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

```
df = pd.read_csv("/content/abalone.csv")
```

```
df.head()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	M	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15
1	M	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7
2	F	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9
3	M	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10
4	I	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	7

```
df.tail()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
4172	F	0.565	0.450	0.165	0.8870	0.3700	0.2390	0.2490	11
4173	M	0.590	0.440	0.135	0.9660	0.4390	0.2145	0.2605	10
4174	M	0.600	0.475	0.205	1.1760	0.5255	0.2875	0.3080	9
4175	F	0.625	0.485	0.150	1.0945	0.5310	0.2610	0.2960	10
4176	M	0.710	0.555	0.195	1.9485	0.9455	0.3765	0.4950	12

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4177 entries, 0 to 4176
Data columns (total 9 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   Sex             4177 non-null   object 
 1   Length          4177 non-null   float64
 2   Diameter        4177 non-null   float64
 3   Height          4177 non-null   float64
 4   Whole weight    4177 non-null   float64
 5   Shucked weight  4177 non-null   float64
 6   Viscera weight  4177 non-null   float64
 7   Shell weight    4177 non-null   float64
 8   Rings           4177 non-null   int64  
dtypes: float64(7), int64(1), object(1)
memory usage: 293.8+ KB
```

```
df.describe()
```

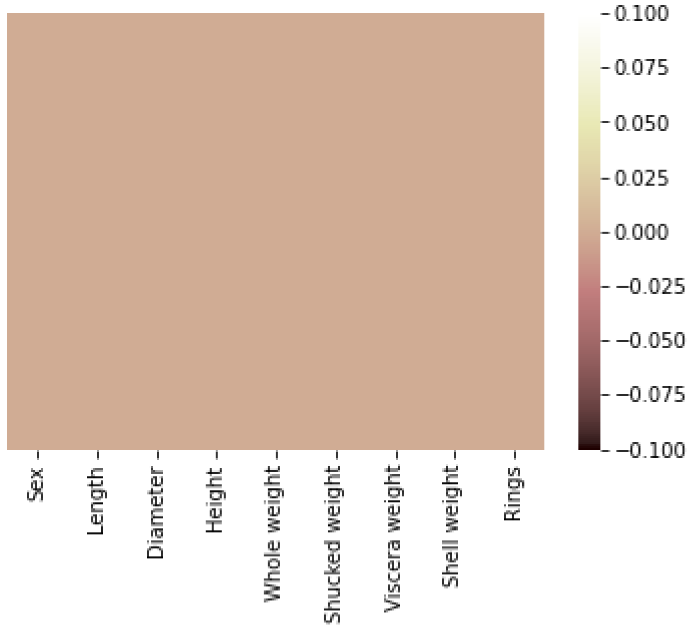
	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	
count	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	41
mean	0.523992	0.407881	0.139516	0.828742	0.359367	0.180594	
std	0.120093	0.099240	0.041827	0.490389	0.221963	0.109614	
min	0.075000	0.055000	0.000000	0.002000	0.001000	0.000500	
25%	0.450000	0.350000	0.115000	0.441500	0.186000	0.093500	
50%	0.545000	0.425000	0.140000	0.799500	0.336000	0.171000	
75%	0.615000	0.480000	0.165000	1.153000	0.502000	0.253000	

```
df.isnull().sum()
```

```
Sex               0
Length            0
Diameter          0
Height            0
Whole weight      0
Shucked weight    0
Viscera weight    0
Shell weight      0
Rings             0
dtype: int64
```

```
sns.heatmap(df.isnull(),yticklabels=False,cmap='pink')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fade2148810>
```



```
df.corr()
```

	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Ring
Length	1.000000	0.986812	0.827554	0.925261	0.897914	0.903018	0.897706	0.55672
Diameter	0.986812	1.000000	0.833684	0.925452	0.893162	0.899724	0.905330	0.57466
Height	0.827554	0.833684	1.000000	0.819221	0.774972	0.798319	0.817338	0.55746
Whole weight	0.925261	0.925452	0.819221	1.000000	0.969405	0.966375	0.955355	0.54039
Shucked weight	0.897914	0.893162	0.774972	0.969405	1.000000	0.931961	0.882617	0.42088
Viscera weight	0.903018	0.899724	0.798319	0.966375	0.931961	1.000000	0.907656	0.50381

```
df['Sex'].value_counts()
```

```
M    1528
I    1342
F    1307
Name: Sex, dtype: int64
```

```
df['Sex'].unique()
```

```
array(['M', 'F', 'I'], dtype=object)
```

```
df['Sex'] = df['Sex'].map({'M': 0, 'I': 1, 'F':2})
```

```
df.head()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	0	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15
1	0	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7
2	2	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9
3	0	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10
4	1	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	7

```
df.tail()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
4172	2	0.565	0.450	0.165	0.8870	0.3700	0.2390	0.2490	11
4173	0	0.590	0.440	0.135	0.9660	0.4390	0.2145	0.2605	10
4175	2	0.625	0.485	0.150	1.0945	0.5310	0.2610	0.2960	10

ADDING AGE COLUMN

```
df['Age'] = df['Rings'] + 2.5
```

```
df.head()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings	Age
0	0	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15	17.5
1	0	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7	9.5
2	2	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9	11.5
3	0	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10	12.5
4	1	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	7	9.5

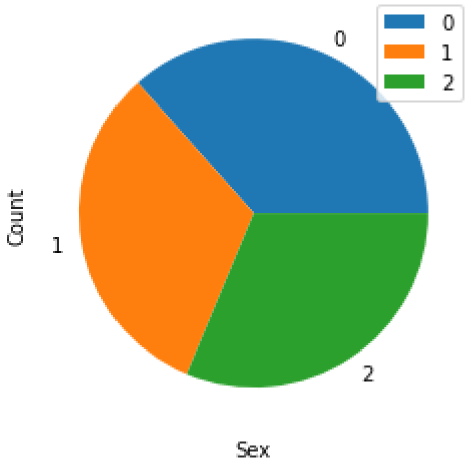
```
df.columns
```

```
Index(['Sex', 'Length', 'Diameter', 'Height', 'Whole weight', 'Shucked weight',
       'Viscera weight', 'Shell weight', 'Rings', 'Age'],
      dtype='object')
```

Data visualization

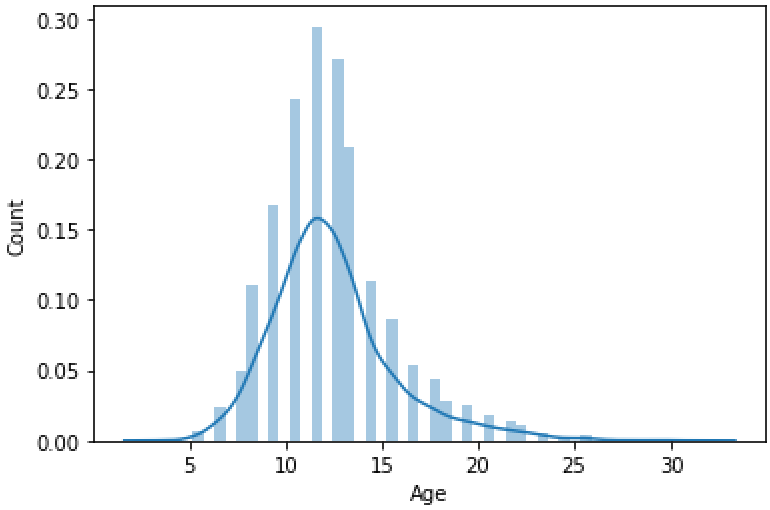
```
df['Sex'].value_counts().plot(kind='pie')
plt.legend()
plt.xlabel('Sex')
plt.ylabel('Count')
```

```
Text(0, 0.5, 'Count')
```



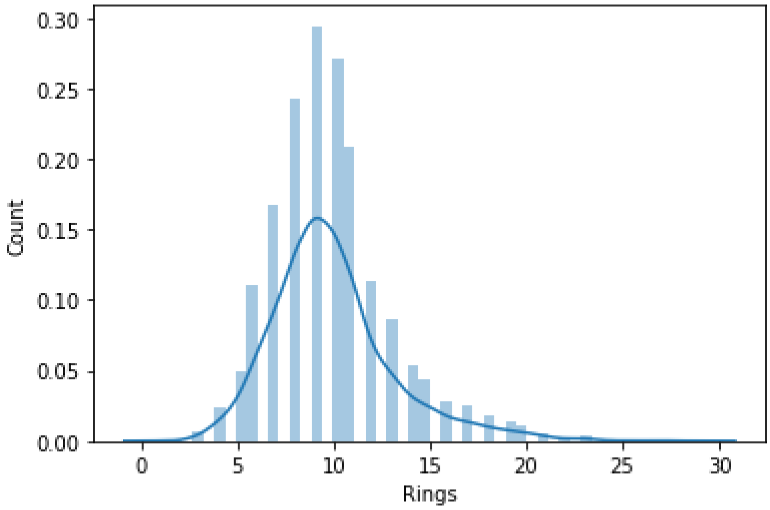
```
sns.distplot(df['Age'])
plt.xlabel('Age')
plt.ylabel('Count')
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2619: FutureWarning:
  warnings.warn(msg, FutureWarning)
Text(0, 0.5, 'Count')
```



```
sns.distplot(df['Rings'])
plt.xlabel('Rings')
plt.ylabel('Count')
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2619: FutureWarning:
  warnings.warn(msg, FutureWarning)
Text(0, 0.5, 'Count')
```



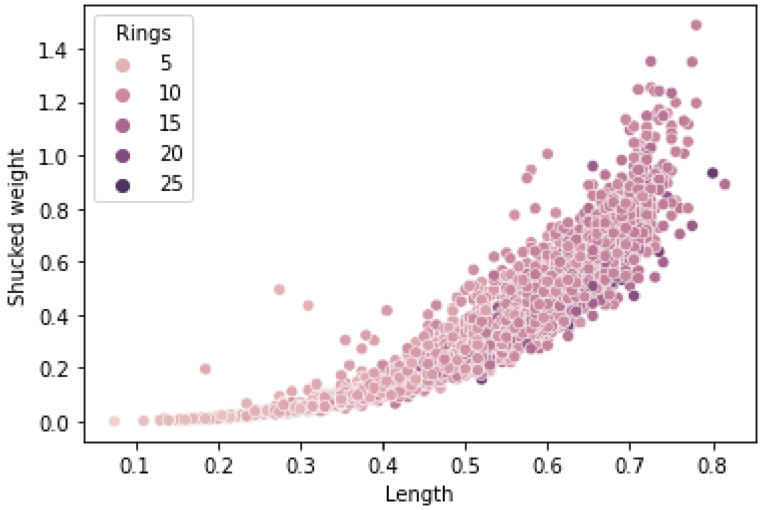
Bi-variate analysis

```
df.head()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings	Age
0	0	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15	17.5
1	0	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7	9.5
2	2	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9	11.5
3	0	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10	12.5
4	1	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	7	9.5

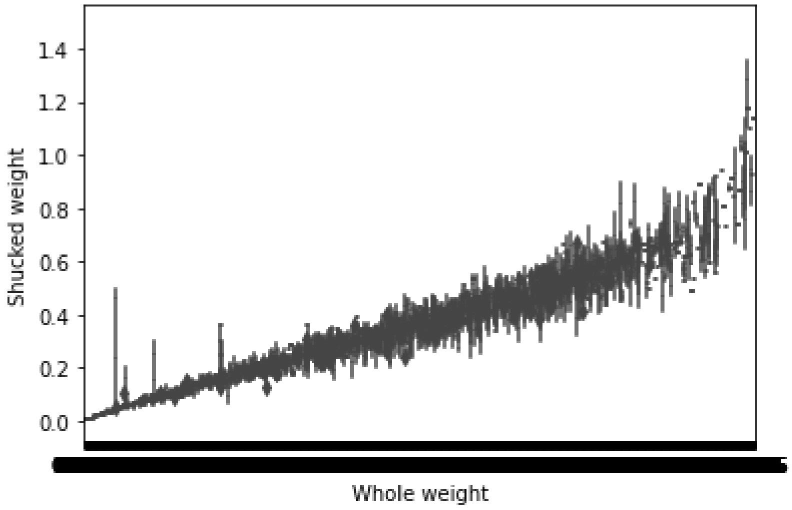
```
sns.scatterplot(data=df, x='Length', y='Shucked weight', hue='Rings',)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7faddf02c310>
```



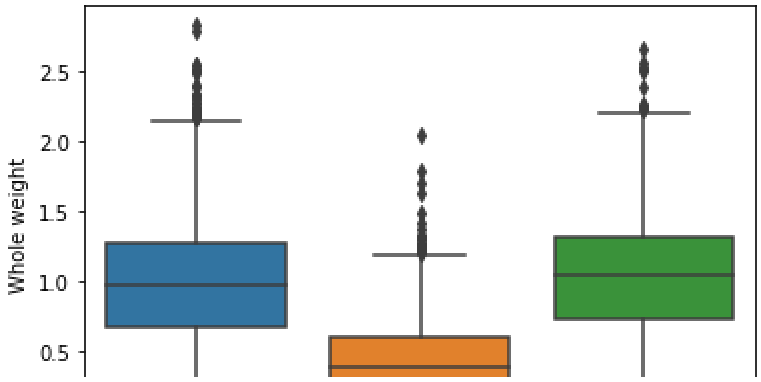
```
sns.boxplot(data=df, x='Whole weight', y='Shucked weight')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fadde8d9b50>
```



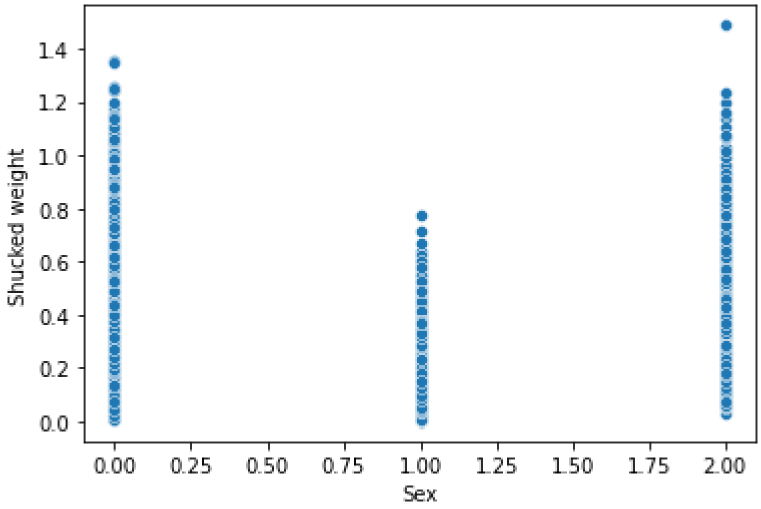
```
sns.boxplot(data=df, x='Sex', y='Whole weight')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fadd0312190>
```



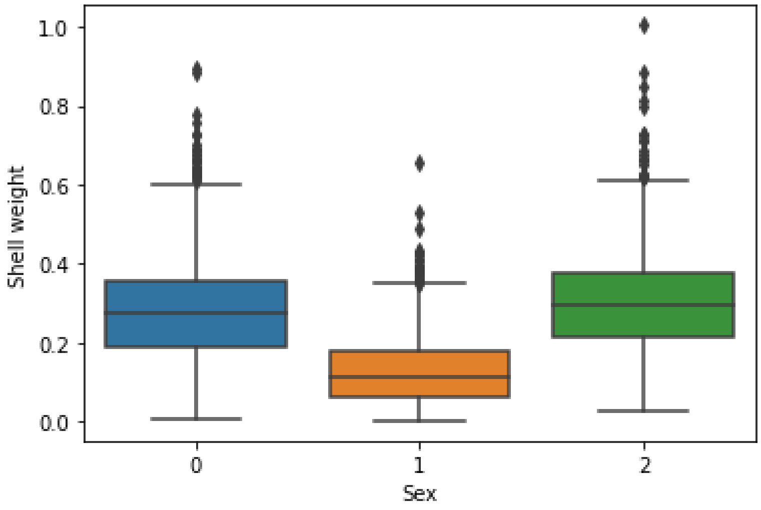
```
sns.scatterplot(data=df, x='Sex', y='Shucked weight')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fadd0445e90>
```



```
sns.boxplot(data=df, x='Sex', y='Shell weight')
```

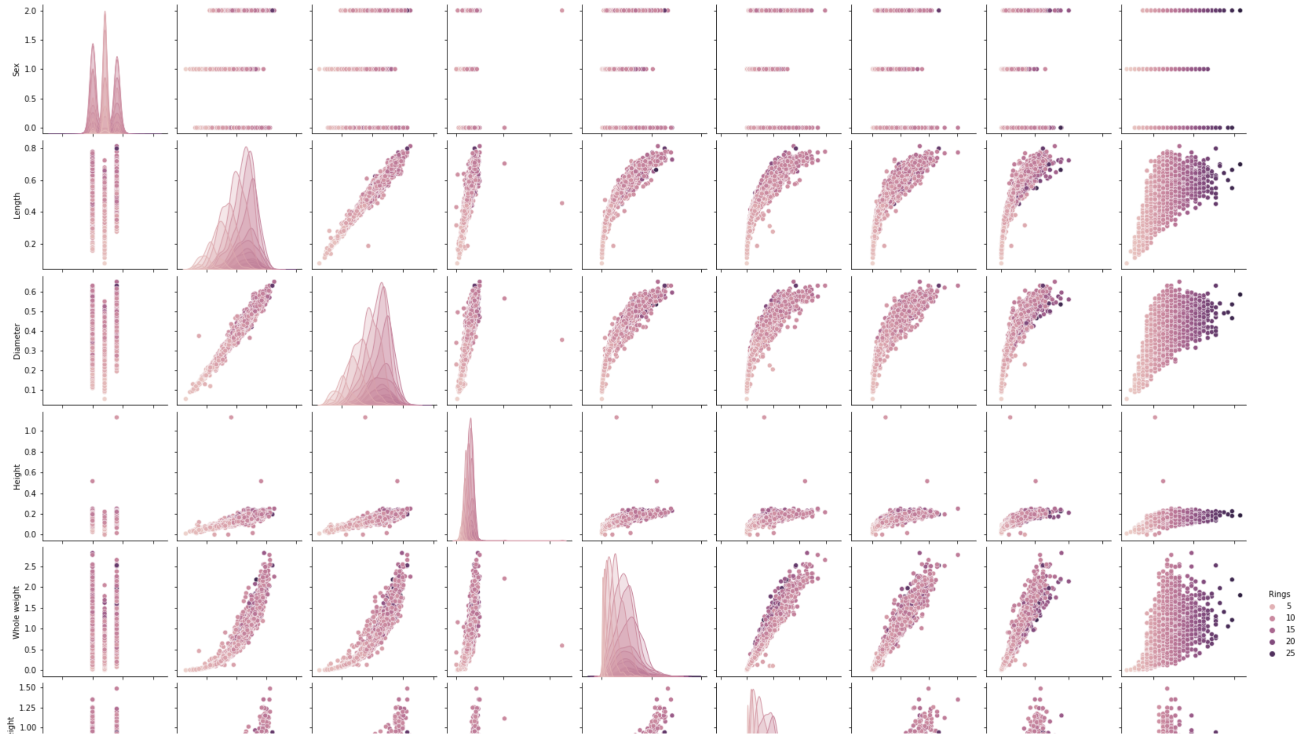
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fadd0176510>
```



Univariate analysis

```
sns.pairplot(data=df, hue='Rings')
```

```
<seaborn.axisgrid.PairGrid at 0x7fadd0263490>
```



```
df.describe()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	
count	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	41
mean	0.947091	0.523992	0.407881	0.139516	0.828742	0.359367	
std	0.822240	0.120093	0.099240	0.041827	0.490389	0.221963	
min	0.000000	0.075000	0.055000	0.000000	0.002000	0.001000	
25%	0.000000	0.450000	0.350000	0.115000	0.441500	0.186000	
50%	1.000000	0.545000	0.425000	0.140000	0.799500	0.336000	
75%	2.000000	0.615000	0.480000	0.165000	1.153000	0.502000	

```
df.corr()['Age']
```

```
Sex               0.034627
Length            0.556720
Diameter          0.574660
Height            0.557467
Whole weight      0.540390
Shucked weight    0.420884
Viscera weight    0.503819
Shell weight      0.627574
Rings             1.000000
Age               1.000000
Name: Age, dtype: float64
```

```
df.shape
```

```
(4177, 10)
```

Checking outliers for the data

```
df.head()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings	Age
0	0	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15	17.5
1	0	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7	9.5
2	2	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9	11.5
3	0	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10	12.5
4	1	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	7	9.5

```
df.drop('Age',axis=1,inplace=True)
```

```
df.head()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	0	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15
1	0	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7
2	2	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9
3	0	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10
4	1	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	7

```
sns.boxplot(x=df['Length'])
```

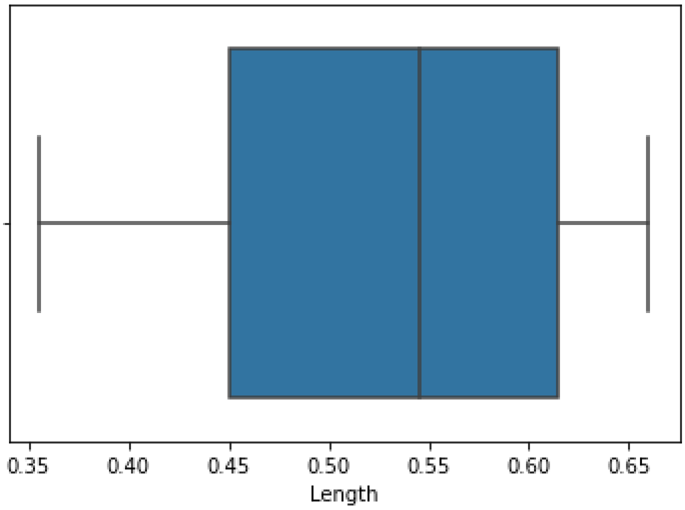
```
<matplotlib.axes._subplots.AxesSubplot at 0x7faddef3f650>
```

```
tenth_per = np.percentile(df['Length'], 10)
nine_per  = np.percentile(df['Length'], 90)

df['Length'] = np.where(df['Length'] < tenth_per, tenth_per, df['Length'])
df['Length'] = np.where(df['Length'] > nine_per, nine_per, df['Length'])
```

IQR

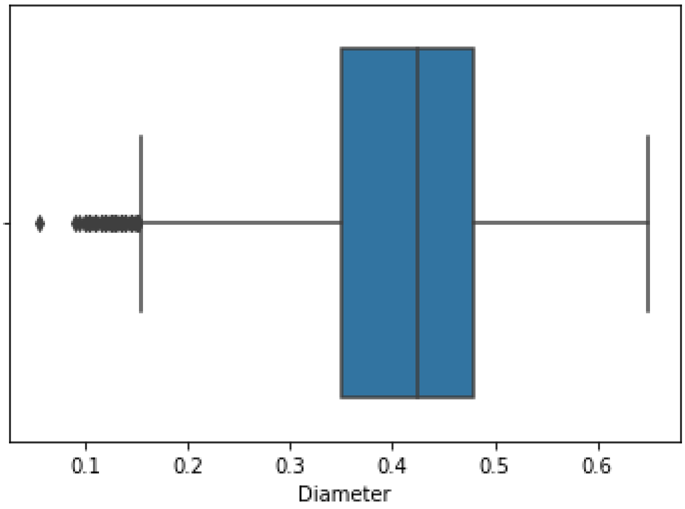
```
sns.boxplot(x=df['Length'])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fadcdee4410>
```



```
sns.boxplot(x=df['Diameter'])
```

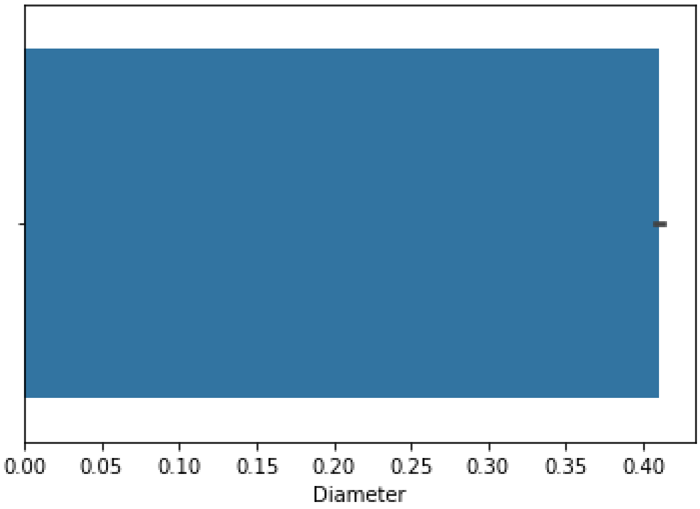
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fadcdafd590>
```



```
tenth_per = np.percentile(df['Diameter'], 10)
nine_per  = np.percentile(df['Diameter'], 90)

df['Diameter'] = np.where(df['Diameter'] < tenth_per, tenth_per, df['Diameter'])
df['Diameter'] = np.where(df['Diameter'] > nine_per, nine_per, df['Diameter'])
```

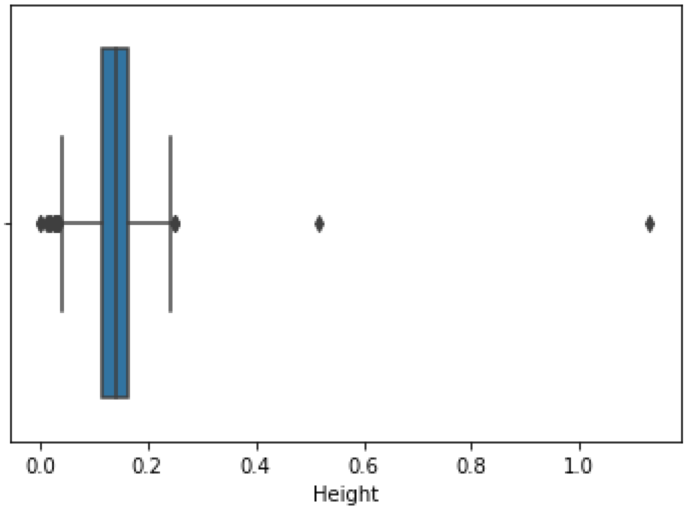
```
sns.barplot(x=df['Diameter'])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fadcc26a450>
```



```
sns.boxplot(x=df['Height'])
```

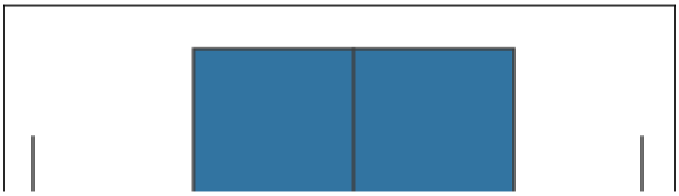
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fadcc1e0210>
```



```
tenth_per = np.percentile(df['Height'], 10)
nine_per  = np.percentile(df['Height'], 90)

df['Height'] = np.where(df['Height'] < tenth_per, tenth_per, df['Height'])
df['Height'] = np.where(df['Height'] > nine_per, nine_per, df['Height'])
```

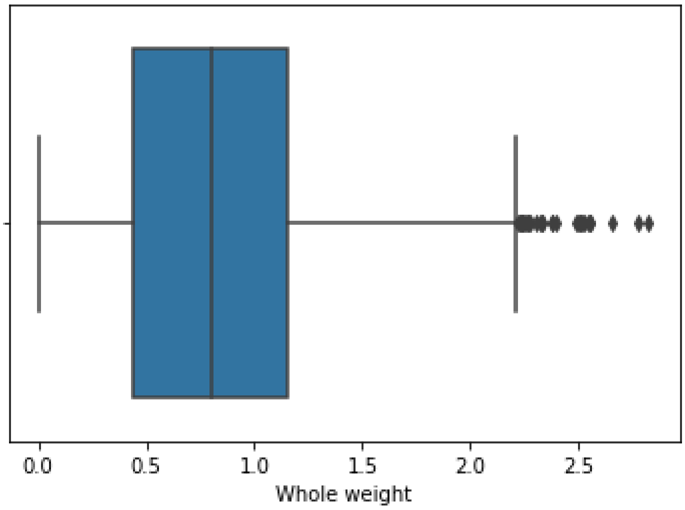
```
sns.boxplot(x=df['Height'])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fadcc14dfd0>
```



```
sns.boxplot(x=df['Whole weight'])
```

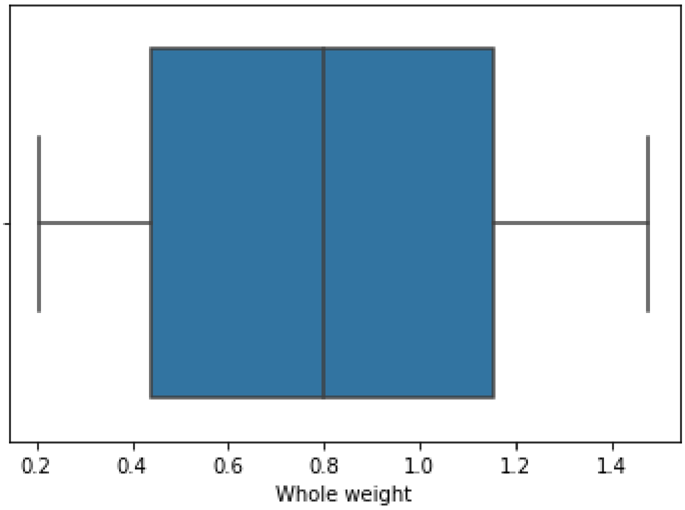
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fadcc12d510>
```



```
tenth_per = np.percentile(df['Whole weight'], 10)
nine_per  = np.percentile(df['Whole weight'], 90)

df['Whole weight'] = np.where(df['Whole weight'] < tenth_per, tenth_per, df['Whole weight'
df['Whole weight'] = np.where(df['Whole weight'] > nine_per, nine_per, df['Whole weight'])
```

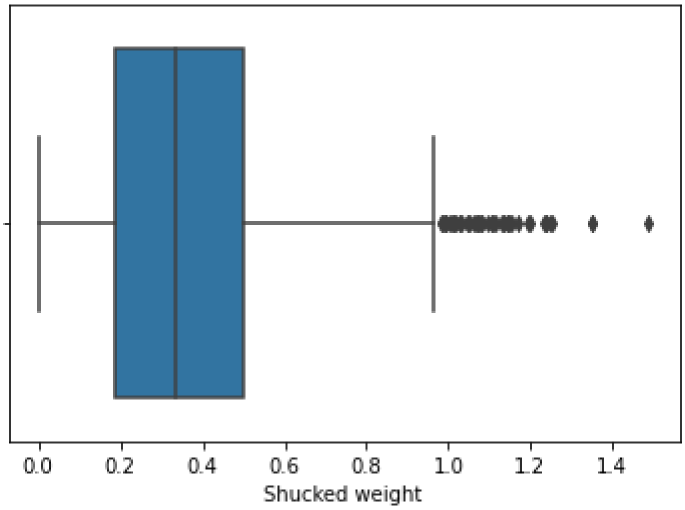
```
sns.boxplot(x=df['Whole weight'])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fadcc0a1410>
```



```
sns.boxplot(x=df['Shucked weight'])
```

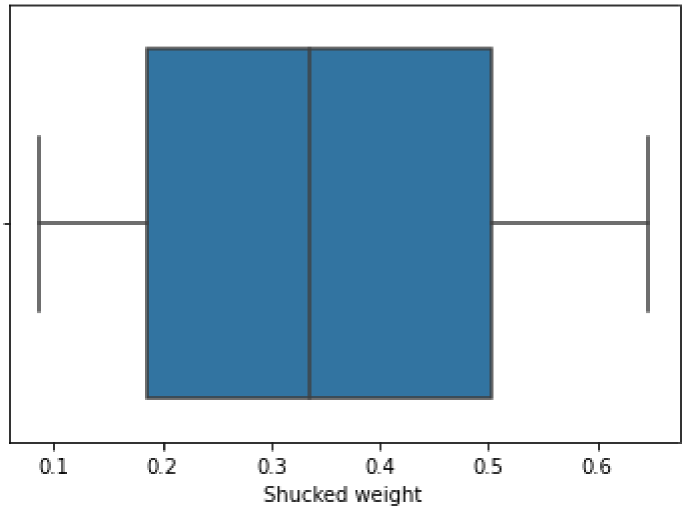
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fadcc013bd0>
```



```
tenth_per = np.percentile(df['Shucked weight'], 10)
nine_per  = np.percentile(df['Shucked weight'], 90)

df['Shucked weight'] = np.where(df['Shucked weight'] < tenth_per, tenth_per, df['Shucked w
df['Shucked weight'] = np.where(df['Shucked weight'] > nine_per, nine_per, df['Shucked wei
```

```
sns.boxplot(x=df['Shucked weight'])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fadcbff6d10>
```

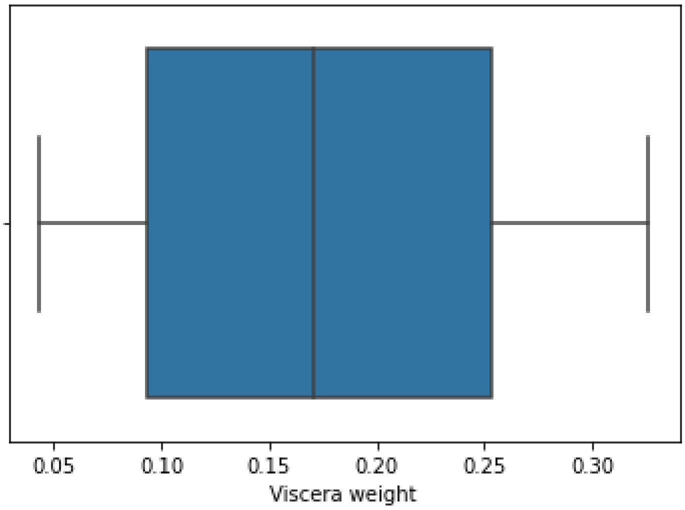


```
sns.boxplot(x=df['Viscera weight'])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fadcbf57ed0>
```

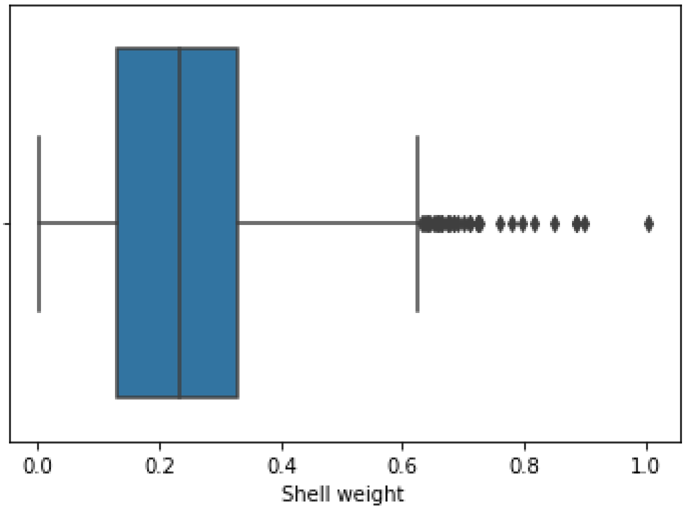
```
tenth_per = np.percentile(df['Viscera weight'], 10)
nine_per  = np.percentile(df['Viscera weight'], 90)

df['Viscera weight'] = np.where(df['Viscera weight'] < tenth_per, tenth_per, df['Viscera w
df['Viscera weight'] = np.where(df['Viscera weight'] > nine_per, nine_per, df['Viscera wei
sns.boxplot(x=df['Viscera weight'])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fadcbf47490>
```



```
sns.boxplot(df['Shell weight'])
```

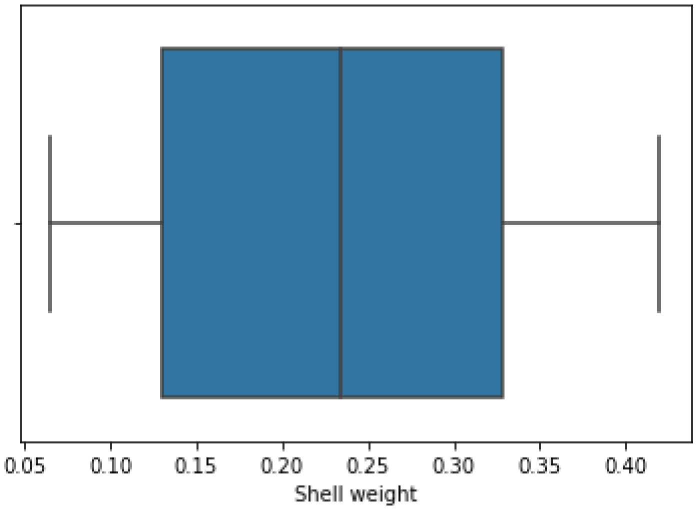
```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pas
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7fadcbebb310>
```



```
tenth_per = np.percentile(df['Shell weight'], 10)
nine_per  = np.percentile(df['Shell weight'], 90)
```

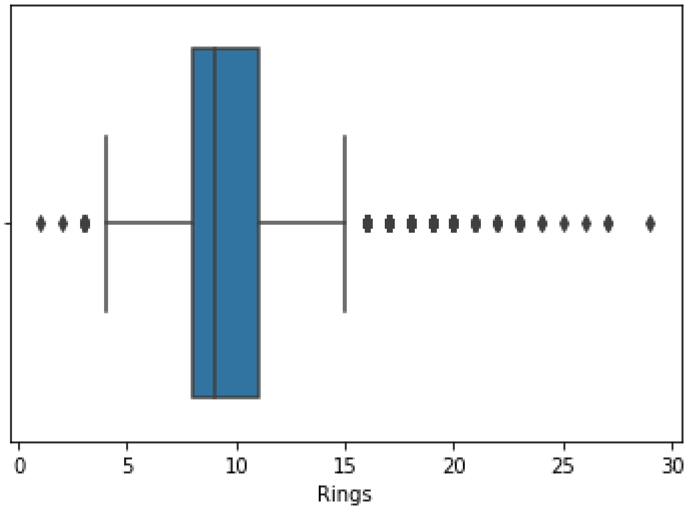
```
df['Shell weight'] = np.where(df['Shell weight'] < tenth_per, tenth_per, df['Shell weight'
df['Shell weight'] = np.where(df['Shell weight'] > nine_per, nine_per, df['Shell weight'])
sns.boxplot(df['Shell weight'])
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pas
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7fadcbe27410>
```



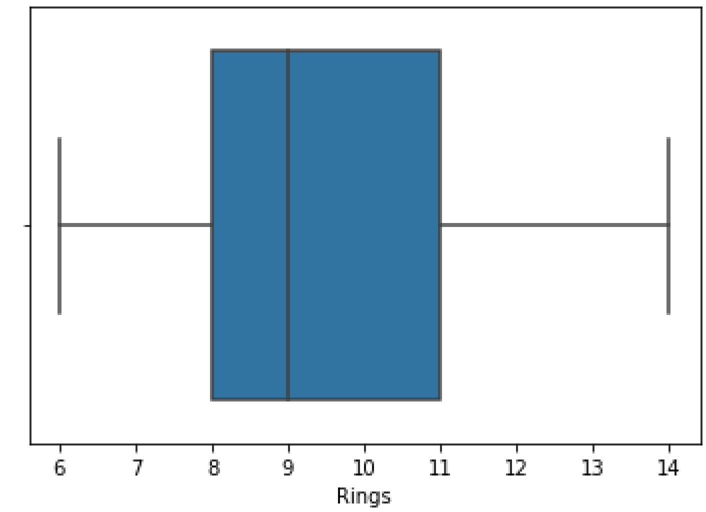
```
sns.boxplot(df['Rings'])
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pas
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7fadcbd99a90>
```



```
tenth_per = np.percentile(df['Rings'], 10)
nine_per  = np.percentile(df['Rings'], 90)

df['Rings'] = np.where(df['Rings'] < tenth_per, tenth_per, df['Rings'])
df['Rings'] = np.where(df['Rings'] > nine_per, nine_per, df['Rings'])
sns.boxplot(df['Rings'])
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pas
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7fadcbd140d0>
```



```
df.describe()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	
count	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	41
mean	0.947091	0.527491	0.410466	0.139701	0.807958	0.348481	
std	0.822240	0.099873	0.083713	0.031559	0.418877	0.185356	
min	0.000000	0.355000	0.265000	0.090000	0.205000	0.086500	
25%	0.000000	0.450000	0.350000	0.115000	0.441500	0.186000	
50%	1.000000	0.545000	0.425000	0.140000	0.799500	0.336000	
75%	2.000000	0.615000	0.480000	0.165000	1.153000	0.502000	

```
df.head()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	0	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	14.0
1	0	0.355	0.265	0.090	0.2255	0.0995	0.0485	0.070	7.0
2	2	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9.0
3	0	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10.0
4	1	0.355	0.265	0.090	0.2050	0.0895	0.0433	0.065	7.0

Outlier treatment

```
df['Age'] = df['Rings'] + 2.5
```

```
df.head()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings	Age
0	0	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	14.0	16.5
1	0	0.355	0.265	0.090	0.2255	0.0995	0.0485	0.070	7.0	9.5
2	2	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9.0	11.5
3	0	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10.0	12.5
4	1	0.355	0.265	0.090	0.2050	0.0895	0.0433	0.065	7.0	9.5

```
X = df.drop('Age', axis=1)
y = df['Age']
```

```
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test  = train_test_split(X, y, test_size=0.3, random_state=101)
```

```
X_train.shape

     (2923, 9)
```

```
X_test.shape

     (1254, 9)
```

```
y_train.shape

     (2923,)
```

```
y_test.shape

     (1254,)
```

```
from sklearn.linear_model import LinearRegression
model1 = LinearRegression()
model1.fit(X_train,y_train)

     LinearRegression()
```

```
y_pred1 = model1.predict(X_test)
```

```
y_pred1

     array([12.5,  9.5, 12.5, ...,  8.5, 16.5, 12.5])
```

```
from sklearn.metrics import mean_squared_error, mean_absolute_error, r2_score

print(mean_absolute_error( y_test, y_pred1))
print(mean_squared_error(y_test, y_pred1))

     7.592721418808088e-16
     1.4544229767711159e-30
```

```
print(r2_score( y_test,y_pred1))

     1.0
```

```
from sklearn.ensemble import RandomForestRegressor
model2 = RandomForestRegressor(n_estimators=500)
model2.fit(X_train, y_train)

     RandomForestRegressor(n_estimators=500)
```

```
y_pred2 = model2.predict(X_test)
```

```
y_pred2

     array([12.5,  9.5, 12.5, ...,  8.5, 16.5, 12.5])
```

```
print(r2_score( y_test,y_pred2))

     1.0
```

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