1 Batch 5 Task 2

[4]:
```
import pandas as pd
```

[52]:
```
df = pd.read_csv ("C:/Users/prath/Downloads/winequality-blue-black.csv")
```

[53]:
```
df
```

[53]:

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	\
0	7.4	0.700	0.00	1.9	0.076	
1	7.8	0.880	0.00	2.6	0.098	
2	7.8	0.760	0.04	2.3	0.092	
3	11.2	0.280	0.56	1.9	0.075	
4	7.4	0.700	0.00	1.9	0.076	
...	...	...	...	...	...	
1594	6.2	0.600	0.08	2.0	0.090	
1595	5.9	0.550	0.10	2.2	0.062	
1596	6.3	0.510	0.13	2.3	0.076	
1597	5.9	0.645	0.12	2.0	0.075	
1598	6.0	0.310	0.47	3.6	0.067	

	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates	\
0	11.0	34.0	0.99780	3.51	0.56	
1	25.0	67.0	0.99680	3.20	0.68	
2	15.0	54.0	0.99700	3.26	0.65	
3	17.0	60.0	0.99800	3.16	0.58	
4	11.0	34.0	0.99780	3.51	0.56	
...	...	...	...	...	...	
1594	32.0	44.0	0.99490	3.45	0.58	
1595	39.0	51.0	0.99512	3.52	0.76	
1596	29.0	40.0	0.99574	3.42	0.75	
1597	32.0	44.0	0.99547	3.57	0.71	
1598	18.0	42.0	0.99549	3.39	0.66	

	alcohol	quality
0	9.4	5
1	9.8	5

```
2            9.8        5
3            9.8        6
4            9.4        5
...          ...      ...
1594        10.5        5
1595        11.2        6
1596        11.0        6
1597        10.2        5
1598        11.0        6

[1599 rows x 12 columns]
```

[54]:
```
df.columns
```

[54] :
```
Index(['fixed acidity', 'volatile acidity', 'citric acid', 'residual sugar',
       'chlorides', 'free sulfur dioxide', 'total sulfur dioxide', 'density',
       'pH', 'sulphates', 'alcohol', 'quality'],
      dtype='object')
```

[55] :
```
import matplotlib.pyplot as plt
```

[56] :
```
print("Original DataFrame:")
print(df)

print("\nRows that are duplicates of a previous row:")
print(df.duplicated())
```

```
Original DataFrame:
      fixed acidity  volatile acidity  citric acid  residual sugar  chlorides  \
0               7.4             0.700         0.00             1.9      0.076
1               7.8             0.880         0.00             2.6      0.098
2               7.8             0.760         0.04             2.3      0.092
3              11.2             0.280         0.56             1.9      0.075
4               7.4             0.700         0.00             1.9      0.076
...             ...               ...          ...             ...        ...
1594            6.2             0.600         0.08             2.0      0.090
1595            5.9             0.550         0.10             2.2      0.062
1596            6.3             0.510         0.13             2.3      0.076
1597            5.9             0.645         0.12             2.0      0.075
1598            6.0             0.310         0.47             3.6      0.067

      free sulfur dioxide  total sulfur dioxide  density    pH  sulphates  \
0                    11.0                  34.0  0.99780  3.51       0.56
1                    25.0                  67.0  0.99680  3.20       0.68
2                    15.0                  54.0  0.99700  3.26       0.65
3                    17.0                  60.0  0.99800  3.16       0.58
4                    11.0                  34.0  0.99780  3.51       0.56
```

```
...                    ...                  ...     ...      ...          ...
1594                   32.0                 44.0    0.99490  3.45         0.58
1595                   39.0                 51.0    0.99512  3.52         0.76
1596                   29.0                 40.0    0.99574  3.42         0.75
1597                   32.0                 44.0    0.99547  3.57         0.71
1598                   18.0                 42.0    0.99549  3.39         0.66

      alcohol  quality
0         9.4        5
1         9.8        5
2         9.8        5
3         9.8        6
4         9.4        5
...       ...      ...
1594     10.5        5
1595     11.2        6
1596     11.0        6
1597     10.2        5
1598     11.0        6

[1599 rows x 12 columns]

Rows that are duplicates of a previous row:
0       False
1       False
2       False
3       False
4        True
        ...
1594    False
1595    False
1596     True
1597    False
1598    False
Length: 1599, dtype: bool
```

[57] :
```
df.describe()
```

[57]:

	fixed acidity	volatile acidity	citric acid	residual sugar	\
count	1599.000000	1599.000000	1599.000000	1599.000000	
mean	8.319637	0.527821	0.270976	2.538806	
std	1.741096	0.179060	0.194801	1.409928	
min	4.600000	0.120000	0.000000	0.900000	
25%	7.100000	0.390000	0.090000	1.900000	
50%	7.900000	0.520000	0.260000	2.200000	
75%	9.200000	0.640000	0.420000	2.600000	
max	15.900000	1.580000	1.000000	15.500000	

	chlorides	free sulfur dioxide	total sulfur dioxide	density	\
count	1599.000000	1599.000000	1599.000000	1599.000000	
mean	0.087467	15.874922	46.467792	0.996747	
std	0.047065	10.460157	32.895324	0.001887	
min	0.012000	1.000000	6.000000	0.990070	
25%	0.070000	7.000000	22.000000	0.995600	
50%	0.079000	14.000000	38.000000	0.996750	
75%	0.090000	21.000000	62.000000	0.997835	
max	0.611000	72.000000	289.000000	1.003690	

	pH	sulphates	alcohol	quality
count	1599.000000	1599.000000	1599.000000	1599.000000
mean	3.311113	0.658149	10.422983	5.636023
std	0.154386	0.169507	1.065668	0.807569
min	2.740000	0.330000	8.400000	3.000000
25%	3.210000	0.550000	9.500000	5.000000
50%	3.310000	0.620000	10.200000	6.000000
75%	3.400000	0.730000	11.100000	6.000000
max	4.010000	2.000000	14.900000	8.000000

[73]:
```
X=df.iloc[:100,0]
X
```

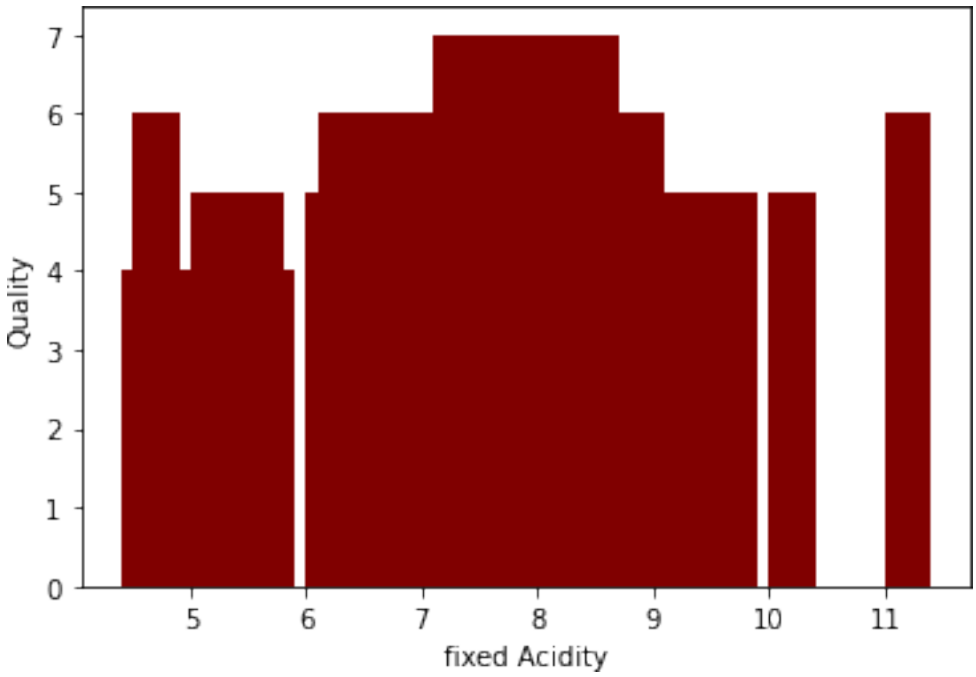
[73]:
```
0      7.4
1      7.8
2      7.8
3     11.2
4      7.4
      ...
95     4.7
96     6.8
97     7.0
98     7.6
99     8.1
Name: fixed acidity, Length: 100, dtype: float64
```

[74]:
```
Y=df.iloc[:100,11]
Y
```

[74]:
```
0     5
1     5
2     5
3     6
4     5
     --
95    6
```

```
96    5
97    5
98    5
99    6
Name: quality, Length: 100, dtype: int64
```

[76]:
```
import matplotlib.pyplot as plt
plt.bar(X,Y,color="maroon",width=0.4)
plt.xlabel("fixed Acidity")
plt.ylabel("Quality")
plt.show()
```



2 Inference:

The value of Fixed Acidity mainly hovers between 6 and 10. The average value is 8 where the highest Quality is obtained.

[98]:
```
Z=df.iloc[:100,1]
Z
```

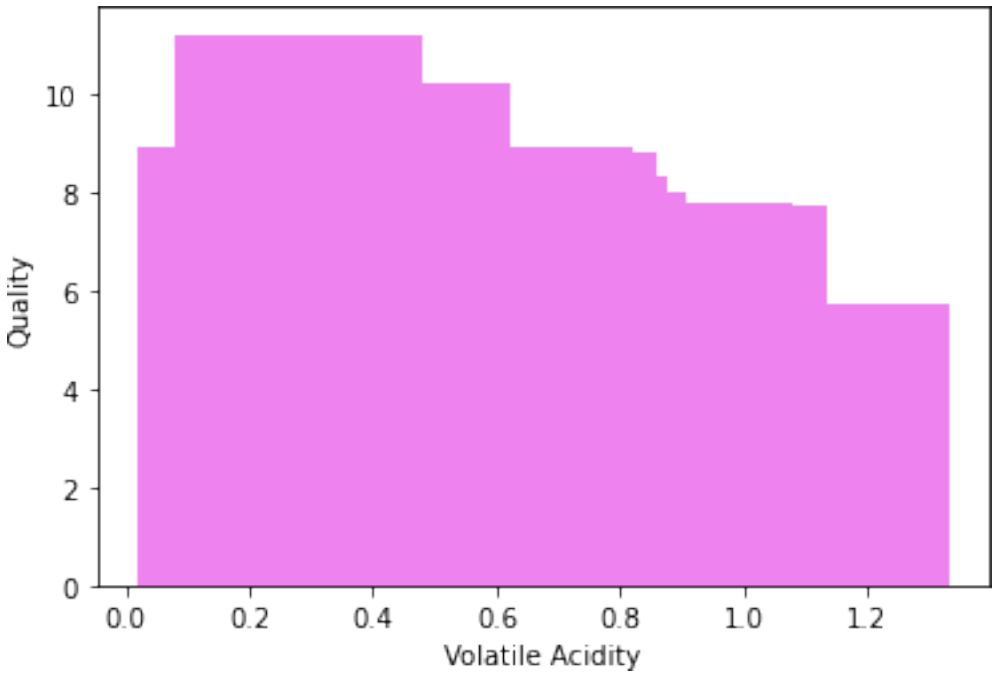
[98]:
```
0    0.700
1    0.880
2    0.760
3    0.280
```

```
4     0.700
      ...
95    0.600
96    0.775
97    0.500
98    0.900
99    0.545
Name: volatile acidity, Length: 100, dtype: float64
```

[78]:
```
U=df.iloc[:100,0]
U
```

[78]:
```
0      7.4
1      7.8
2      7.8
3     11.2
4      7.4
      ...
95     4.7
96     6.8
97     7.0
98     7.6
99     8.1
Name: fixed acidity, Length: 100, dtype: float64
```

[99]:
```
import matplotlib.pyplot as plt
plt.bar(Z,U,color="violet",width=0.4)
plt.xlabel("Volatile Acidity")
plt.ylabel("Quality")
plt.show()
```



3 Inference:

Volatile Acidity decreases on increasing the quality of Wine.

[80]:
```
A=df.iloc[:100,2]
A
```

[80]:
```
0     0.00
1     0.00
2     0.04
3     0.56
4     0.00
     ...
95    0.17
96    0.00
97    0.25
98    0.06
99    0.18
Name: citric acid, Length: 100, dtype: float64
```

[81]:
```
B=df.iloc[:100,3]
B
```

[81]:
```
0      1.9
1      2.6
2      2.3
3      1.9
4      1.9
      ...
95     2.3
96     3.0
97     2.0
98     2.5
99     1.9
Name: residual sugar, Length: 100, dtype: float64
```

[82]:
```
C=df.iloc[:100,4]
C
```

[82]:
```
0      0.076
1      0.098
2      0.092
3      0.075
4      0.076
      ...
95     0.058
96     0.102
97     0.070
98     0.079
99     0.080
Name: chlorides, Length: 100, dtype: float64
```

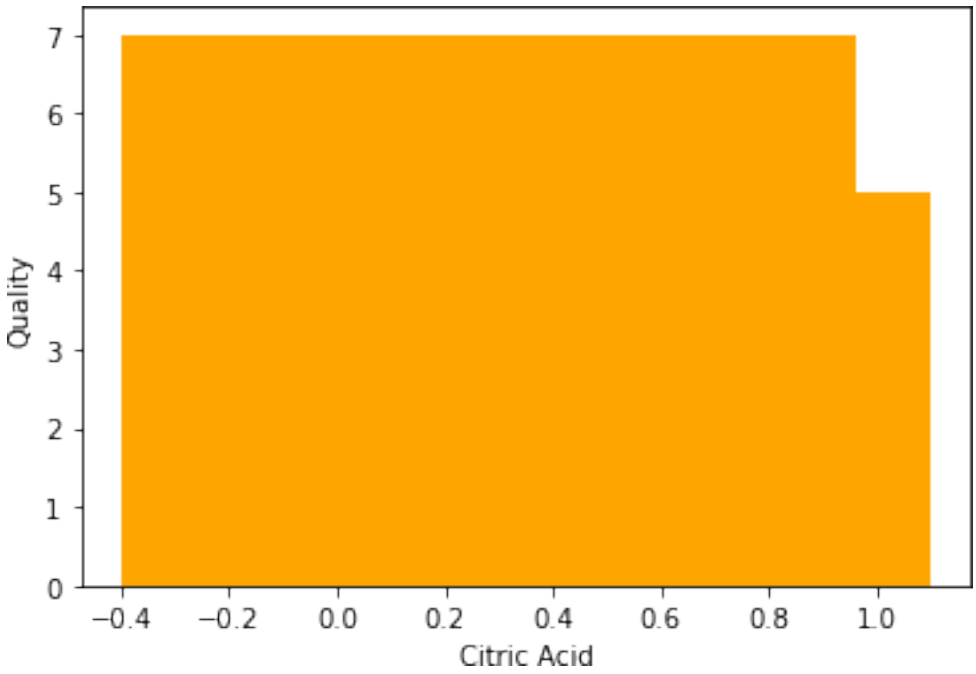
[94]:
```
D=df.iloc[:100,7]
D
```

[94]:
```
0      0.9978
1      0.9968
2      0.9970
3      0.9980
4      0.9978
       ...
95     0.9932
96     0.9965
97     0.9963
98     0.9967
99     0.9972
Name: density, Length: 100, dtype: float64
```

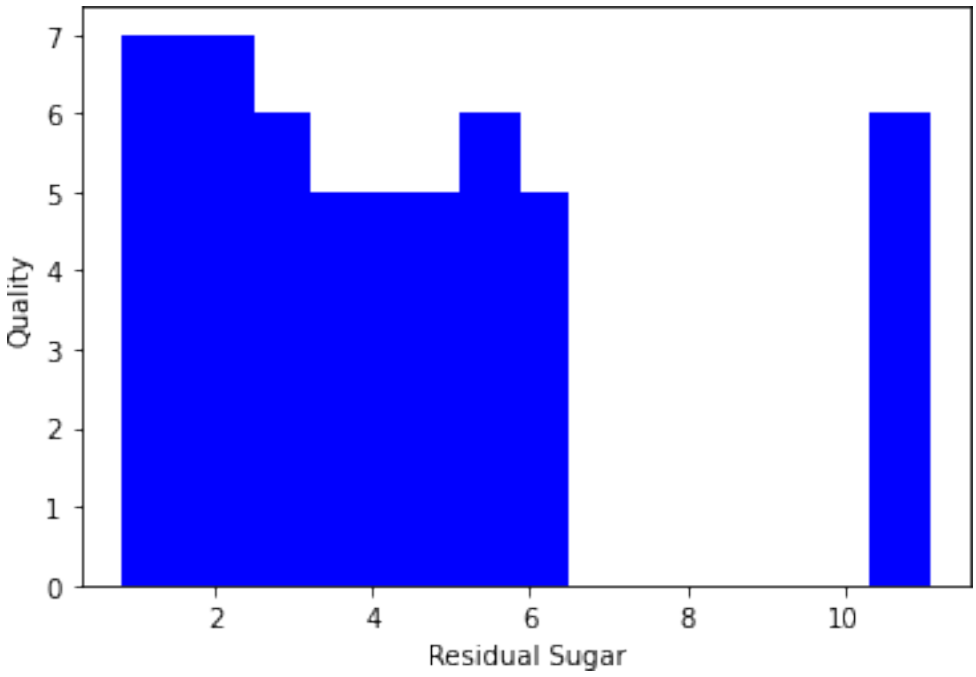
[95]:
```
E=df.iloc[:100,8]
E
```

[95]:
```
0     3.51
1     3.20
2     3.26
3     3.16
4     3.51
      ...
95    3.85
96    3.45
97    3.25
98    3.39
99    3.30
Name: pH, Length: 100, dtype: float64
```

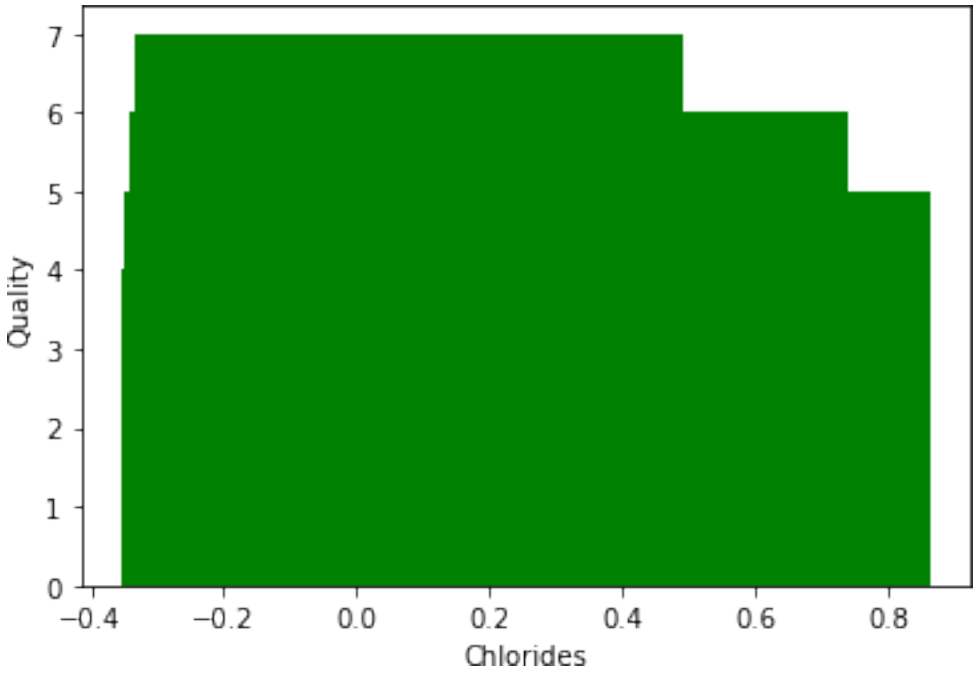
[88]:
```
import matplotlib.pyplot as plt
plt.bar(A,Y,color="orange")
plt.xlabel("Citric Acid")
plt.ylabel("Quality")
plt.show()
```



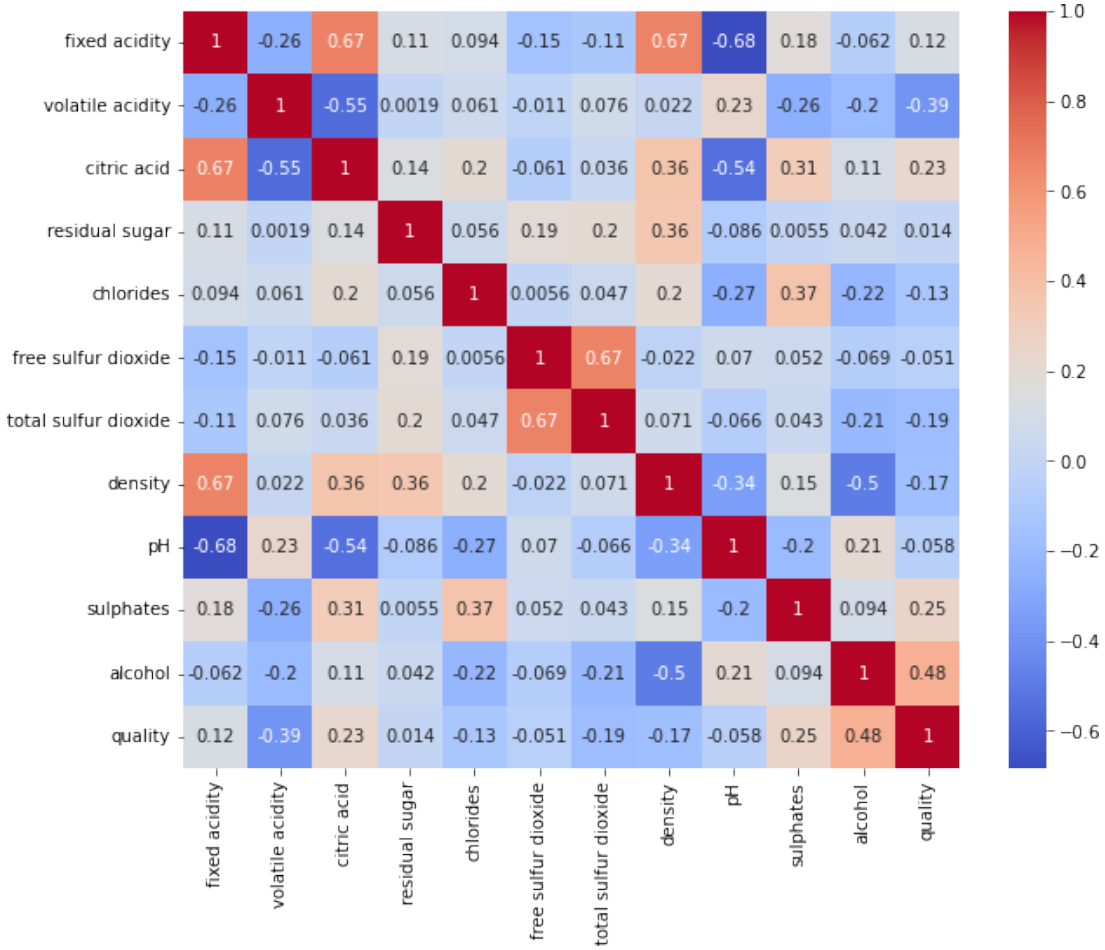
[89]:
```
import matplotlib.pyplot as plt
plt.bar(B,Y,color="blue")
plt.xlabel("Residual Sugar")
plt.ylabel("Quality")
plt.show()
```



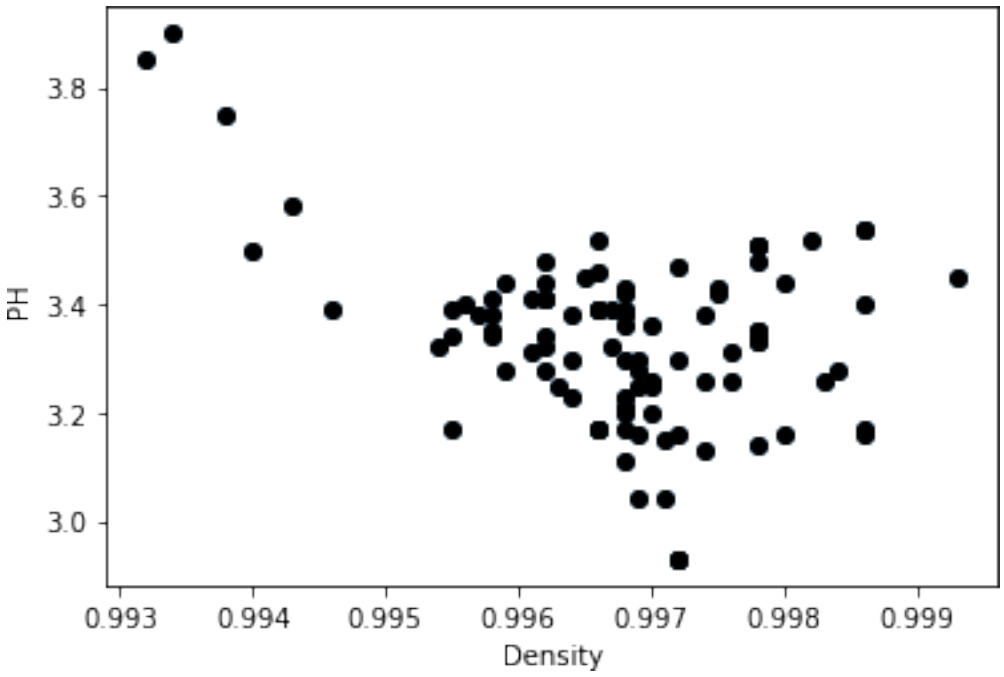
[91]:
```
import matplotlib.pyplot as plt
plt.bar(C,Y,color="Green")
plt.xlabel("Chlorides")
plt.ylabel("Quality")
plt.show()
```



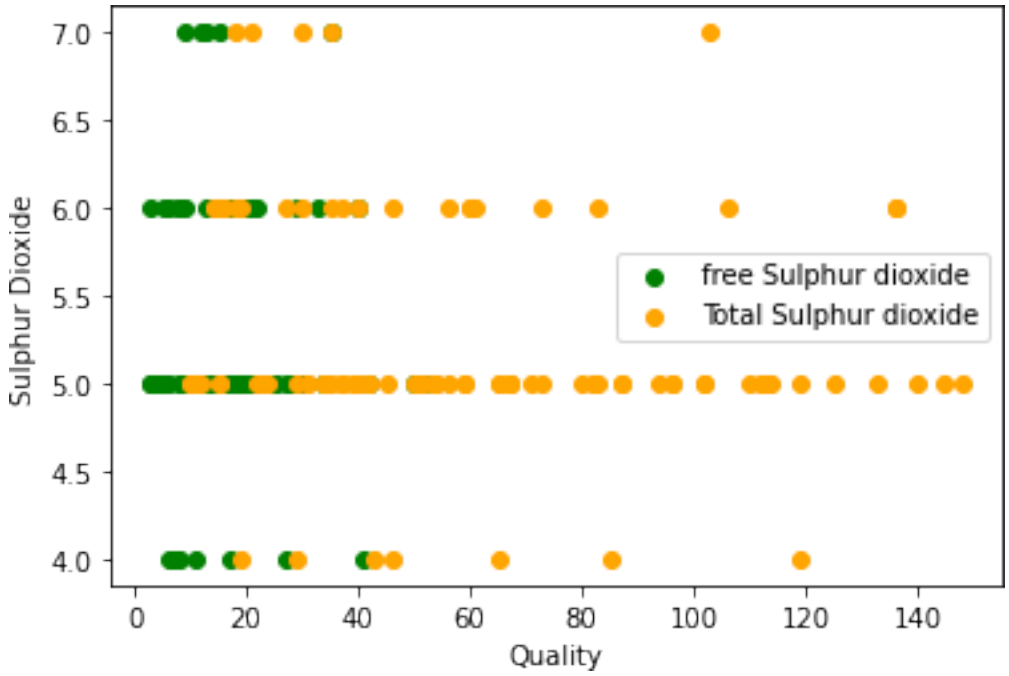
[93]:
```
import seaborn as sns
# Calculate the correlation matrix
corr = df.corr()

# Display the correlation matrix as a heatmap
plt.figure(figsize=(10, 8))
sns.heatmap(corr, annot=True, cmap='coolwarm')
plt.show()
```



[97]:
```
plt.scatter(D,E)
plt.scatter(D,E,color="black")
plt.xlabel("Density")
plt.ylabel("PH")
plt.show()
```


PH
3.8
3.6
3.4
3.2
3.0
0.993
0.994
0.995
0.996
0.997
0.998
0.999
Density

[106]:
```
M=df.iloc[:100,5]
N=df.iloc[:100,6]
plt.scatter(M,Y,label="free Sulphur dioxide",color="Green")
plt.scatter(N,Y,label="Total Sulphur dioxide",color="orange")
plt.legend()
plt.xlabel("Quality")
plt.ylabel("Sulphur Dioxide")
plt.show()
```



4 **Conclusion: We studied the data on wine quality. Various parameters were studied such as acidity, sugar level, chlorides, sugar, citric acid etc.**

5 **The plotted graphs show a few very visible trends.**

6 **The value of Fixed Acidity mainly hovers between 6 and 10. The average value is 8 where the highest Quality is obtained.**

7 **Volatile Acidity decreases on increasing the quality of Wine.**

8 **The quality of wine decreases as chlorides and citric acid increases.**

9 **Fixed acidity and Ph are the most inversely correlated.**