In [247]:
```
import pandas as pd
import numpy as np
import seaborn as sns
```

In [248]:
```
df1=pd.read_csv('C:/Users/ashiq/Desktop/csv/assignment_4/delivery_time.csv')
```

In [249]:
```
df1_copy= df1.copy()
```

In [250]:
```
df1_copy
```

Out[250]:

	Delivery_Time	Sorting_Time
0	21.00	10
1	13.50	4
2	19.75	6
3	24.00	9
4	29.00	10
5	15.35	6
6	19.00	7
7	9.50	3
8	17.90	10
9	18.75	9
10	19.83	8
11	10.75	4
12	16.68	7
13	11.50	3
14	12.03	3
15	14.88	4
16	13.75	6
17	18.11	7
18	8.00	2
19	17.83	7
20	21.50	5

In [251]:
```
df1.head()
```

Out[251]:

	Delivery_Time	Sorting_Time
0	21.00	10
1	13.50	4
2	19.75	6
3	24.00	9
4	29.00	10

In [252]:
```
df1.shape
```

Out[252]:
```
(21, 2)
```

In [253]:
```
df1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 21 entries, 0 to 20
Data columns (total 2 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   Delivery_Time  21 non-null     float64
 1   Sorting_Time   21 non-null     int64
dtypes: float64(1), int64(1)
memory usage: 464.0 bytes
```

In [254]:
```
df1.corr()
```

Out[254]:

	Delivery_Time	Sorting_Time
Delivery_Time	1.000000	0.825997
Sorting_Time	0.825997	1.000000

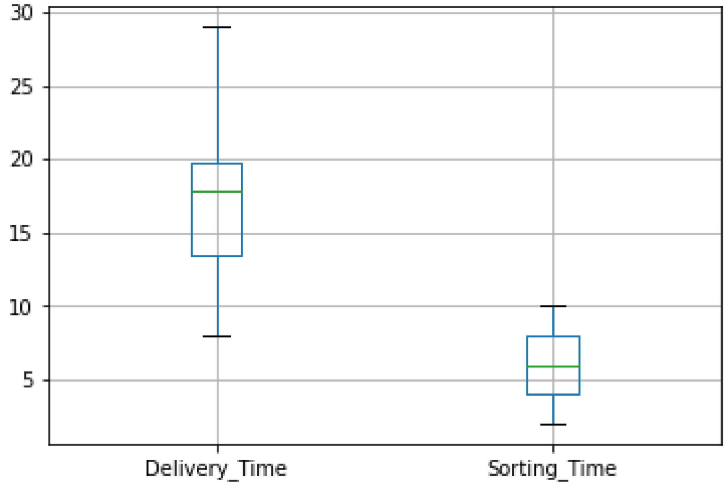
In [255]:
```
df1.describe()
```

Out[255]:

	Delivery_Time	Sorting_Time
count	21.000000	21.000000
mean	16.790952	6.190476
std	5.074901	2.542028
min	8.000000	2.000000
25%	13.500000	4.000000
50%	17.830000	6.000000
75%	19.750000	8.000000
max	29.000000	10.000000

In [256]:
```
df1.boxplot()
```

Out[256]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1cb88737250>
```

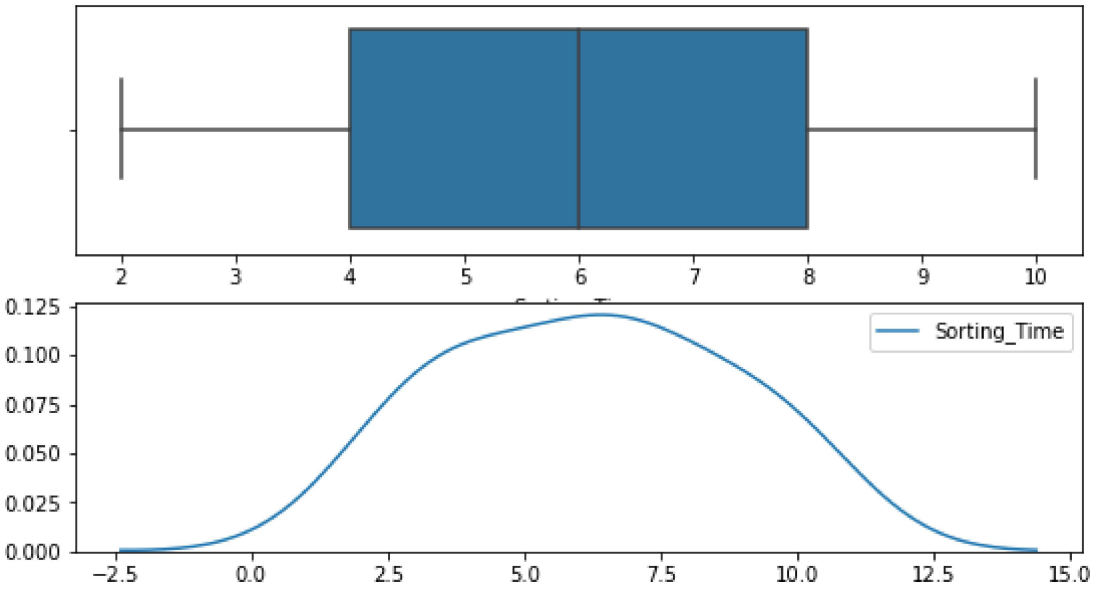


In [257]:
```
import matplotlib.pyplot as plt
plt.figure(figsize = (9, 5))

plt.subplot(211)
sns.boxplot(df1['Sorting_Time'])

plt.subplot(212)
sns.kdeplot(df1['Sorting_Time'])
```

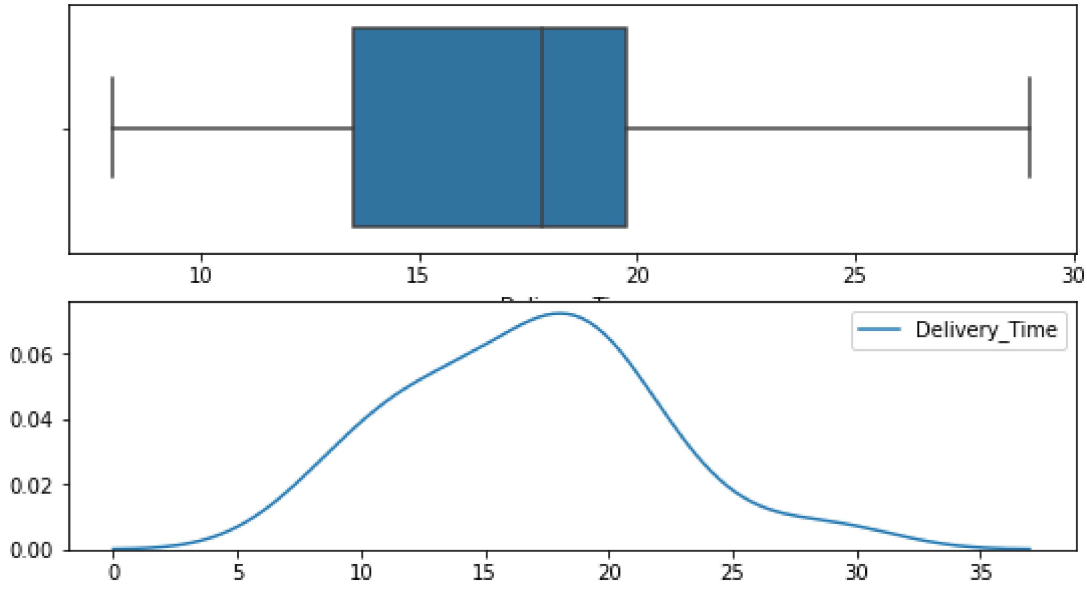
Out[257]: <matplotlib.axes._subplots.AxesSubplot at 0x1cb887b31f0>



In [258]:
```
plt.figure(figsize = (9, 5))
plt.subplot(211)
sns.boxplot(df1['Delivery_Time'])

plt.subplot(212)
sns.kdeplot(df1['Delivery_Time'])
```

Out[258]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1cb88853b20>
```



In [259]:
```
from scipy.stats import kurtosis
from scipy.stats import skew
(kurtosis(df1['Delivery_Time']),skew(df1['Delivery_Time']))
```

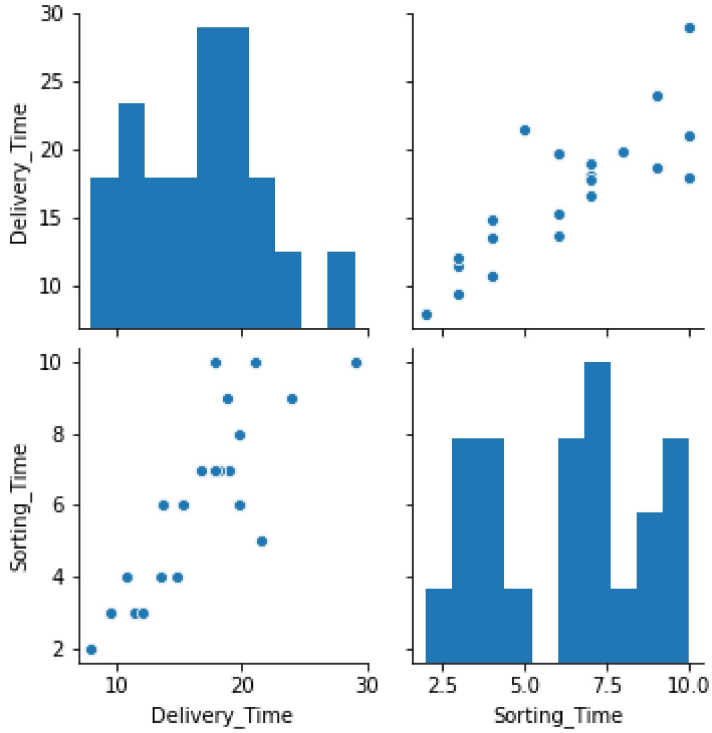
Out[259]:
```
(-0.02558576894549036, 0.326702631656106)
```

In [260]:
```
(kurtosis(df1['Sorting_Time']),skew(df1['Sorting_Time']))
```

Out[260]:
```
(-1.1653901357029155, 0.043680994983108075)
```

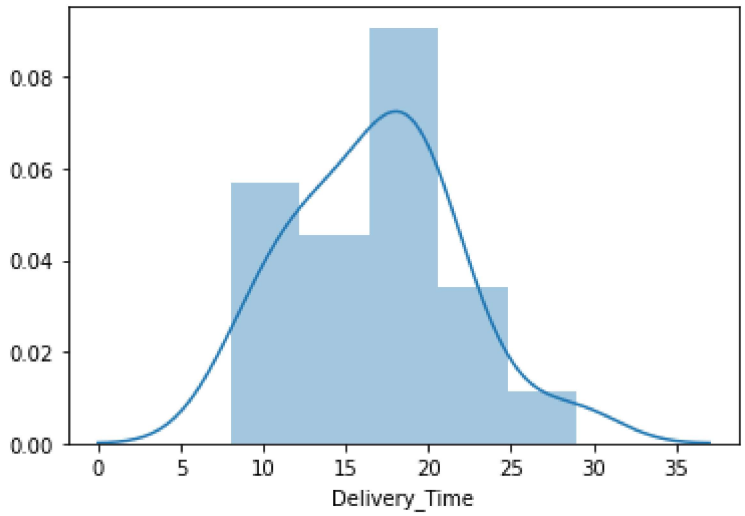
In [261]:
```
sns.pairplot(df1)
```

Out[261]:
```
<seaborn.axisgrid.PairGrid at 0x1cb898e7c10>
```



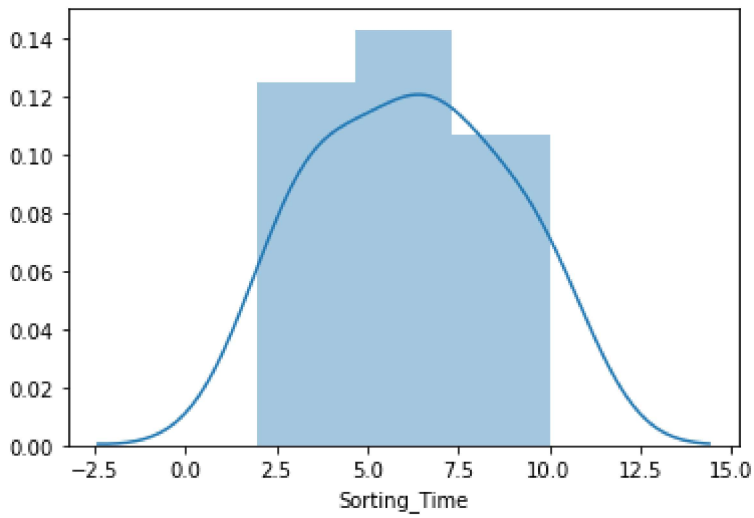
In [262]:
```
import seaborn as sns
sns.distplot(df1['Delivery_Time'])
```

Out[262]: <matplotlib.axes._subplots.AxesSubplot at 0x1cb89a84370>



In [263]:
```
sns.distplot(df1['Sorting_Time'])
```

Out[263]: <matplotlib.axes._subplots.AxesSubplot at 0x1cb89b03cd0>



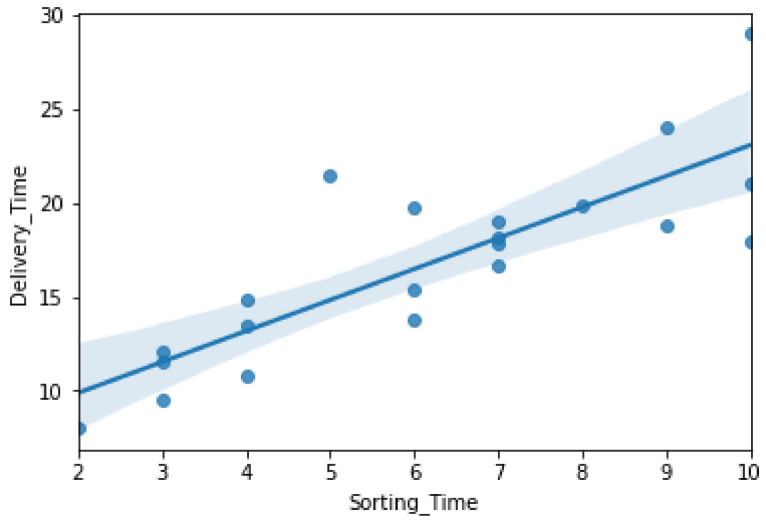
In [264]:
```
import statsmodels.formula.api as smf
model=smf.ols('df1.Delivery_Time~df1.Sorting_Time', data= df1).fit()
```

In [265]:
```
model.params
```

Out[265]:
```
Intercept           6.582734
df1.Sorting_Time    1.649020
dtype: float64
```

In [266]:
```
sns.regplot(x=df1.Sorting_Time,y=df1.Delivery_Time, data=df1)
```

Out[266]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1cb89b60430>
```



In [267]:
```
(model.tvalues, model.pvalues)
```

Out[267]:
```
(Intercept           3.823349
 df1.Sorting_Time    6.387447
 dtype: float64,
 Intercept           0.001147
 df1.Sorting_Time    0.000004
 dtype: float64)
```

In [268]:
```
(model.rsquared,model.rsquared_adj)
```

Out[268]:
```
(0.6822714748417231, 0.6655489208860244)
```

In [ ]:

min_max

In [269]:
```
array=df1_copy.values
```

In [270]:
```
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler(feature_range=(0,1))
rescaledX = scaler.fit_transform(array[:,:])
```

In [271]:
```
rescaledX
```

Out[271]:
```
array([[0.61904762, 1.        ],
       [0.26190476, 0.25      ],
       [0.55952381, 0.5       ],
       [0.76190476, 0.875     ],
       [1.        , 1.        ],
       [0.35      , 0.5       ],
       [0.52380952, 0.625     ],
       [0.07142857, 0.125     ],
       [0.47142857, 1.        ],
       [0.51190476, 0.875     ],
       [0.56333333, 0.75      ],
       [0.13095238, 0.25      ],
       [0.41333333, 0.625     ],
       [0.16666667, 0.125     ],
       [0.19190476, 0.125     ],
       [0.32761905, 0.25      ],
       [0.27380952, 0.5       ],
       [0.48142857, 0.625     ],
       [0.        , 0.        ],
       [0.46809524, 0.625     ],
       [0.64285714, 0.375     ]])
```

In [272]:
```
column_values = ['Delivery_Time','Sorting_Time']
df = pd.DataFrame(data = rescaledX,
                  columns = column_values)
```

In [273]:
```
df
```

Out[273]:

	Delivery_Time	Sorting_Time
0	0.619048	1.000
1	0.261905	0.250
2	0.559524	0.500
3	0.761905	0.875
4	1.000000	1.000
5	0.350000	0.500
6	0.523810	0.625
7	0.071429	0.125
8	0.471429	1.000
9	0.511905	0.875
10	0.563333	0.750
11	0.130952	0.250
12	0.413333	0.625
13	0.166667	0.125
14	0.191905	0.125
15	0.327619	0.250
16	0.273810	0.500
17	0.481429	0.625
18	0.000000	0.000
19	0.468095	0.625
20	0.642857	0.375

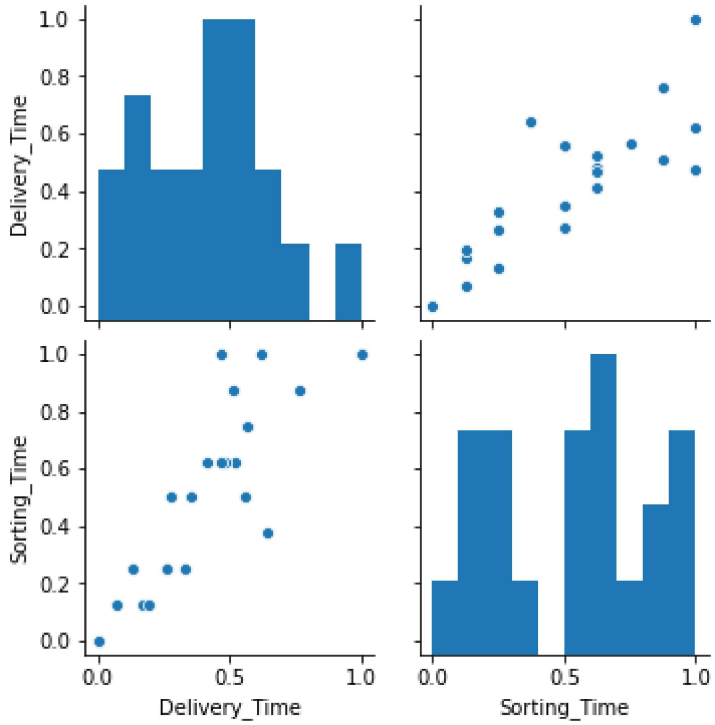
In [274]:
```
df.corr()
```

Out[274]:

	Delivery_Time	Sorting_Time
Delivery_Time	1.000000	0.825997
Sorting_Time	0.825997	1.000000

In [275]:
```
sns.pairplot(df)
```

Out[275]:
```
<seaborn.axisgrid.PairGrid at 0x1cb89b08460>
```



In [276]:
```
model1=smf.ols('df1.Delivery_Time~df1.Sorting_Time', data= df).fit()
```

In [277]:
```
model1.params
```

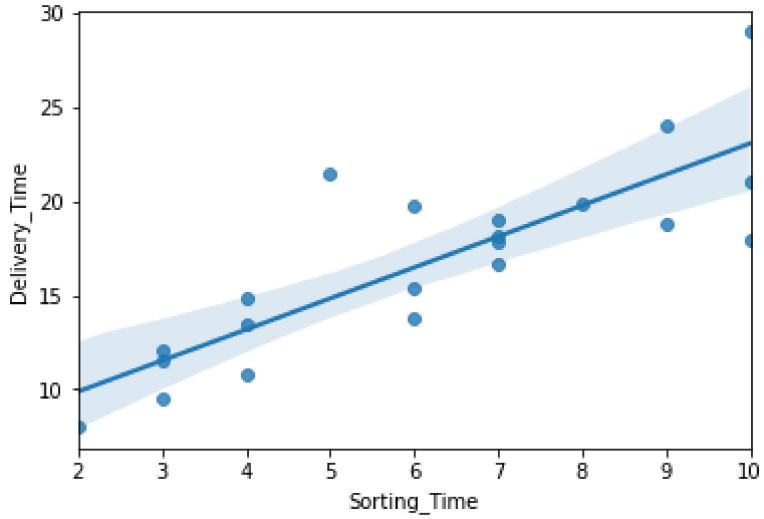
Out[277]:
```
Intercept           6.582734
df1.Sorting_Time    1.649020
dtype: float64
```

In [278]:
```
(model1.tvalues, model1.pvalues)
```

Out[278]:
```
(Intercept           3.823349
 df1.Sorting_Time    6.387447
 dtype: float64,
 Intercept           0.001147
 df1.Sorting_Time    0.000004
 dtype: float64)
```

In [279]:
```
sns.regplot(x=df1.Sorting_Time,y=df1.Delivery_Time, data=df1)
```

Out[279]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1cb89d993d0>
```



In [280]:
```
(model1.rsquared,model1.rsquared_adj)
```

Out[280]:
```
(0.6822714748417231, 0.6655489208860244)
```

standard scalar

In [281]:
```
from sklearn.preprocessing import StandardScaler
```

In [282]:
```
array = df1_copy.values
scaler = StandardScaler().fit(array)
rescaledX = scaler.transform(array)
```

In [283]:
```
rescaledX
```

Out[283]:
```
array([[ 0.84986692,  1.53562462],
       [-0.66449036, -0.88298415],
       [ 0.59747404, -0.07678123],
       [ 1.45560983,  1.13252315],
       [ 2.46518134,  1.53562462],
       [-0.2909489 , -0.07678123],
       [ 0.44603831,  0.32632023],
       [-1.47214757, -1.28608562],
       [ 0.22393258,  1.53562462],
       [ 0.39555973,  1.13252315],
       [ 0.61362718,  0.72942169],
       [-1.21975469, -0.88298415],
       [-0.02240287,  0.32632023],
       [-1.06831896, -1.28608562],
       [-0.96130438, -1.28608562],
       [-0.38584862, -0.88298415],
       [-0.61401178, -0.07678123],
       [ 0.26633458,  0.32632023],
       [-1.77501902, -1.68918708],
       [ 0.20979858,  0.32632023],
       [ 0.95082407, -0.47988269]])
```

In [284]:
```
column_values = ['Delivery_Time','Sorting_Time']
df3 = pd.DataFrame(data = rescaledX,
                   columns = column_values)
```

In [285]:
```
df3
```

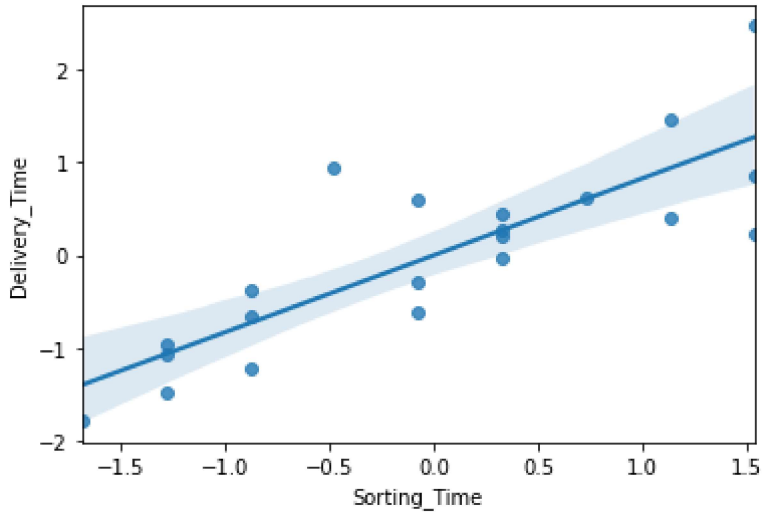
Out[285]:

	Delivery_Time	Sorting_Time
0	0.849867	1.535625
1	-0.664490	-0.882984
2	0.597474	-0.076781
3	1.455610	1.132523
4	2.465181	1.535625
5	-0.290949	-0.076781
6	0.446038	0.326320
7	-1.472148	-1.286086
8	0.223933	1.535625
9	0.395560	1.132523
10	0.613627	0.729422
11	-1.219755	-0.882984
12	-0.022403	0.326320
13	-1.068319	-1.286086
14	-0.961304	-1.286086
15	-0.385849	-0.882984
16	-0.614012	-0.076781
17	0.266335	0.326320
18	-1.775019	-1.689187
19	0.209799	0.326320
20	0.950824	-0.479883

In [286]:
```
model2=smf.ols('df3.Delivery_Time~df3.Sorting_Time', data= df3).fit()
```

In [287]:
```
sns.regplot(x=df3.Sorting_Time,y=df3.Delivery_Time, data=df3)
```

Out[287]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1cb89de3130>
```



In [288]:
```
model2.params
```

Out[288]:
```
Intercept          -5.134781e-16
df3.Sorting_Time    8.259973e-01
dtype: float64
```

In [289]:
```
(model2.tvalues, model2.pvalues)
```

Out[289]:
```
(Intercept          -3.970733e-15
 df3.Sorting_Time    6.387447e+00
 dtype: float64,
 Intercept           1.000000
 df3.Sorting_Time    0.000004
 dtype: float64)
```

In [290]:
```
(model2.rsquared,model2.rsquared_adj)
```

Out[290]:
```
(0.6822714748417231, 0.6655489208860244)
```

In [ ]:

In [ ]:

exponential

In [291]:
```
from numpy import exp
```

In [292]:
```
data4 = exp(df1_copy)
```

In [293]:
```
data4
```

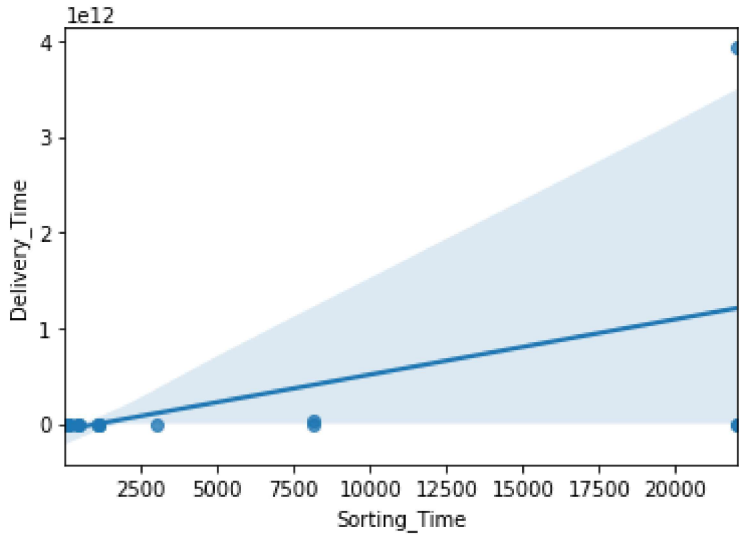
Out[293]:

	Delivery_Time	Sorting_Time
0	1.318816e+09	22026.465795
1	7.294164e+05	54.598150
2	3.778470e+08	403.428793
3	2.648912e+10	8103.083928
4	3.931334e+12	22026.465795
5	4.638956e+06	403.428793
6	1.784823e+08	1096.633158
7	1.335973e+04	20.085537
8	5.941160e+07	22026.465795
9	1.390022e+08	8103.083928
10	4.093168e+08	2980.957987
11	4.663003e+04	54.598150
12	1.754010e+07	1096.633158
13	9.871577e+04	20.085537
14	1.677114e+05	20.085537
15	2.899358e+06	54.598150
16	9.365892e+05	403.428793
17	7.329478e+07	1096.633158
18	2.980958e+03	7.389056
19	5.539501e+07	1096.633158
20	2.174360e+09	148.413159

In [294]:
```
model3=smf.ols('data4.Delivery_Time~data4.Sorting_Time', data= data4).fit()
```

In [295]:
```
sns.regplot(x=data4.Sorting_Time,y=data4.Delivery_Time, data=data4)
```

Out[295]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1cb89d64fa0>
```



In [296]:
```
model3.params
```

Out[296]:
```
Intercept           -6.243560e+10
data4.Sorting_Time   5.779920e+07
dtype: float64
```

In [297]:
```
(model3.tvalues, model3.pvalues)
```

Out[297]:
```
(Intercept           -0.330955
 data4.Sorting_Time   2.675152
 dtype: float64,
 Intercept            0.744301
 data4.Sorting_Time   0.014970
 dtype: float64)
```

In [298]:
```
(model3.rsquared,model3.rsquared_adj)
```

Out[298]:
```
(0.27360134105224776, 0.23536983268657663)
```

4_model

In [299]:
```
from sklearn.preprocessing import RobustScaler
array = df1_copy.values
```

In [300]:
```
transformer = RobustScaler().fit_transform(array)
```

In [301]:
```
transformer
```

Out[301]:
```
array([[ 0.5072,  1.    ],
       [-0.6928, -0.5   ],
       [ 0.3072,  0.    ],
       [ 0.9872,  0.75  ],
       [ 1.7872,  1.    ],
       [-0.3968,  0.    ],
       [ 0.1872,  0.25  ],
       [-1.3328, -0.75  ],
       [ 0.0112,  1.    ],
       [ 0.1472,  0.75  ],
       [ 0.32  ,  0.5   ],
       [-1.1328, -0.5   ],
       [-0.184 ,  0.25  ],
       [-1.0128, -0.75  ],
       [-0.928 , -0.75  ],
       [-0.472 , -0.5   ],
       [-0.6528,  0.    ],
       [ 0.0448,  0.25  ],
       [-1.5728, -1.    ],
       [ 0.    ,  0.25  ],
       [ 0.5872, -0.25  ]])
```

In [302]:
```
column_values = ['Delivery_Time','Sorting_Time']
df4 = pd.DataFrame(data = transformer,
                   columns = column_values)
```

In [ ]:
```

```

In [303]:
```
model4=smf.ols('df4.Delivery_Time~df4.Sorting_Time', data= df4).fit()
```

In [304]:
```
model4.params
```

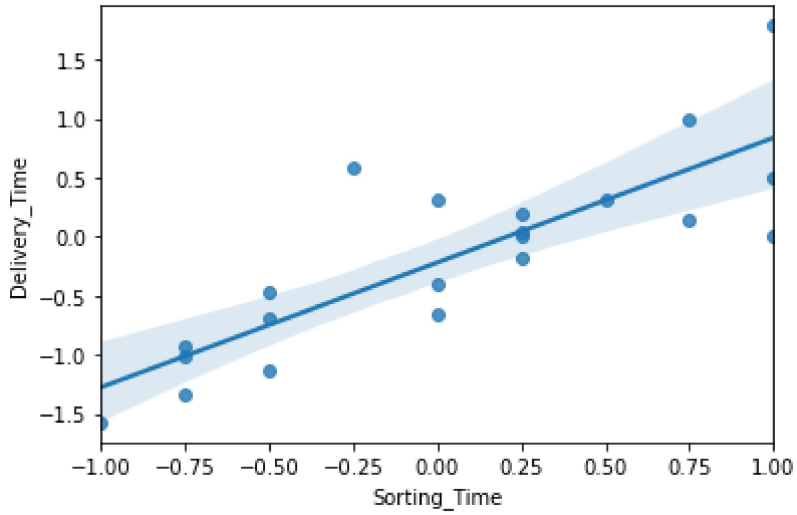
Out[304]:
```
Intercept          -0.216503
df4.Sorting_Time    1.055373
dtype: float64
```

In [305]:
```
(model4.tvalues, model4.pvalues)
```

Out[305]:
```
(Intercept          -2.106611
 df4.Sorting_Time    6.387447
 dtype: float64,
 Intercept           0.048673
 df4.Sorting_Time    0.000004
 dtype: float64)
```

In [306]:
```
sns.regplot(x=df4.Sorting_Time,y=df4.Delivery_Time, data=df4)
```

Out[306]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1cb89de8880>
```



In [307]:
```
(model4.rsquared,model4.rsquared_adj)
```

Out[307]:
```
(0.6822714748417231, 0.6655489208860244)
```

In [ ]:

In [ ]:

In [ ]: