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
```

In [2]:
```
# loading the dataset to a Pandas DataFrame
wine_dataset = pd.read_csv('D:\Machine learning\Wine_quality_prediction\winequality-red.csv')
```

In [3]:
```
wine_dataset.head()
```

Out[3]:

	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 [4]:
```
#number of columns of rows and dataset
wine_dataset.shape
```

Out[4]:
```
(1599, 12)
```

In [7]:
```
wine_dataset.isnull().sum()
```

Out[7]:
```
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
```

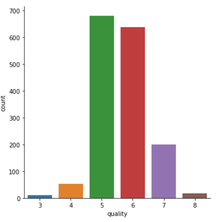
In [8]:
```
wine_dataset.describe()
```

Out[8]:

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates	
count	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	159
mean	8.319637	0.527821	0.270976	2.538806	0.087467	15.874922	46.467792	0.996747	3.311113	0.658149	1
std	1.741096	0.179060	0.194801	1.409928	0.047065	10.460157	32.895324	0.001887	0.154386	0.169507	
min	4.600000	0.120000	0.000000	0.900000	0.012000	1.000000	6.000000	0.990070	2.740000	0.330000	
25%	7.100000	0.390000	0.090000	1.900000	0.070000	7.000000	22.000000	0.995600	3.210000	0.550000	
50%	7.900000	0.520000	0.260000	2.200000	0.079000	14.000000	38.000000	0.996750	3.310000	0.620000	1
75%	9.200000	0.640000	0.420000	2.600000	0.090000	21.000000	62.000000	0.997835	3.400000	0.730000	1
max	15.900000	1.580000	1.000000	15.500000	0.611000	72.000000	289.000000	1.003690	4.010000	2.000000	1

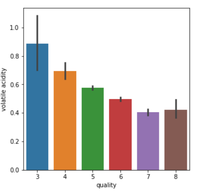
In [9]:
```
# no of values for each quality
sns.catplot(x='quality',data = wine_dataset,kind='count')
```

Out[9]:
```
<seaborn.axisgrid.FacetGrid at 0x22c75b6ce80>
```



In [12]:
```
# volatile vs quality
plot =plt.figure(figsize=(5,5))
sns.barplot(x='quality',y='volatile acidity',data = wine_dataset)
```

Out[12]:
```
<AxesSubplot:xlabel='quality', ylabel='volatile acidity'>
```

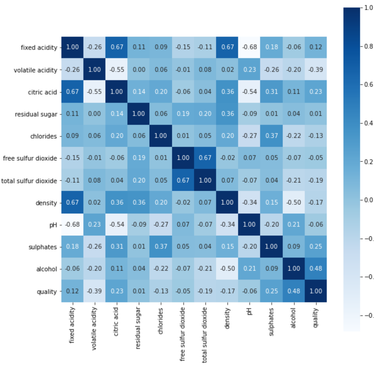


Correaltion # Positive Correlation # Negative Correlation

In [13]:
```
correlation= wine_dataset.corr()
```

In [61]:
```
plt.figure(figsize=(10,10))
sns.heatmap(correlation,cbar=True, square=True, fmt='.2f',annot=True,cmap='Blues')
```

Out[61]:
```
<AxesSubplot:>
```



In [19]:
```
# Data Preprocessing
```

In [21]:
```
X= wine_dataset.drop('quality',axis=1)
X
```

Out[21]:

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates	alcohol
0	7.4	0.700	0.00	1.9	0.076	11.0	34.0	0.99780	3.51	0.56	9.4
1	7.8	0.880	0.00	2.6	0.098	25.0	67.0	0.99680	3.20	0.68	9.8
2	7.8	0.760	0.04	2.3	0.092	15.0	54.0	0.99700	3.26	0.65	9.8
3	11.2	0.280	0.56	1.9	0.075	17.0	60.0	0.99800	3.16	0.58	9.8
4	7.4	0.700	0.00	1.9	0.076	11.0	34.0	0.99780	3.51	0.56	9.4
...	...	...	...	...	...	...	...	...	...	...	...
1594	6.2	0.600	0.08	2.0	0.090	32.0	44.0	0.99490	3.45	0.58	10.5
1595	5.9	0.550	0.10	2.2	0.062	39.0	51.0	0.99512	3.52	0.76	11.2
1596	6.3	0.510	0.13	2.3	0.076	29.0	40.0	0.99574	3.42	0.75	11.0
1597	5.9	0.645	0.12	2.0	0.075	32.0	44.0	0.99547	3.57	0.71	10.2
1598	6.0	0.310	0.47	3.6	0.067	18.0	42.0	0.99549	3.39	0.66	11.0

1599 rows × 11 columns

In [1]:
```
Y= wine_dataset['quality'].apply(lambda y_value: 1 if y_value>6 or 2 if y_value==6 or 3 y_value<6 )
```

```
  File "<ipython-input-1-1a91e140e5ca>", line 1
    Y= wine_dataset['quality'].apply(lambda y_value: 1 if y_value>6 or 2 if y_value==6 or 3 y_value<6 )
                                                                                 ^
SyntaxError: invalid syntax
```

In [23]:
```
Y
```

Out[23]:
```
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
```

In [24]:
```
#Train Test split
```

In [25]:
```
X_train,X_test,Y_train,Y_test= train_test_split(X,Y,test_size=0.2,random_state=3)
```

In [26]:
```
# Model training
# Random Forest Classifier
```

In [27]:
```
model= RandomForestClassifier()
```

In [28]:
```
model.fit(X_train,Y_train)
```

Out[28]:
```
RandomForestClassifier()
```

In [31]:
```
# Model Evaluation
# Accuracy Score
```

In [33]:
```
X_test_prediction= model.predict(X_test)
```

In [34]:
```
test_data_accuracy = accuracy_score(X_test_prediction,Y_test)
```

In [35]:
```
test_data_accuracy
```

Out[35]:
```
0.93125
```

In [47]:
```
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)
```

In [48]:
```
prediction=model.predict(input_data_reshaped)
```

In [49]:
```
if (prediction[0] == 1):
    print('Good Quality Wine')
else:
    print('Bad Quality')
```

```
Bad Quality
```

In [ ]: