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

```
wine_data=pd.read_csv('/content/winequality-red.csv')
```

```
wine_data.describe()
```

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	su
count	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599
mean	8.319637	0.527821	0.270976	2.538806	0.087467	15.874922	46.467792	0.996747	3.311113	0
std	1.741096	0.179060	0.194801	1.409928	0.047065	10.460157	32.895324	0.001887	0.154386	0
min	4.600000	0.120000	0.000000	0.900000	0.012000	1.000000	6.000000	0.990070	2.740000	0
25%	7.100000	0.390000	0.090000	1.900000	0.070000	7.000000	22.000000	0.995600	3.210000	0
50%	7.900000	0.520000	0.260000	2.200000	0.079000	14.000000	38.000000	0.996750	3.310000	0
75%	9.200000	0.640000	0.420000	2.600000	0.090000	21.000000	62.000000	0.997835	3.400000	0

```
wine_data.shape
```

```
(1599, 12)
```

```
wine_data.head
```

```
pandas.core.generic.NDFrame.head
def head(n: int=5) -> Self
```

```
/usr/local/lib/python3.12/dist-packages/pandas/core/generic.py
Return the first `n` rows.

This function returns the first `n` rows for the object based
on position. It is useful for quickly testing if your object
has the right type of data in it.
```

```
wine_data.head()
```

	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

Next steps: Generate code with wine_data New interactive sheet

```
wine_data.isnull().sum()
```

	0
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

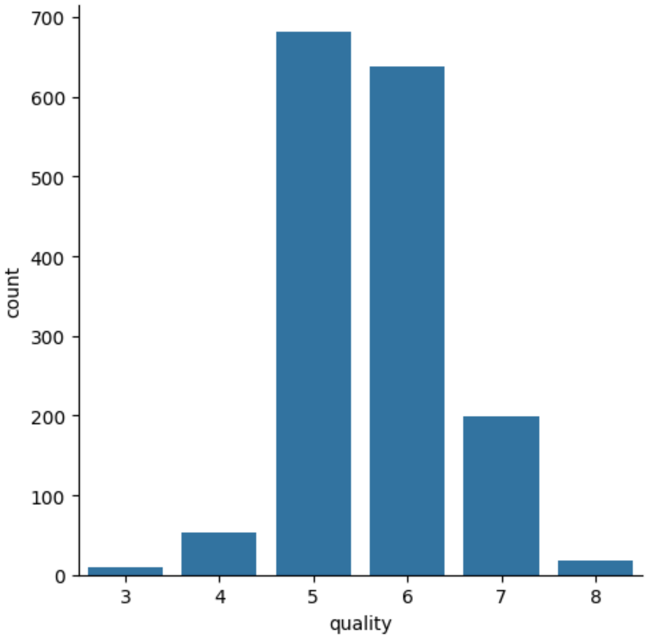
dtype: int64

```
wine_data.describe()
```

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	su
count	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599
mean	8.319637	0.527821	0.270976	2.538806	0.087467	15.874922	46.467792	0.996747	3.311113	0
std	1.741096	0.179060	0.194801	1.409928	0.047065	10.460157	32.895324	0.001887	0.154386	0
min	4.600000	0.120000	0.000000	0.900000	0.012000	1.000000	6.000000	0.990070	2.740000	0
25%	7.100000	0.390000	0.090000	1.900000	0.070000	7.000000	22.000000	0.995600	3.210000	0
50%	7.900000	0.520000	0.260000	2.200000	0.079000	14.000000	38.000000	0.996750	3.310000	0
75%	9.200000	0.640000	0.420000	2.600000	0.090000	21.000000	62.000000	0.997835	3.400000	0

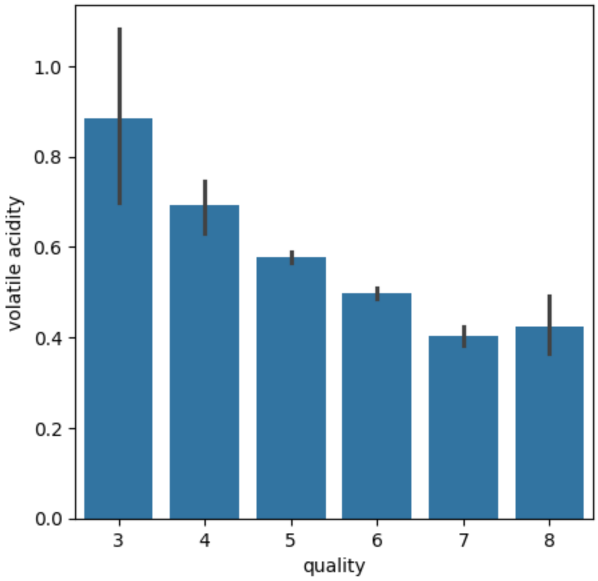
```
sns.catplot(x='quality',data=wine_data,kind='count')
```

```
<seaborn.axisgrid.FacetGrid at 0x7aad933b0590>
```



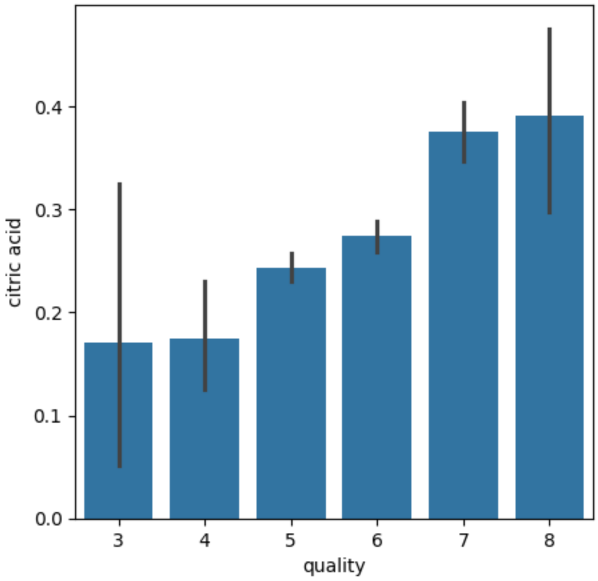
```
plot=plt.figure(figsize=(5,5))
sns.barplot(x='quality',y='volatile acidity',data=wine_data)
```

```
<Axes: xlabel='quality', ylabel='volatile acidity'>
```



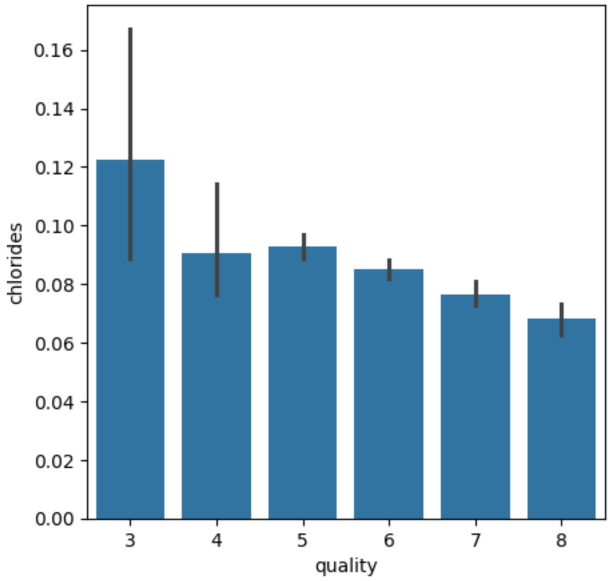
```
plot=plt.figure(figsize=(5,5))
sns.barplot(x='quality',y='citric acid',data=wine_data)
```

```
<Axes: xlabel='quality', ylabel='citric acid'>
```



```
plot=plt.figure(figsize=(5,5))
sns.barplot(x='quality',y='chlorides',data=wine_data)
```

```
<Axes: xlabel='quality', ylabel='chlorides'>
```



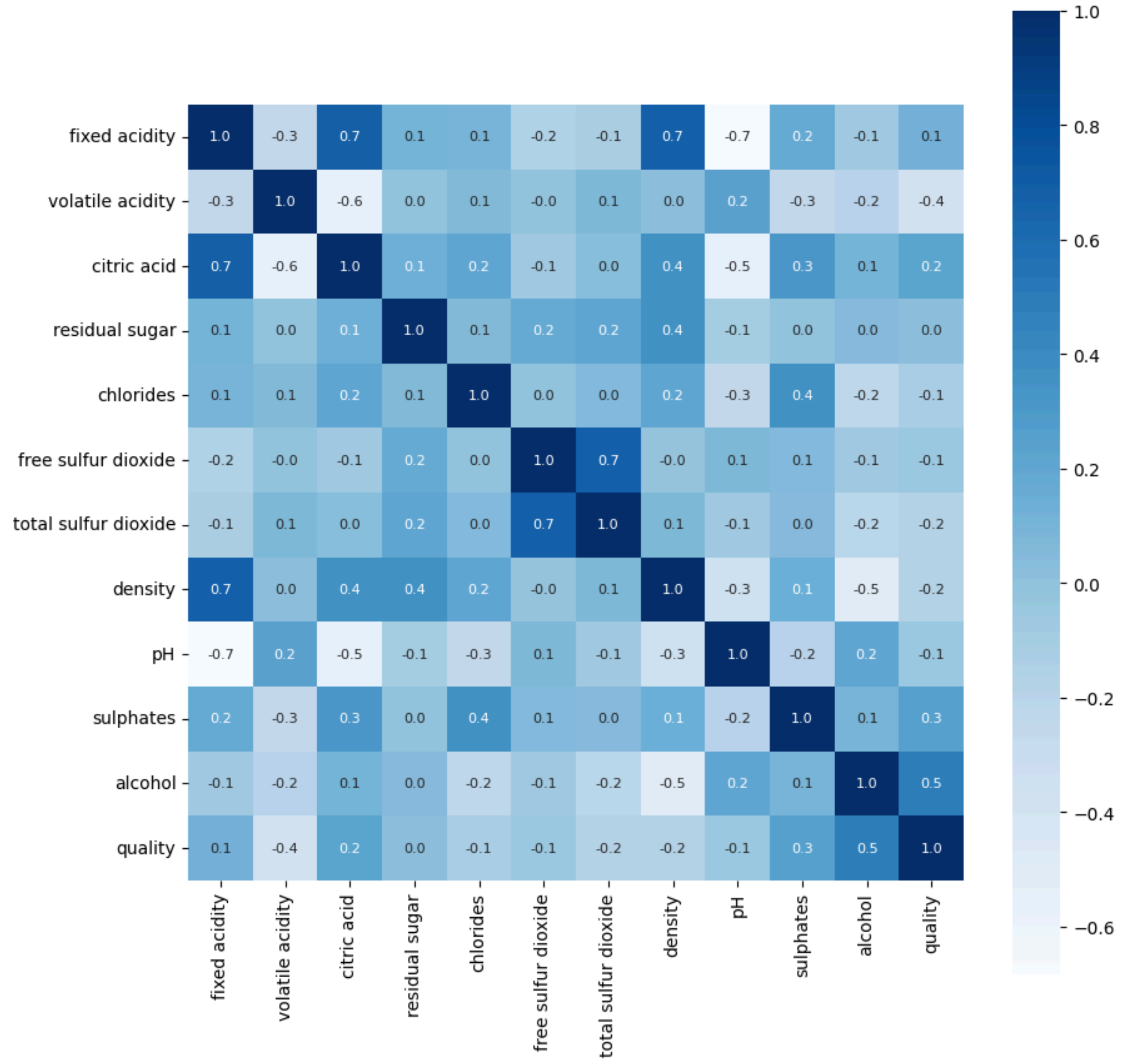
correlation

```
correlation=wine_data.corr()
```

constructing the heat map to understand the correlations

```
plt.figure(figsize=(10,10))
sns.heatmap(correlation,cbar=True,square=True,fmt='.1f',annot=True,annot_kws={'size':8},cmap='Blues')
```

```
<Axes: >
```



Data Preprocessing

```
X=wine_data.drop('quality',axis=1)
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 binarisation

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

```
X_train,X_test,Y_train,Y_test=train_test_split(X,Y,test_size=.2,random_state=2,stratify=Y)
```

```
print(X.shape,Y.shape,Y_train.shape,Y_test.shape)
```

```
(1599, 11) (1599,) (1279,) (320,)
```