Assignment-3
Statistical Machine Learning Approaches
To Liver Disease Prediction

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Maximum Marks	2 Marks

Abalone Age Prediction:

Download the dataset

Load the dataset into the tool.

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```
import numpy as np
import pandas as pd
d=pd.read_csv("/Kamali-Dataset.csv")
d.head()
```

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

```
Age = []
for x in d["Rings"]:
  Age.append(x+1.5)
d['Age'] = Age
d['Age'].head()
```

```
0    16.5
1     8.5
2    10.5
3    11.5
4     8.5
Name: Age, dtype: float64
```

```
d.drop(columns=['Rings'],axis=1,inplace=True)
```

Univariate Analysis
Bi-Variate Analysis
Multi-Variate Analysis

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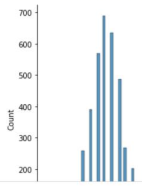
```
d.drop(columns=['Rings'],axis=1,inplace=True)
d.head()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Age
0	M	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	16.5
1	M	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	8.5
2	F	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	10.5
3	M	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	11.5
4	I	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	8.5

```
import seaborn as sns
sns.displot(d["Age"])
```

<seaborn.axisgrid.FacetGrid at 0x7f11d47f38d0>



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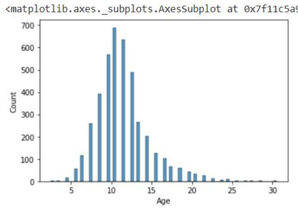
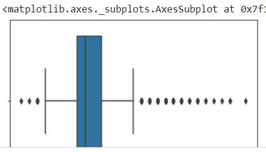
```
sns.histplot(x=d['Age'])
```

<matplotlib.axes._subplots.AxesSubplot at 0x7f11c5a9d410>




```
sns.boxplot(x=d['Age'])
```

<matplotlib.axes._subplots.AxesSubplot at 0x7f11c553bd10>



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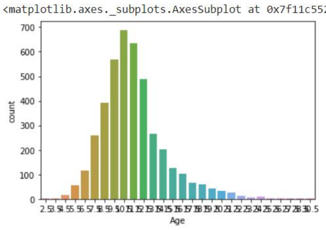
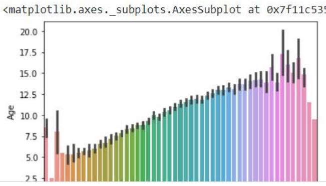
```
sns.countplot(x=d['Age'])
```

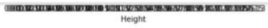
<matplotlib.axes._subplots.AxesSubplot at 0x7f11c552f990>




```
sns.barplot(x=d['Height'],y=d['Age'])
```

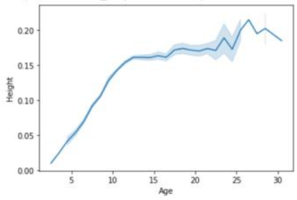
<matplotlib.axes._subplots.AxesSubplot at 0x7f11c5353d90>





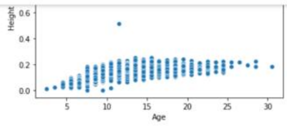
```
sns.lineplot(x=d['Age'],y=d['Height'])
```

<matplotlib.axes._subplots.AxesSubplot at 0x7f11c5401250>



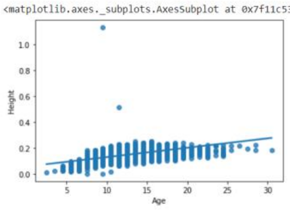

```
sns.scatterplot(x=d['Age'],y=d['Height'])
```

<matplotlib.axes._subplots.AxesSubplot at 0x7f11c5080a50>

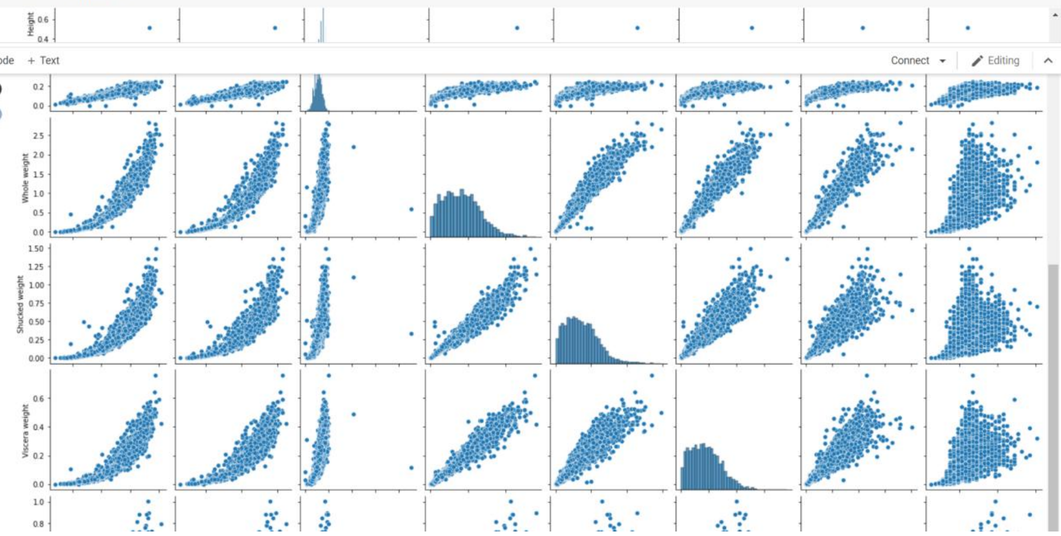



```
sns.regplot(x=d['Age'],y=d['Height'])
```

<matplotlib.axes._subplots.AxesSubplot at 0x7f11c539abd0>




```
sns.pairplot(data=d)
```



Perform descriptive statistics on the dataset.

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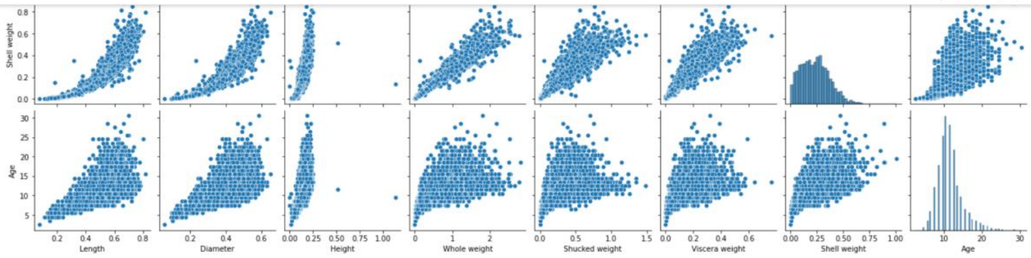

```
d.describe()
```

	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Age
count	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000
mean	0.523992	0.407881	0.139516	0.828742	0.359367	0.180594	0.238831	11.433684
std	0.120093	0.099240	0.041827	0.490389	0.221963	0.109614	0.139203	3.224169
min	0.075000	0.055000	0.000000	0.002000	0.001000	0.000500	0.001500	2.500000
25%	0.450000	0.350000	0.115000	0.441500	0.186000	0.093500	0.130000	9.500000
50%	0.545000	0.425000	0.140000	0.799500	0.336000	0.171000	0.234000	10.500000

Check for Missing values and deal with them.

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max	0.815000	0.650000	1.130000	2.825500	1.488000	0.760000	1.005000	30.500000

```
d.isnull().sum()
```

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

```
d.isna().any()
```

```
Sex               False
Length            False
Diameter          False
Height            False
Whole weight      False
Shucked weight    False
Viscera weight    False
Shell weight      False
Age               False
dtype: bool
```

```
x = sns.boxplot(x=d["Age"])
```

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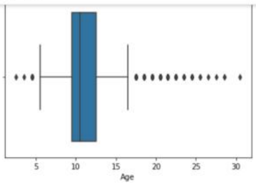
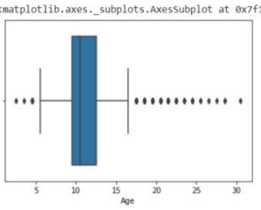


```
x = d.Age
sns.boxplot(x=x)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f11c304b550>
```



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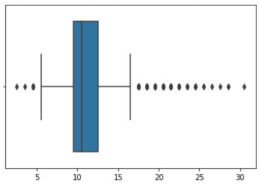
```
[ ] x = np.where(d['Age']>57,39, d['Age'])
    x
```

```
array([16.5,  8.5, 10.5, ..., 10.5, 11.5, 13.5])
```

```
sns.boxplot(x=x)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f11c17ff310>
```




```
[ ] import warnings
    warnings.filterwarnings('ignore')
    pd.Categorical(d["Whole weight"])
```

```
[0.5140, 0.2255, 0.6770, 0.5160, 0.2050, ..., 0.8870, 0.9660, 1.1760, 1.0945, 1.9485]
Length: 4177
Categories (2429, float64): [0.0020, 0.0080, 0.0105, 0.0130, ..., 2.5550, 2.6570, 2.7795, 2.8255]
```

Split the data into dependent and independent variables.

Check for Categorical columns and perform encoding.

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```
pd.get_dummies(d["Height"]).head()
```

	0.000	0.010	0.015	0.020	0.025	0.030	0.035	0.040	0.045	0.050	...	0.210	0.215	0.220	0.225	0.230	0.235	0.240	0.250	0.515	1.130
0	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0

5 rows × 51 columns

```
[ ] pd.get_dummies(d).head()
```

	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Age	Sex_F	Sex_I	Sex_M
0	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	16.5	0	0	1
1	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	8.5	0	0	1
2	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	10.5	1	0	0
3	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	11.5	0	0	1
4	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	8.5	0	1	0

```
[ ] X = d.iloc[:, :-1].values
    X
```

Scale the independent variables

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```
X = d.iloc[:, :-1].values
X
```

```
array([['M', 0.455, 0.365, ..., 0.2245, 0.101, 0.15],
       ['M', 0.35, 0.265, ..., 0.0995, 0.0485, 0.07],
       ['F', 0.53, 0.42, ..., 0.2565, 0.1415, 0.21],
       ...,
       ['M', 0.6, 0.475, ..., 0.5255, 0.2875, 0.308],
       ['F', 0.625, 0.485, ..., 0.531, 0.261, 0.296],
       ['M', 0.71, 0.555, ..., 0.9455, 0.3765, 0.495]], dtype=object)
```

```
[ ] Y = d.iloc[:, -1].values
    Y
```

```
array([16.5,  8.5, 10.5, ..., 10.5, 11.5, 13.5])
```

```
[ ] from sklearn.preprocessing import scale
    x = scale(d["Viscera weight"])
    x
```

```
array([-0.72621157, -1.20522124, -0.35668983, ...,  0.97541324,
        0.73362741,  1.78744868])
```

```
[ ] x = d.iloc[:, 1:7]
    x
```

	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight
0	0.455	0.365	0.095	0.5140	0.2245	0.1010
1	0.350	0.265	0.090	0.2255	0.0995	0.0485

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1	0.350	0.265	0.090	0.2255	0.0995	0.0485
2	0.530	0.420	0.135	0.6770	0.2565	0.1415
3	0.440	0.365	0.125	0.5160	0.2155	0.1140
4	0.330	0.255	0.080	0.2050	0.0895	0.0395
...	...	...	...	...	...	...
4172	0.565	0.450	0.165	0.8870	0.3700	0.2390
4173	0.590	0.440	0.135	0.9660	0.4390	0.2145
4174	0.600	0.475	0.205	1.1760	0.5255	0.2875
4175	0.625	0.485	0.150	1.0945	0.5310	0.2610
4176	0.710	0.555	0.195	1.9485	0.9455	0.3765

4177 rows × 6 columns

```
y = d.iloc[:, -1]
y
```

```
0       16.5
1        8.5
2       10.5
3       11.5
4        8.5
        ...
4172    12.5
4173    11.5
4174    10.5
4175    11.5
4176    13.5
```

Split the data into training and testing
Build the Model
Train the Model
Test the Model

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```
4175    11.5
4176    13.5
Name: Age, Length: 4177, dtype: float64
```

```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.25,random_state =42)
x_train.shape
```

```
(3132, 6)
```

```
y_test.shape
```

```
(1045,)
```

```
x_train.head()
```

	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight
3823	0.615	0.455	0.135	1.0590	0.4735	0.2630
3956	0.515	0.395	0.140	0.6860	0.2810	0.1255
3623	0.660	0.530	0.175	1.5830	0.7395	0.3505
0	0.455	0.365	0.095	0.5140	0.2245	0.1010
2183	0.495	0.400	0.155	0.8085	0.2345	0.1155

```
x_test.head()
```

Length Diameter Height Whole weight Shucked weight Viscera weight

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```
x_test.head()
```

	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight
866	0.605	0.455	0.160	1.1035	0.4210	0.3015
1483	0.590	0.440	0.150	0.8725	0.3870	0.2150
599	0.560	0.445	0.195	0.9810	0.3050	0.2245
1702	0.635	0.490	0.170	1.2615	0.5385	0.2665
670	0.475	0.385	0.145	0.6175	0.2350	0.1080

```
y_train.head()
```

```
3823    10.5
3956    13.5
3623    11.5
0       16.5
2183     7.5
Name: Age, dtype: float64
```

```
y_test.head()
```

```
866     10.5
1483     9.5
599     17.5
1702    10.5
670     15.5
Name: Age, dtype: float64
```

Measure the performance using Metrics.

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```
from sklearn.linear_model import LinearRegression
model=LinearRegression()
model.fit(x_train,y_train)
```

```
LinearRegression()
```

```
Y_predict_train = model.predict(x_train)
Y_predict_train
```

```
array([11.25888828, 11.95379472, 12.33692259, ..., 11.12903068,
       10.71152746, 11.59516371])
```

```
y_predict = model.predict(x_test)
y_predict
```

```
array([13.0478407 , 11.43166184, 15.59825921, ..., 13.69440346,
       11.79279231, 10.83037939])
```

```
import math
from sklearn.metrics import mean_squared_error
print(mean_squared_error(y_test, y_predict))
print(math.sqrt(mean_squared_error(y_test, y_predict)))
```

```
4.862459933051861
2.2050986220692854
```