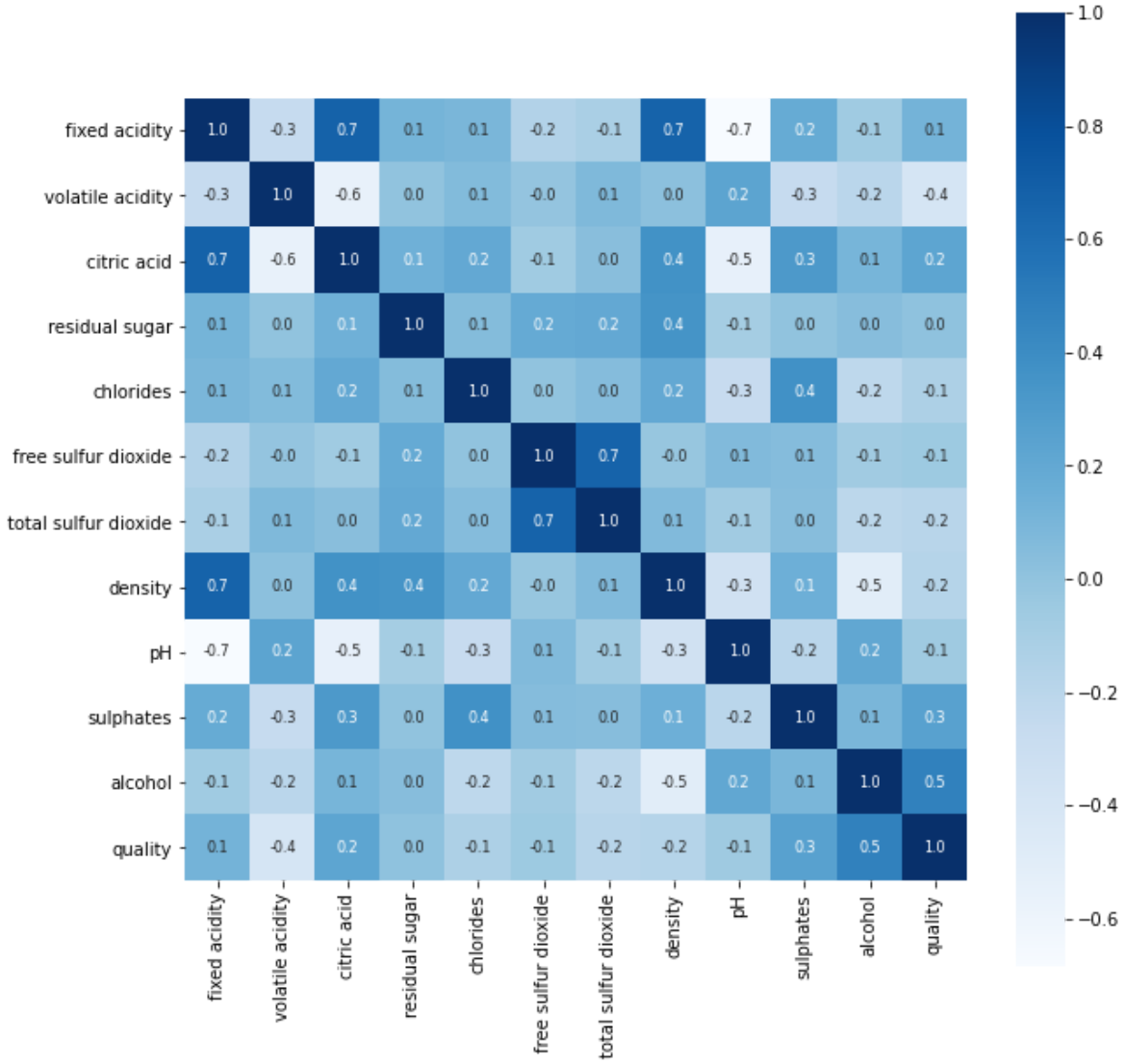
Correlation

1. Positive Correlation
2. Negative Correlation

In [10]:
```
correlation = wine_dataset.corr()
```

In [11]:
```
# constructing a heatmap to understand the correlation between the columns
plt.figure(figsize=(10,10))
sns.heatmap(correlation, cbar=True, square=True, fmt = '.1f', annot = True,
            annot_kws={'size':8}, cmap = 'Blues')
```

Out[11]: <matplotlib.axes._subplots.AxesSubplot at 0x7fb0fd356950>



Data Preprocessing

In [12]:
```
# separate the data and Label
X = wine_dataset.drop('quality',axis=1)
```

In [13]:
```
print(X)
```

```
      fixed acidity  volatile acidity  citric acid  ...    pH  sulphates  alcohol
0               7.4             0.700         0.00  ...  3.51       0.56      9.4
1               7.8             0.880         0.00  ...  3.20       0.68      9.8
2               7.8             0.760         0.04  ...  3.26       0.65      9.8
3              11.2             0.280         0.56  ...  3.16       0.58      9.8
4               7.4             0.700         0.00  ...  3.51       0.56      9.4
...             ...               ...          ...  ...   ...        ...      ...
1594            6.2             0.600         0.08  ...  3.45       0.58     10.5
1595            5.9             0.550         0.10  ...  3.52       0.76     11.2
1596            6.3             0.510         0.13  ...  3.42       0.75     11.0
1597            5.9             0.645         0.12  ...  3.57       0.71     10.2
1598            6.0             0.310         0.47  ...  3.39       0.66     11.0

[1599 rows x 11 columns]
```

Label Binarizaton

In [14]:
```
Y = wine_dataset['quality'].apply(lambda y_value: 1 if y_value>=7 else 0)
```

In [15]:
```
print(Y)
```

```
0       0
1       0
2       0
3       0
4       0
       ..
1594    0
1595    0
1596    0
1597    0
1598    0
Name: quality, Length: 1599, dtype: int64
```

Train & Test Split

In [16]:
```
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.2, random_state=
```

In [17]:
```
print(Y.shape, Y_train.shape, Y_test.shape)
```

```
(1599,) (1279,) (320,)
```

Model Training:

Random Forest Classifier

In [18]:
```
model = RandomForestClassifier()
```

In [19]:
```
model.fit(X_train, Y_train)
```

Out[19]:
```
RandomForestClassifier(bootstrap=True, ccp_alpha=0.0, class_weight=None,
                       criterion='gini', max_depth=None, max_features='auto',
                       max_leaf_nodes=None, max_samples=None,
                       min_impurity_decrease=0.0, min_impurity_split=None,
                       min_samples_leaf=1, min_samples_split=2,
                       min_weight_fraction_leaf=0.0, n_estimators=100,
                       n_jobs=None, oob_score=False, random_state=None,
                       verbose=0, warm_start=False)
```

Model Evaluation

Accuracy Score

In [20]:
```
# accuracy on test data
X_test_prediction = model.predict(X_test)
test_data_accuracy = accuracy_score(X_test_prediction, Y_test)
```

In [21]:
```
print('Accuracy : ', test_data_accuracy)
```

```
Accuracy :  0.925
```

Building a Predictive System

In [24]:
```
input_data = (7.5,0.5,0.36,6.1,0.071,17.0,102.0,0.9978,3.35,0.8,10.5)

# changing the input data to a numpy array
input_data_as_numpy_array = np.asarray(input_data)

# reshape the data as we are predicting the label for only one instance
input_data_reshaped = input_data_as_numpy_array.reshape(1,-1)

prediction = model.predict(input_data_reshaped)
print(prediction)

if (prediction[0]==1):
  print('Good Quality Wine')
else:
  print('Bad Quality Wine')
```

```
[0]
Bad Quality Wine
```