In [1]:

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

In [2]:

```
data=pd.read_csv('WINE DATA\\winequality-red.csv',delimiter = ";")
```

In [3]:

```
data
```

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	0.700	0.00	1.9	0.076	11.0	34.0	0.99780	3.51	0.56	9.4	5
1	7.8	0.880	0.00	2.6	0.098	25.0	67.0	0.99680	3.20	0.68	9.8	5
2	7.8	0.760	0.04	2.3	0.092	15.0	54.0	0.99700	3.26	0.65	9.8	5
3	11.2	0.280	0.56	1.9	0.075	17.0	60.0	0.99800	3.16	0.58	9.8	6
4	7.4	0.700	0.00	1.9	0.076	11.0	34.0	0.99780	3.51	0.56	9.4	5
...	...	...	...	...	...	...	...	...	...	...	...	...
1594	6.2	0.600	0.08	2.0	0.090	32.0	44.0	0.99490	3.45	0.58	10.5	5
1595	5.9	0.550	0.10	2.2	0.062	39.0	51.0	0.99512	3.52	0.76	11.2	6
1596	6.3	0.510	0.13	2.3	0.076	29.0	40.0	0.99574	3.42	0.75	11.0	6
1597	5.9	0.645	0.12	2.0	0.075	32.0	44.0	0.99547	3.57	0.71	10.2	5
1598	6.0	0.310	0.47	3.6	0.067	18.0	42.0	0.99549	3.39	0.66	11.0	6

1599 rows × 12 columns

In [4]:

```
print("Total quantity of wine quality 3 : ",len([a for a in data['quality'] if a==3]))
print("Total quantity of wine quality 4 : ",len([a for a in data['quality'] if a==4]))
print("Total quantity of wine quality 5 : ",len([a for a in data['quality'] if a==5]))
print("Total quantity of wine quality 6 : ",len([a for a in data['quality'] if a==6]))
print("Total quantity of wine quality 7 : ",len([a for a in data['quality'] if a==7]))
print("Total quantity of wine quality 8 : ",len([a for a in data['quality'] if a==8]))
```

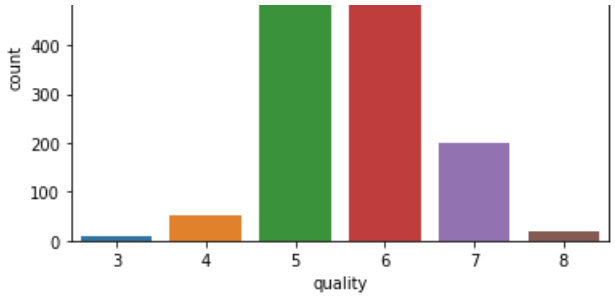
```
Total quantity of wine quality 3 :  10
Total quantity of wine quality 4 :  53
Total quantity of wine quality 5 :  681
Total quantity of wine quality 6 :  638
Total quantity of wine quality 7 :  199
Total quantity of wine quality 8 :  18
```

In [5]:

```
sns.countplot(x='quality', data=data)
```

Out[5]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x277cbd20b38>
```



In [6]:

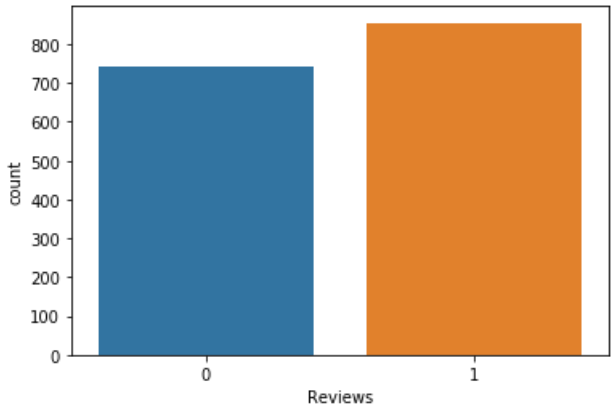
```
reviews = []
for i in data['quality']:
    if i <= 5:
        reviews.append(0)
    else:
        reviews.append(1)
data['Reviews'] = reviews
```

In [7]:

```
sns.countplot(x='Reviews', data=data)
```

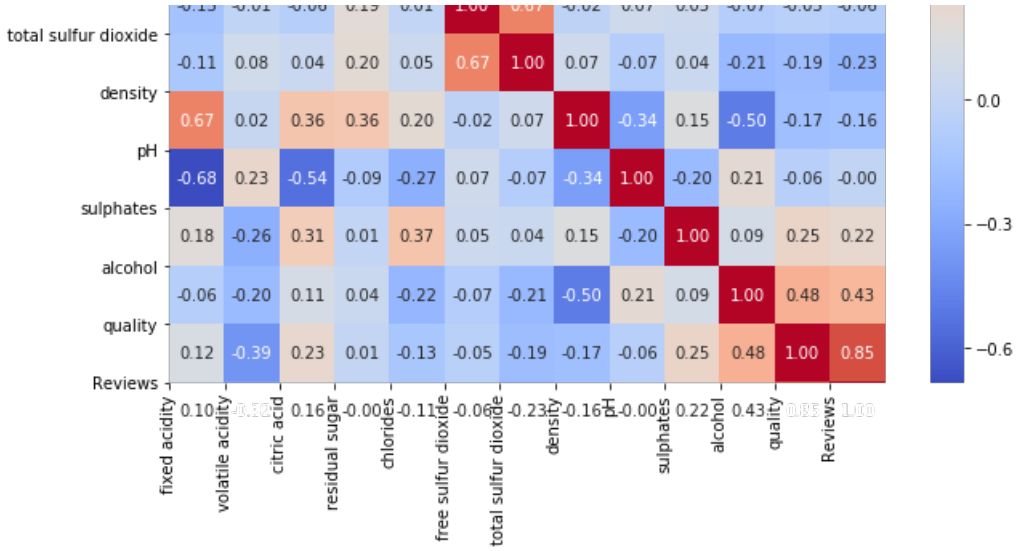
Out[7]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x277d0b62198>
```



In [8]:

```
corr = data.corr()
#Plot figsize
fig, ax = plt.subplots(figsize=(10, 8))
#Generate Heat Map, allow annotations and place floats in map
sns.heatmap(corr, cmap='coolwarm', annot=True, fmt=".2f")
#Apply xticks
plt.xticks(range(len(corr.columns)), corr.columns);
#Apply yticks
plt.yticks(range(len(corr.columns)), corr.columns)
#show plot
plt.show()
```



In [9]:

```
X = data.iloc[:,0:11]
y = data.iloc[:,12]
y_mul = data.iloc[:,11]
```

In [10]:

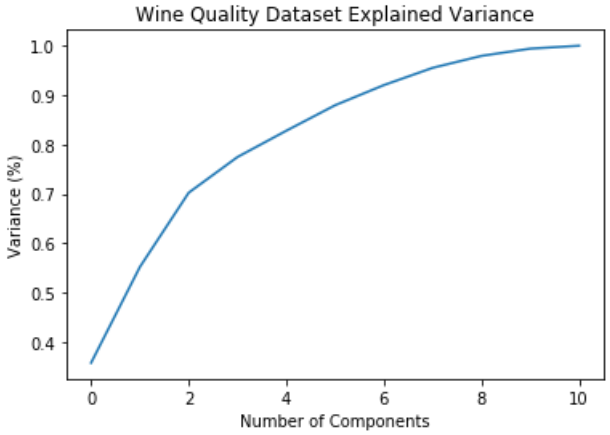
```
from sklearn.preprocessing import MinMaxScaler
minmax = MinMaxScaler()
X_s = minmax.fit_transform(X)
```

In [13]:

```
from sklearn.decomposition import PCA
pca = PCA()
X_s_pca = pca.fit(X_s)
```

In [14]:

```
plt.figure()
plt.plot(np.cumsum(X_s_pca.explained_variance_ratio_))
plt.xlabel('Number of Components')
plt.ylabel('Variance (%)') #for each component
plt.title('Wine Quality Dataset Explained Variance')
plt.show()
```



In [15]:

```
pca = PCA(n_components=9)
X_s_pca = pca.fit_transform(X_s)
```

In [16]:

```
from sklearn.model_selection import train_test_split

X_train,X_test,y_train,y_test = train_test_split(X_s_pca,y,test_size = 0.3,random_state = 42)
```

In [17]:

```
print(X_train.shape)
print(X_test.shape)
```

```
(1119, 9)
(480, 9)
```

In [18]:

```
from sklearn.svm import SVC
from sklearn.metrics import accuracy_score,classification_report,confusion_matrix
```

In [19]:

```
svc_lin  = SVC(kernel = 'linear')
svc_lin.fit(X_train, y_train)
y_pred_svc_lin=svc_lin.predict(X_test)
lin_svc_conf_matrix = confusion_matrix(y_test, y_pred_svc_lin)
lin_svc_clf = classification_report(y_test, y_pred_svc_lin)
print(lin_svc_conf_matrix)
print(lin_svc_clf)
```

```
[[164  49]
 [ 87 180]]
              precision    recall  f1-score   support

           0       0.65      0.77      0.71       213
           1       0.79      0.67      0.73       267

    accuracy                           0.72       480
   macro avg       0.72      0.72      0.72       480
weighted avg       0.73      0.72      0.72       480
```

In [20]:

```
svc_rbf  = SVC(kernel = 'rbf')
svc_rbf.fit(X_train, y_train)
y_pred_svc_rbf=svc_rbf.predict(X_test)
rbf_svc_conf_matrix = confusion_matrix(y_test, y_pred_svc_rbf)
rbf_svc_clf = classification_report(y_test, y_pred_svc_rbf)
print(rbf_svc_conf_matrix)
print(rbf_svc_clf)
```

```
[[160  53]
 [ 71 196]]
              precision    recall  f1-score   support

           0       0.69      0.75      0.72       213
           1       0.79      0.73      0.76       267

    accuracy                           0.74       480
   macro avg       0.74      0.74      0.74       480
weighted avg       0.75      0.74      0.74       480
```

In [21]:

```
svc_poly  = SVC(kernel = 'poly')
svc_poly.fit(X_train, y_train)
y_pred_svc_poly =  svc_poly.predict(X_test)
poly_svc_conf_matrix = confusion_matrix(y_test, y_pred_svc_poly)
poly_svc_clf = classification_report(y_test, y_pred_svc_poly)
```

```
print(poly_svc_conf_matrix)
print(poly_svc_clf)
```

```
[[161  52]
 [ 68 199]]
              precision    recall  f1-score   support

           0       0.70      0.76      0.73       213
           1       0.79      0.75      0.77       267

    accuracy                           0.75       480
   macro avg       0.75      0.75      0.75       480
weighted avg       0.75      0.75      0.75       480
```

In [22]:

```
svc_sigmoid  = SVC(kernel = 'sigmoid')
svc_sigmoid.fit(X_train, y_train)
y_pred_svc_sigmoid=svc_sigmoid.predict(X_test)
sigmoid_svc_conf_matrix = confusion_matrix(y_test, y_pred_svc_sigmoid)
sigmoid_svc_clf = classification_report(y_test, y_pred_svc_sigmoid)
print(sigmoid_svc_conf_matrix)
print(sigmoid_svc_clf)
```

```
[[120  93]
 [ 86 181]]
              precision    recall  f1-score   support

           0       0.58      0.56      0.57       213
           1       0.66      0.68      0.67       267

    accuracy                           0.63       480
   macro avg       0.62      0.62      0.62       480
weighted avg       0.63      0.63      0.63       480
```

In [30]:

```
from sklearn.model_selection import cross_val_score
clf = SVC(kernel='linear', C=1)
scores = cross_val_score(clf, X_s_pca, y, cv=5)
print(scores)
print("Accuracy: %0.2f (+/- %0.2f)" % (scores.mean(), scores.std() * 2))
```

```
[0.696875  0.69375   0.78125   0.753125  0.7460815]
Accuracy: 0.73 (+/- 0.07)
```

In [29]:

```
from sklearn.model_selection import cross_val_score
clf = SVC(kernel='rbf', C=1)
scores = cross_val_score(clf, X_s_pca, y, cv=5)
print(scores)
print("Accuracy: %0.2f (+/- %0.2f)" % (scores.mean(), scores.std() * 2))
```

```
[0.715625   0.709375   0.790625   0.753125   0.73981191]
Accuracy: 0.74 (+/- 0.06)
```

In [28]:

```
from sklearn.model_selection import cross_val_score
clf = SVC(kernel='poly',C=1)
scores = cross_val_score(clf, X_s_pca, y, cv=5)
print(scores)
print("Accuracy: %0.2f (+/- %0.2f)" % (scores.mean(), scores.std() * 2))
```

```
[0.684375   0.715625   0.765625   0.728125   0.72727273]
Accuracy: 0.72 (+/- 0.05)
```

In [27]:

```
from sklearn.model_selection import cross_val_score
clf = SVC(kernel='sigmoid',C=1)
scores = cross_val_score(clf, X_s_pca, y, cv=5)
print(scores)
print("Accuracy: %0.2f (+/- %0.2f)" % (scores.mean(), scores.std() * 2))
```

```
[0.684375   0.6        0.678125   0.625      0.58934169]
Accuracy: 0.64 (+/- 0.08)
```

In [ ]:

```
```