Import libraries

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from IPython import get_ipython
import plotly.express as px
import plotly.graph_objects as go
import warnings
warnings.filterwarnings('ignore')


from sklearn.linear_model import LinearRegression
from sklearn.tree import DecisionTreeRegressor
from sklearn.ensemble import RandomForestRegressor, GradientBoostingRegressor, AdaBoo
from xgboost import XGBRegressor
from catboost import CatBoostRegressor
from lightgbm import LGBMRegressor


from sklearn.model_selection import train_test_split
from sklearn.metrics import r2_score
from sklearn.preprocessing import StandardScaler
```

Import the data

In [2]:
```
df = pd.read_csv("/kaggle/input/playground-series-s3e16/train.csv")
```

In [3]:
```
df
```

Out[3]:

	id	Sex	Length	Diameter	Height	Weight	Shucked Weight	Viscera Weight	Shell Weight	A
0	0	I	1.5250	1.1750	0.3750	28.973189	12.728926	6.647958	8.348928	
1	1	I	1.1000	0.8250	0.2750	10.418441	4.521745	2.324659	3.401940	
2	2	M	1.3875	1.1125	0.3750	24.777463	11.339800	5.556502	6.662133	
3	3	F	1.7000	1.4125	0.5000	50.660556	20.354941	10.991839	14.996885	
4	4	I	1.2500	1.0125	0.3375	23.289114	11.977664	4.507570	5.953395	
...	...	...	...	...	...	...	...	...	...	
74046	74046	F	1.6625	1.2625	0.4375	50.660556	20.680960	10.361742	12.332033	
74047	74047	I	1.0750	0.8625	0.2750	10.446791	4.323299	2.296310	3.543687	
74048	74048	F	1.4875	1.2000	0.4125	29.483480	12.303683	7.540967	8.079607	
74049	74049	I	1.2125	0.9625	0.3125	16.768729	8.972617	2.919999	4.280774	
74050	74050	I	0.9125	0.6750	0.2000	5.386405	2.055339	1.034757	1.700970	

74051 rows × 10 columns

EXPLORATORY DATA ANALYSIS

In [4]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 74051 entries, 0 to 74050
Data columns (total 10 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   id              74051 non-null  int64  
 1   Sex             74051 non-null  object 
 2   Length          74051 non-null  float64
 3   Diameter        74051 non-null  float64
 4   Height          74051 non-null  float64
 5   Weight          74051 non-null  float64
 6   Shucked Weight  74051 non-null  float64
 7   Viscera Weight  74051 non-null  float64
 8   Shell Weight    74051 non-null  float64
 9   Age             74051 non-null  int64  
dtypes: float64(7), int64(2), object(1)
memory usage: 5.6+ MB
```

In [5]:
```
df.duplicated().sum()
```

Out[5]:
```
0
```

In [6]:
```
df.isnull().sum()
```

Out[6]:
```
id                0
Sex               0
Length            0
Diameter          0
Height            0
Weight            0
Shucked Weight    0
Viscera Weight    0
Shell Weight      0
Age               0
dtype: int64
```

In [7]:
```
df.nunique()
```

Out[7]:
```
id                74051
Sex                   3
Length              144
Diameter            122
Height               65
Weight             3096
Shucked Weight     1766
Viscera Weight      967
Shell Weight       1048
Age                  28
dtype: int64
```

In [8]:
```
df.describe().T
```

Out[8]:

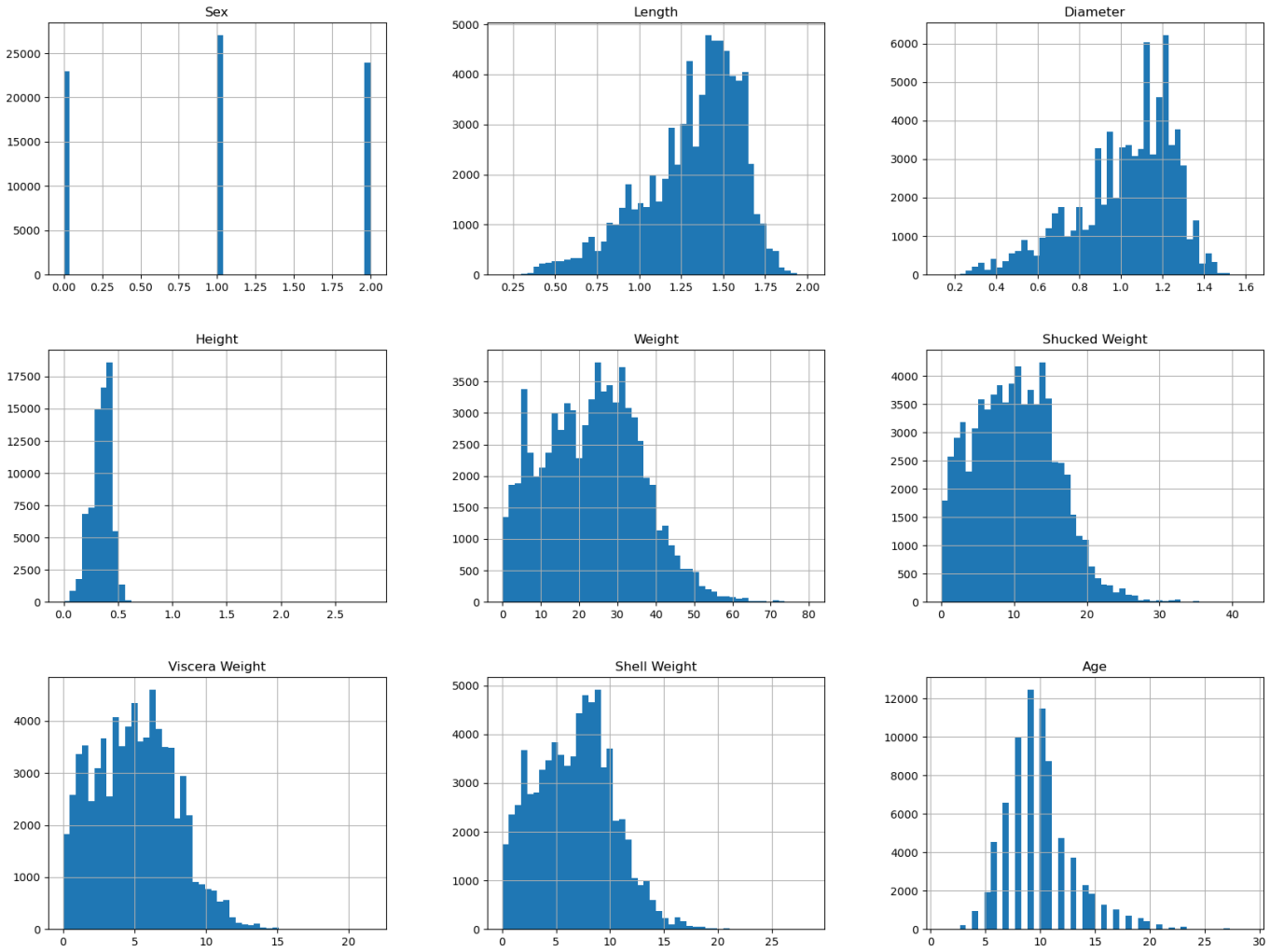
	count	mean	std	min	25%	50%	
id	74051.0	37025.000000	21376.826729	0.000000	18512.500000	37025.000000	55537.5
Length	74051.0	1.317460	0.287757	0.187500	1.150000	1.375000	1.5
Diameter	74051.0	1.024496	0.237396	0.137500	0.887500	1.075000	1.2
Height	74051.0	0.348089	0.092034	0.000000	0.300000	0.362500	0.4
Weight	74051.0	23.385217	12.648153	0.056699	13.437663	23.799405	32.1
Shucked Weight	74051.0	10.104270	5.618025	0.028349	5.712424	9.908150	14.0
Viscera Weight	74051.0	5.058386	2.792729	0.042524	2.863300	4.989512	6.9
Shell Weight	74051.0	6.723870	3.584372	0.042524	3.968930	6.931453	9.0
Age	74051.0	9.967806	3.175189	1.000000	8.000000	10.000000	11.0

In [9]:
```
df = df.drop('id', axis=1)
```

In [10]:
```
df['Sex'] = df['Sex'].map({'F': 0, 'M': 1,'I':2})
```

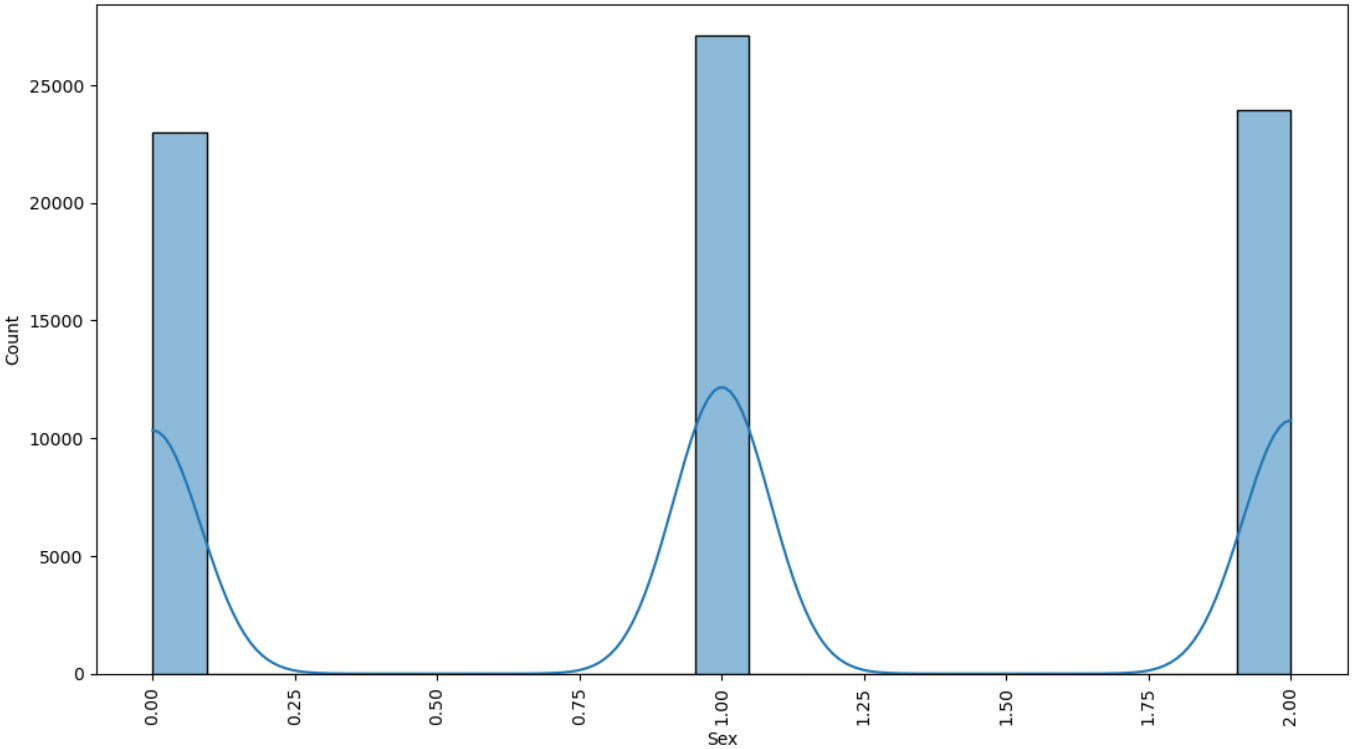
Data Visualization

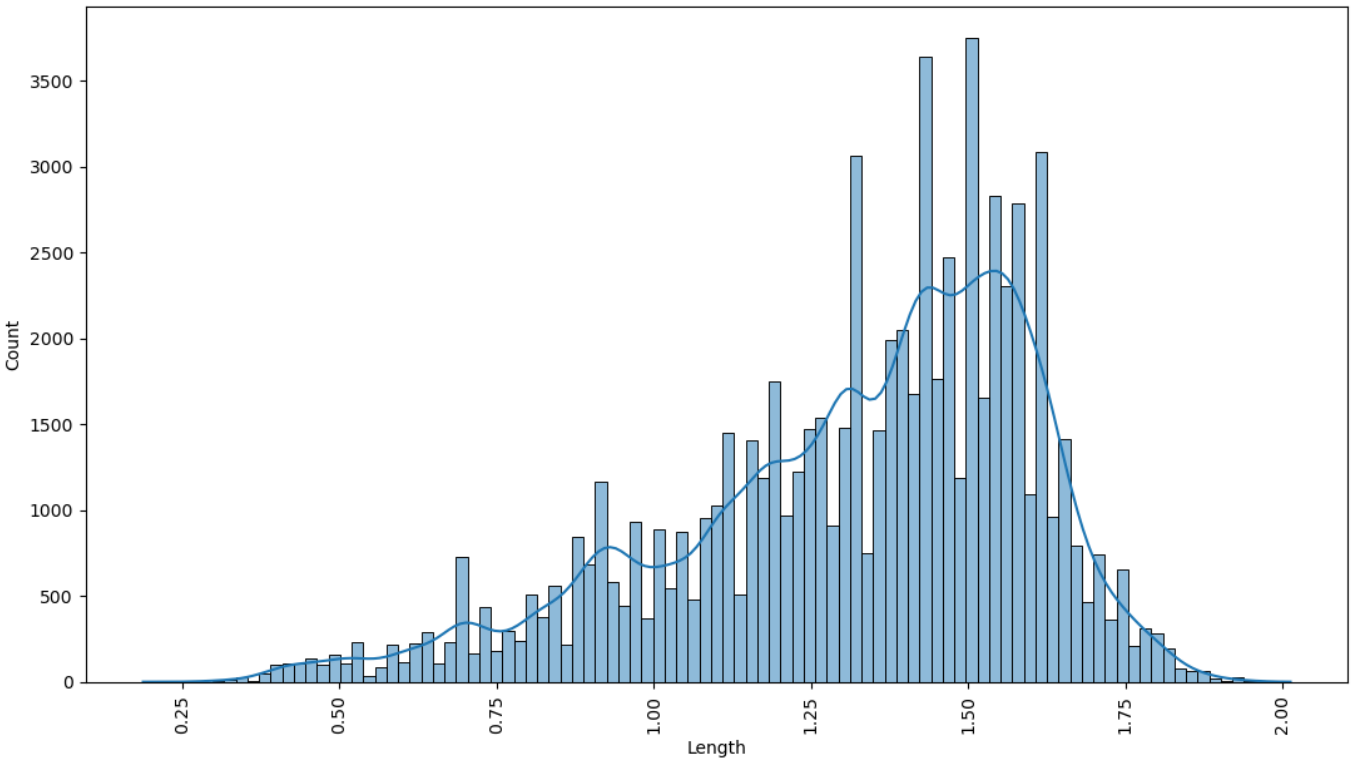
In [11]:
```
df.hist(bins=50, figsize=(20,15))
plt.show()
```

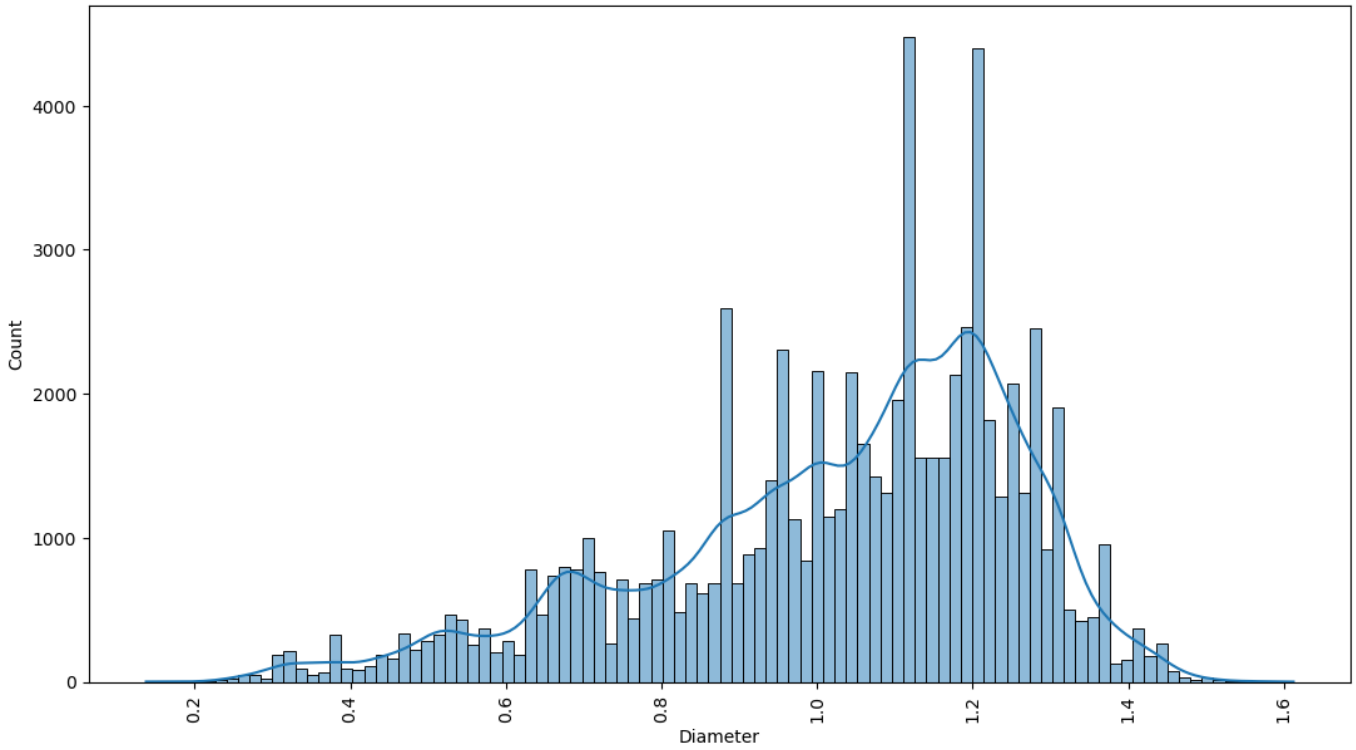


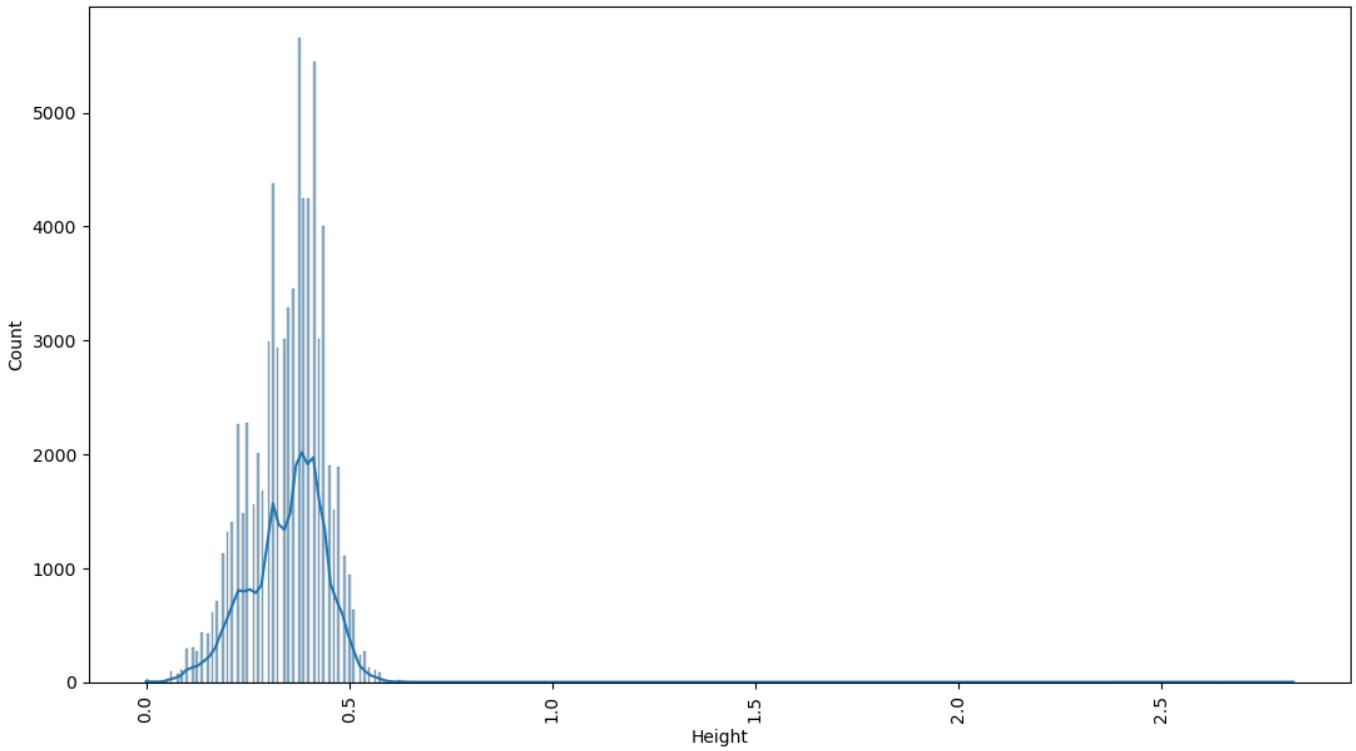
In [12]:
```
for i in df.columns:
    plt.figure(figsize=(13,7))
```

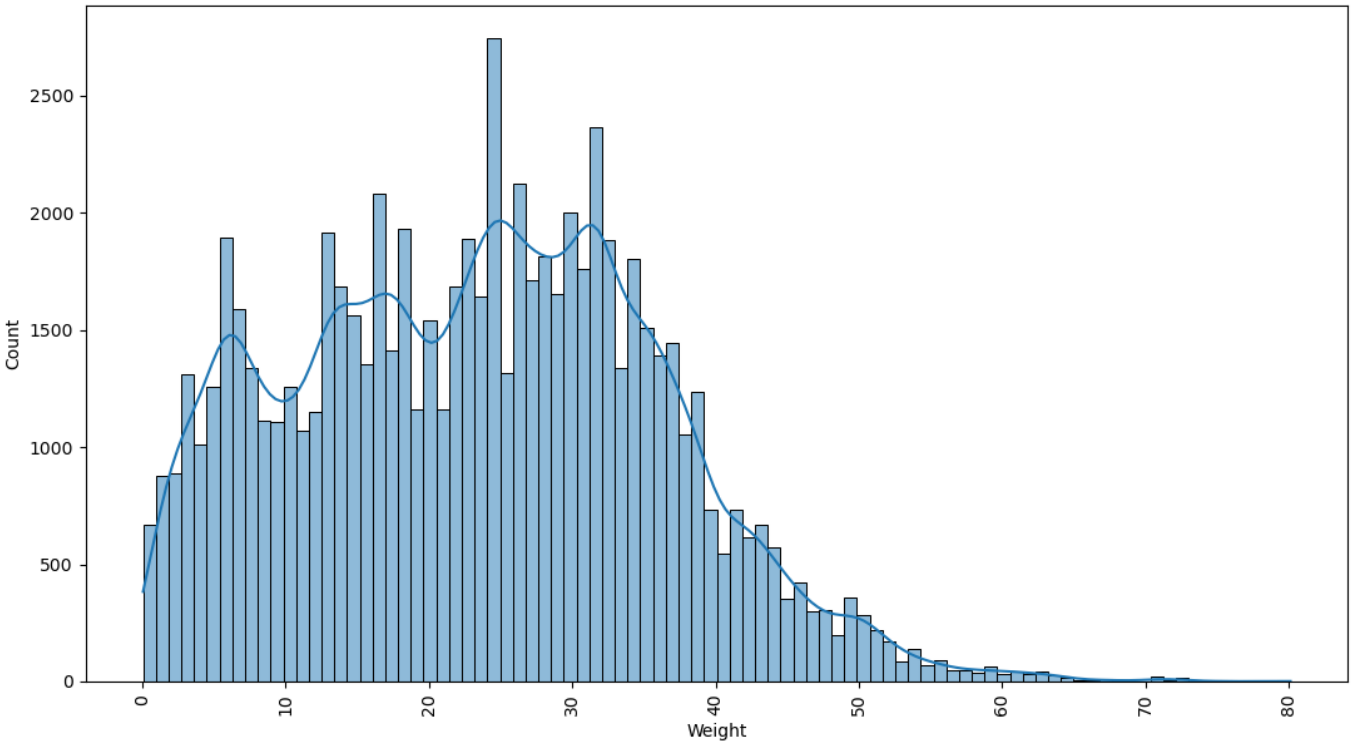
```
    sns.histplot(data = df[i], kde=True, multiple='stack')
    plt.xticks(rotation=90)
    plt.show()
```

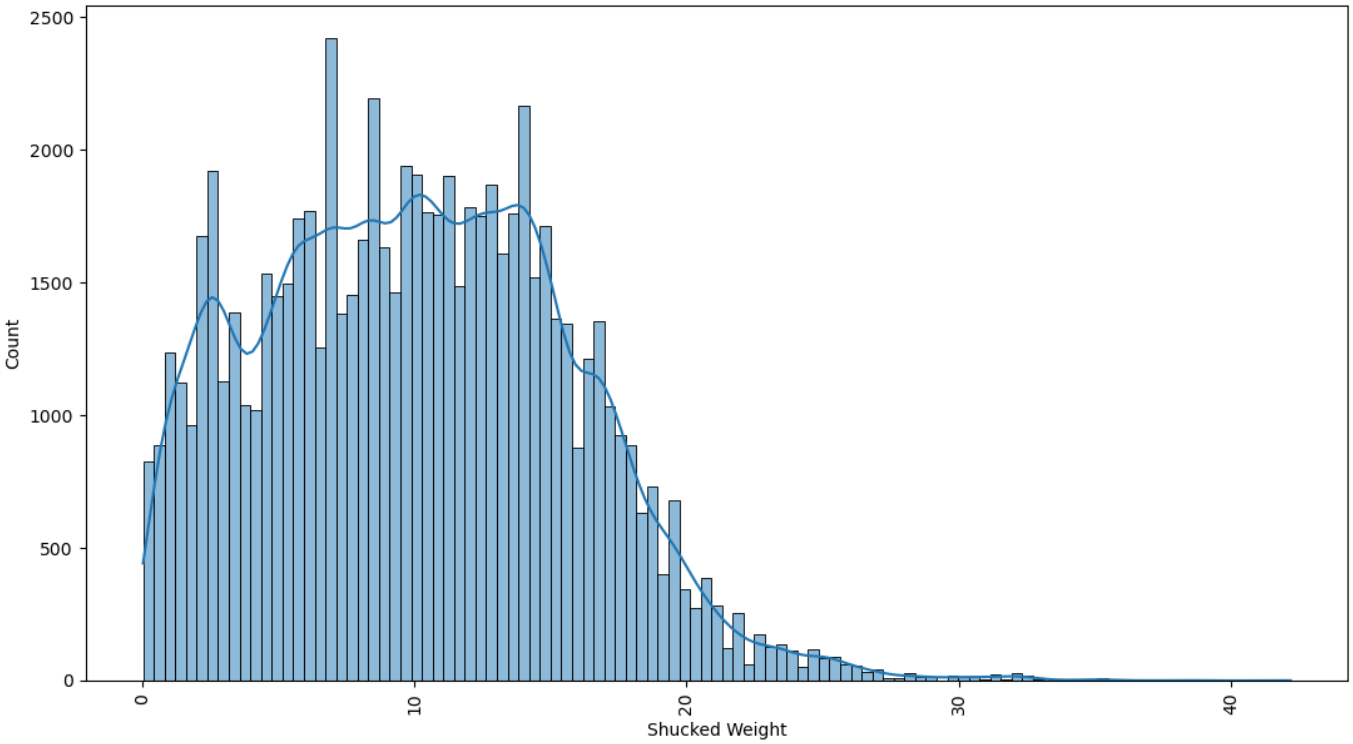


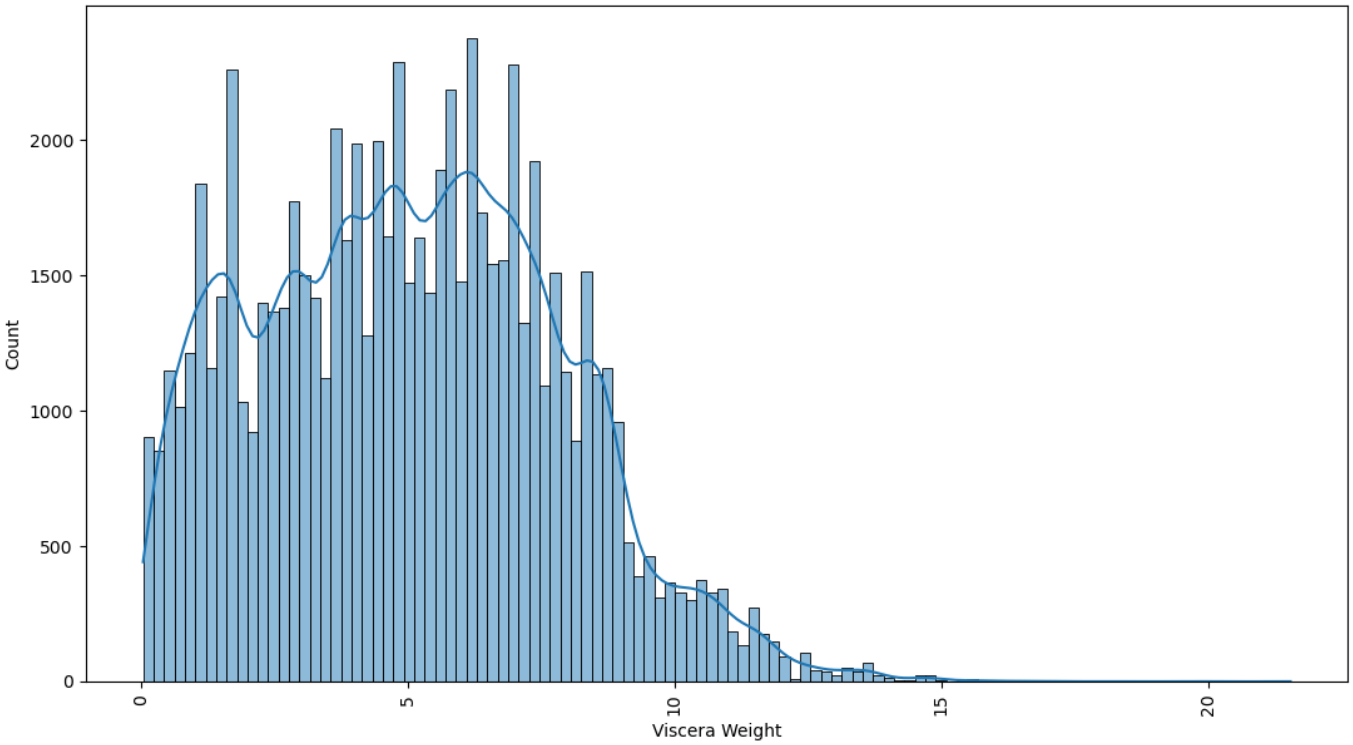


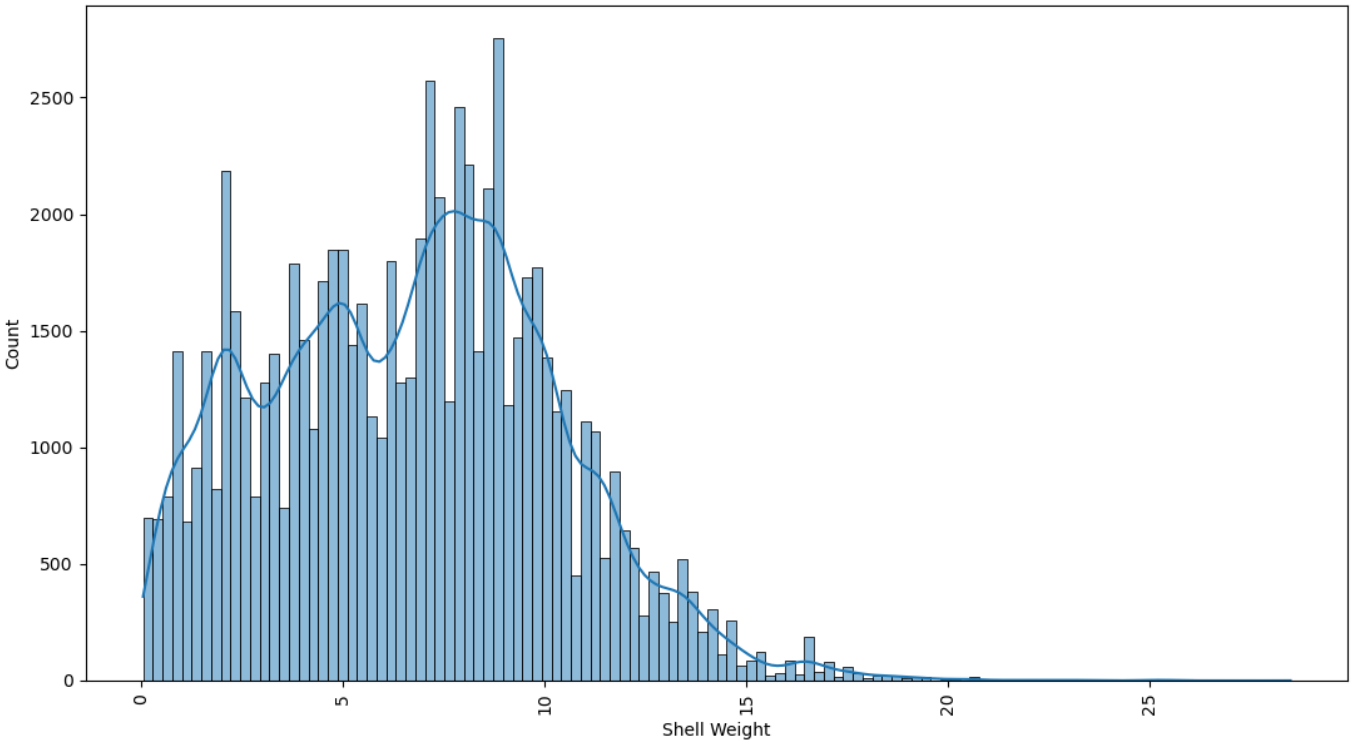

Count
4000
3000
2000
1000
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
Diameter

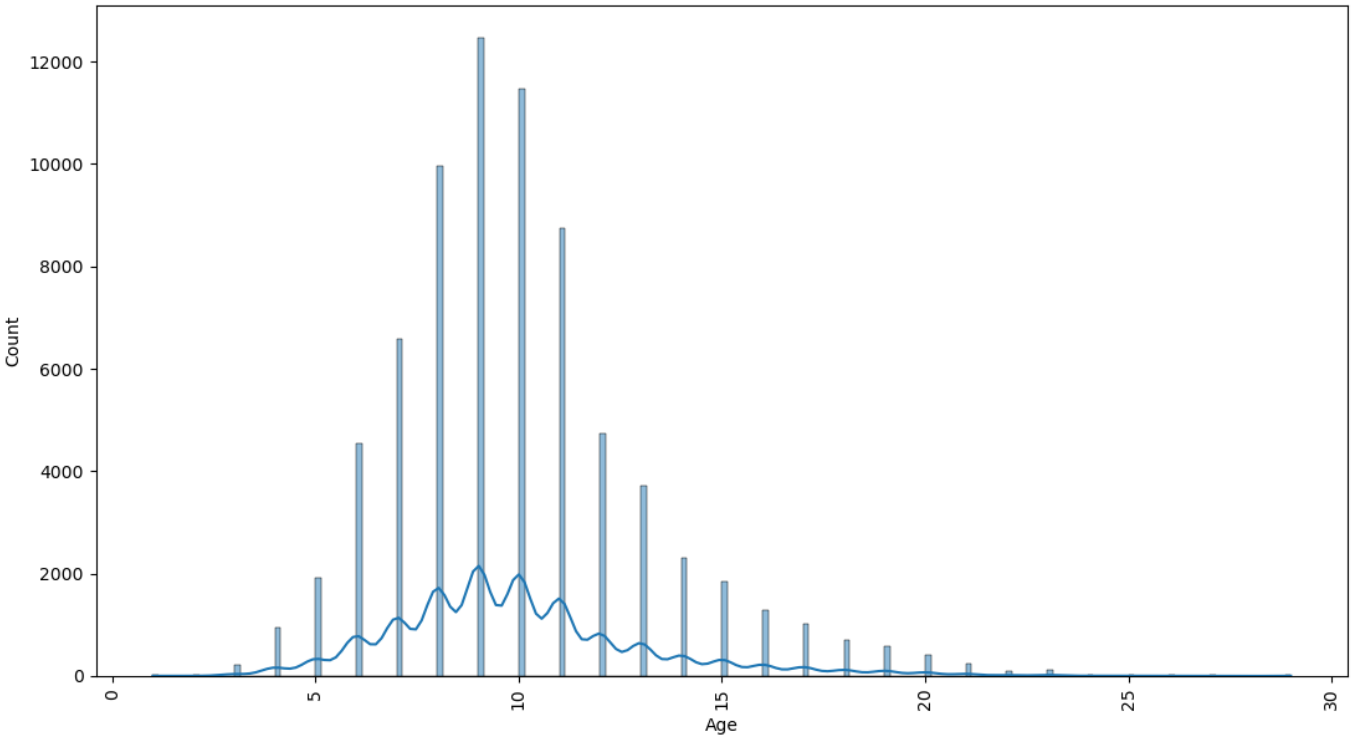

Count
5000
4000
3000
2000
1000
0
0.0
0.5
1.0
1.5
2.0
2.5
Height


Count
2500
2000
1500
1000
500
0
0
10
20
30
40
50
60
70
80
Weight

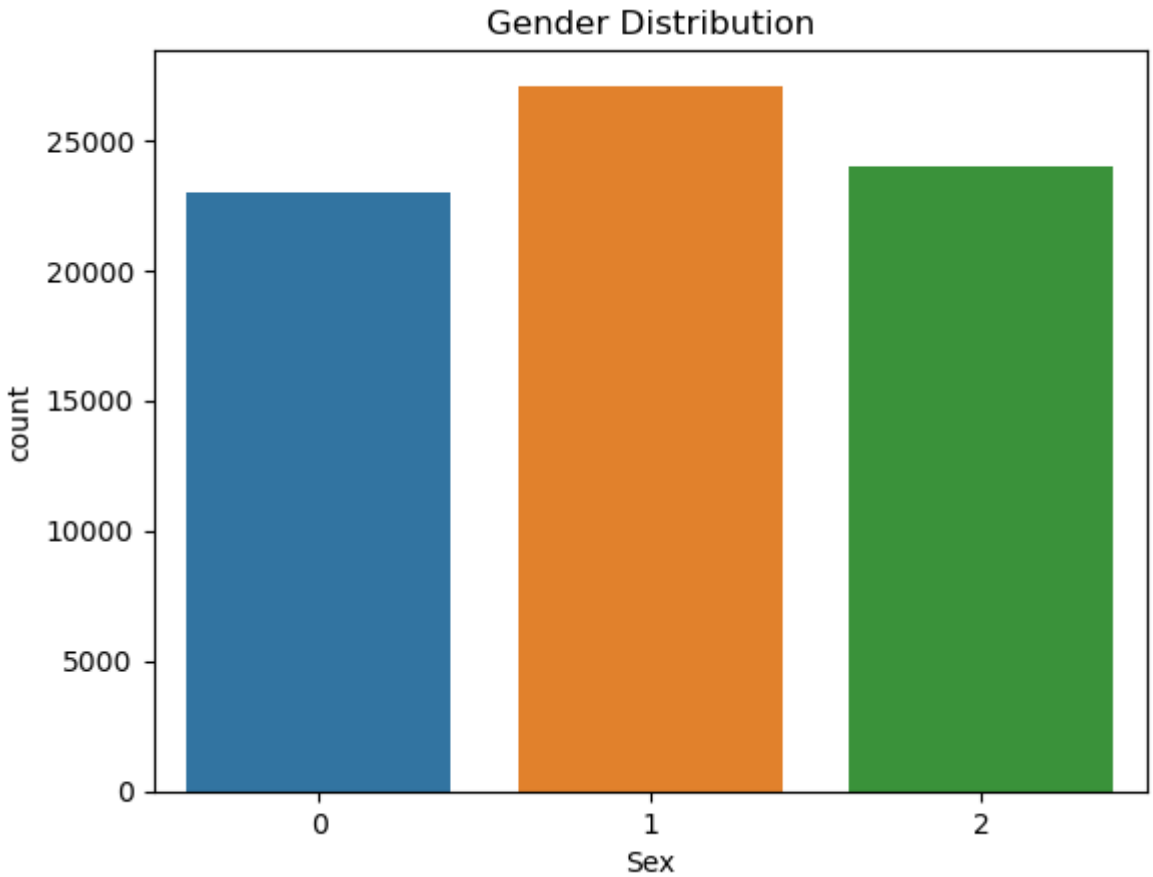

Count
2500
2000
1500
1000
500
0
0
10
20
30
40
Shucked Weight


Count
2000
1500
1000
500
0
0
5
10
15
20
Viscera Weight

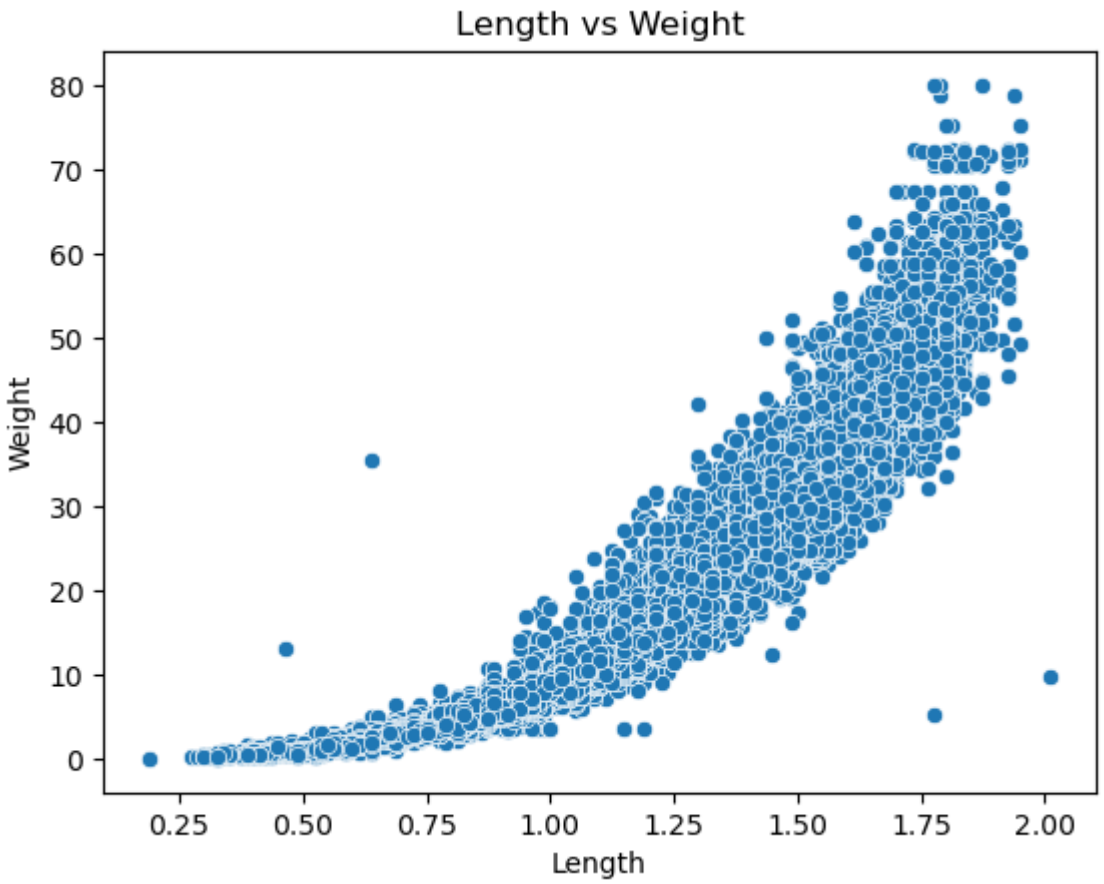

Count
2500
2000
1500
1000
500
0
0
5
10
15
20
25
Shell Weight



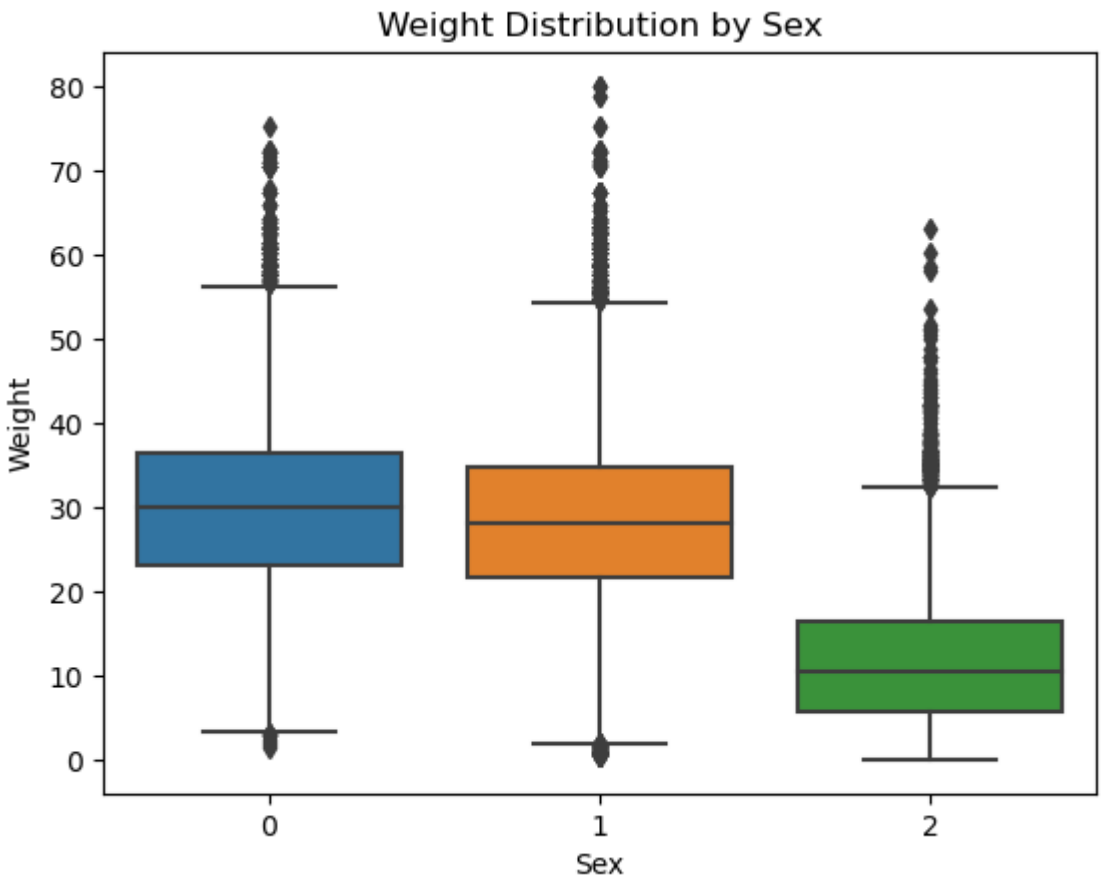
In [13]:
```
# Bar plot for gender
sns.countplot(x='Sex', data=df)
plt.title('Gender Distribution')
plt.show()
```



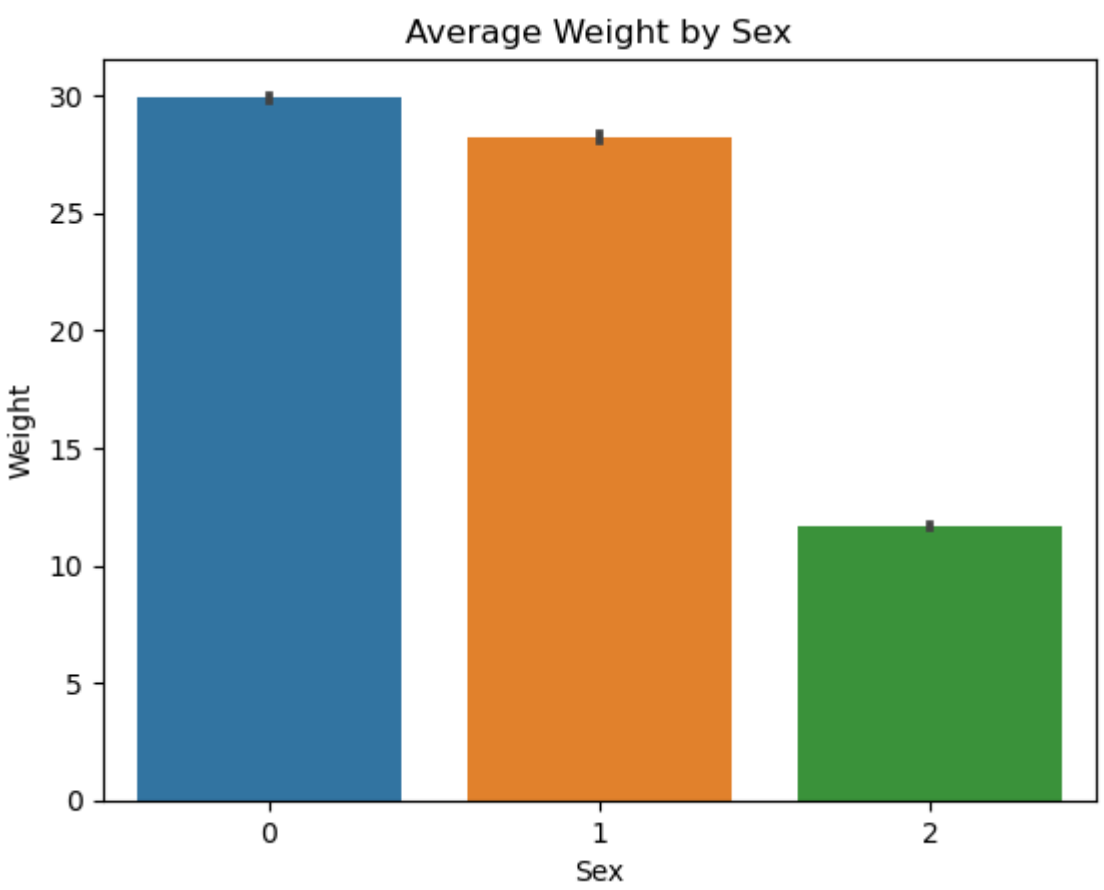
In [14]:
```
#Scatter plot between Length and Weight
sns.scatterplot(x='Length', y='Weight', data=df)
plt.title('Length vs Weight')
plt.show()
```



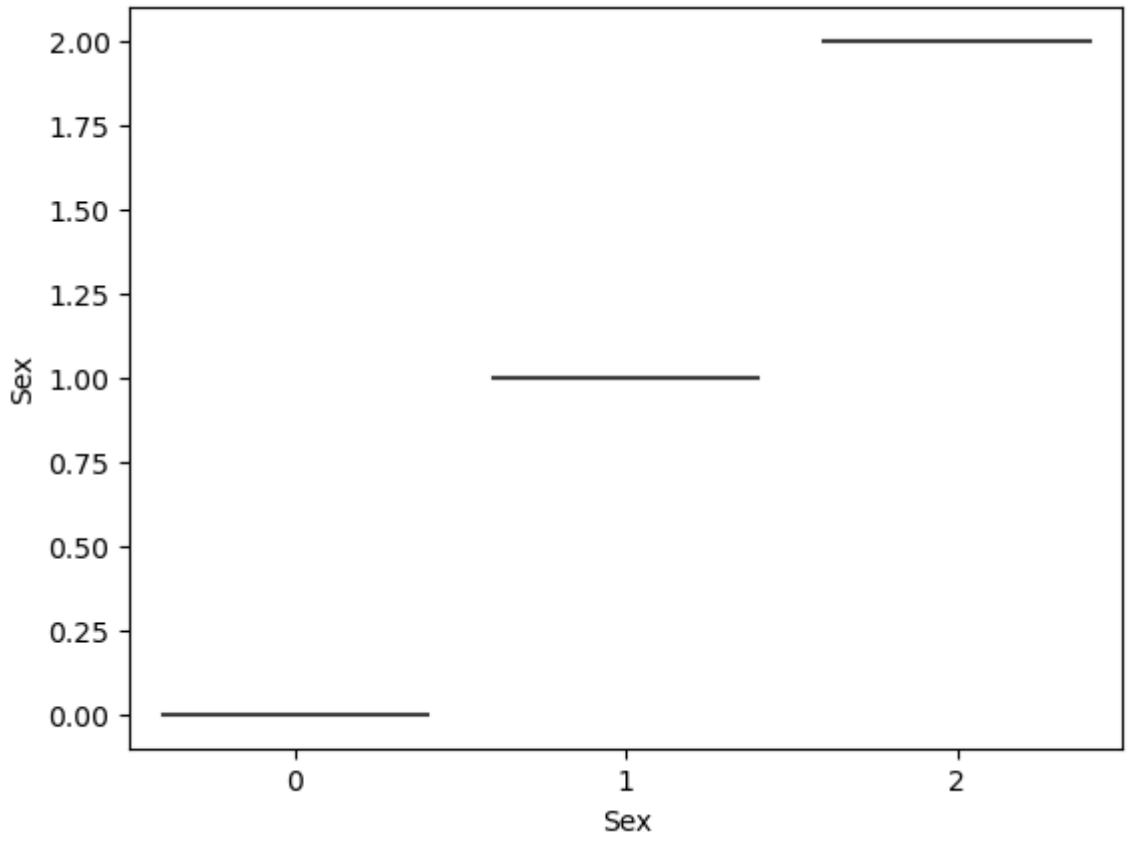
In [15]:
```
#Box plot of Weight by Sex
sns.boxplot(x='Sex', y='Weight', data=df)
plt.title('Weight Distribution by Sex')
plt.show()
```

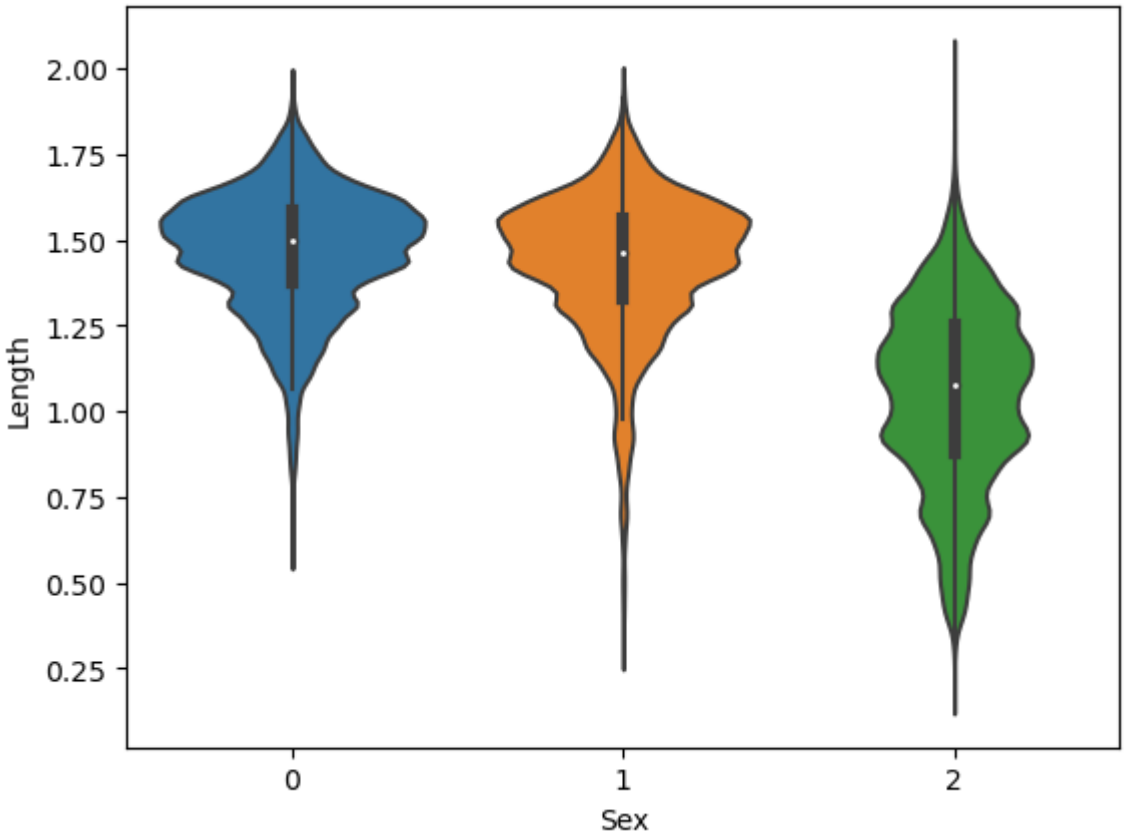


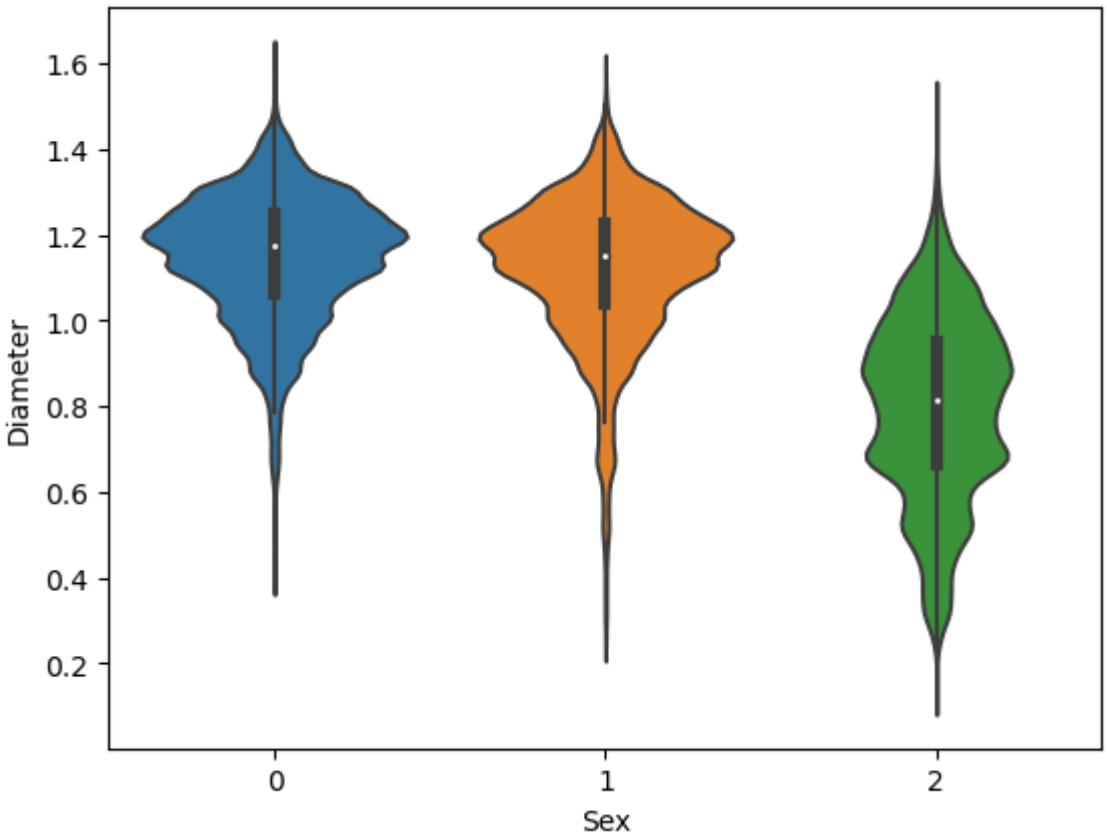
In [16]:
```
#Box plot of Weight by Sex
sns.barplot(x='Sex', y='Weight', data=df, estimator=np.mean)
plt.title('Average Weight by Sex')
plt.show()
```

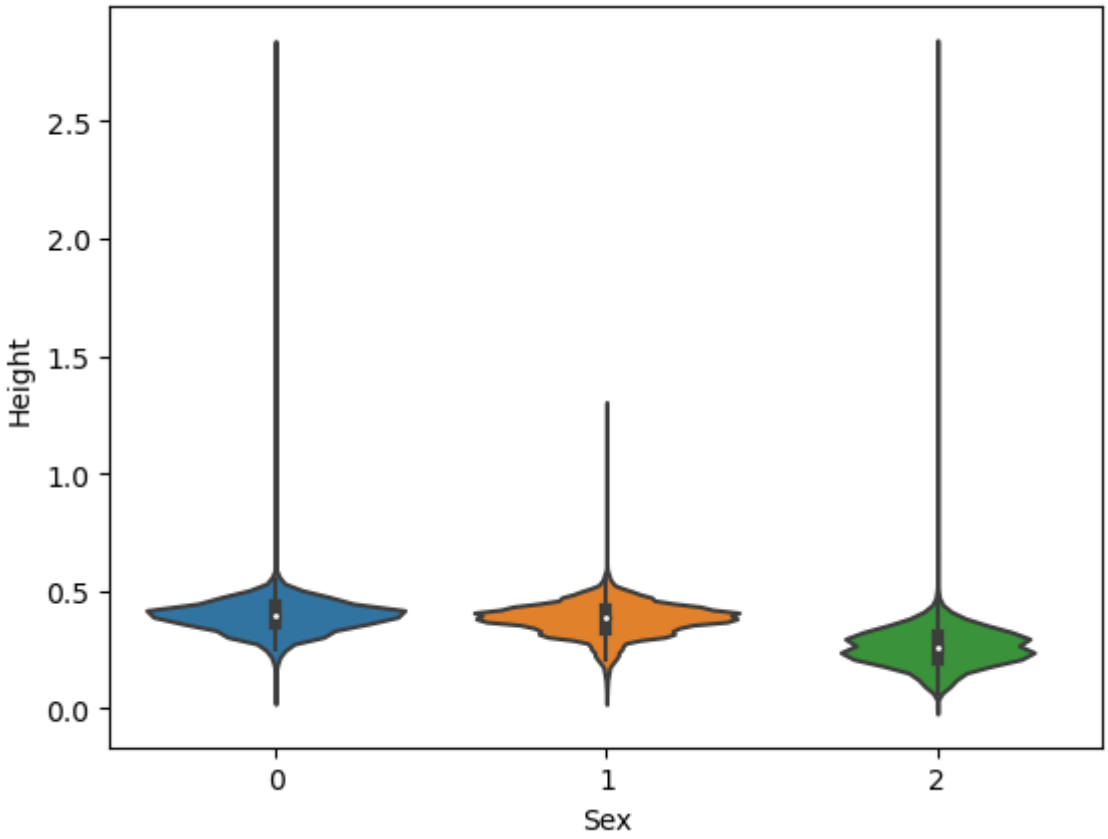


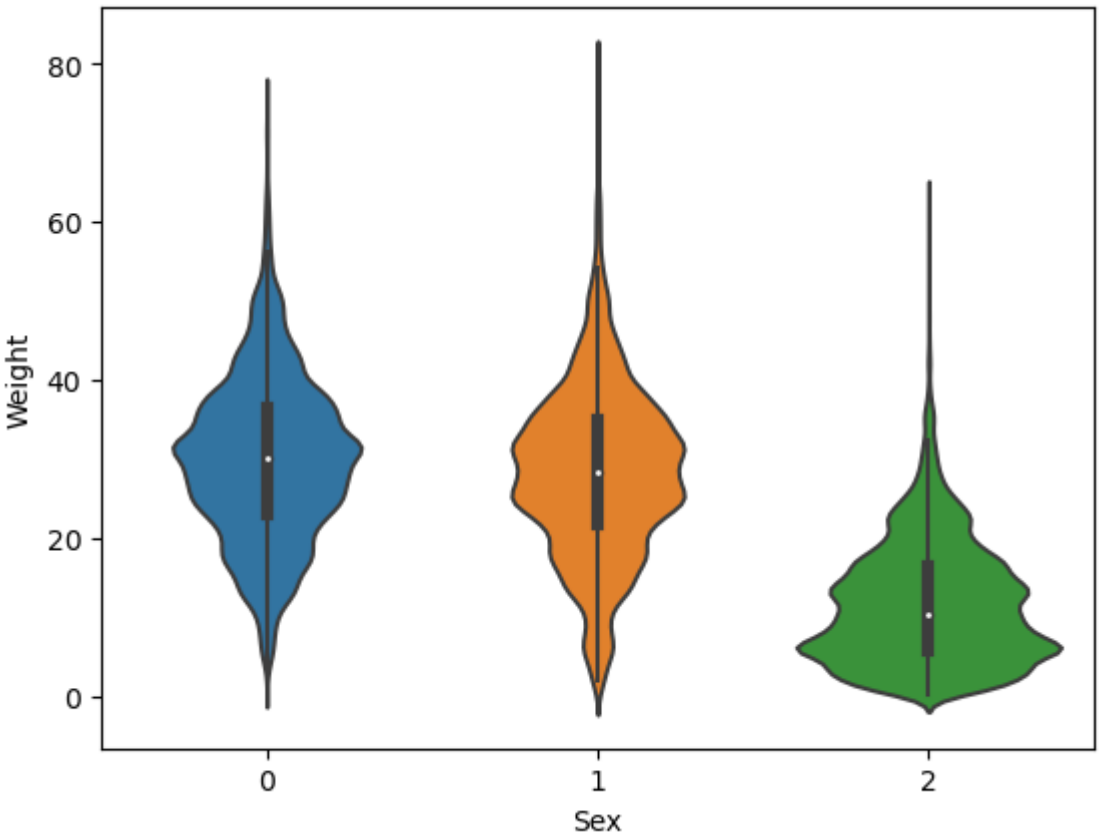
In [17]:
```
for column in df.select_dtypes(include=[np.number]).columns:
    sns.violinplot(x='Sex', y=column, data=df)
    plt.show()
```

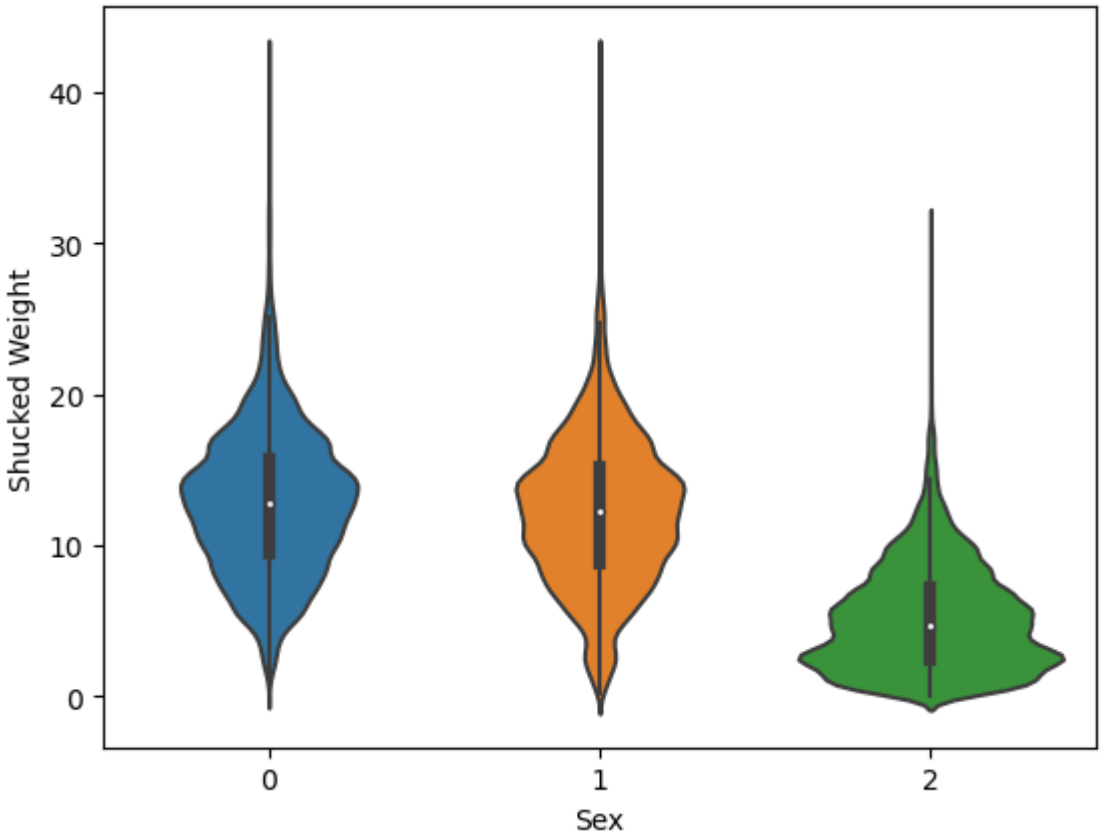


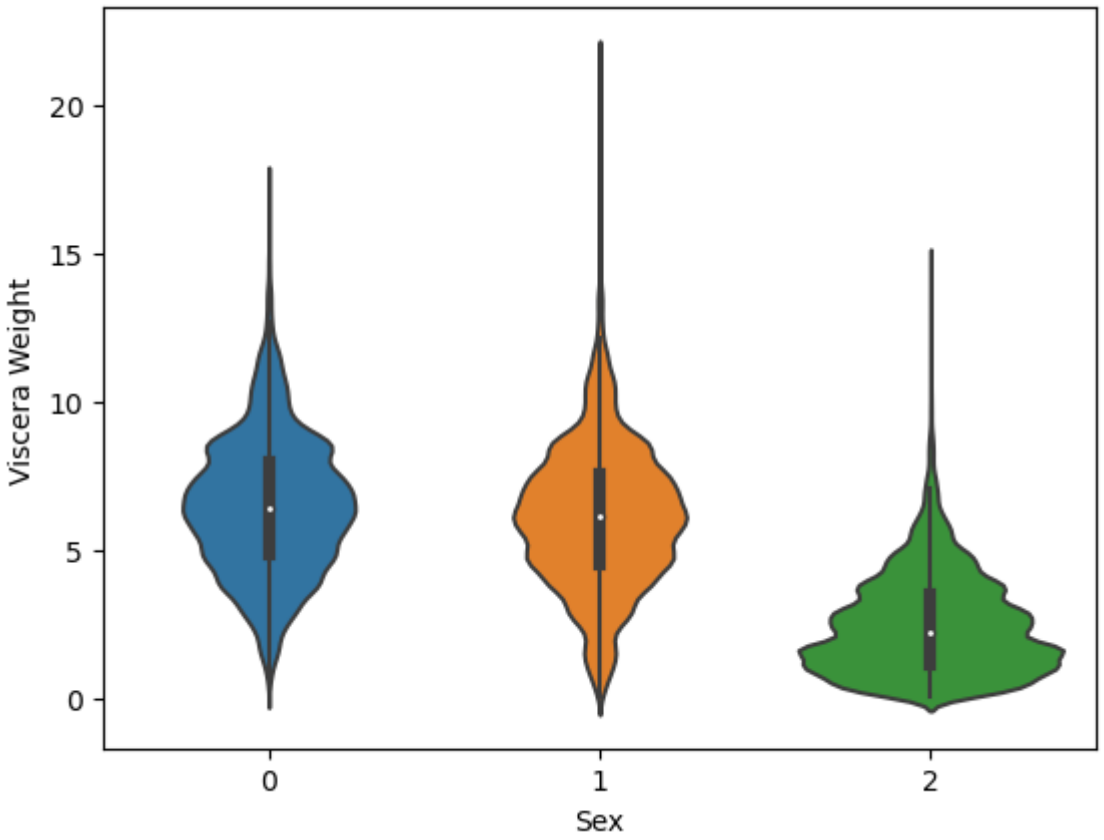

2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
Length
0
1
2
Sex

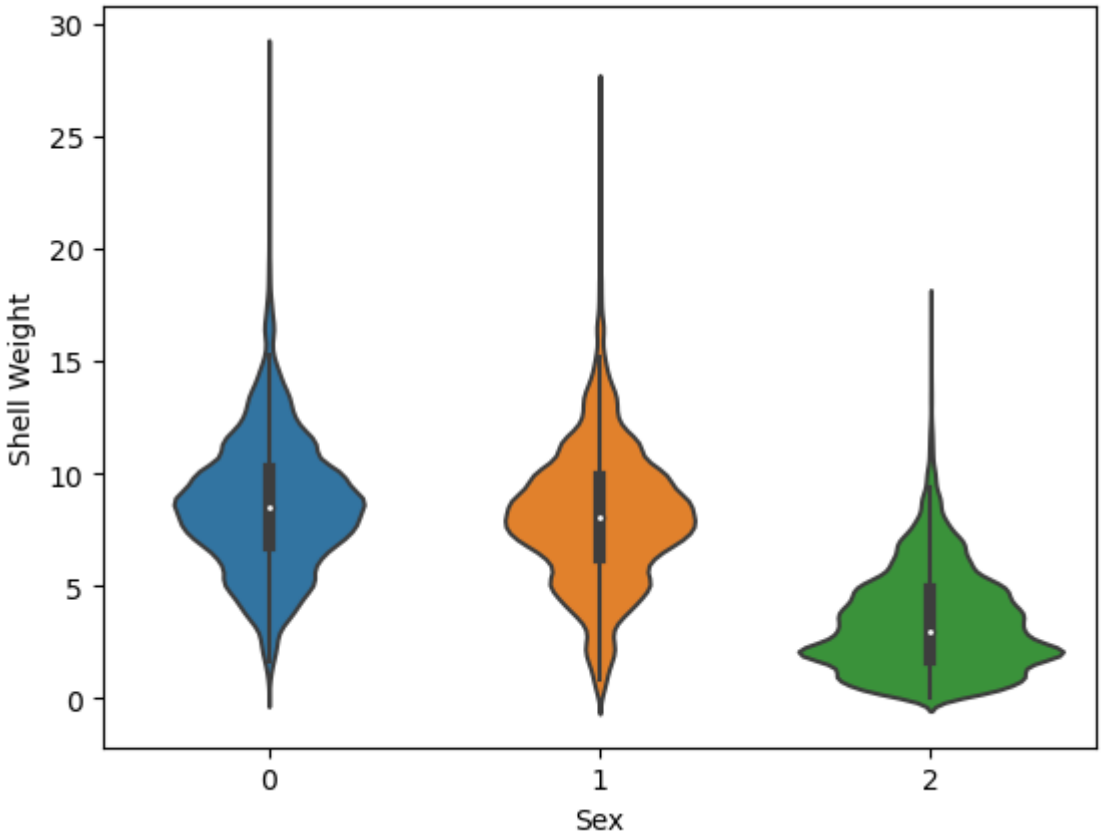

1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
Diameter
0
1
2
Sex

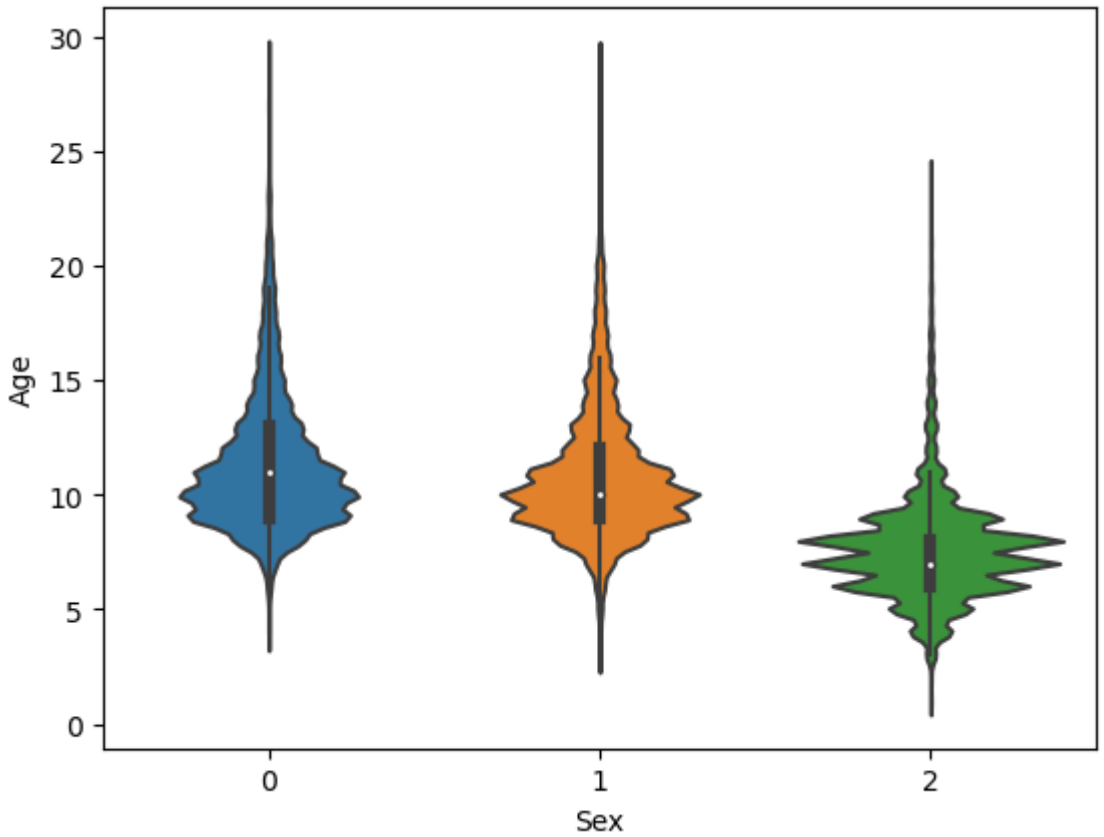

Height
2.5
2.0
1.5
1.0
0.5
0.0
0
1
2
Sex


Weight
80
60
40
20
0
0
1
2
Sex

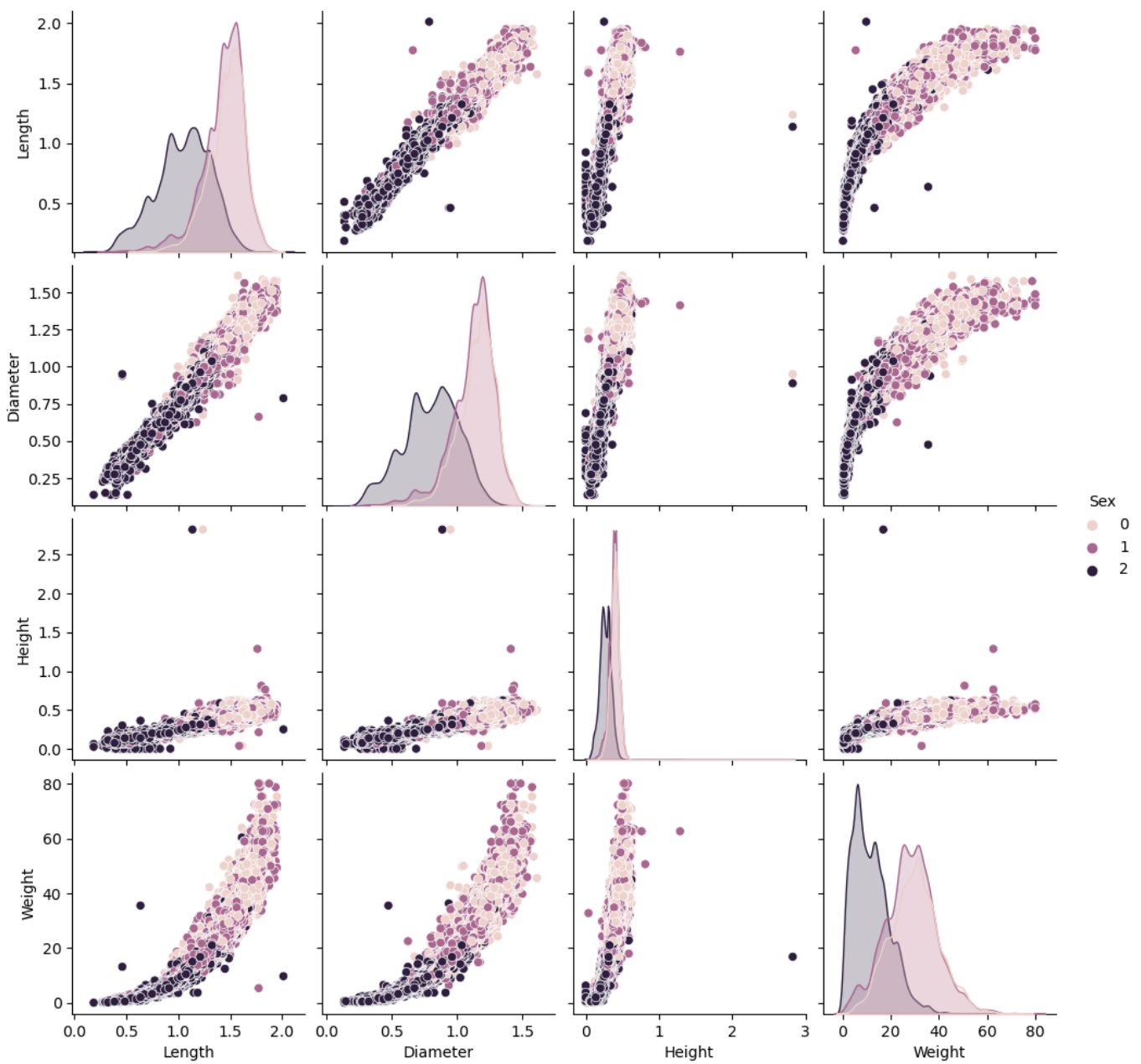

Shucked Weight
40
30
20
10
0
0
1
2
Sex


Viscera Weight
20
15
10
5
0
0
1
2
Sex



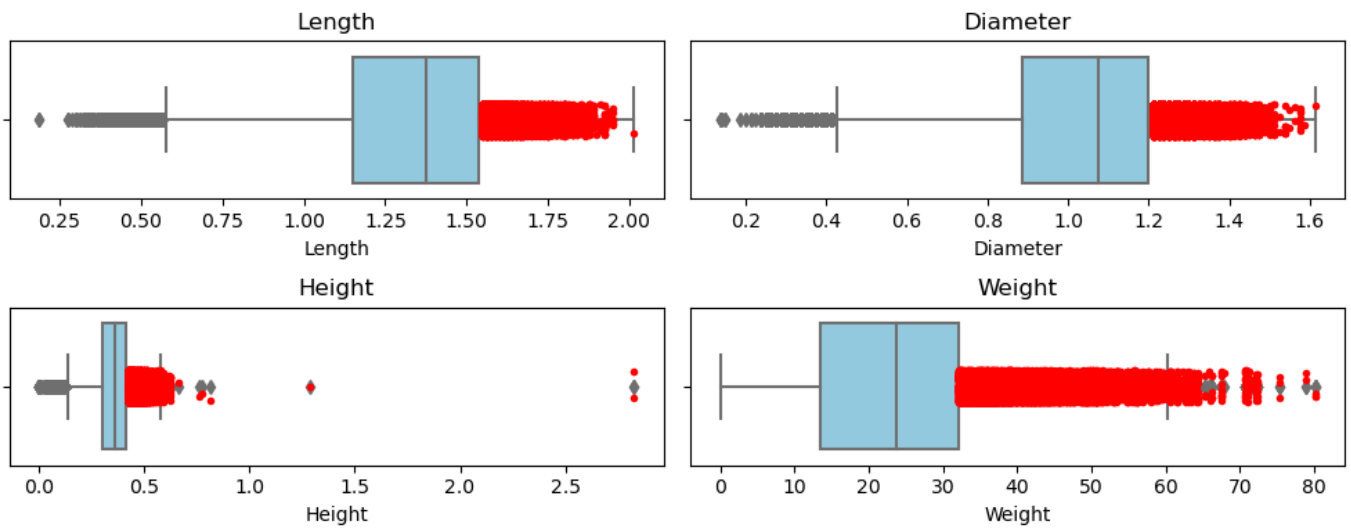


In [18]:
```
sns.pairplot(df, vars=["Length", "Diameter", "Height", "Weight"], hue="Sex")
plt.show()
```

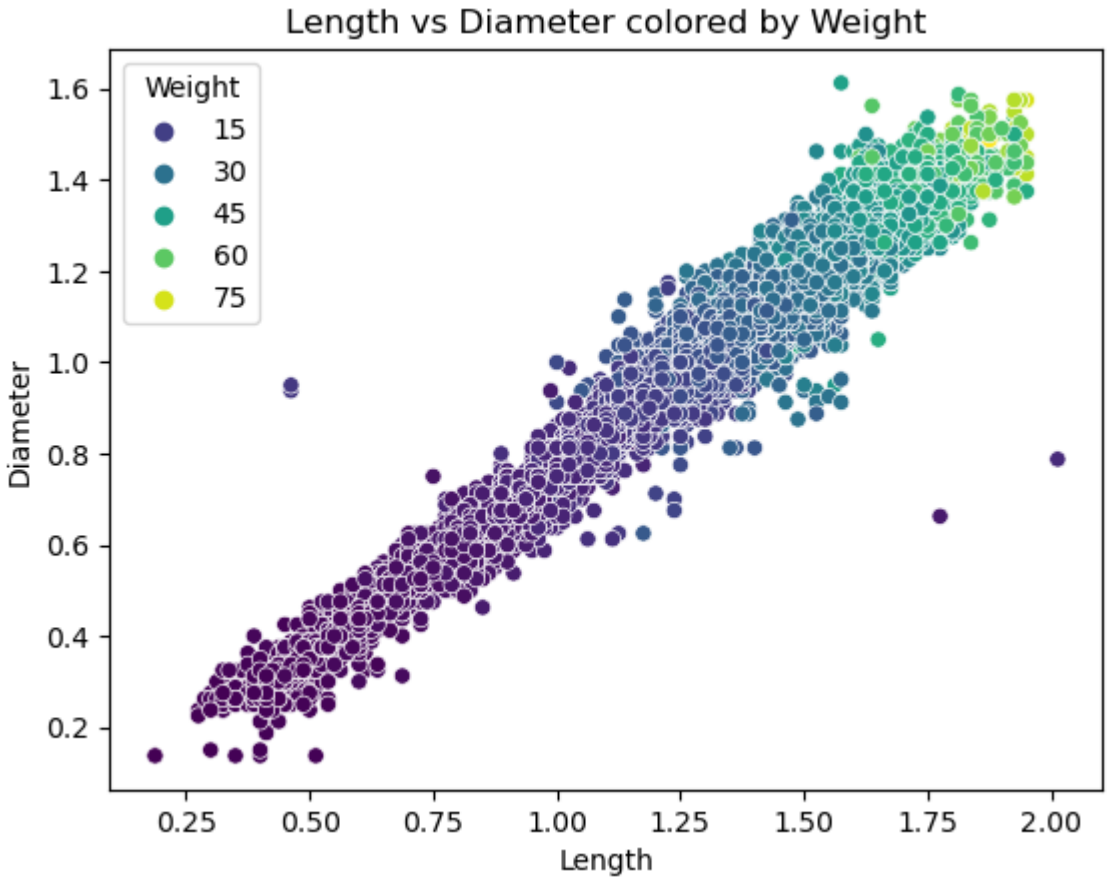


In [19]:

```
col=["Length", "Diameter", "Height", "Weight"]

fig, axs = plt.subplots(ncols=2, nrows=2, figsize=(10, 4))
axs = axs.flatten()

for i, col_name in enumerate(col):
    sns.boxplot(x=df[col_name], ax=axs[i], color='skyblue')
    sns.stripplot(x=df[col_name][df[col_name] > df[col_name].quantile(0.75)], ax=axs[
    axs[i].set_title(col_name)
    if i == len(col)-1:
        break

fig.tight_layout()

# Show the plot
plt.show()
```

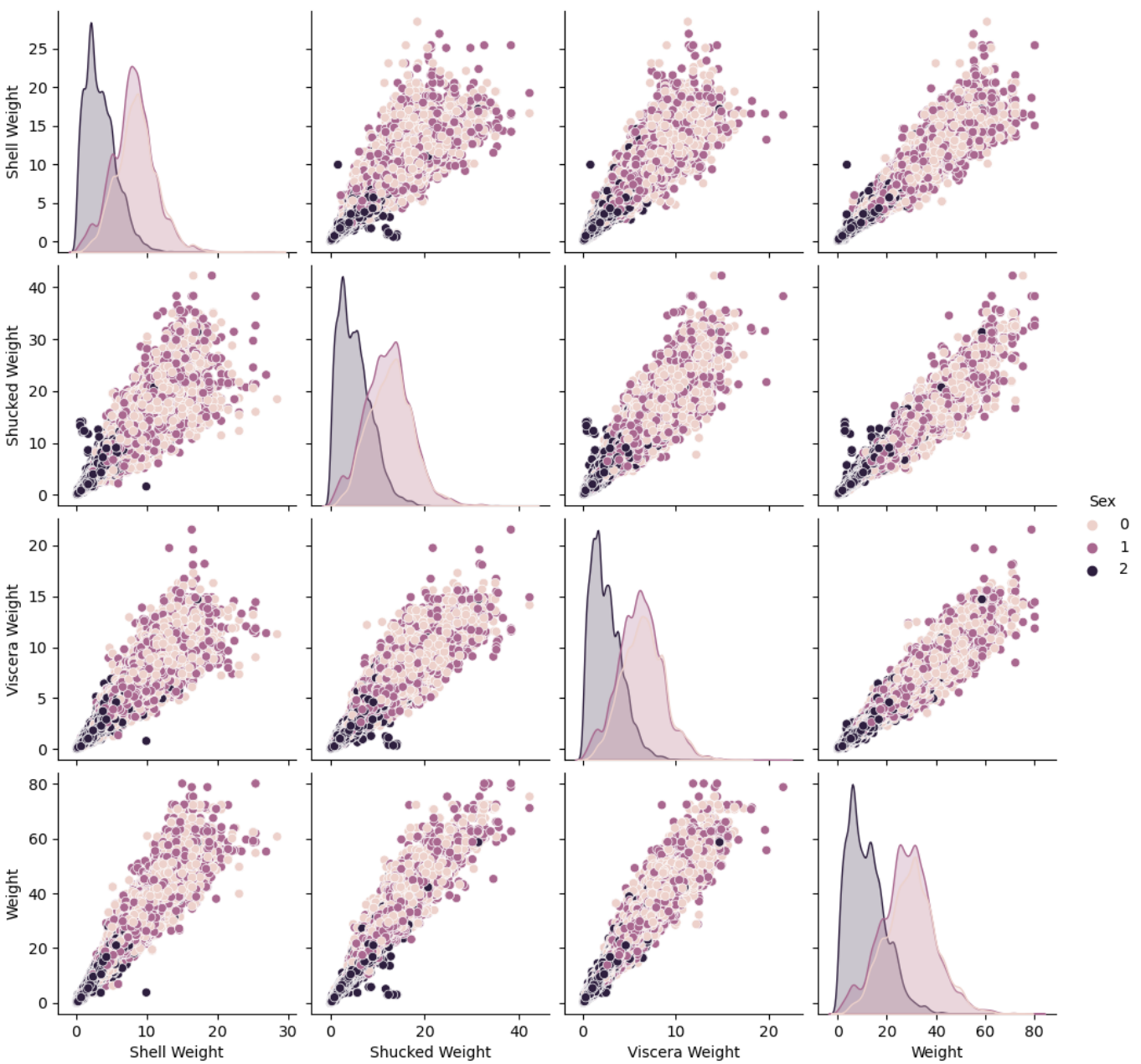


In [20]:
```
sns.scatterplot(x='Length', y='Diameter', hue='Weight', data=df, palette='viridis')
plt.title('Length vs Diameter colored by Weight')
plt.show()
```



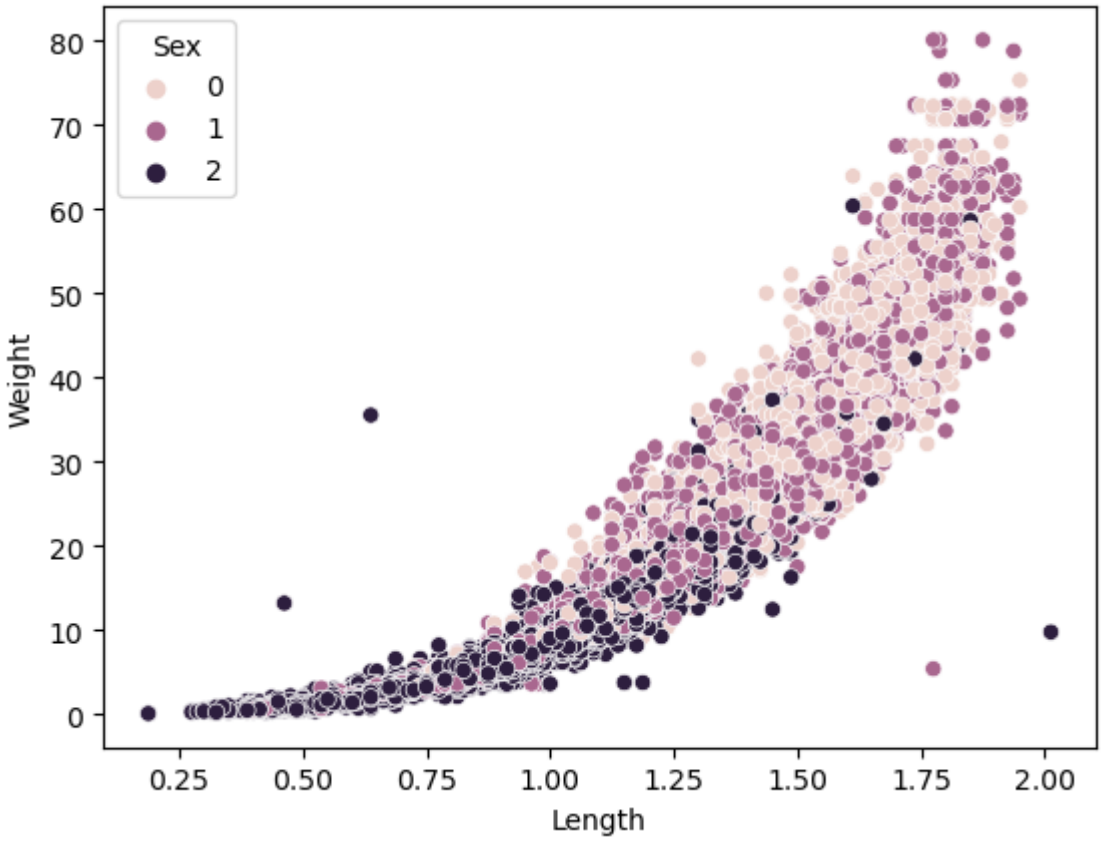
In [21]:
```
sns.pairplot(df, vars=["Shell Weight", "Shucked Weight", "Viscera Weight", "Weight"],
```

Out[21]:
```
<seaborn.axisgrid.PairGrid at 0x7d7ef4886d10>
```



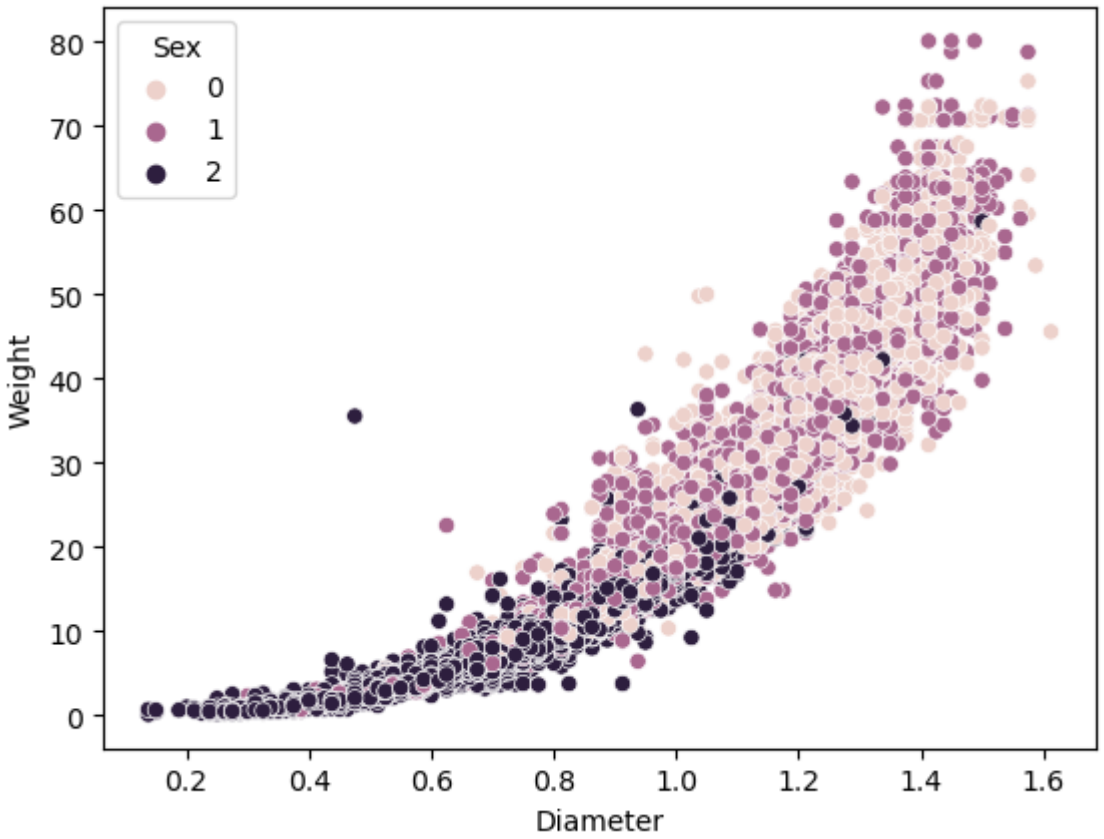
In [22]:
```
sns.scatterplot(x='Length', y='Weight', hue='Sex', data=df)
```

Out[22]: <Axes: xlabel='Length', ylabel='Weight'>



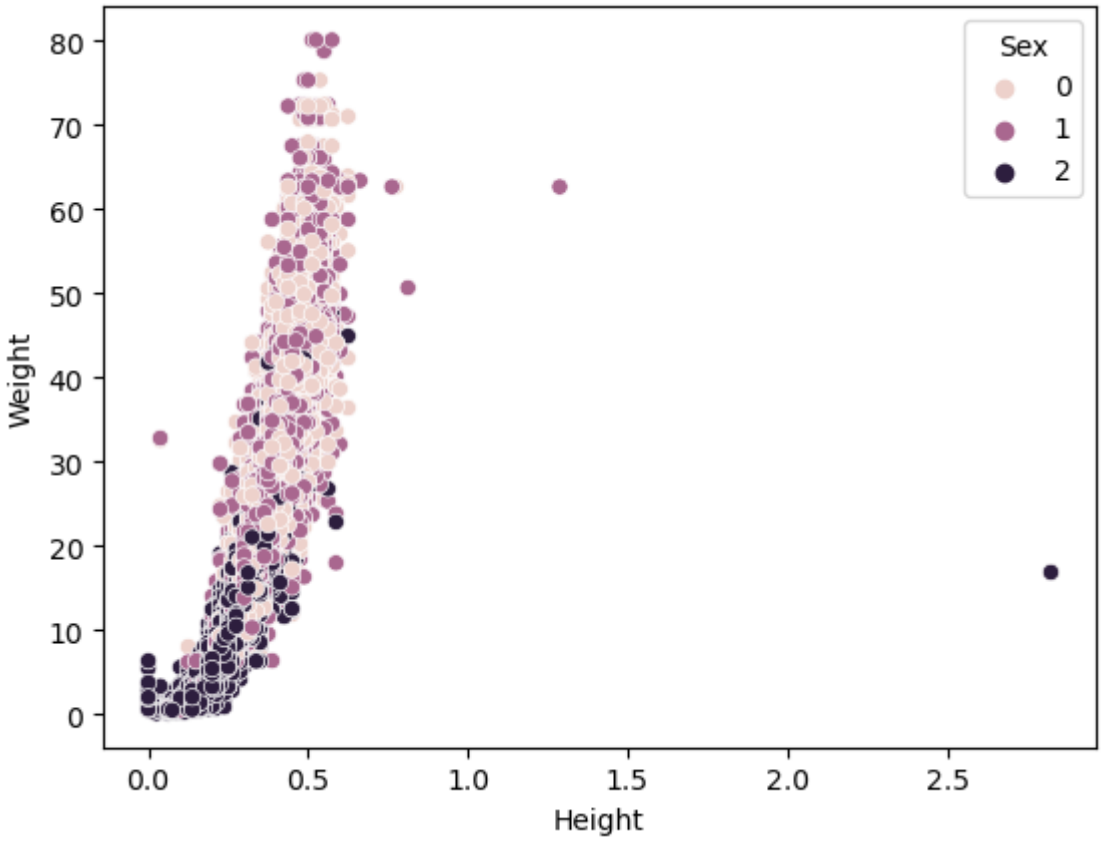
In [23]:
```
sns.scatterplot(x='Diameter', y='Weight', hue='Sex', data=df)
```

Out[23]: <Axes: xlabel='Diameter', ylabel='Weight'>



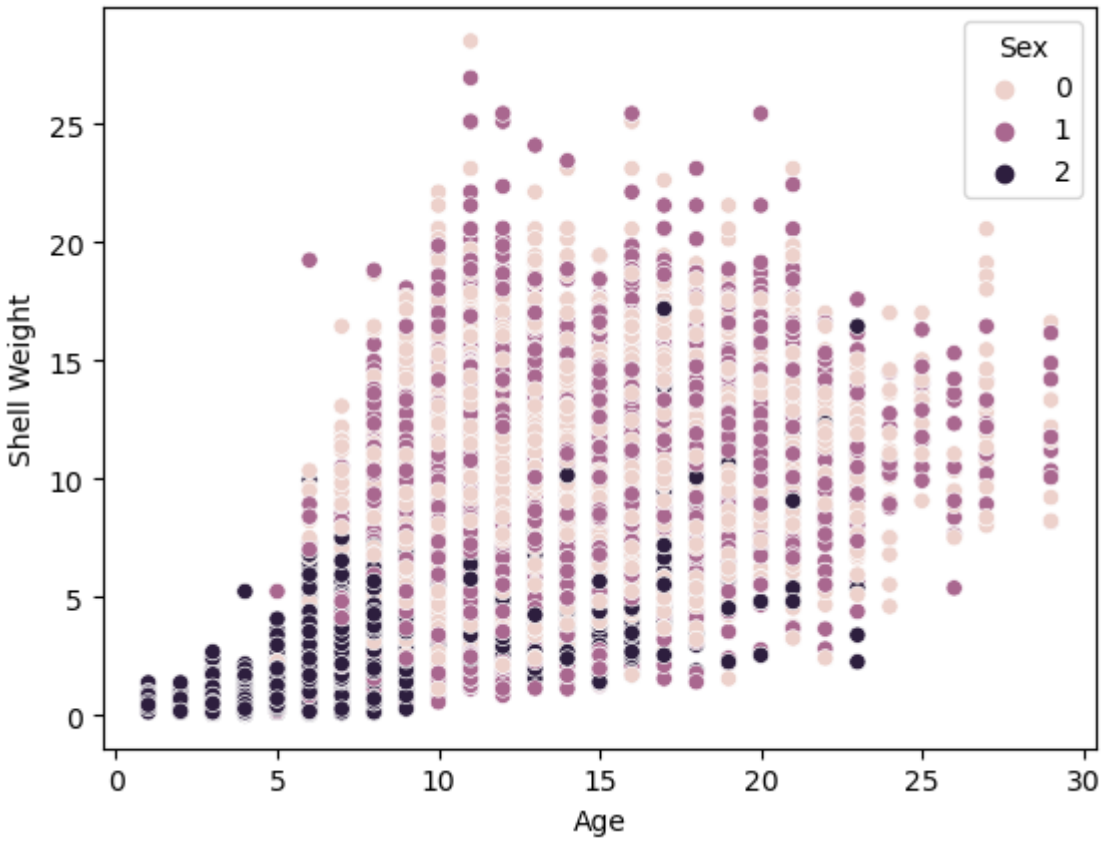
In [24]:
```
sns.scatterplot(x='Height', y='Weight', hue='Sex', data=df)
```

Out[24]: <Axes: xlabel='Height', ylabel='Weight'>



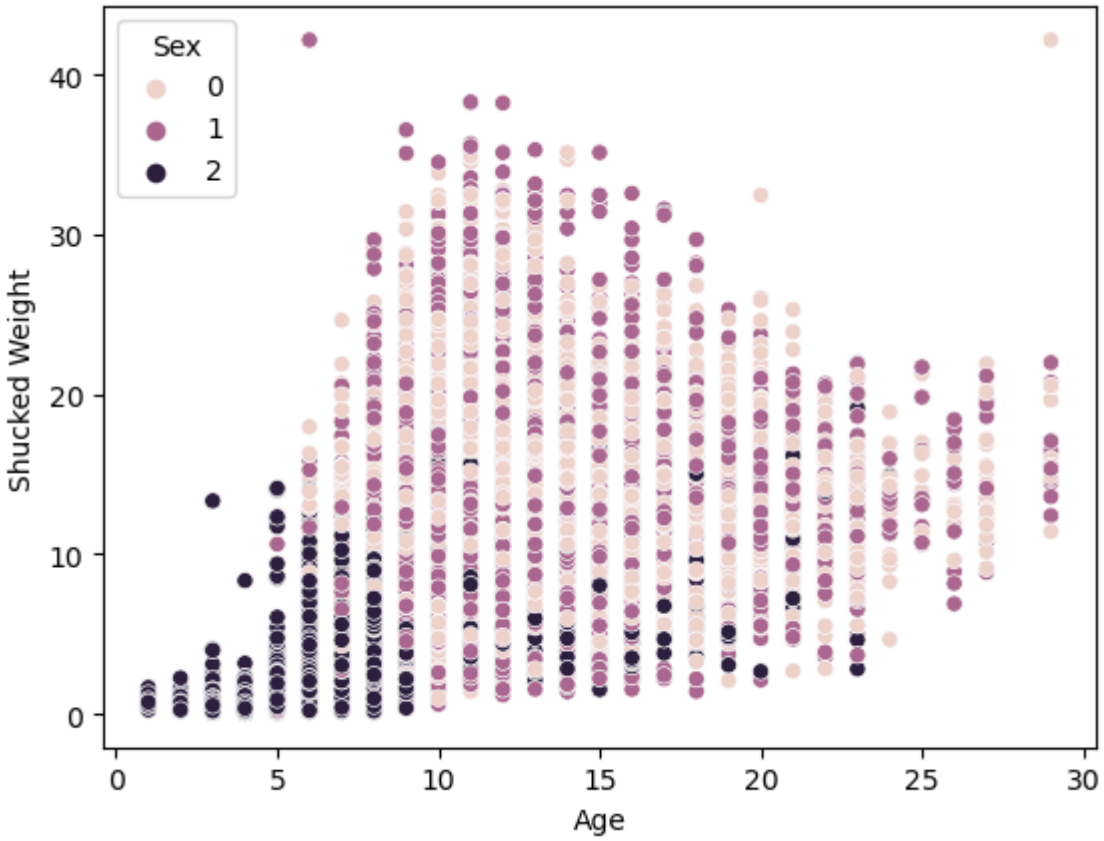
In [25]:
```
sns.scatterplot(x='Age', y='Shell Weight', hue='Sex', data=df)
```

Out[25]: <Axes: xlabel='Age', ylabel='Shell Weight'>



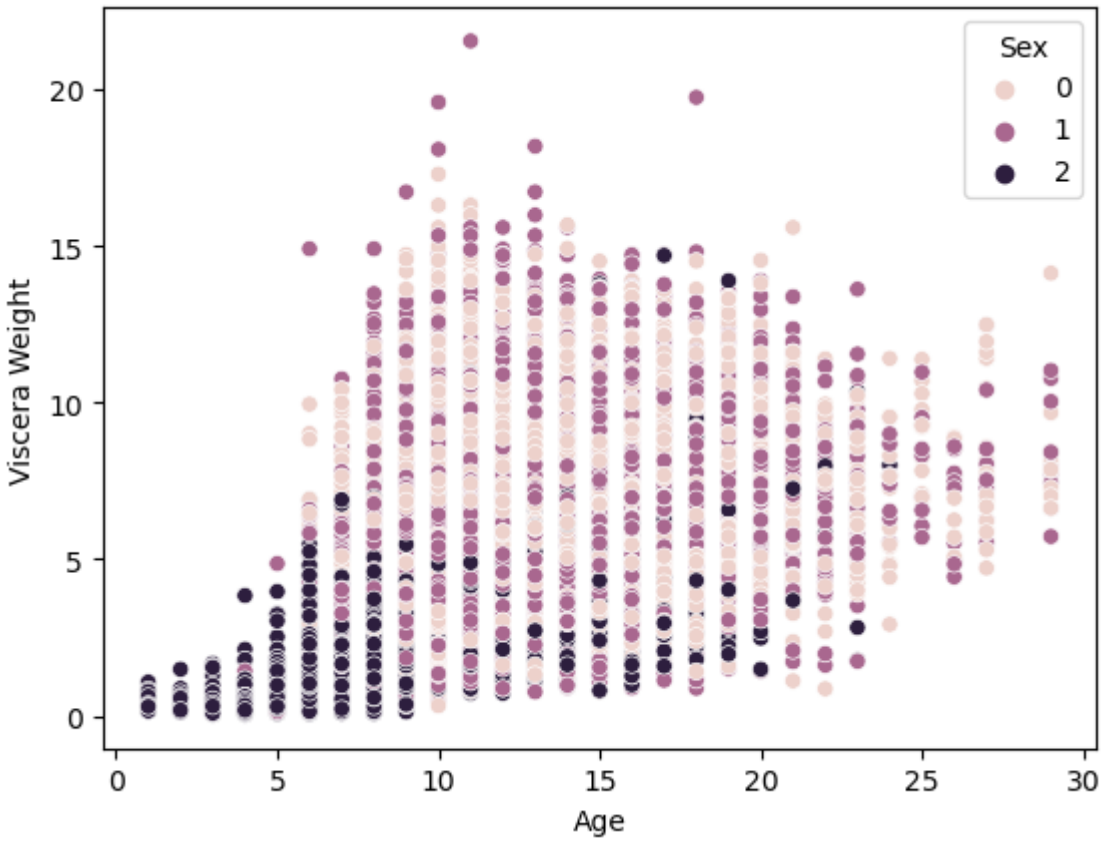
In [26]:
```
sns.scatterplot(x='Age', y='Shucked Weight', hue='Sex', data=df)
```

Out[26]: <Axes: xlabel='Age', ylabel='Shucked Weight'>



In [27]:
```
sns.scatterplot(x='Age', y='Viscera Weight', hue='Sex', data=df)
```

Out[27]: <Axes: xlabel='Age', ylabel='Viscera Weight'>



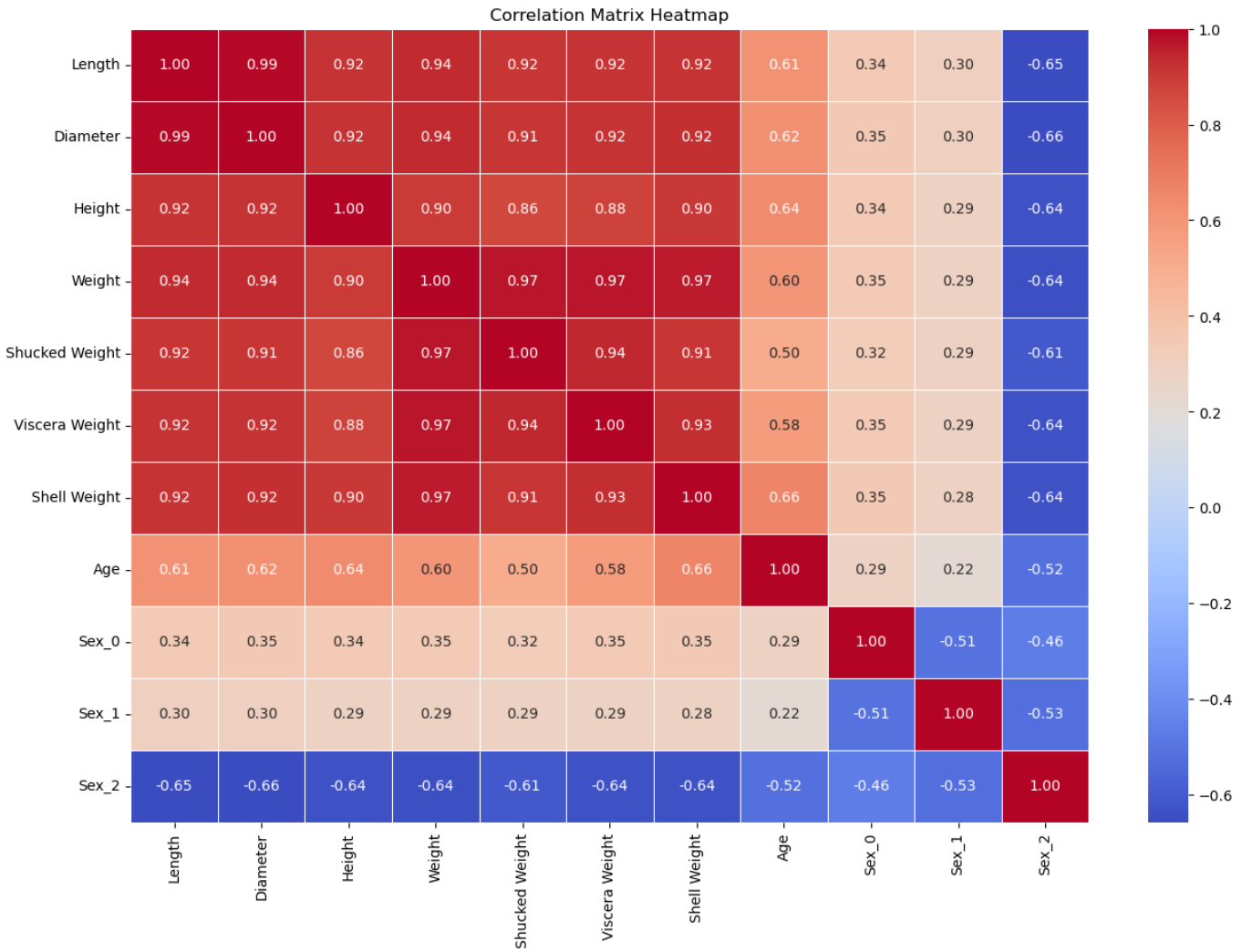
CORRELATION ANALYSIS

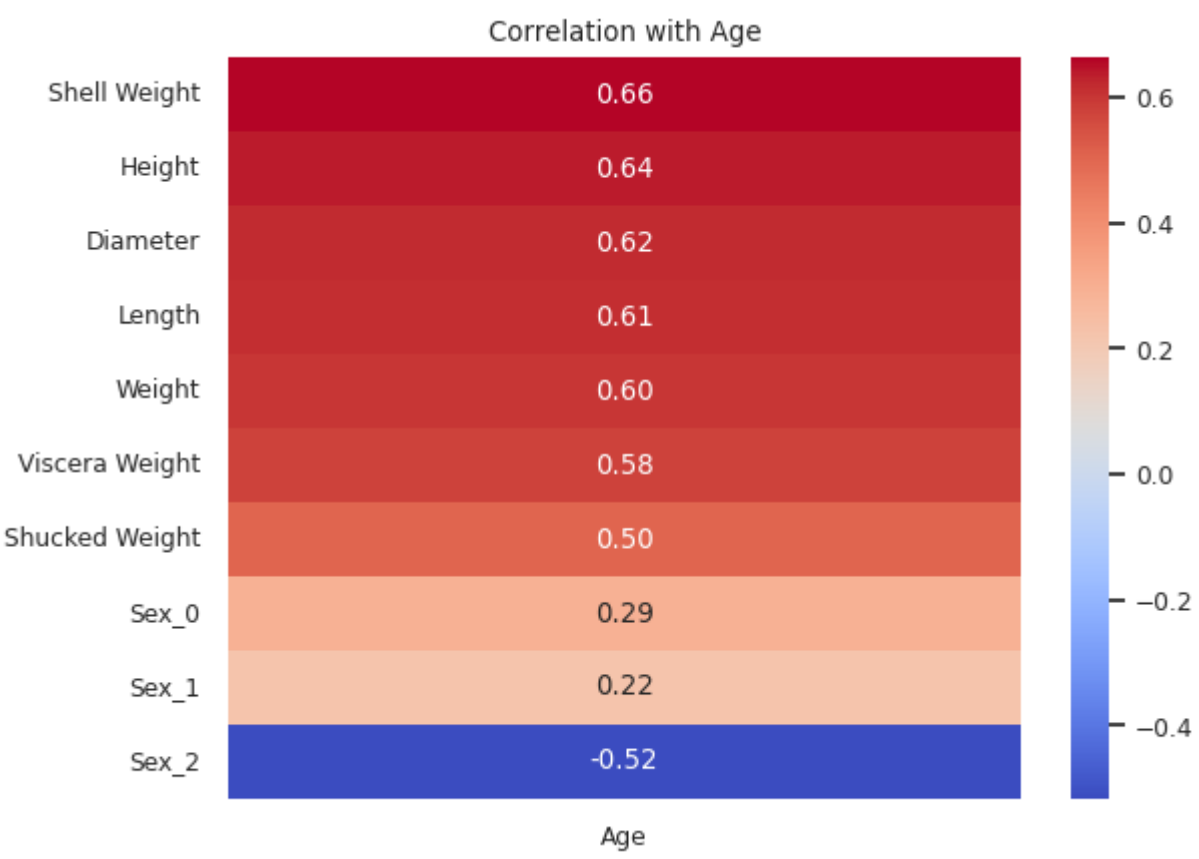
In [28]:
```
def perform_one_hot_encoding(df, column_name):
    # Perform one-hot encoding on the specified column
    dummies = pd.get_dummies(df[column_name], prefix=column_name)

    # Drop the original column and append the new dummy columns to the dataframe
```

```
    df = pd.concat([df.drop(column_name, axis=1), dummies], axis=1)

    return df

# Perform one-hot encoding on the gender variable
data = perform_one_hot_encoding(df, 'Sex')
```

In [29]:

```
# Compute the correlation matrix
correlation_matrix = data.corr()

#Graph I.
plt.figure(figsize=(15, 10))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm', linewidths=0.5, fmt='.2f
plt.title("Correlation Matrix Heatmap")
plt.show()

#Graph II
# Create a heatmap of the correlations with the target column
corr = data.corr()
target_corr = corr['Age'].drop('Age')

# Sort correlation values in descending order
target_corr_sorted = target_corr.sort_values(ascending=False)

sns.set(font_scale=0.8)
sns.set_style("white")
sns.set_palette("PuBuGn_d")
sns.heatmap(target_corr_sorted.to_frame(), cmap="coolwarm", annot=True, fmt='.2f')
plt.title('Correlation with Age')
plt.show()
```





Shell Weight (0.66) has the most positive relationship with Age. This indicates that as the shell weight grows, so does the creature's age. The correlation is moderately strong, indicating a meaningful association.

Height (0.64), like Age, has a high positive connection. The age of the creature seems to rise with its height.

Diameter (0.62), Length (0.61), Weight (0.61), and Viscera Weight (0.58): These all exhibit positive associations with Age, implying that as these metrics grow, so does the creature's age. The correlations are rather strong, showing that there is a meaningful link.

Shucked Weight (0.50) has a moderately positive relationship with Age. The shucked weight seems to raise the creature's age, but the association is not as strong as the other parameters.

Sex_F (0.29): This indicates that females are older than men, but the correlation is weak, showing that gender is not a major predictor of age in this situation.

Sex_M (0.22): This indicates that men are younger than females, but the correlation is weak, showing that sex is not a powerful predictor of age.

Age has a moderate negative connection with Sex_I(-0.52). Individuals categorised as "I" are likely to be younger. The negative correlation shows that the creature's chance of being "I" increases.

DROPPING THE TARGET COLUMN

In [30]:
```
x = df.drop(columns=["Age"])
y = df["Age"]
```

Dividing the dataset into train, test

In [31]:
```
from sklearn.model_selection import train_test_split
```

```
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.33,random_state=42)
```

In [32]:
```
print("x_train - >  ",x_train.shape)
print("x_test - >  ",x_test.shape)
print("y_train - >  ",y_train.shape)
print("y_test - >  ",y_test.shape)
```

```
x_train - >   (49614, 8)
x_test - >   (24437, 8)
y_train - >   (49614,)
y_test - >   (24437,)
```

In [33]:
```
training_score = []
testing_score = []
```

MODEL BUILDING

In [34]:
```
def model_prediction(model):
    model.fit(x_train,y_train)
    x_train_pred = model.predict(x_train)
    x_test_pred = model.predict(x_test)
    a = r2_score(y_train,x_train_pred)*100
    b = r2_score(y_test,x_test_pred)*100
    training_score.append(a)
    testing_score.append(b)

    print(f"r2_Score of {model} model on Training Data is:",a)
    print(f"r2_Score of {model} model on Testing Data is:",b)
```

LinearRegression

In [35]:
```
model_prediction(LinearRegression())
```

```
r2_Score of LinearRegression() model on Training Data is: 54.510029666416806
r2_Score of LinearRegression() model on Testing Data is: 55.235676355448234
```

DecisionTreeRegressor

In [36]:
```
model_prediction(DecisionTreeRegressor())
```

```
r2_Score of DecisionTreeRegressor() model on Training Data is: 100.0
r2_Score of DecisionTreeRegressor() model on Testing Data is: 13.086124613590544
```

RandomForestRegressor

In [37]:
```
model_prediction(RandomForestRegressor())
```

```
r2_Score of RandomForestRegressor() model on Training Data is: 93.77225523256769
r2_Score of RandomForestRegressor() model on Testing Data is: 56.419959747333536
```

AdaBoostRegressor

In [38]:
```
model_prediction(AdaBoostRegressor())
```

```
r2_Score of AdaBoostRegressor() model on Training Data is: 26.857952974034493
r2_Score of AdaBoostRegressor() model on Testing Data is: 26.584186999186542
```

GradientBoostingRegressor

In [39]:
```
model_prediction(GradientBoostingRegressor())
```

```
r2_Score of GradientBoostingRegressor() model on Training Data is: 58.545846408363246
r2_Score of GradientBoostingRegressor() model on Testing Data is: 58.127882247238816
```

LGBMRegressor

In [40]:
```
model_prediction(LGBMRegressor())
```

```
r2_Score of LGBMRegressor() model on Training Data is: 62.55497017443592
r2_Score of LGBMRegressor() model on Testing Data is: 58.88238922093139
```

XGBRegressor

In [41]:
```
model_prediction(XGBRegressor())
```

```
r2_Score of XGBRegressor(base_score=None, booster=None, callbacks=None,
             colsample_bylevel=None, colsample_bynode=None,
             colsample_bytree=None, early_stopping_rounds=None,
             enable_categorical=False, eval_metric=None, feature_types=None,
             gamma=None, gpu_id=None, grow_policy=None, importance_type=None,
             interaction_constraints=None, learning_rate=None, max_bin=None,
             max_cat_threshold=None, max_cat_to_onehot=None,
             max_delta_step=None, max_depth=None, max_leaves=None,
             min_child_weight=None, missing=nan, monotone_constraints=None,
             n_estimators=100, n_jobs=None, num_parallel_tree=None,
             predictor=None, random_state=None, ...) model on Training Data is: 69.096
48422221018
r2_Score of XGBRegressor(base_score=None, booster=None, callbacks=None,
             colsample_bylevel=None, colsample_bynode=None,
             colsample_bytree=None, early_stopping_rounds=None,
             enable_categorical=False, eval_metric=None, feature_types=None,
             gamma=None, gpu_id=None, grow_policy=None, importance_type=None,
             interaction_constraints=None, learning_rate=None, max_bin=None,
             max_cat_threshold=None, max_cat_to_onehot=None,
             max_delta_step=None, max_depth=None, max_leaves=None,
             min_child_weight=None, missing=nan, monotone_constraints=None,
             n_estimators=100, n_jobs=None, num_parallel_tree=None,
             predictor=None, random_state=None, ...) model on Testing Data is: 57.5656
9271148335
```

CatBoostRegressor

In [42]:
```
model_prediction(CatBoostRegressor(verbose=False))
```

```
r2_Score of <catboost.core.CatBoostRegressor object at 0x7d7ef658c4c0> model on Traini
ng Data is: 65.28564983642518
r2_Score of <catboost.core.CatBoostRegressor object at 0x7d7ef658c4c0> model on Testin
g Data is: 58.928092606572434
```

In [43]:
```
models = ["Linear Regression","Decision Tree","Random Forest","Ada Boost","Gradient B
```

In [44]:
```
df = pd.DataFrame({"Algorithms":models,
                   "Training Score":training_score,
                   "Testing Score":testing_score})
```

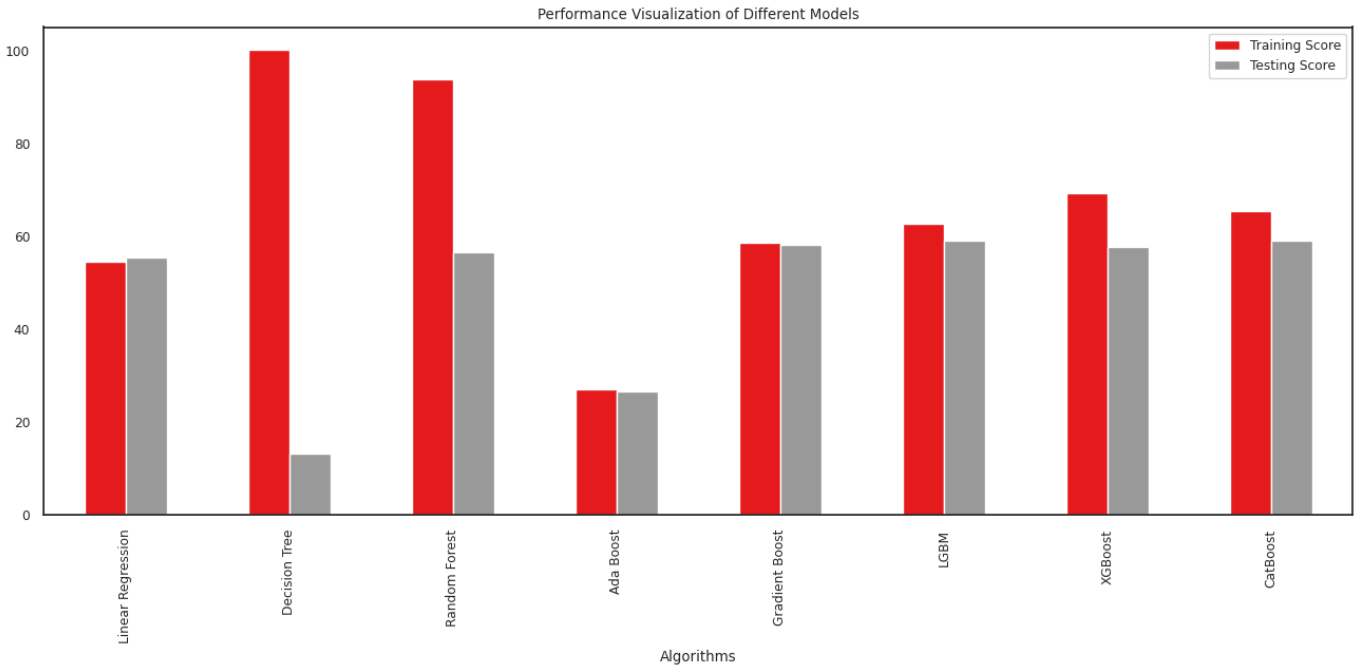
In [45]:
```
df
```

Out[45]:

	Algorithms	Training Score	Testing Score
0	Linear Regression	54.510030	55.235676
1	Decision Tree	100.000000	13.086125
2	Random Forest	93.772255	56.419960
3	Ada Boost	26.857953	26.584187
4	Gradient Boost	58.545846	58.127882
5	LGBM	62.554970	58.882389
6	XGBoost	69.096484	57.565693
7	CatBoost	65.285650	58.928093

Accuracy Plot

In [46]:
```
df.plot(x="Algorithms",y=["Training Score","Testing Score"], figsize=(16,6),kind="bar
        title="Performance Visualization of Different Models",colormap="Set1")
plt.show()
```



Prediction

In [47]:
```
from sklearn.metrics import mean_absolute_error
# Instantiate the model
cat_model = CatBoostRegressor()

# Fit the model to the training data
cat_model.fit(x_train, y_train)

# Use the model to make predictions on the test data
y_pred = cat_model.predict(x_test)

# Calculate the mean absolute error of the model
score = mean_absolute_error(y_test, y_pred)
score
```

```
Learning rate set to 0.075873
0:      learn: 3.0606465        total: 7.87ms   remaining: 7.86s
1:      learn: 2.9622820        total: 14.8ms   remaining: 7.37s
2:      learn: 2.8790779        total: 21.8ms   remaining: 7.23s
3:      learn: 2.8030472        total: 29ms     remaining: 7.22s
4:      learn: 2.7329001        total: 36.4ms   remaining: 7.24s
5:      learn: 2.6697214        total: 43.8ms   remaining: 7.26s
6:      learn: 2.6106736        total: 50.8ms   remaining: 7.2s
7:      learn: 2.5597765        total: 58.4ms   remaining: 7.25s
8:      learn: 2.5146316        total: 65.4ms   remaining: 7.2s
9:      learn: 2.4732141        total: 72.4ms   remaining: 7.17s
10:     learn: 2.4373214        total: 79.7ms   remaining: 7.17s
11:     learn: 2.4065020        total: 86.8ms   remaining: 7.14s
12:     learn: 2.3783747        total: 93.8ms   remaining: 7.12s
13:     learn: 2.3543971        total: 101ms    remaining: 7.08s
14:     learn: 2.3312203        total: 108ms    remaining: 7.09s
15:     learn: 2.3111205        total: 115ms    remaining: 7.08s
16:     learn: 2.2928079        total: 122ms    remaining: 7.05s
17:     learn: 2.2763464        total: 129ms    remaining: 7.03s
18:     learn: 2.2603539        total: 136ms    remaining: 7.02s
19:     learn: 2.2472730        total: 144ms    remaining: 7.04s
20:     learn: 2.2349254        total: 151ms    remaining: 7.05s
21:     learn: 2.2243784        total: 158ms    remaining: 7.04s
22:     learn: 2.2152585        total: 165ms    remaining: 7.01s
23:     learn: 2.2068986        total: 172ms    remaining: 7.01s
24:     learn: 2.1997505        total: 180ms    remaining: 7.01s
25:     learn: 2.1918748        total: 187ms    remaining: 7.01s
26:     learn: 2.1846579        total: 195ms    remaining: 7.02s
27:     learn: 2.1789934        total: 202ms    remaining: 7.01s
28:     learn: 2.1732710        total: 210ms    remaining: 7.02s
29:     learn: 2.1674014        total: 217ms    remaining: 7.01s
30:     learn: 2.1614370        total: 224ms    remaining: 7s
31:     learn: 2.1573143        total: 231ms    remaining: 6.98s
32:     learn: 2.1521935        total: 238ms    remaining: 6.97s
33:     learn: 2.1475428        total: 245ms    remaining: 6.95s
34:     learn: 2.1436523        total: 251ms    remaining: 6.92s
35:     learn: 2.1401824        total: 259ms    remaining: 6.93s
36:     learn: 2.1366638        total: 265ms    remaining: 6.91s
37:     learn: 2.1333795        total: 272ms    remaining: 6.89s
38:     learn: 2.1298445        total: 280ms    remaining: 6.89s
39:     learn: 2.1271375        total: 286ms    remaining: 6.86s
40:     learn: 2.1245214        total: 292ms    remaining: 6.84s
41:     learn: 2.1222008        total: 299ms    remaining: 6.82s
42:     learn: 2.1194799        total: 306ms    remaining: 6.82s
43:     learn: 2.1173447        total: 313ms    remaining: 6.81s
44:     learn: 2.1148046        total: 321ms    remaining: 6.8s
45:     learn: 2.1123995        total: 328ms    remaining: 6.79s
46:     learn: 2.1099309        total: 335ms    remaining: 6.79s
47:     learn: 2.1080022        total: 341ms    remaining: 6.77s
48:     learn: 2.1057125        total: 349ms    remaining: 6.76s
49:     learn: 2.1041452        total: 355ms    remaining: 6.75s
50:     learn: 2.1026773        total: 362ms    remaining: 6.73s
51:     learn: 2.1012741        total: 368ms    remaining: 6.71s
52:     learn: 2.0993542        total: 376ms    remaining: 6.72s
53:     learn: 2.0970875        total: 384ms    remaining: 6.72s
54:     learn: 2.0955586        total: 390ms    remaining: 6.7s
55:     learn: 2.0939496        total: 399ms    remaining: 6.72s
56:     learn: 2.0931356        total: 406ms    remaining: 6.71s
57:     learn: 2.0919513        total: 412ms    remaining: 6.69s
58:     learn: 2.0907427        total: 418ms    remaining: 6.67s
59:     learn: 2.0892060        total: 425ms    remaining: 6.66s
60:     learn: 2.0876715        total: 433ms    remaining: 6.66s
61:     learn: 2.0866592        total: 439ms    remaining: 6.64s
62:     learn: 2.0849688        total: 447ms    remaining: 6.65s
63:     learn: 2.0843543        total: 453ms    remaining: 6.63s
```

```
64:     learn: 2.0832223        total: 460ms    remaining: 6.61s
65:     learn: 2.0822915        total: 466ms    remaining: 6.6s
66:     learn: 2.0812470        total: 474ms    remaining: 6.6s
67:     learn: 2.0800827        total: 481ms    remaining: 6.59s
68:     learn: 2.0788686        total: 488ms    remaining: 6.59s
69:     learn: 2.0781864        total: 495ms    remaining: 6.57s
70:     learn: 2.0775092        total: 502ms    remaining: 6.57s
71:     learn: 2.0763359        total: 509ms    remaining: 6.56s
72:     learn: 2.0754290        total: 516ms    remaining: 6.56s
73:     learn: 2.0747184        total: 523ms    remaining: 6.54s
74:     learn: 2.0738016        total: 530ms    remaining: 6.53s
75:     learn: 2.0730659        total: 537ms    remaining: 6.53s
76:     learn: 2.0719374        total: 544ms    remaining: 6.53s
77:     learn: 2.0713035        total: 551ms    remaining: 6.52s
78:     learn: 2.0704427        total: 559ms    remaining: 6.52s
79:     learn: 2.0695902        total: 566ms    remaining: 6.5s
80:     learn: 2.0691455        total: 572ms    remaining: 6.49s
81:     learn: 2.0685382        total: 579ms    remaining: 6.48s
82:     learn: 2.0678757        total: 586ms    remaining: 6.47s
83:     learn: 2.0673427        total: 593ms    remaining: 6.46s
84:     learn: 2.0667444        total: 601ms    remaining: 6.46s
85:     learn: 2.0660983        total: 608ms    remaining: 6.46s
86:     learn: 2.0655043        total: 615ms    remaining: 6.45s
87:     learn: 2.0648648        total: 622ms    remaining: 6.45s
88:     learn: 2.0640585        total: 629ms    remaining: 6.43s
89:     learn: 2.0635665        total: 636ms    remaining: 6.43s
90:     learn: 2.0629236        total: 642ms    remaining: 6.42s
91:     learn: 2.0623173        total: 649ms    remaining: 6.41s
92:     learn: 2.0615632        total: 657ms    remaining: 6.41s
93:     learn: 2.0608713        total: 664ms    remaining: 6.4s
94:     learn: 2.0601422        total: 671ms    remaining: 6.39s
95:     learn: 2.0597051        total: 683ms    remaining: 6.43s
96:     learn: 2.0591791        total: 688ms    remaining: 6.41s
97:     learn: 2.0586559        total: 694ms    remaining: 6.39s
98:     learn: 2.0578270        total: 701ms    remaining: 6.38s
99:     learn: 2.0571084        total: 708ms    remaining: 6.37s
100:    learn: 2.0565811        total: 714ms    remaining: 6.35s
101:    learn: 2.0561211        total: 720ms    remaining: 6.34s
102:    learn: 2.0556556        total: 726ms    remaining: 6.32s
103:    learn: 2.0550692        total: 733ms    remaining: 6.31s
104:    learn: 2.0546545        total: 739ms    remaining: 6.3s
105:    learn: 2.0545136        total: 744ms    remaining: 6.28s
106:    learn: 2.0540961        total: 750ms    remaining: 6.26s
107:    learn: 2.0537119        total: 756ms    remaining: 6.25s
108:    learn: 2.0532643        total: 763ms    remaining: 6.23s
109:    learn: 2.0526676        total: 768ms    remaining: 6.21s
110:    learn: 2.0524033        total: 773ms    remaining: 6.19s
111:    learn: 2.0518713        total: 779ms    remaining: 6.18s
112:    learn: 2.0513497        total: 785ms    remaining: 6.16s
113:    learn: 2.0508693        total: 791ms    remaining: 6.14s
114:    learn: 2.0504352        total: 800ms    remaining: 6.16s
115:    learn: 2.0500971        total: 806ms    remaining: 6.14s
116:    learn: 2.0496149        total: 812ms    remaining: 6.13s
117:    learn: 2.0491587        total: 818ms    remaining: 6.11s
118:    learn: 2.0488160        total: 824ms    remaining: 6.1s
119:    learn: 2.0485161        total: 830ms    remaining: 6.09s
120:    learn: 2.0479717        total: 836ms    remaining: 6.08s
121:    learn: 2.0477146        total: 842ms    remaining: 6.06s
122:    learn: 2.0473238        total: 848ms    remaining: 6.04s
123:    learn: 2.0469988        total: 854ms    remaining: 6.03s
124:    learn: 2.0464813        total: 860ms    remaining: 6.02s
125:    learn: 2.0457930        total: 867ms    remaining: 6.01s
126:    learn: 2.0453665        total: 873ms    remaining: 6s
127:    learn: 2.0448916        total: 879ms    remaining: 5.99s
128:    learn: 2.0444449        total: 886ms    remaining: 5.98s
```

```
129:    learn: 2.0439360        total: 891ms    remaining: 5.96s
130:    learn: 2.0435408        total: 897ms    remaining: 5.95s
131:    learn: 2.0432476        total: 903ms    remaining: 5.94s
132:    learn: 2.0427957        total: 909ms    remaining: 5.92s
133:    learn: 2.0423622        total: 914ms    remaining: 5.91s
134:    learn: 2.0420950        total: 920ms    remaining: 5.89s
135:    learn: 2.0414367        total: 926ms    remaining: 5.88s
136:    learn: 2.0409309        total: 932ms    remaining: 5.87s
137:    learn: 2.0405296        total: 938ms    remaining: 5.86s
138:    learn: 2.0401890        total: 944ms    remaining: 5.84s
139:    learn: 2.0398610        total: 950ms    remaining: 5.83s
140:    learn: 2.0394195        total: 955ms    remaining: 5.82s
141:    learn: 2.0391191        total: 961ms    remaining: 5.81s
142:    learn: 2.0386660        total: 967ms    remaining: 5.8s
143:    learn: 2.0382153        total: 973ms    remaining: 5.78s
144:    learn: 2.0378551        total: 978ms    remaining: 5.77s
145:    learn: 2.0374429        total: 984ms    remaining: 5.76s
146:    learn: 2.0369967        total: 990ms    remaining: 5.75s
147:    learn: 2.0365028        total: 999ms    remaining: 5.75s
148:    learn: 2.0361617        total: 1s       remaining: 5.74s
149:    learn: 2.0358927        total: 1.01s    remaining: 5.72s
150:    learn: 2.0352947        total: 1.02s    remaining: 5.71s
151:    learn: 2.0348351        total: 1.02s    remaining: 5.71s
152:    learn: 2.0341782        total: 1.03s    remaining: 5.7s
153:    learn: 2.0338714        total: 1.03s    remaining: 5.68s
154:    learn: 2.0334664        total: 1.04s    remaining: 5.67s
155:    learn: 2.0328574        total: 1.05s    remaining: 5.66s
156:    learn: 2.0325030        total: 1.05s    remaining: 5.65s
157:    learn: 2.0321374        total: 1.06s    remaining: 5.64s
158:    learn: 2.0317720        total: 1.06s    remaining: 5.63s
159:    learn: 2.0314701        total: 1.07s    remaining: 5.62s
160:    learn: 2.0310837        total: 1.07s    remaining: 5.6s
161:    learn: 2.0306165        total: 1.08s    remaining: 5.58s
162:    learn: 2.0301542        total: 1.08s    remaining: 5.58s
163:    learn: 2.0298878        total: 1.09s    remaining: 5.56s
164:    learn: 2.0294586        total: 1.1s     remaining: 5.55s
165:    learn: 2.0290860        total: 1.1s     remaining: 5.53s
166:    learn: 2.0288211        total: 1.11s    remaining: 5.52s
167:    learn: 2.0287157        total: 1.11s    remaining: 5.51s
168:    learn: 2.0284412        total: 1.12s    remaining: 5.49s
169:    learn: 2.0282063        total: 1.12s    remaining: 5.47s
170:    learn: 2.0277473        total: 1.13s    remaining: 5.46s
171:    learn: 2.0272780        total: 1.13s    remaining: 5.46s
172:    learn: 2.0271497        total: 1.14s    remaining: 5.44s
173:    learn: 2.0270385        total: 1.14s    remaining: 5.43s
174:    learn: 2.0265074        total: 1.15s    remaining: 5.42s
175:    learn: 2.0260371        total: 1.16s    remaining: 5.41s
176:    learn: 2.0259322        total: 1.16s    remaining: 5.39s
177:    learn: 2.0257104        total: 1.17s    remaining: 5.38s
178:    learn: 2.0253266        total: 1.17s    remaining: 5.37s
179:    learn: 2.0247838        total: 1.18s    remaining: 5.36s
180:    learn: 2.0245507        total: 1.18s    remaining: 5.35s
181:    learn: 2.0244526        total: 1.19s    remaining: 5.33s
182:    learn: 2.0238081        total: 1.2s     remaining: 5.34s
183:    learn: 2.0233748        total: 1.2s     remaining: 5.33s
184:    learn: 2.0229291        total: 1.21s    remaining: 5.32s
185:    learn: 2.0225210        total: 1.21s    remaining: 5.31s
186:    learn: 2.0221044        total: 1.22s    remaining: 5.3s
187:    learn: 2.0217546        total: 1.22s    remaining: 5.29s
188:    learn: 2.0213088        total: 1.23s    remaining: 5.28s
189:    learn: 2.0209035        total: 1.24s    remaining: 5.27s
190:    learn: 2.0206246        total: 1.24s    remaining: 5.26s
191:    learn: 2.0201186        total: 1.25s    remaining: 5.25s
192:    learn: 2.0195934        total: 1.25s    remaining: 5.25s
193:    learn: 2.0192036        total: 1.26s    remaining: 5.24s
```

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194:    learn: 2.0190784        total: 1.26s    remaining: 5.22s
195:    learn: 2.0187191        total: 1.27s    remaining: 5.21s
196:    learn: 2.0184597        total: 1.28s    remaining: 5.2s
197:    learn: 2.0180238        total: 1.28s    remaining: 5.2s
198:    learn: 2.0175926        total: 1.29s    remaining: 5.19s
199:    learn: 2.0171142        total: 1.29s    remaining: 5.18s
200:    learn: 2.0166624        total: 1.3s     remaining: 5.17s
201:    learn: 2.0162564        total: 1.31s    remaining: 5.16s
202:    learn: 2.0158478        total: 1.31s    remaining: 5.15s
203:    learn: 2.0153708        total: 1.32s    remaining: 5.14s
204:    learn: 2.0152804        total: 1.32s    remaining: 5.13s
205:    learn: 2.0149403        total: 1.33s    remaining: 5.12s
206:    learn: 2.0145057        total: 1.33s    remaining: 5.11s
207:    learn: 2.0141821        total: 1.34s    remaining: 5.11s
208:    learn: 2.0141020        total: 1.34s    remaining: 5.09s
209:    learn: 2.0137455        total: 1.35s    remaining: 5.08s
210:    learn: 2.0133750        total: 1.36s    remaining: 5.08s
211:    learn: 2.0130464        total: 1.36s    remaining: 5.07s
212:    learn: 2.0125550        total: 1.37s    remaining: 5.06s
213:    learn: 2.0120230        total: 1.38s    remaining: 5.05s
214:    learn: 2.0119645        total: 1.38s    remaining: 5.04s
215:    learn: 2.0115778        total: 1.39s    remaining: 5.03s
216:    learn: 2.0114704        total: 1.39s    remaining: 5.03s
217:    learn: 2.0112141        total: 1.4s     remaining: 5.02s
218:    learn: 2.0108926        total: 1.41s    remaining: 5.01s
219:    learn: 2.0105426        total: 1.41s    remaining: 5.01s
220:    learn: 2.0101046        total: 1.42s    remaining: 5s
221:    learn: 2.0099214        total: 1.42s    remaining: 4.99s
222:    learn: 2.0095651        total: 1.43s    remaining: 4.98s
223:    learn: 2.0091448        total: 1.43s    remaining: 4.97s
224:    learn: 2.0088663        total: 1.44s    remaining: 4.96s
225:    learn: 2.0084686        total: 1.45s    remaining: 4.95s
226:    learn: 2.0082620        total: 1.45s    remaining: 4.94s
227:    learn: 2.0078376        total: 1.46s    remaining: 4.93s
228:    learn: 2.0076234        total: 1.46s    remaining: 4.92s
229:    learn: 2.0075600        total: 1.47s    remaining: 4.91s
230:    learn: 2.0075015        total: 1.47s    remaining: 4.9s
231:    learn: 2.0070753        total: 1.48s    remaining: 4.89s
232:    learn: 2.0067859        total: 1.48s    remaining: 4.88s
233:    learn: 2.0064481        total: 1.49s    remaining: 4.88s
234:    learn: 2.0064244        total: 1.49s    remaining: 4.86s
235:    learn: 2.0061223        total: 1.5s     remaining: 4.85s
236:    learn: 2.0060612        total: 1.5s     remaining: 4.84s
237:    learn: 2.0058219        total: 1.51s    remaining: 4.83s
238:    learn: 2.0056209        total: 1.51s    remaining: 4.82s
239:    learn: 2.0052224        total: 1.52s    remaining: 4.81s
240:    learn: 2.0050994        total: 1.52s    remaining: 4.8s
241:    learn: 2.0048966        total: 1.53s    remaining: 4.79s
242:    learn: 2.0045915        total: 1.54s    remaining: 4.79s
243:    learn: 2.0042404        total: 1.54s    remaining: 4.78s
244:    learn: 2.0037879        total: 1.55s    remaining: 4.77s
245:    learn: 2.0037253        total: 1.55s    remaining: 4.76s
246:    learn: 2.0034562        total: 1.56s    remaining: 4.75s
247:    learn: 2.0033690        total: 1.56s    remaining: 4.74s
248:    learn: 2.0031617        total: 1.57s    remaining: 4.74s
249:    learn: 2.0025364        total: 1.58s    remaining: 4.73s
250:    learn: 2.0022922        total: 1.58s    remaining: 4.72s
251:    learn: 2.0021254        total: 1.59s    remaining: 4.72s
252:    learn: 2.0017859        total: 1.6s     remaining: 4.72s
253:    learn: 2.0015412        total: 1.6s     remaining: 4.71s
254:    learn: 2.0013373        total: 1.61s    remaining: 4.7s
255:    learn: 2.0010059        total: 1.62s    remaining: 4.7s
256:    learn: 2.0007559        total: 1.62s    remaining: 4.69s
257:    learn: 2.0005204        total: 1.63s    remaining: 4.68s
258:    learn: 2.0002287        total: 1.63s    remaining: 4.67s
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259:    learn: 1.9998552        total: 1.64s    remaining: 4.67s
260:    learn: 1.9994981        total: 1.65s    remaining: 4.66s
261:    learn: 1.9992142        total: 1.65s    remaining: 4.65s
262:    learn: 1.9988493        total: 1.66s    remaining: 4.64s
263:    learn: 1.9986905        total: 1.66s    remaining: 4.63s
264:    learn: 1.9985244        total: 1.67s    remaining: 4.62s
265:    learn: 1.9984714        total: 1.67s    remaining: 4.61s
266:    learn: 1.9981709        total: 1.68s    remaining: 4.6s
267:    learn: 1.9977209        total: 1.68s    remaining: 4.59s
268:    learn: 1.9974668        total: 1.69s    remaining: 4.59s
269:    learn: 1.9970871        total: 1.69s    remaining: 4.58s
270:    learn: 1.9967821        total: 1.7s     remaining: 4.58s
271:    learn: 1.9964503        total: 1.71s    remaining: 4.57s
272:    learn: 1.9961826        total: 1.71s    remaining: 4.56s
273:    learn: 1.9958585        total: 1.72s    remaining: 4.55s
274:    learn: 1.9954428        total: 1.72s    remaining: 4.54s
275:    learn: 1.9951985        total: 1.73s    remaining: 4.54s
276:    learn: 1.9948004        total: 1.74s    remaining: 4.53s
277:    learn: 1.9944587        total: 1.74s    remaining: 4.53s
278:    learn: 1.9942731        total: 1.75s    remaining: 4.52s
279:    learn: 1.9939173        total: 1.75s    remaining: 4.51s
280:    learn: 1.9937059        total: 1.76s    remaining: 4.5s
281:    learn: 1.9936682        total: 1.76s    remaining: 4.49s
282:    learn: 1.9934684        total: 1.77s    remaining: 4.48s
283:    learn: 1.9930861        total: 1.77s    remaining: 4.48s
284:    learn: 1.9928033        total: 1.78s    remaining: 4.47s
285:    learn: 1.9926466        total: 1.79s    remaining: 4.47s
286:    learn: 1.9926126        total: 1.79s    remaining: 4.46s
287:    learn: 1.9920614        total: 1.8s     remaining: 4.45s
288:    learn: 1.9917261        total: 1.81s    remaining: 4.45s
289:    learn: 1.9914652        total: 1.81s    remaining: 4.44s
290:    learn: 1.9910821        total: 1.82s    remaining: 4.43s
291:    learn: 1.9908860        total: 1.82s    remaining: 4.42s
292:    learn: 1.9906650        total: 1.83s    remaining: 4.42s
293:    learn: 1.9904264        total: 1.83s    remaining: 4.41s
294:    learn: 1.9899967        total: 1.84s    remaining: 4.4s
295:    learn: 1.9895880        total: 1.85s    remaining: 4.4s
296:    learn: 1.9893809        total: 1.85s    remaining: 4.39s
297:    learn: 1.9890439        total: 1.86s    remaining: 4.38s
298:    learn: 1.9887928        total: 1.87s    remaining: 4.38s
299:    learn: 1.9885050        total: 1.87s    remaining: 4.37s
300:    learn: 1.9882589        total: 1.88s    remaining: 4.36s
301:    learn: 1.9882172        total: 1.88s    remaining: 4.35s
302:    learn: 1.9878899        total: 1.89s    remaining: 4.35s
303:    learn: 1.9877287        total: 1.9s     remaining: 4.34s
304:    learn: 1.9877105        total: 1.9s     remaining: 4.33s
305:    learn: 1.9873647        total: 1.91s    remaining: 4.32s
306:    learn: 1.9871645        total: 1.91s    remaining: 4.31s
307:    learn: 1.9868913        total: 1.92s    remaining: 4.3s
308:    learn: 1.9866615        total: 1.92s    remaining: 4.3s
309:    learn: 1.9861862        total: 1.93s    remaining: 4.29s
310:    learn: 1.9859072        total: 1.94s    remaining: 4.29s
311:    learn: 1.9857485        total: 1.94s    remaining: 4.28s
312:    learn: 1.9855296        total: 1.95s    remaining: 4.27s
313:    learn: 1.9851986        total: 1.95s    remaining: 4.26s
314:    learn: 1.9849470        total: 1.96s    remaining: 4.26s
315:    learn: 1.9848986        total: 1.96s    remaining: 4.25s
316:    learn: 1.9845881        total: 1.97s    remaining: 4.24s
317:    learn: 1.9843026        total: 1.98s    remaining: 4.24s
318:    learn: 1.9838369        total: 1.98s    remaining: 4.23s
319:    learn: 1.9835295        total: 1.99s    remaining: 4.23s
320:    learn: 1.9831852        total: 2s       remaining: 4.22s
321:    learn: 1.9829922        total: 2s       remaining: 4.22s
322:    learn: 1.9826406        total: 2.01s    remaining: 4.21s
323:    learn: 1.9824657        total: 2.01s    remaining: 4.2s
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324:    learn: 1.9821601        total: 2.02s    remaining: 4.19s
325:    learn: 1.9818408        total: 2.02s    remaining: 4.19s
326:    learn: 1.9816721        total: 2.03s    remaining: 4.18s
327:    learn: 1.9814623        total: 2.04s    remaining: 4.17s
328:    learn: 1.9810873        total: 2.04s    remaining: 4.17s
329:    learn: 1.9810547        total: 2.05s    remaining: 4.16s
330:    learn: 1.9808178        total: 2.05s    remaining: 4.15s
331:    learn: 1.9804621        total: 2.06s    remaining: 4.14s
332:    learn: 1.9801365        total: 2.06s    remaining: 4.14s
333:    learn: 1.9798471        total: 2.07s    remaining: 4.13s
334:    learn: 1.9795269        total: 2.08s    remaining: 4.12s
335:    learn: 1.9793893        total: 2.08s    remaining: 4.12s
336:    learn: 1.9793729        total: 2.09s    remaining: 4.1s
337:    learn: 1.9791280        total: 2.09s    remaining: 4.1s
338:    learn: 1.9790126        total: 2.1s     remaining: 4.09s
339:    learn: 1.9788512        total: 2.1s     remaining: 4.08s
340:    learn: 1.9785467        total: 2.11s    remaining: 4.08s
341:    learn: 1.9782936        total: 2.12s    remaining: 4.07s
342:    learn: 1.9780758        total: 2.12s    remaining: 4.07s
343:    learn: 1.9778172        total: 2.13s    remaining: 4.06s
344:    learn: 1.9775572        total: 2.13s    remaining: 4.05s
345:    learn: 1.9773790        total: 2.14s    remaining: 4.04s
346:    learn: 1.9772252        total: 2.15s    remaining: 4.04s
347:    learn: 1.9769813        total: 2.15s    remaining: 4.03s
348:    learn: 1.9768015        total: 2.15s    remaining: 4.02s
349:    learn: 1.9765018        total: 2.16s    remaining: 4.01s
350:    learn: 1.9762244        total: 2.17s    remaining: 4.01s
351:    learn: 1.9759764        total: 2.17s    remaining: 4s
352:    learn: 1.9759589        total: 2.18s    remaining: 3.99s
353:    learn: 1.9756585        total: 2.18s    remaining: 3.98s
354:    learn: 1.9753964        total: 2.19s    remaining: 3.98s
355:    learn: 1.9751217        total: 2.2s     remaining: 3.98s
356:    learn: 1.9749488        total: 2.2s     remaining: 3.97s
357:    learn: 1.9749298        total: 2.21s    remaining: 3.96s
358:    learn: 1.9746328        total: 2.21s    remaining: 3.95s
359:    learn: 1.9743372        total: 2.22s    remaining: 3.94s
360:    learn: 1.9742097        total: 2.22s    remaining: 3.94s
361:    learn: 1.9737776        total: 2.23s    remaining: 3.93s
362:    learn: 1.9737078        total: 2.24s    remaining: 3.92s
363:    learn: 1.9735397        total: 2.24s    remaining: 3.92s
364:    learn: 1.9732286        total: 2.25s    remaining: 3.91s
365:    learn: 1.9729729        total: 2.25s    remaining: 3.9s
366:    learn: 1.9727049        total: 2.26s    remaining: 3.9s
367:    learn: 1.9724027        total: 2.26s    remaining: 3.89s
368:    learn: 1.9722124        total: 2.27s    remaining: 3.88s
369:    learn: 1.9718958        total: 2.28s    remaining: 3.88s
370:    learn: 1.9718166        total: 2.28s    remaining: 3.87s
371:    learn: 1.9715509        total: 2.29s    remaining: 3.86s
372:    learn: 1.9711270        total: 2.29s    remaining: 3.86s
373:    learn: 1.9708339        total: 2.3s     remaining: 3.85s
374:    learn: 1.9706068        total: 2.31s    remaining: 3.84s
375:    learn: 1.9703291        total: 2.31s    remaining: 3.84s
376:    learn: 1.9700946        total: 2.32s    remaining: 3.84s
377:    learn: 1.9698838        total: 2.33s    remaining: 3.83s
378:    learn: 1.9696600        total: 2.33s    remaining: 3.83s
379:    learn: 1.9694795        total: 2.34s    remaining: 3.82s
380:    learn: 1.9691451        total: 2.35s    remaining: 3.81s
381:    learn: 1.9689318        total: 2.35s    remaining: 3.81s
382:    learn: 1.9687180        total: 2.36s    remaining: 3.8s
383:    learn: 1.9685278        total: 2.36s    remaining: 3.79s
384:    learn: 1.9685063        total: 2.37s    remaining: 3.79s
385:    learn: 1.9683156        total: 2.38s    remaining: 3.78s
386:    learn: 1.9682853        total: 2.38s    remaining: 3.77s
387:    learn: 1.9679351        total: 2.39s    remaining: 3.77s
388:    learn: 1.9676031        total: 2.4s     remaining: 3.76s
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389:    learn: 1.9673804        total: 2.4s     remaining: 3.76s
390:    learn: 1.9671166        total: 2.41s    remaining: 3.75s
391:    learn: 1.9668587        total: 2.41s    remaining: 3.74s
392:    learn: 1.9666001        total: 2.42s    remaining: 3.74s
393:    learn: 1.9663198        total: 2.42s    remaining: 3.73s
394:    learn: 1.9661454        total: 2.43s    remaining: 3.72s
395:    learn: 1.9658421        total: 2.44s    remaining: 3.72s
396:    learn: 1.9655906        total: 2.44s    remaining: 3.71s
397:    learn: 1.9654503        total: 2.45s    remaining: 3.7s
398:    learn: 1.9652199        total: 2.45s    remaining: 3.7s
399:    learn: 1.9650706        total: 2.46s    remaining: 3.69s
400:    learn: 1.9647650        total: 2.46s    remaining: 3.68s
401:    learn: 1.9647281        total: 2.47s    remaining: 3.67s
402:    learn: 1.9645615        total: 2.48s    remaining: 3.67s
403:    learn: 1.9643339        total: 2.48s    remaining: 3.66s
404:    learn: 1.9641368        total: 2.49s    remaining: 3.65s
405:    learn: 1.9639816        total: 2.49s    remaining: 3.65s
406:    learn: 1.9638365        total: 2.5s     remaining: 3.64s
407:    learn: 1.9636942        total: 2.5s     remaining: 3.63s
408:    learn: 1.9634601        total: 2.51s    remaining: 3.62s
409:    learn: 1.9631758        total: 2.51s    remaining: 3.62s
410:    learn: 1.9630804        total: 2.52s    remaining: 3.61s
411:    learn: 1.9628179        total: 2.53s    remaining: 3.6s
412:    learn: 1.9625291        total: 2.53s    remaining: 3.6s
413:    learn: 1.9623237        total: 2.54s    remaining: 3.59s
414:    learn: 1.9620649        total: 2.54s    remaining: 3.59s
415:    learn: 1.9618603        total: 2.55s    remaining: 3.58s
416:    learn: 1.9617150        total: 2.56s    remaining: 3.57s
417:    learn: 1.9615466        total: 2.56s    remaining: 3.56s
418:    learn: 1.9612911        total: 2.57s    remaining: 3.56s
419:    learn: 1.9609882        total: 2.57s    remaining: 3.55s
420:    learn: 1.9607524        total: 2.58s    remaining: 3.54s
421:    learn: 1.9606320        total: 2.59s    remaining: 3.54s
422:    learn: 1.9605553        total: 2.59s    remaining: 3.54s
423:    learn: 1.9602873        total: 2.6s     remaining: 3.53s
424:    learn: 1.9600217        total: 2.6s     remaining: 3.52s
425:    learn: 1.9596969        total: 2.61s    remaining: 3.52s
426:    learn: 1.9594745        total: 2.62s    remaining: 3.51s
427:    learn: 1.9594351        total: 2.62s    remaining: 3.51s
428:    learn: 1.9592326        total: 2.63s    remaining: 3.5s
429:    learn: 1.9590122        total: 2.63s    remaining: 3.49s
430:    learn: 1.9587254        total: 2.64s    remaining: 3.49s
431:    learn: 1.9586051        total: 2.65s    remaining: 3.48s
432:    learn: 1.9584326        total: 2.65s    remaining: 3.48s
433:    learn: 1.9582519        total: 2.66s    remaining: 3.47s
434:    learn: 1.9580287        total: 2.67s    remaining: 3.46s
435:    learn: 1.9578487        total: 2.67s    remaining: 3.46s
436:    learn: 1.9576255        total: 2.68s    remaining: 3.45s
437:    learn: 1.9573736        total: 2.68s    remaining: 3.44s
438:    learn: 1.9572050        total: 2.69s    remaining: 3.44s
439:    learn: 1.9569583        total: 2.7s     remaining: 3.43s
440:    learn: 1.9567049        total: 2.7s     remaining: 3.42s
441:    learn: 1.9564469        total: 2.71s    remaining: 3.42s
442:    learn: 1.9562134        total: 2.71s    remaining: 3.41s
443:    learn: 1.9559428        total: 2.72s    remaining: 3.41s
444:    learn: 1.9556914        total: 2.73s    remaining: 3.4s
445:    learn: 1.9553598        total: 2.73s    remaining: 3.4s
446:    learn: 1.9553345        total: 2.74s    remaining: 3.39s
447:    learn: 1.9551173        total: 2.74s    remaining: 3.38s
448:    learn: 1.9547808        total: 2.75s    remaining: 3.38s
449:    learn: 1.9545175        total: 2.76s    remaining: 3.37s
450:    learn: 1.9542453        total: 2.76s    remaining: 3.36s
451:    learn: 1.9539943        total: 2.77s    remaining: 3.35s
452:    learn: 1.9538318        total: 2.77s    remaining: 3.35s
453:    learn: 1.9536261        total: 2.78s    remaining: 3.34s
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454:    learn: 1.9533618        total: 2.79s    remaining: 3.34s
455:    learn: 1.9532033        total: 2.79s    remaining: 3.33s
456:    learn: 1.9530133        total: 2.8s     remaining: 3.33s
457:    learn: 1.9526377        total: 2.81s    remaining: 3.32s
458:    learn: 1.9524589        total: 2.81s    remaining: 3.32s
459:    learn: 1.9523068        total: 2.82s    remaining: 3.31s
460:    learn: 1.9522486        total: 2.82s    remaining: 3.3s
461:    learn: 1.9520304        total: 2.83s    remaining: 3.29s
462:    learn: 1.9517291        total: 2.83s    remaining: 3.29s
463:    learn: 1.9516843        total: 2.84s    remaining: 3.28s
464:    learn: 1.9513910        total: 2.85s    remaining: 3.28s
465:    learn: 1.9510771        total: 2.85s    remaining: 3.27s
466:    learn: 1.9508763        total: 2.86s    remaining: 3.26s
467:    learn: 1.9508150        total: 2.87s    remaining: 3.26s
468:    learn: 1.9506302        total: 2.87s    remaining: 3.25s
469:    learn: 1.9503733        total: 2.88s    remaining: 3.25s
470:    learn: 1.9502271        total: 2.88s    remaining: 3.24s
471:    learn: 1.9499095        total: 2.89s    remaining: 3.23s
472:    learn: 1.9496970        total: 2.9s     remaining: 3.23s
473:    learn: 1.9495763        total: 2.9s     remaining: 3.22s
474:    learn: 1.9493215        total: 2.91s    remaining: 3.21s
475:    learn: 1.9492342        total: 2.91s    remaining: 3.21s
476:    learn: 1.9489750        total: 2.92s    remaining: 3.2s
477:    learn: 1.9489241        total: 2.92s    remaining: 3.19s
478:    learn: 1.9486248        total: 2.93s    remaining: 3.19s
479:    learn: 1.9483912        total: 2.94s    remaining: 3.18s
480:    learn: 1.9482816        total: 2.94s    remaining: 3.17s
481:    learn: 1.9481000        total: 2.94s    remaining: 3.17s
482:    learn: 1.9478934        total: 2.95s    remaining: 3.16s
483:    learn: 1.9477343        total: 2.96s    remaining: 3.15s
484:    learn: 1.9475025        total: 2.96s    remaining: 3.15s
485:    learn: 1.9473443        total: 2.97s    remaining: 3.14s
486:    learn: 1.9471319        total: 2.98s    remaining: 3.13s
487:    learn: 1.9469081        total: 2.98s    remaining: 3.13s
488:    learn: 1.9468591        total: 2.99s    remaining: 3.12s
489:    learn: 1.9467189        total: 3s       remaining: 3.12s
490:    learn: 1.9465828        total: 3s       remaining: 3.11s
491:    learn: 1.9464272        total: 3.01s    remaining: 3.1s
492:    learn: 1.9462347        total: 3.01s    remaining: 3.1s
493:    learn: 1.9462046        total: 3.02s    remaining: 3.09s
494:    learn: 1.9461837        total: 3.02s    remaining: 3.08s
495:    learn: 1.9458767        total: 3.03s    remaining: 3.08s
496:    learn: 1.9456197        total: 3.03s    remaining: 3.07s
497:    learn: 1.9453900        total: 3.04s    remaining: 3.06s
498:    learn: 1.9452029        total: 3.04s    remaining: 3.06s
499:    learn: 1.9449624        total: 3.05s    remaining: 3.05s
500:    learn: 1.9448383        total: 3.06s    remaining: 3.04s
501:    learn: 1.9447055        total: 3.06s    remaining: 3.04s
502:    learn: 1.9443887        total: 3.07s    remaining: 3.03s
503:    learn: 1.9442206        total: 3.07s    remaining: 3.02s
504:    learn: 1.9440697        total: 3.08s    remaining: 3.02s
505:    learn: 1.9439304        total: 3.08s    remaining: 3.01s
506:    learn: 1.9437840        total: 3.09s    remaining: 3s
507:    learn: 1.9435448        total: 3.1s     remaining: 3s
508:    learn: 1.9434580        total: 3.1s     remaining: 2.99s
509:    learn: 1.9433205        total: 3.11s    remaining: 2.99s
510:    learn: 1.9430910        total: 3.12s    remaining: 2.98s
511:    learn: 1.9428665        total: 3.12s    remaining: 2.97s
512:    learn: 1.9425492        total: 3.13s    remaining: 2.97s
513:    learn: 1.9424495        total: 3.13s    remaining: 2.96s
514:    learn: 1.9422126        total: 3.14s    remaining: 2.96s
515:    learn: 1.9420790        total: 3.14s    remaining: 2.95s
516:    learn: 1.9418872        total: 3.15s    remaining: 2.94s
517:    learn: 1.9416528        total: 3.16s    remaining: 2.94s
518:    learn: 1.9413559        total: 3.16s    remaining: 2.93s
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519:    learn: 1.9411345        total: 3.17s    remaining: 2.92s
520:    learn: 1.9409121        total: 3.17s    remaining: 2.92s
521:    learn: 1.9408039        total: 3.18s    remaining: 2.91s
522:    learn: 1.9405957        total: 3.19s    remaining: 2.91s
523:    learn: 1.9404569        total: 3.19s    remaining: 2.9s
524:    learn: 1.9401687        total: 3.2s     remaining: 2.9s
525:    learn: 1.9399565        total: 3.21s    remaining: 2.89s
526:    learn: 1.9399274        total: 3.21s    remaining: 2.88s
527:    learn: 1.9396316        total: 3.22s    remaining: 2.88s
528:    learn: 1.9394497        total: 3.22s    remaining: 2.87s
529:    learn: 1.9392289        total: 3.23s    remaining: 2.86s
530:    learn: 1.9389964        total: 3.24s    remaining: 2.86s
531:    learn: 1.9386957        total: 3.24s    remaining: 2.85s
532:    learn: 1.9385230        total: 3.25s    remaining: 2.85s
533:    learn: 1.9383500        total: 3.25s    remaining: 2.84s
534:    learn: 1.9382304        total: 3.26s    remaining: 2.83s
535:    learn: 1.9379759        total: 3.27s    remaining: 2.83s
536:    learn: 1.9378514        total: 3.27s    remaining: 2.82s
537:    learn: 1.9375576        total: 3.28s    remaining: 2.81s
538:    learn: 1.9373424        total: 3.28s    remaining: 2.81s
539:    learn: 1.9371106        total: 3.29s    remaining: 2.8s
540:    learn: 1.9368834        total: 3.3s     remaining: 2.8s
541:    learn: 1.9367340        total: 3.3s     remaining: 2.79s
542:    learn: 1.9366142        total: 3.31s    remaining: 2.78s
543:    learn: 1.9364039        total: 3.31s    remaining: 2.78s
544:    learn: 1.9362084        total: 3.32s    remaining: 2.77s
545:    learn: 1.9360256        total: 3.33s    remaining: 2.77s
546:    learn: 1.9358253        total: 3.33s    remaining: 2.76s
547:    learn: 1.9355191        total: 3.34s    remaining: 2.75s
548:    learn: 1.9353418        total: 3.34s    remaining: 2.75s
549:    learn: 1.9350635        total: 3.35s    remaining: 2.74s
550:    learn: 1.9348898        total: 3.35s    remaining: 2.73s
551:    learn: 1.9346074        total: 3.36s    remaining: 2.73s
552:    learn: 1.9342904        total: 3.37s    remaining: 2.72s
553:    learn: 1.9340827        total: 3.37s    remaining: 2.71s
554:    learn: 1.9338968        total: 3.38s    remaining: 2.71s
555:    learn: 1.9336241        total: 3.38s    remaining: 2.7s
556:    learn: 1.9333950        total: 3.39s    remaining: 2.7s
557:    learn: 1.9331624        total: 3.4s     remaining: 2.69s
558:    learn: 1.9329035        total: 3.4s     remaining: 2.69s
559:    learn: 1.9327499        total: 3.41s    remaining: 2.68s
560:    learn: 1.9325728        total: 3.42s    remaining: 2.67s
561:    learn: 1.9323593        total: 3.42s    remaining: 2.67s
562:    learn: 1.9321327        total: 3.43s    remaining: 2.66s
563:    learn: 1.9320561        total: 3.44s    remaining: 2.65s
564:    learn: 1.9318963        total: 3.44s    remaining: 2.65s
565:    learn: 1.9316490        total: 3.45s    remaining: 2.64s
566:    learn: 1.9314478        total: 3.45s    remaining: 2.64s
567:    learn: 1.9314147        total: 3.46s    remaining: 2.63s
568:    learn: 1.9313952        total: 3.46s    remaining: 2.62s
569:    learn: 1.9313098        total: 3.47s    remaining: 2.62s
570:    learn: 1.9311879        total: 3.47s    remaining: 2.61s
571:    learn: 1.9309594        total: 3.48s    remaining: 2.6s
572:    learn: 1.9307528        total: 3.48s    remaining: 2.6s
573:    learn: 1.9304695        total: 3.49s    remaining: 2.59s
574:    learn: 1.9303732        total: 3.5s     remaining: 2.58s
575:    learn: 1.9302738        total: 3.5s     remaining: 2.58s
576:    learn: 1.9301732        total: 3.51s    remaining: 2.57s
577:    learn: 1.9298874        total: 3.51s    remaining: 2.56s
578:    learn: 1.9297555        total: 3.52s    remaining: 2.56s
579:    learn: 1.9296326        total: 3.52s    remaining: 2.55s
580:    learn: 1.9293244        total: 3.53s    remaining: 2.55s
581:    learn: 1.9291124        total: 3.54s    remaining: 2.54s
582:    learn: 1.9289838        total: 3.54s    remaining: 2.53s
583:    learn: 1.9287188        total: 3.55s    remaining: 2.53s
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584:    learn: 1.9284559        total: 3.55s    remaining: 2.52s
585:    learn: 1.9282649        total: 3.56s    remaining: 2.51s
586:    learn: 1.9280411        total: 3.56s    remaining: 2.51s
587:    learn: 1.9279595        total: 3.57s    remaining: 2.5s
588:    learn: 1.9279175        total: 3.58s    remaining: 2.49s
589:    learn: 1.9278071        total: 3.58s    remaining: 2.49s
590:    learn: 1.9276913        total: 3.59s    remaining: 2.48s
591:    learn: 1.9276073        total: 3.6s     remaining: 2.48s
592:    learn: 1.9274376        total: 3.6s     remaining: 2.47s
593:    learn: 1.9272382        total: 3.61s    remaining: 2.47s
594:    learn: 1.9269867        total: 3.61s    remaining: 2.46s
595:    learn: 1.9268177        total: 3.62s    remaining: 2.45s
596:    learn: 1.9266938        total: 3.63s    remaining: 2.45s
597:    learn: 1.9264961        total: 3.63s    remaining: 2.44s
598:    learn: 1.9263514        total: 3.64s    remaining: 2.43s
599:    learn: 1.9261021        total: 3.64s    remaining: 2.43s
600:    learn: 1.9260758        total: 3.65s    remaining: 2.42s
601:    learn: 1.9258305        total: 3.65s    remaining: 2.42s
602:    learn: 1.9255983        total: 3.66s    remaining: 2.41s
603:    learn: 1.9253510        total: 3.67s    remaining: 2.4s
604:    learn: 1.9251413        total: 3.67s    remaining: 2.4s
605:    learn: 1.9249380        total: 3.68s    remaining: 2.39s
606:    learn: 1.9248379        total: 3.68s    remaining: 2.38s
607:    learn: 1.9247091        total: 3.69s    remaining: 2.38s
608:    learn: 1.9246560        total: 3.69s    remaining: 2.37s
609:    learn: 1.9245125        total: 3.7s     remaining: 2.37s
610:    learn: 1.9243745        total: 3.71s    remaining: 2.36s
611:    learn: 1.9241292        total: 3.71s    remaining: 2.35s
612:    learn: 1.9240223        total: 3.72s    remaining: 2.35s
613:    learn: 1.9239255        total: 3.72s    remaining: 2.34s
614:    learn: 1.9237882        total: 3.73s    remaining: 2.33s
615:    learn: 1.9236320        total: 3.73s    remaining: 2.33s
616:    learn: 1.9235873        total: 3.74s    remaining: 2.32s
617:    learn: 1.9235413        total: 3.75s    remaining: 2.31s
618:    learn: 1.9235132        total: 3.75s    remaining: 2.31s
619:    learn: 1.9232814        total: 3.76s    remaining: 2.3s
620:    learn: 1.9231413        total: 3.76s    remaining: 2.3s
621:    learn: 1.9229676        total: 3.77s    remaining: 2.29s
622:    learn: 1.9227958        total: 3.77s    remaining: 2.28s
623:    learn: 1.9225507        total: 3.78s    remaining: 2.28s
624:    learn: 1.9223884        total: 3.79s    remaining: 2.27s
625:    learn: 1.9222809        total: 3.79s    remaining: 2.27s
626:    learn: 1.9221288        total: 3.8s     remaining: 2.26s
627:    learn: 1.9218824        total: 3.81s    remaining: 2.25s
628:    learn: 1.9218346        total: 3.81s    remaining: 2.25s
629:    learn: 1.9216132        total: 3.82s    remaining: 2.24s
630:    learn: 1.9215094        total: 3.82s    remaining: 2.24s
631:    learn: 1.9214034        total: 3.83s    remaining: 2.23s
632:    learn: 1.9212409        total: 3.83s    remaining: 2.22s
633:    learn: 1.9210788        total: 3.84s    remaining: 2.22s
634:    learn: 1.9208956        total: 3.85s    remaining: 2.21s
635:    learn: 1.9206957        total: 3.85s    remaining: 2.21s
636:    learn: 1.9204843        total: 3.86s    remaining: 2.2s
637:    learn: 1.9202710        total: 3.87s    remaining: 2.19s
638:    learn: 1.9201454        total: 3.87s    remaining: 2.19s
639:    learn: 1.9199558        total: 3.88s    remaining: 2.18s
640:    learn: 1.9199547        total: 3.88s    remaining: 2.17s
641:    learn: 1.9198731        total: 3.89s    remaining: 2.17s
642:    learn: 1.9197262        total: 3.89s    remaining: 2.16s
643:    learn: 1.9194102        total: 3.9s     remaining: 2.15s
644:    learn: 1.9194092        total: 3.9s     remaining: 2.15s
645:    learn: 1.9192852        total: 3.91s    remaining: 2.14s
646:    learn: 1.9191118        total: 3.91s    remaining: 2.13s
647:    learn: 1.9190050        total: 3.92s    remaining: 2.13s
648:    learn: 1.9187496        total: 3.93s    remaining: 2.12s
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649:    learn: 1.9187487        total: 3.93s    remaining: 2.12s
650:    learn: 1.9187260        total: 3.94s    remaining: 2.11s
651:    learn: 1.9185958        total: 3.94s    remaining: 2.1s
652:    learn: 1.9182426        total: 3.95s    remaining: 2.1s
653:    learn: 1.9181513        total: 3.95s    remaining: 2.09s
654:    learn: 1.9178423        total: 3.96s    remaining: 2.08s
655:    learn: 1.9177107        total: 3.96s    remaining: 2.08s
656:    learn: 1.9175518        total: 3.97s    remaining: 2.07s
657:    learn: 1.9173821        total: 3.97s    remaining: 2.06s
658:    learn: 1.9172210        total: 3.98s    remaining: 2.06s
659:    learn: 1.9171495        total: 3.99s    remaining: 2.05s
660:    learn: 1.9170220        total: 3.99s    remaining: 2.05s
661:    learn: 1.9168587        total: 4s       remaining: 2.04s
662:    learn: 1.9166490        total: 4.01s    remaining: 2.04s
663:    learn: 1.9165381        total: 4.01s    remaining: 2.03s
664:    learn: 1.9163927        total: 4.02s    remaining: 2.02s
665:    learn: 1.9162013        total: 4.03s    remaining: 2.02s
666:    learn: 1.9160422        total: 4.03s    remaining: 2.01s
667:    learn: 1.9160044        total: 4.04s    remaining: 2s
668:    learn: 1.9158998        total: 4.04s    remaining: 2s
669:    learn: 1.9157340        total: 4.05s    remaining: 1.99s
670:    learn: 1.9156902        total: 4.05s    remaining: 1.99s
671:    learn: 1.9155353        total: 4.06s    remaining: 1.98s
672:    learn: 1.9152888        total: 4.06s    remaining: 1.97s
673:    learn: 1.9152199        total: 4.07s    remaining: 1.97s
674:    learn: 1.9150332        total: 4.07s    remaining: 1.96s
675:    learn: 1.9148779        total: 4.08s    remaining: 1.96s
676:    learn: 1.9145897        total: 4.08s    remaining: 1.95s
677:    learn: 1.9145082        total: 4.09s    remaining: 1.94s
678:    learn: 1.9143080        total: 4.1s     remaining: 1.94s
679:    learn: 1.9140866        total: 4.1s     remaining: 1.93s
680:    learn: 1.9138148        total: 4.11s    remaining: 1.92s
681:    learn: 1.9136379        total: 4.11s    remaining: 1.92s
682:    learn: 1.9135531        total: 4.12s    remaining: 1.91s
683:    learn: 1.9134040        total: 4.12s    remaining: 1.91s
684:    learn: 1.9131240        total: 4.13s    remaining: 1.9s
685:    learn: 1.9130263        total: 4.14s    remaining: 1.89s
686:    learn: 1.9127946        total: 4.14s    remaining: 1.89s
687:    learn: 1.9127793        total: 4.14s    remaining: 1.88s
688:    learn: 1.9126069        total: 4.15s    remaining: 1.87s
689:    learn: 1.9124243        total: 4.16s    remaining: 1.87s
690:    learn: 1.9124093        total: 4.16s    remaining: 1.86s
691:    learn: 1.9124079        total: 4.17s    remaining: 1.85s
692:    learn: 1.9121768        total: 4.17s    remaining: 1.85s
693:    learn: 1.9120611        total: 4.18s    remaining: 1.84s
694:    learn: 1.9119121        total: 4.18s    remaining: 1.84s
695:    learn: 1.9118173        total: 4.19s    remaining: 1.83s
696:    learn: 1.9115772        total: 4.2s     remaining: 1.82s
697:    learn: 1.9115635        total: 4.2s     remaining: 1.82s
698:    learn: 1.9115154        total: 4.21s    remaining: 1.81s
699:    learn: 1.9112705        total: 4.21s    remaining: 1.8s
700:    learn: 1.9109880        total: 4.22s    remaining: 1.8s
701:    learn: 1.9107895        total: 4.22s    remaining: 1.79s
702:    learn: 1.9105754        total: 4.23s    remaining: 1.79s
703:    learn: 1.9104148        total: 4.24s    remaining: 1.78s
704:    learn: 1.9101961        total: 4.24s    remaining: 1.77s
705:    learn: 1.9100062        total: 4.25s    remaining: 1.77s
706:    learn: 1.9098175        total: 4.25s    remaining: 1.76s
707:    learn: 1.9095797        total: 4.26s    remaining: 1.76s
708:    learn: 1.9094537        total: 4.27s    remaining: 1.75s
709:    learn: 1.9093672        total: 4.27s    remaining: 1.75s
710:    learn: 1.9091596        total: 4.28s    remaining: 1.74s
711:    learn: 1.9090390        total: 4.29s    remaining: 1.73s
712:    learn: 1.9088664        total: 4.29s    remaining: 1.73s
713:    learn: 1.9088606        total: 4.29s    remaining: 1.72s
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714:    learn: 1.9087387        total: 4.3s     remaining: 1.71s
715:    learn: 1.9085133        total: 4.31s    remaining: 1.71s
716:    learn: 1.9082185        total: 4.31s    remaining: 1.7s
717:    learn: 1.9081452        total: 4.32s    remaining: 1.7s
718:    learn: 1.9080468        total: 4.32s    remaining: 1.69s
719:    learn: 1.9078675        total: 4.33s    remaining: 1.68s
720:    learn: 1.9077564        total: 4.33s    remaining: 1.68s
721:    learn: 1.9075606        total: 4.34s    remaining: 1.67s
722:    learn: 1.9075154        total: 4.35s    remaining: 1.67s
723:    learn: 1.9075142        total: 4.35s    remaining: 1.66s
724:    learn: 1.9073529        total: 4.36s    remaining: 1.65s
725:    learn: 1.9070790        total: 4.36s    remaining: 1.65s
726:    learn: 1.9070306        total: 4.37s    remaining: 1.64s
727:    learn: 1.9068511        total: 4.37s    remaining: 1.63s
728:    learn: 1.9066562        total: 4.38s    remaining: 1.63s
729:    learn: 1.9065375        total: 4.39s    remaining: 1.62s
730:    learn: 1.9062465        total: 4.39s    remaining: 1.62s
731:    learn: 1.9062213        total: 4.4s     remaining: 1.61s
732:    learn: 1.9060913        total: 4.41s    remaining: 1.6s
733:    learn: 1.9060502        total: 4.41s    remaining: 1.6s
734:    learn: 1.9060414        total: 4.42s    remaining: 1.59s
735:    learn: 1.9059027        total: 4.42s    remaining: 1.58s
736:    learn: 1.9058714        total: 4.42s    remaining: 1.58s
737:    learn: 1.9058571        total: 4.43s    remaining: 1.57s
738:    learn: 1.9056813        total: 4.43s    remaining: 1.57s
739:    learn: 1.9055410        total: 4.44s    remaining: 1.56s
740:    learn: 1.9054807        total: 4.45s    remaining: 1.55s
741:    learn: 1.9053706        total: 4.45s    remaining: 1.55s
742:    learn: 1.9051608        total: 4.46s    remaining: 1.54s
743:    learn: 1.9050178        total: 4.46s    remaining: 1.54s
744:    learn: 1.9048774        total: 4.47s    remaining: 1.53s
745:    learn: 1.9047037        total: 4.48s    remaining: 1.52s
746:    learn: 1.9046471        total: 4.48s    remaining: 1.52s
747:    learn: 1.9045032        total: 4.49s    remaining: 1.51s
748:    learn: 1.9042977        total: 4.49s    remaining: 1.51s
749:    learn: 1.9041401        total: 4.5s     remaining: 1.5s
750:    learn: 1.9039998        total: 4.51s    remaining: 1.49s
751:    learn: 1.9037898        total: 4.51s    remaining: 1.49s
752:    learn: 1.9036066        total: 4.52s    remaining: 1.48s
753:    learn: 1.9035598        total: 4.52s    remaining: 1.48s
754:    learn: 1.9035510        total: 4.53s    remaining: 1.47s
755:    learn: 1.9034227        total: 4.54s    remaining: 1.46s
756:    learn: 1.9031899        total: 4.54s    remaining: 1.46s
757:    learn: 1.9031254        total: 4.55s    remaining: 1.45s
758:    learn: 1.9029275        total: 4.55s    remaining: 1.45s
759:    learn: 1.9028456        total: 4.56s    remaining: 1.44s
760:    learn: 1.9027913        total: 4.56s    remaining: 1.43s
761:    learn: 1.9025809        total: 4.57s    remaining: 1.43s
762:    learn: 1.9025466        total: 4.57s    remaining: 1.42s
763:    learn: 1.9023915        total: 4.58s    remaining: 1.41s
764:    learn: 1.9021939        total: 4.59s    remaining: 1.41s
765:    learn: 1.9020170        total: 4.59s    remaining: 1.4s
766:    learn: 1.9018199        total: 4.6s     remaining: 1.4s
767:    learn: 1.9017198        total: 4.61s    remaining: 1.39s
768:    learn: 1.9015715        total: 4.61s    remaining: 1.39s
769:    learn: 1.9013563        total: 4.62s    remaining: 1.38s
770:    learn: 1.9012493        total: 4.62s    remaining: 1.37s
771:    learn: 1.9012335        total: 4.63s    remaining: 1.37s
772:    learn: 1.9010132        total: 4.63s    remaining: 1.36s
773:    learn: 1.9008053        total: 4.64s    remaining: 1.35s
774:    learn: 1.9007770        total: 4.64s    remaining: 1.35s
775:    learn: 1.9006247        total: 4.65s    remaining: 1.34s
776:    learn: 1.9004802        total: 4.66s    remaining: 1.34s
777:    learn: 1.9003369        total: 4.66s    remaining: 1.33s
778:    learn: 1.9001818        total: 4.67s    remaining: 1.32s
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779:    learn: 1.8999593        total: 4.67s    remaining: 1.32s
780:    learn: 1.8997906        total: 4.68s    remaining: 1.31s
781:    learn: 1.8997673        total: 4.68s    remaining: 1.3s
782:    learn: 1.8995755        total: 4.69s    remaining: 1.3s
783:    learn: 1.8995747        total: 4.69s    remaining: 1.29s
784:    learn: 1.8992854        total: 4.7s     remaining: 1.29s
785:    learn: 1.8991741        total: 4.71s    remaining: 1.28s
786:    learn: 1.8990770        total: 4.71s    remaining: 1.27s
787:    learn: 1.8989331        total: 4.72s    remaining: 1.27s
788:    learn: 1.8987435        total: 4.72s    remaining: 1.26s
789:    learn: 1.8985514        total: 4.73s    remaining: 1.26s
790:    learn: 1.8983614        total: 4.74s    remaining: 1.25s
791:    learn: 1.8983603        total: 4.74s    remaining: 1.25s
792:    learn: 1.8982186        total: 4.75s    remaining: 1.24s
793:    learn: 1.8980365        total: 4.75s    remaining: 1.23s
794:    learn: 1.8978102        total: 4.76s    remaining: 1.23s
795:    learn: 1.8976695        total: 4.76s    remaining: 1.22s
796:    learn: 1.8974482        total: 4.77s    remaining: 1.22s
797:    learn: 1.8972125        total: 4.78s    remaining: 1.21s
798:    learn: 1.8970365        total: 4.79s    remaining: 1.2s
799:    learn: 1.8969126        total: 4.79s    remaining: 1.2s
800:    learn: 1.8967361        total: 4.8s     remaining: 1.19s
801:    learn: 1.8965629        total: 4.8s     remaining: 1.19s
802:    learn: 1.8964117        total: 4.81s    remaining: 1.18s
803:    learn: 1.8963184        total: 4.81s    remaining: 1.17s
804:    learn: 1.8961128        total: 4.82s    remaining: 1.17s
805:    learn: 1.8959114        total: 4.83s    remaining: 1.16s
806:    learn: 1.8959087        total: 4.83s    remaining: 1.16s
807:    learn: 1.8957712        total: 4.83s    remaining: 1.15s
808:    learn: 1.8956443        total: 4.84s    remaining: 1.14s
809:    learn: 1.8954593        total: 4.85s    remaining: 1.14s
810:    learn: 1.8953869        total: 4.85s    remaining: 1.13s
811:    learn: 1.8952839        total: 4.86s    remaining: 1.12s
812:    learn: 1.8951909        total: 4.86s    remaining: 1.12s
813:    learn: 1.8950418        total: 4.87s    remaining: 1.11s
814:    learn: 1.8949155        total: 4.87s    remaining: 1.11s
815:    learn: 1.8947137        total: 4.88s    remaining: 1.1s
816:    learn: 1.8944999        total: 4.89s    remaining: 1.09s
817:    learn: 1.8943639        total: 4.89s    remaining: 1.09s
818:    learn: 1.8942653        total: 4.9s     remaining: 1.08s
819:    learn: 1.8941023        total: 4.9s     remaining: 1.08s
820:    learn: 1.8939595        total: 4.91s    remaining: 1.07s
821:    learn: 1.8938075        total: 4.92s    remaining: 1.06s
822:    learn: 1.8935711        total: 4.92s    remaining: 1.06s
823:    learn: 1.8933434        total: 4.93s    remaining: 1.05s
824:    learn: 1.8932339        total: 4.93s    remaining: 1.05s
825:    learn: 1.8930354        total: 4.94s    remaining: 1.04s
826:    learn: 1.8928963        total: 4.95s    remaining: 1.03s
827:    learn: 1.8926958        total: 4.95s    remaining: 1.03s
828:    learn: 1.8924673        total: 4.96s    remaining: 1.02s
829:    learn: 1.8922812        total: 4.96s    remaining: 1.02s
830:    learn: 1.8921336        total: 4.97s    remaining: 1.01s
831:    learn: 1.8920143        total: 4.97s    remaining: 1s
832:    learn: 1.8918867        total: 4.98s    remaining: 999ms
833:    learn: 1.8917293        total: 4.99s    remaining: 993ms
834:    learn: 1.8916000        total: 4.99s    remaining: 987ms
835:    learn: 1.8913860        total: 5s       remaining: 981ms
836:    learn: 1.8912758        total: 5.01s    remaining: 975ms
837:    learn: 1.8910930        total: 5.01s    remaining: 969ms
838:    learn: 1.8910031        total: 5.02s    remaining: 963ms
839:    learn: 1.8907689        total: 5.02s    remaining: 957ms
840:    learn: 1.8905665        total: 5.03s    remaining: 951ms
841:    learn: 1.8905511        total: 5.03s    remaining: 945ms
842:    learn: 1.8903912        total: 5.04s    remaining: 939ms
843:    learn: 1.8903704        total: 5.04s    remaining: 933ms
```

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844:    learn: 1.8902583        total: 5.05s    remaining: 926ms
845:    learn: 1.8902014        total: 5.06s    remaining: 921ms
846:    learn: 1.8900644        total: 5.06s    remaining: 915ms
847:    learn: 1.8900158        total: 5.07s    remaining: 908ms
848:    learn: 1.8897874        total: 5.07s    remaining: 903ms
849:    learn: 1.8896157        total: 5.08s    remaining: 897ms
850:    learn: 1.8894771        total: 5.09s    remaining: 891ms
851:    learn: 1.8893226        total: 5.09s    remaining: 885ms
852:    learn: 1.8891096        total: 5.1s     remaining: 879ms
853:    learn: 1.8889900        total: 5.1s     remaining: 872ms
854:    learn: 1.8888795        total: 5.11s    remaining: 866ms
855:    learn: 1.8886840        total: 5.11s    remaining: 860ms
856:    learn: 1.8884876        total: 5.12s    remaining: 854ms
857:    learn: 1.8883648        total: 5.13s    remaining: 848ms
858:    learn: 1.8883357        total: 5.13s    remaining: 842ms
859:    learn: 1.8881430        total: 5.14s    remaining: 836ms
860:    learn: 1.8879741        total: 5.14s    remaining: 830ms
861:    learn: 1.8879179        total: 5.15s    remaining: 824ms
862:    learn: 1.8877715        total: 5.15s    remaining: 818ms
863:    learn: 1.8876188        total: 5.16s    remaining: 812ms
864:    learn: 1.8873992        total: 5.16s    remaining: 806ms
865:    learn: 1.8872355        total: 5.17s    remaining: 800ms
866:    learn: 1.8870617        total: 5.18s    remaining: 794ms
867:    learn: 1.8869354        total: 5.18s    remaining: 788ms
868:    learn: 1.8868053        total: 5.19s    remaining: 782ms
869:    learn: 1.8867559        total: 5.19s    remaining: 776ms
870:    learn: 1.8867173        total: 5.2s     remaining: 770ms
871:    learn: 1.8864772        total: 5.21s    remaining: 764ms
872:    learn: 1.8863645        total: 5.21s    remaining: 759ms
873:    learn: 1.8861512        total: 5.22s    remaining: 753ms
874:    learn: 1.8859922        total: 5.23s    remaining: 747ms
875:    learn: 1.8858784        total: 5.23s    remaining: 741ms
876:    learn: 1.8857241        total: 5.24s    remaining: 735ms
877:    learn: 1.8853947        total: 5.24s    remaining: 729ms
878:    learn: 1.8851622        total: 5.25s    remaining: 723ms
879:    learn: 1.8849806        total: 5.26s    remaining: 717ms
880:    learn: 1.8849579        total: 5.26s    remaining: 711ms
881:    learn: 1.8848295        total: 5.27s    remaining: 705ms
882:    learn: 1.8846918        total: 5.27s    remaining: 699ms
883:    learn: 1.8846020        total: 5.28s    remaining: 693ms
884:    learn: 1.8844355        total: 5.28s    remaining: 687ms
885:    learn: 1.8841806        total: 5.29s    remaining: 681ms
886:    learn: 1.8840310        total: 5.29s    remaining: 675ms
887:    learn: 1.8838450        total: 5.3s     remaining: 669ms
888:    learn: 1.8836699        total: 5.31s    remaining: 663ms
889:    learn: 1.8835058        total: 5.31s    remaining: 657ms
890:    learn: 1.8833424        total: 5.32s    remaining: 651ms
891:    learn: 1.8831954        total: 5.32s    remaining: 645ms
892:    learn: 1.8830607        total: 5.33s    remaining: 639ms
893:    learn: 1.8829798        total: 5.33s    remaining: 633ms
894:    learn: 1.8827307        total: 5.34s    remaining: 627ms
895:    learn: 1.8825544        total: 5.35s    remaining: 621ms
896:    learn: 1.8822349        total: 5.35s    remaining: 615ms
897:    learn: 1.8822251        total: 5.36s    remaining: 609ms
898:    learn: 1.8822067        total: 5.36s    remaining: 603ms
899:    learn: 1.8820627        total: 5.37s    remaining: 597ms
900:    learn: 1.8818985        total: 5.38s    remaining: 591ms
901:    learn: 1.8818678        total: 5.38s    remaining: 585ms
902:    learn: 1.8818462        total: 5.39s    remaining: 579ms
903:    learn: 1.8817091        total: 5.39s    remaining: 573ms
904:    learn: 1.8816032        total: 5.4s     remaining: 567ms
905:    learn: 1.8815387        total: 5.41s    remaining: 561ms
906:    learn: 1.8813967        total: 5.41s    remaining: 555ms
907:    learn: 1.8813683        total: 5.42s    remaining: 549ms
908:    learn: 1.8813565        total: 5.42s    remaining: 543ms
```

```
909:    learn: 1.8812364        total: 5.43s    remaining: 537ms
910:    learn: 1.8810999        total: 5.43s    remaining: 531ms
911:    learn: 1.8809432        total: 5.44s    remaining: 525ms
912:    learn: 1.8808247        total: 5.44s    remaining: 519ms
913:    learn: 1.8805910        total: 5.45s    remaining: 513ms
914:    learn: 1.8804949        total: 5.46s    remaining: 507ms
915:    learn: 1.8803817        total: 5.46s    remaining: 501ms
916:    learn: 1.8801443        total: 5.47s    remaining: 495ms
917:    learn: 1.8800711        total: 5.47s    remaining: 489ms
918:    learn: 1.8798673        total: 5.48s    remaining: 483ms
919:    learn: 1.8796261        total: 5.49s    remaining: 477ms
920:    learn: 1.8794319        total: 5.49s    remaining: 471ms
921:    learn: 1.8791807        total: 5.5s     remaining: 465ms
922:    learn: 1.8791221        total: 5.5s     remaining: 459ms
923:    learn: 1.8788600        total: 5.51s    remaining: 453ms
924:    learn: 1.8788397        total: 5.51s    remaining: 447ms
925:    learn: 1.8788116        total: 5.52s    remaining: 441ms
926:    learn: 1.8786220        total: 5.53s    remaining: 435ms
927:    learn: 1.8784896        total: 5.53s    remaining: 429ms
928:    learn: 1.8784241        total: 5.54s    remaining: 423ms
929:    learn: 1.8783617        total: 5.54s    remaining: 417ms
930:    learn: 1.8782889        total: 5.55s    remaining: 411ms
931:    learn: 1.8781511        total: 5.55s    remaining: 405ms
932:    learn: 1.8780613        total: 5.56s    remaining: 399ms
933:    learn: 1.8779361        total: 5.56s    remaining: 393ms
934:    learn: 1.8777318        total: 5.57s    remaining: 387ms
935:    learn: 1.8774837        total: 5.58s    remaining: 382ms
936:    learn: 1.8774585        total: 5.58s    remaining: 376ms
937:    learn: 1.8773268        total: 5.59s    remaining: 370ms
938:    learn: 1.8770858        total: 5.6s     remaining: 364ms
939:    learn: 1.8770185        total: 5.6s     remaining: 358ms
940:    learn: 1.8769058        total: 5.61s    remaining: 352ms
941:    learn: 1.8767031        total: 5.61s    remaining: 346ms
942:    learn: 1.8765762        total: 5.62s    remaining: 340ms
943:    learn: 1.8763909        total: 5.63s    remaining: 334ms
944:    learn: 1.8762474        total: 5.63s    remaining: 328ms
945:    learn: 1.8761186        total: 5.64s    remaining: 322ms
946:    learn: 1.8759305        total: 5.64s    remaining: 316ms
947:    learn: 1.8759293        total: 5.65s    remaining: 310ms
948:    learn: 1.8757620        total: 5.65s    remaining: 304ms
949:    learn: 1.8755953        total: 5.66s    remaining: 298ms
950:    learn: 1.8754241        total: 5.67s    remaining: 292ms
951:    learn: 1.8752526        total: 5.67s    remaining: 286ms
952:    learn: 1.8751353        total: 5.68s    remaining: 280ms
953:    learn: 1.8749902        total: 5.68s    remaining: 274ms
954:    learn: 1.8748347        total: 5.69s    remaining: 268ms
955:    learn: 1.8747344        total: 5.69s    remaining: 262ms
956:    learn: 1.8745585        total: 5.7s     remaining: 256ms
957:    learn: 1.8743016        total: 5.71s    remaining: 250ms
958:    learn: 1.8741567        total: 5.71s    remaining: 244ms
959:    learn: 1.8740038        total: 5.72s    remaining: 238ms
960:    learn: 1.8738907        total: 5.72s    remaining: 232ms
961:    learn: 1.8737958        total: 5.73s    remaining: 226ms
962:    learn: 1.8735104        total: 5.73s    remaining: 220ms
963:    learn: 1.8733375        total: 5.74s    remaining: 214ms
964:    learn: 1.8732005        total: 5.75s    remaining: 208ms
965:    learn: 1.8731060        total: 5.75s    remaining: 202ms
966:    learn: 1.8729295        total: 5.76s    remaining: 196ms
967:    learn: 1.8728023        total: 5.76s    remaining: 191ms
968:    learn: 1.8726460        total: 5.77s    remaining: 185ms
969:    learn: 1.8726147        total: 5.77s    remaining: 179ms
970:    learn: 1.8724617        total: 5.78s    remaining: 173ms
971:    learn: 1.8722216        total: 5.79s    remaining: 167ms
972:    learn: 1.8721850        total: 5.79s    remaining: 161ms
973:    learn: 1.8720051        total: 5.8s     remaining: 155ms
```

```
974:    learn: 1.8718098        total: 5.8s     remaining: 149ms
975:    learn: 1.8717150        total: 5.81s    remaining: 143ms
976:    learn: 1.8715960        total: 5.82s    remaining: 137ms
977:    learn: 1.8713981        total: 5.82s    remaining: 131ms
978:    learn: 1.8713932        total: 5.83s    remaining: 125ms
979:    learn: 1.8713925        total: 5.83s    remaining: 119ms
980:    learn: 1.8712340        total: 5.83s    remaining: 113ms
981:    learn: 1.8711471        total: 5.84s    remaining: 107ms
982:    learn: 1.8711066        total: 5.85s    remaining: 101ms
983:    learn: 1.8709246        total: 5.85s    remaining: 95.2ms
984:    learn: 1.8707875        total: 5.86s    remaining: 89.2ms
985:    learn: 1.8707016        total: 5.86s    remaining: 83.3ms
986:    learn: 1.8705756        total: 5.87s    remaining: 77.3ms
987:    learn: 1.8703648        total: 5.87s    remaining: 71.4ms
988:    learn: 1.8702404        total: 5.88s    remaining: 65.4ms
989:    learn: 1.8701382        total: 5.88s    remaining: 59.4ms
990:    learn: 1.8700164        total: 5.89s    remaining: 53.5ms
991:    learn: 1.8698633        total: 5.9s     remaining: 47.6ms
992:    learn: 1.8697919        total: 5.9s     remaining: 41.6ms
993:    learn: 1.8697552        total: 5.91s    remaining: 35.7ms
994:    learn: 1.8695380        total: 5.91s    remaining: 29.7ms
995:    learn: 1.8693622        total: 5.92s    remaining: 23.8ms
996:    learn: 1.8691850        total: 5.92s    remaining: 17.8ms
997:    learn: 1.8690396        total: 5.93s    remaining: 11.9ms
998:    learn: 1.8689416        total: 5.93s    remaining: 5.94ms
999:    learn: 1.8688035        total: 5.94s    remaining: 0us
```

Out[47]: 1.4049496256403158

In [48]:
```python
from sklearn.metrics import mean_absolute_error
# Instantiate the model
gb_model = GradientBoostingRegressor()

# Fit the model to the training data
gb_model.fit(x_train, y_train)

# Use the model to make predictions on the test data
gb_y_pred = gb_model.predict(x_test)

# Calculate the mean absolute error of the model
score = mean_absolute_error(y_test, gb_y_pred)
score
```

Out[48]: 1.423003784522968

In [49]:
```python
from sklearn.metrics import mean_absolute_error
# Instantiate the model
lgbm_model = LGBMRegressor()

# Fit the model to the training data
lgbm_model.fit(x_train, y_train)

# Use the model to make predictions on the test data
y_pred = lgbm_model.predict(x_test)

# Calculate the mean absolute error of the model
score = mean_absolute_error(y_test, y_pred)
score
```

Out[49]: 1.4047858888263385

In [50]:
```python
test_df=pd.read_csv('/kaggle/input/playground-series-s3e16/test.csv')
```

In [51]:
```python
test_df
```

Out[51]:

	id	Sex	Length	Diameter	Height	Weight	Shucked Weight	Viscera Weight	Shell Weight
0	74051	I	1.0500	0.7625	0.2750	8.618248	3.657085	1.729319	2.721552
1	74052	I	1.1625	0.8875	0.2750	15.507176	7.030676	3.246018	3.968930
2	74053	F	1.2875	0.9875	0.3250	14.571643	5.556502	3.883882	4.819415
3	74054	F	1.5500	0.9875	0.3875	28.377849	13.380964	6.548735	7.030676
4	74055	I	1.1125	0.8500	0.2625	11.765042	5.528153	2.466407	3.331066
...	...	...	...	...	...	...	...	...	...
49363	123414	F	1.3000	1.0375	0.3250	16.315137	6.690482	5.173784	3.756309
49364	123415	I	1.0375	0.7625	0.2625	10.276694	4.436697	1.998640	3.543687
49365	123416	F	1.4875	1.1625	0.3625	31.382897	11.396499	6.846404	8.788345
49366	123417	F	1.2375	0.9500	0.2875	15.663099	6.095142	3.727959	4.961163
49367	123418	M	1.6625	1.3000	0.4375	36.613379	14.911837	8.292229	10.489315

49368 rows × 9 columns

In [52]:
```
sample_sub=pd.read_csv('/kaggle/input/playground-series-s3e16/sample_submission.csv')
sample_sub
```

Out[52]:

	id	Age
0	74051	10
1	74052	10
2	74053	10
3	74054	10
4	74055	10
...	...	...
49363	123414	10
49364	123415	10
49365	123416	10
49366	123417	10
49367	123418	10

49368 rows × 2 columns

In [53]:
```
test_df['Sex'] = test_df['Sex'].map({'F': 0, 'M': 1,'I':2})
```

In [54]:
```
prediction=cat_model.predict(test_df.drop("id",axis=1))
prediction
```

Out[54]:
```
array([ 7.3300931 ,  7.68378105, 10.99535997, ..., 13.33633524,
        9.82719008, 12.33106507])
```

In [55]:
```
submission=pd.DataFrame({"id":test_df.id,"Age":prediction})
submission.head()
```

Out[55]:

	id	Age
0	74051	7.330093
1	74052	7.683781
2	74053	10.995360
3	74054	9.401559
4	74055	7.426228

In [56]:
```
submission.to_csv('submission_cat.csv',index=False)
```

In [ ]:
```

```