In [70]:
```
import warnings
warnings.filterwarnings("ignore")
```

In [71]:
```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import numpy as np
```

In [72]:
```
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score
from sklearn.model_selection import train_test_split
from sklearn import tree
from sklearn import metrics
from sklearn.ensemble import RandomForestClassifier
from sklearn.neighbors import KNeighborsClassifier
import seaborn as sns
from sklearn.svm import SVC
```

In [73]:
```
df = pd.read_csv('water_potability.csv')
```

In [74]:
```
df.head()
```

Out[74]:

	ph	Hardness	Solids	Chloramines	Sulfate	Conductivity	Organic_carbon	Trihalomethanes
0	NaN	204.890455	20791.318981	7.300212	368.516441	564.308654	10.379783	86.990970
1	3.716080	129.422921	18630.057858	6.635246	NaN	592.885359	15.180013	56.329076
2	8.099124	224.236259	19909.541732	9.275884	NaN	418.606213	16.868637	66.420093
3	8.316766	214.373394	22018.417441	8.059332	356.886136	363.266516	18.436524	100.341674
4	9.092223	181.101509	17978.986339	6.546600	310.135738	398.410813	11.558279	31.997993

In [75]:
```
df.shape
```

Out[75]:
```
(3276, 10)
```

In [76]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3276 entries, 0 to 3275
Data columns (total 10 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   ph               2785 non-null   float64
 1   Hardness         3276 non-null   float64
 2   Solids           3276 non-null   float64
 3   Chloramines      3276 non-null   float64
 4   Sulfate          2495 non-null   float64
 5   Conductivity     3276 non-null   float64
 6   Organic_carbon   3276 non-null   float64
 7   Trihalomethanes  3114 non-null   float64
 8   Turbidity        3276 non-null   float64
 9   Potability       3276 non-null   int64  
dtypes: float64(9), int64(1)
memory usage: 256.1 KB
```

In [77]:
```
df.columns
```

Out[77]:
```
Index(['ph', 'Hardness', 'Solids', 'Chloramines', 'Sulfate', 'Conductivity',
       'Organic_carbon', 'Trihalomethanes', 'Turbidity', 'Potability'],
      dtype='object')
```

In [78]:
```
df.dtypes
```

Out[78]:
```
ph                 float64
Hardness           float64
Solids             float64
Chloramines        float64
Sulfate            float64
Conductivity       float64
Organic_carbon     float64
Trihalomethanes    float64
Turbidity          float64
Potability           int64
dtype: object
```

In [79]:
```
df.isnull().sum()
```

Out[79]:
```
ph                 491
Hardness             0
Solids               0
Chloramines          0
Sulfate            781
Conductivity         0
Organic_carbon       0
Trihalomethanes    162
Turbidity            0
Potability           0
dtype: int64
```

In [80]:
```
df.fillna(df.mean(), inplace=True)
```

In [81]:
```
df.isnull().sum()
```

Out[81]:
```
ph                 0
Hardness           0
Solids             0
Chloramines        0
Sulfate            0
Conductivity       0
Organic_carbon     0
Trihalomethanes    0
Turbidity          0
Potability         0
dtype: int64
```

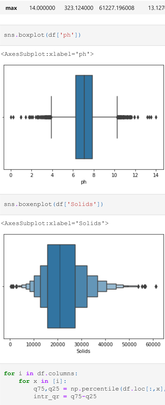
In [82]:
```
df.describe()
```

Out[82]:

	ph	Hardness	Solids	Chloramines	Sulfate	Conductivity	Organic_carbon	Trihal
count	3276.000000	3276.000000	3276.000000	3276.000000	3276.000000	3276.000000	3276.000000	3
mean	7.080795	196.369496	22014.092526	7.122277	333.775777	426.205111	14.284970	
std	1.469956	32.879761	8768.570828	1.583085	36.142612	80.824064	3.308162	
min	0.000000	47.432000	320.942611	0.352000	129.000000	181.483754	2.200000	
25%	6.277673	176.850538	15666.690297	6.127421	317.094638	365.734414	12.065801	
50%	7.080795	196.967627	20927.833607	7.130299	333.775777	421.884968	14.218338	
75%	7.870050	216.667456	27332.762127	8.114887	350.385756	481.792304	16.557652	
max	14.000000	323.124000	61227.196008	13.127000	481.030642	753.342620	28.300000	

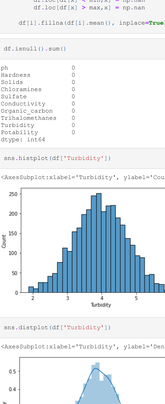
In [83]:
```
sns.boxplot(df['ph'])
```

Out[83]:
```
<AxesSubplot:xlabel='ph'>
```



In [84]:
```
sns.boxenplot(df['Solids'])
```

Out[84]:
```
<AxesSubplot:xlabel='Solids'>
```



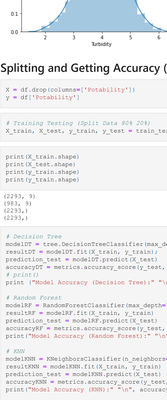
In [85]:
```
for i in df.columns:
    for x in [i]:
        q75,q25 = np.percentile(df.loc[:,x],[75,25])
        intr_qr = q75-q25

        max = q75+(1.5*intr_qr)
        min = q25-(1.5*intr_qr)

        df.loc[df[x] < min,x] = np.nan
        df.loc[df[x] > max,x] = np.nan

    df[i].fillna(df[i].mean(), inplace=True)
```

In [86]:
```
df.isnull().sum()
```

Out[86]:
```
ph                 0
Hardness           0
Solids             0
Chloramines        0
Sulfate            0
Conductivity       0
Organic_carbon     0
Trihalomethanes    0
Turbidity          0
Potability         0
dtype: int64
```

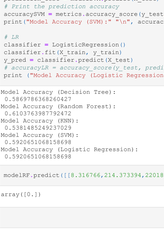
In [87]:
```
sns.histplot(df['Turbidity'])
```

Out[87]:
```
<AxesSubplot:xlabel='Turbidity', ylabel='Count'>
```



In [88]:
```
sns.distplot(df['Turbidity'])
```

Out[88]:
```
<AxesSubplot:xlabel='Turbidity', ylabel='Density'>
```



Splitting and Getting Accuracy (Training Models)

In [89]:
```
X = df.drop(columns=['Potability'])
y = df['Potability']
```

In [90]:
```
# Training Testing (Split Data 80% 20%)
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3)
```

In [91]:
```
print(X_train.shape)
print(X_test.shape)
print(y_train.shape)
print(y_train.shape)
```

```
(2293, 9)
(983, 9)
(2293,)
(2293,)
```

In [95]:
```
# Decision Tree
modelDT = tree.DecisionTreeClassifier(max_depth=9)
resultDT = modelDT.fit(X_train, y_train);
prediction_test = modelDT.predict(X_test)
accuracyDT = metrics.accuracy_score(y_test, prediction_test)
# print()
print ("Model Accuracy (Decision Tree):" "\n", accuracyDT)

# Random Forest
modelRF = RandomForestClassifier(max_depth=9)
resultRF = modelRF.fit(X_train, y_train)
prediction_test = modelRF.predict(X_test)
accuracyRF = metrics.accuracy_score(y_test, prediction_test)
print("Model Accuracy (Random Forest):" "\n", accuracyRF)

# KNN
modelKNN = KNeighborsClassifier(n_neighbors=7)
resultKNN = modelKNN.fit(X_train, y_train)
prediction_test = modelKNN.predict(X_test)
accuracyKNN = metrics.accuracy_score(y_test, prediction_test)
print("Model Accuracy (KNN):" "\n", accuracyKNN)

# SVM
modelSVM = SVC()
resultSVM = modelSVM.fit(X_train, y_train);
prediction_test = modelSVM.predict(X_test)
# Print the prediction accuracy
accuracySVM = metrics.accuracy_score(y_test, prediction_test)
print("Model Accuracy (SVM):" "\n", accuracySVM)

# LR
classifier = LogisticRegression()
classifier.fit(X_train, y_train)
y_pred = classifier.predict(X_test)
# accuracy2 = accuracy_score(y_test, prediction_test)
print ("Model Accuracy (Logistic Regression): \n", accuracy_score(y_test, prediction_t

Model Accuracy (Decision Tree):
 0.5869781368260427
Model Accuracy (Random Forest):
 0.6103763987792472
Model Accuracy (KNN):
 0.5381485249237029
Model Accuracy (SVM):
 0.5920651068158698
Model Accuracy (Logistic Regression):
 0.5920651068158698
```

In [96]:
```
modelRF.predict([[8.316766,214.373394,22018.417441,8.059332,356.886136,363.266516,18.4
```

Out[96]:
```
array([0.])
```

In [ ]:
```

```