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

In [2]:
```python
df = pd.read_csv('winequality-red.csv')
```

In [3]:
```python
df.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]:
```python
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1599 entries, 0 to 1598
Data columns (total 12 columns):
 #   Column                Non-Null Count  Dtype  
---  ------                --------------  -----  
 0   fixed acidity         1599 non-null   float64
 1   volatile acidity      1599 non-null   float64
 2   citric acid           1599 non-null   float64
 3   residual sugar        1599 non-null   float64
 4   chlorides             1599 non-null   float64
 5   free sulfur dioxide   1599 non-null   float64
 6   total sulfur dioxide  1599 non-null   float64
 7   density               1599 non-null   float64
 8   pH                    1599 non-null   float64
 9   sulphates             1599 non-null   float64
 10  alcohol               1599 non-null   float64
 11  quality               1599 non-null   int64  
dtypes: float64(11), int64(1)
memory usage: 150.0 KB
```

In [5]:
```python
df.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
```

In [6]:
```python
df.shape
```

Out[6]:
```
(1599, 12)
```

In [7]:
```python
df.describe()
```

Out[7]:

	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
mean	8.319637	0.527821	0.270976	2.538806	0.087467	15.874922	46.467792	0.996747	3.311113	0.658149
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
75%	9.200000	0.640000	0.420000	2.600000	0.090000	21.000000	62.000000	0.997835	3.400000	0.730000
max	15.900000	1.580000	1.000000	15.500000	0.611000	72.000000	289.000000	1.003690	4.010000	2.000000

Looking for correlations between features

Looking for correlations between features

```
In [8]: df.corr()
```

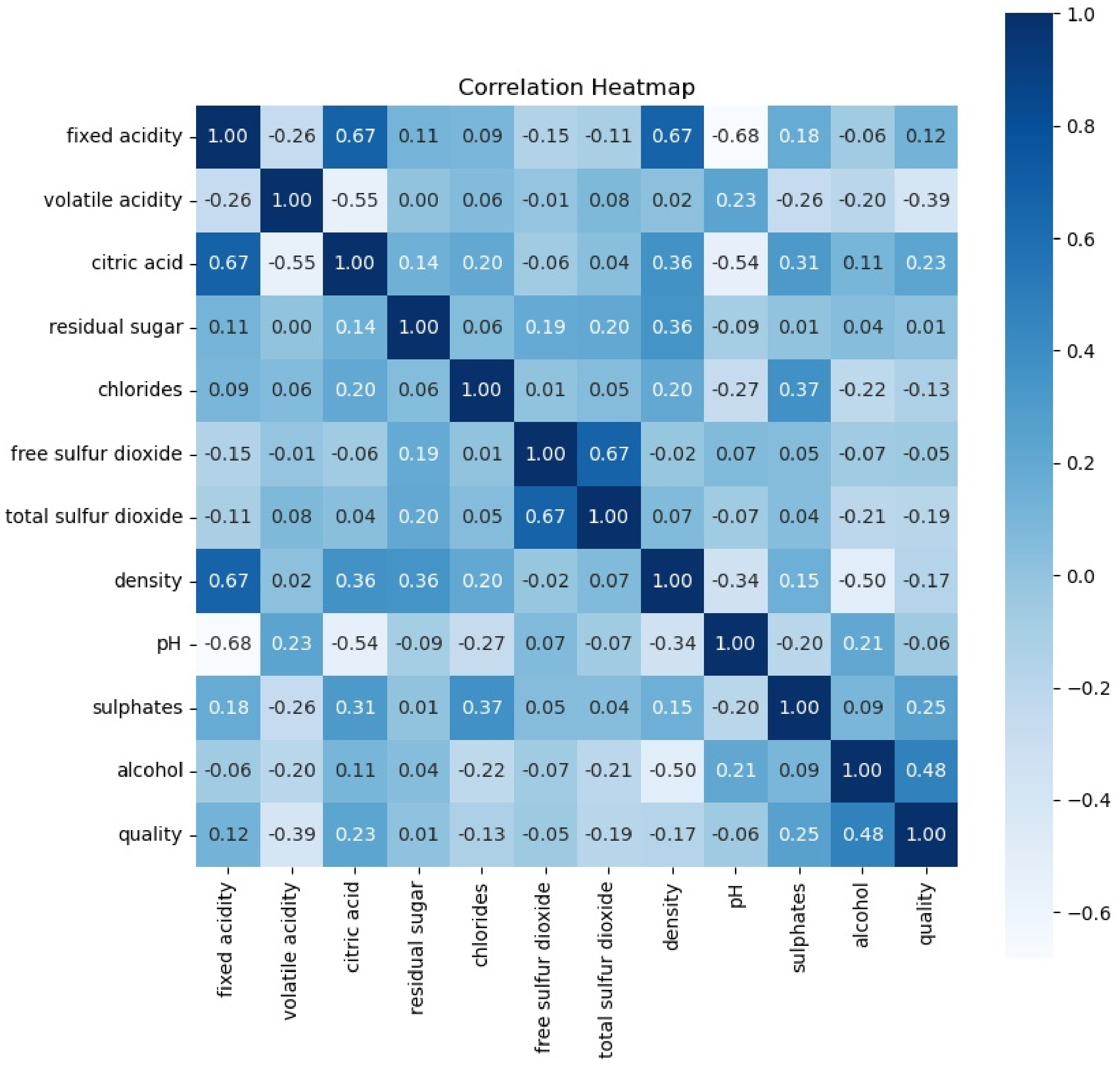
Out[8]:

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates	alcohol	quality
fixed acidity	1.000000	-0.256131	0.671703	0.114777	0.093705	-0.153794	-0.113181	0.668047	-0.682978	0.183006	-0.061668	0.124052
volatile acidity	-0.256131	1.000000	-0.552496	0.001918	0.061298	-0.010504	0.076470	0.022026	0.234937	-0.260987	-0.202288	-0.390558
citric acid	0.671703	-0.552496	1.000000	0.143577	0.203823	-0.060978	0.035533	0.364947	-0.541904	0.312770	0.109903	0.226373
residual sugar	0.114777	0.001918	0.143577	1.000000	0.055610	0.187049	0.203028	0.355283	-0.085652	0.005527	0.042075	0.013732
chlorides	0.093705	0.061298	0.203823	0.055610	1.000000	0.005562	0.047400	0.200632	-0.265026	0.371260	-0.221141	-0.128907
free sulfur dioxide	-0.153794	-0.010504	-0.060978	0.187049	0.005562	1.000000	0.667666	-0.021946	0.070377	0.051658	-0.069408	-0.050656
total sulfur dioxide	-0.113181	0.076470	0.035533	0.203028	0.047400	0.667666	1.000000	0.071269	-0.066495	0.042947	-0.205654	-0.185100
density	0.668047	0.022026	0.364947	0.355283	0.200632	-0.021946	0.071269	1.000000	-0.341699	0.148506	-0.496180	-0.174919
pH	-0.682978	0.234937	-0.541904	-0.085652	-0.265026	0.070377	-0.066495	-0.341699	1.000000	-0.196648	0.205633	-0.057731
sulphates	0.183006	-0.260987	0.312770	0.005527	0.371260	0.051658	0.042947	0.148506	-0.196648	1.000000	0.093595	0.251397
alcohol	-0.061668	-0.202288	0.109903	0.042075	-0.221141	-0.069408	-0.205654	-0.496180	0.205633	0.093595	1.000000	0.476166
quality	0.124052	-0.390558	0.226373	0.013732	-0.128907	-0.050656	-0.185100	-0.174919	-0.057731	0.251397	0.476166	1.000000

```
In [10]: corr_data = df.corr()
```

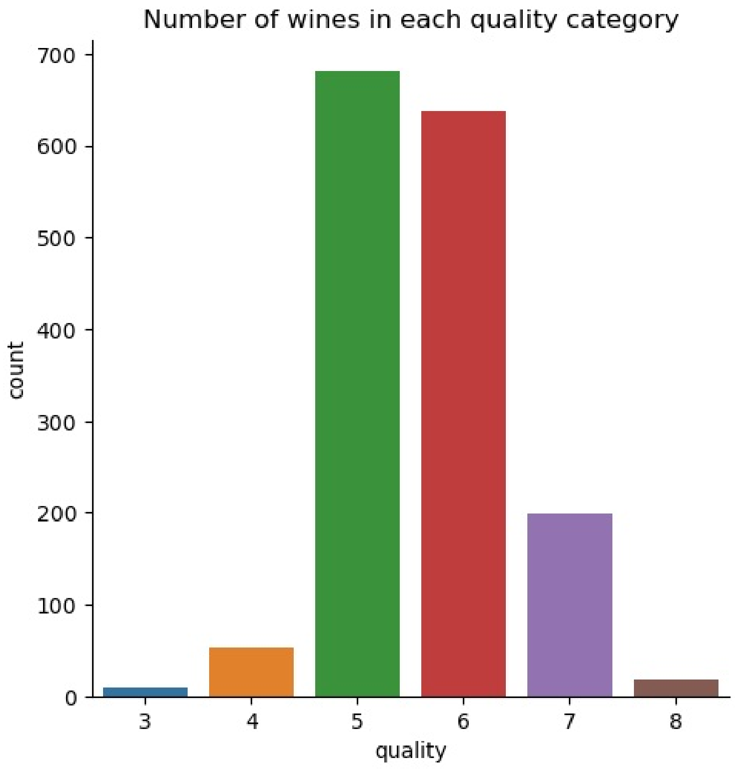
```
In [11]: plt.figure(figsize = (9, 9))
         sns.heatmap(corr_data, cbar = True, square= True, annot=True, fmt= '.2f',  cmap='Blues')
         plt.title('Correlation Heatmap')
```

```
Out[11]: Text(0.5, 1.0, 'Correlation Heatmap')
```



In [12]:
```
# Number of wines in each quality category
sns.catplot(x='quality',  data=df, kind='count')
plt.title('Number of wines in each quality category')
```

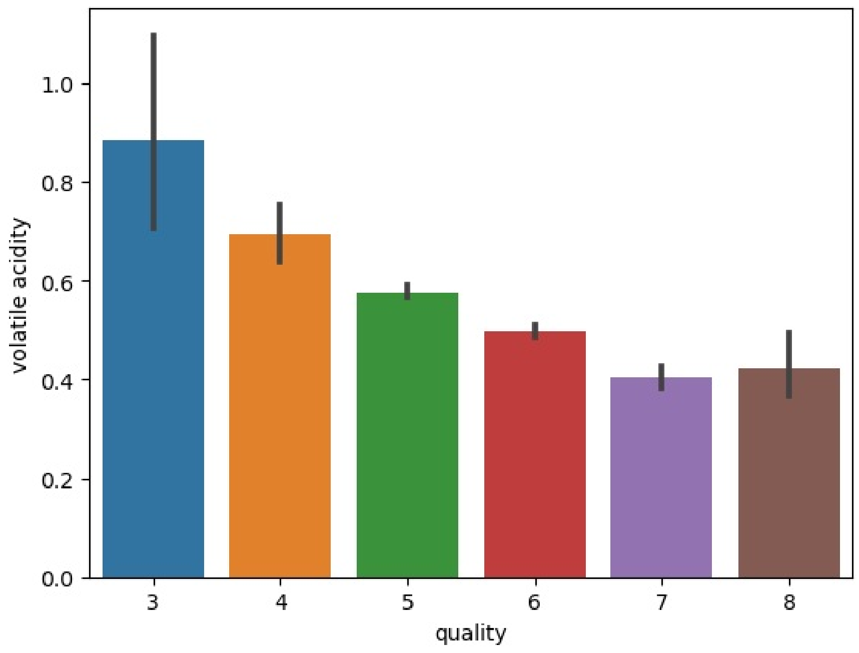
Out[12]:
```
Text(0.5, 1.0, 'Number of wines in each quality category')
```



From the heatmap we can observe the correlation between quality and volatile acidity

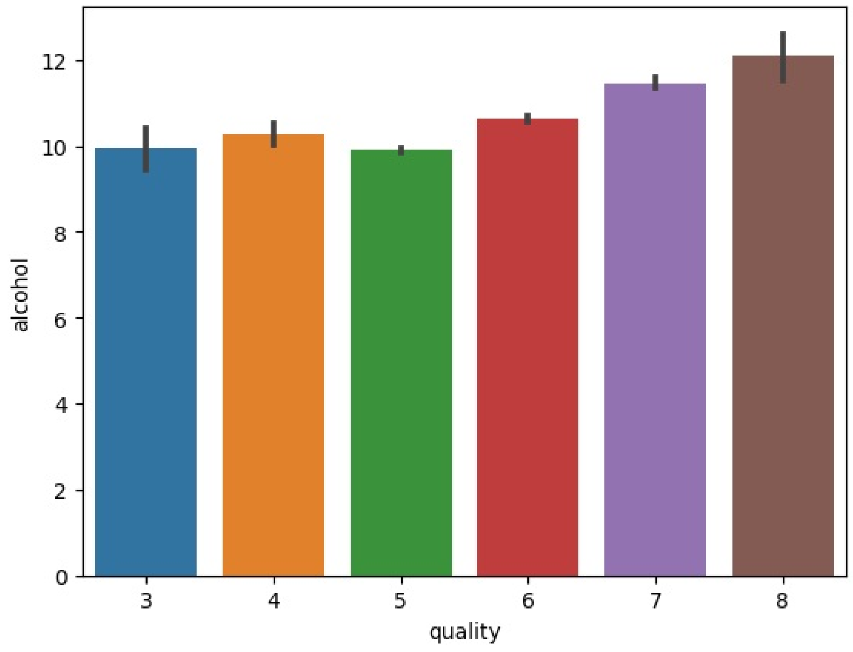
In [14]:
```python
# plotting a barplot for quality vs volatile acidity
sns.barplot(x = 'quality', y= 'volatile acidity', data = df)
```

Out[14]:
```
<Axes: xlabel='quality', ylabel='volatile acidity'>
```



In [15]:
```python
# plotting a barplot for quality vs alcohol
sns.barplot(x = 'quality', y = 'alcohol', data = df)
```

Out[15]:
```
<Axes: xlabel='quality', ylabel='alcohol'>
```



Separating the features and labels

In [17]:
```python
X = df.drop('quality', axis= 1)
y = df['quality'].apply(lambda y_value: 1 if y_value >= 7 else 0)
```

In [18]:
```python
y.value_counts()
```

Out[18]:
```
0    1382
1     217
Name: quality, dtype: int64
```

In [19]:
```python
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state= 3)
```

Training The Model

In [20]:
```python
model = RandomForestClassifier(n_estimators=100, max_depth=5, random_state=1)
```

In [21]:
```python
model.fit(X_train, y_train)
```

```
Out[21]: ▾ RandomForestClassifier
RandomForestClassifier(max_depth=5, random_state=1)
```

```
In [22]: from sklearn.metrics import accuracy_score
```

```
In [23]: #accuracy on test data
X_test_preds = model.predict(X_test)
test_accuracy = accuracy_score(y_test, X_test_preds)
```

```
In [24]: print("Test accuracy: {:.2f}%".format(test_accuracy * 100))

Test accuracy: 91.56%
```

```
In [ ]:
```

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