In [1]:

```
import pandas as pd
import numpy as np
```

In [2]:

```
data = pd.read_csv("delivery_time.csv")
data
```

Out[2]:

	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 [3]:

```
data.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 [4]:

```
data.corr()
```

Out[4]:

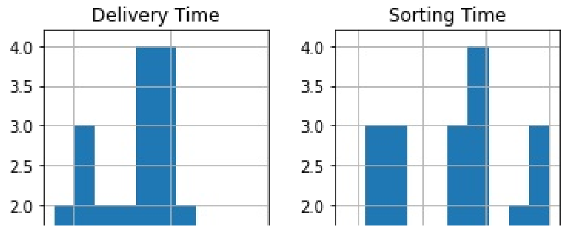
	Delivery Time	Sorting Time
Delivery Time	1.000000	0.825997
Sorting Time	0.825997	1.000000

In [5]:

```
data.hist()
```

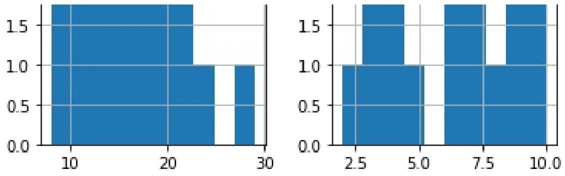
Out[5]:

```
array([[<AxesSubplot:title={'center':'Delivery Time'}>,
        <AxesSubplot:title={'center':'Sorting Time'}>]], dtype=object)
```



Delivery Time

Sorting Time

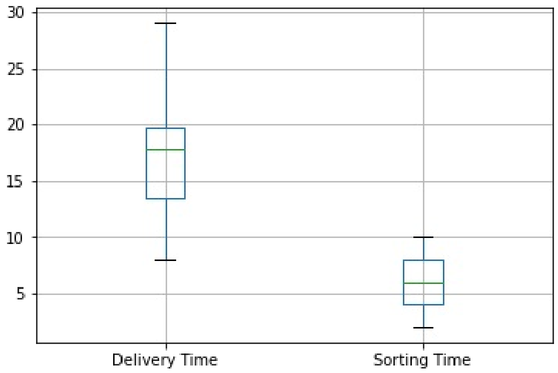


In [6]:

```
data.boxplot()
```

Out[6]:

```
<AxesSubplot:>
```



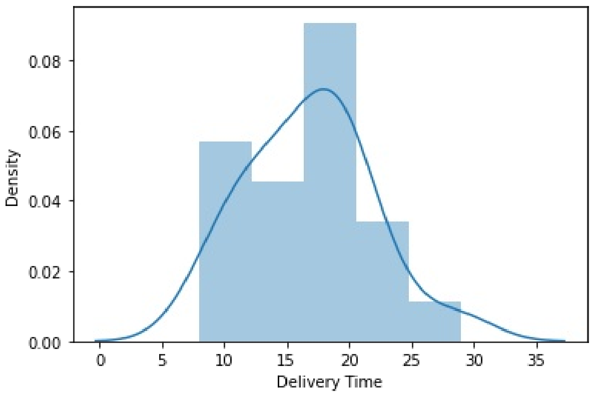
In [7]:

```
import seaborn as sns
sns.distplot(data['Delivery Time'])
```

```
C:\Users\rajesh\anaconda3\lib\site-packages\seaborn\distributions.py:2619: FutureWarning: `distplot` is a depreca
ted function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-le
vel function with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[7]:

```
<AxesSubplot:xlabel='Delivery Time', ylabel='Density'>
```

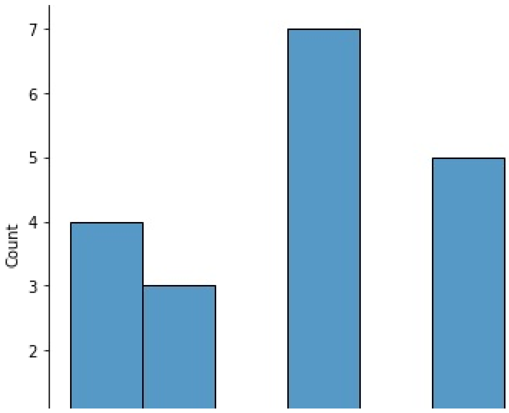


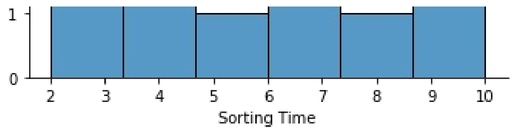
In [8]:

```
sns.displot(data['Sorting Time'])
```

Out[8]:

```
<seaborn.axisgrid.FacetGrid at 0x2c3c00d2d00>
```



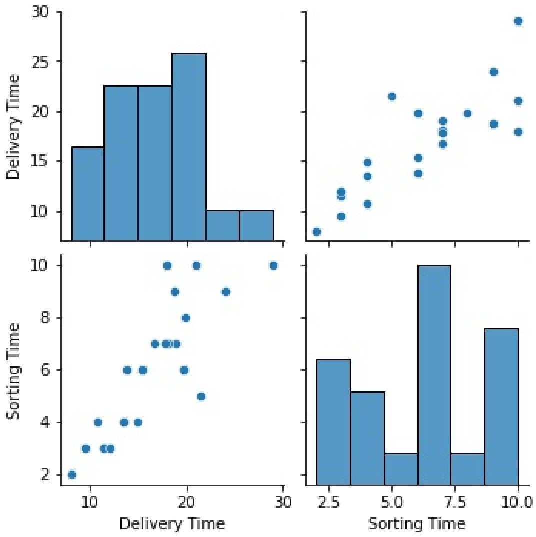


In [9]:

```
sns.pairplot(data)
```

Out[9]:

```
<seaborn.axisgrid.PairGrid at 0x2c3c00e8700>
```



In [10]:

```
#rename the colums with _
data=data.rename({'Delivery Time':'delivery_time','Sorting Time':'sorting_time'},axis=1)
data
```

Out[10]:

	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

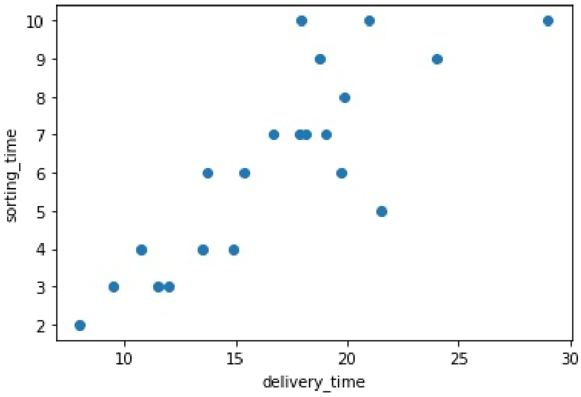
In [11]:

```
import matplotlib.pyplot as plt
%matplotlib inline
import numpy as np
x= data.delivery_time
```

```
y=data.sorting_time
plt.scatter(x,y)
plt.xlabel("delivery_time")
plt.ylabel("sorting_time")
```

Out[11]:

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

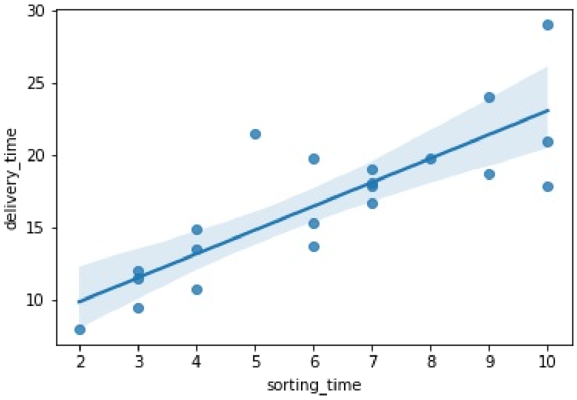


In [12]:

```
sns.regplot(x=data['sorting_time'],y=data['delivery_time'])
```

Out[12]:

```
<AxesSubplot:xlabel='sorting_time', ylabel='delivery_time'>
```



To build model

In [14]:

```
import statsmodels.formula.api as smf
model = smf.ols("delivery_time~sorting_time",data=data).fit()
model.summary()
```

Out[14]:

OLS Regression Results

Dep. Variable:	delivery_time	**R-squared:**	0.682
Model:	OLS	**Adj. R-squared:**	0.666
Method:	Least Squares	**F-statistic:**	40.80
Date:	Tue, 22 Feb 2022	**Prob (F-statistic):**	3.98e-06
Time:	18:22:40	**Log-Likelihood:**	-51.357
No. Observations:	21	**AIC:**	106.7
Df Residuals:	19	**BIC:**	108.8
Df Model:	1		
Covariance Type:	nonrobust		

	coef	**std err**	**t**	**P>|t|**	**[0.025**	**0.975]**
Intercept	6.5827	1.722	3.823	0.001	2.979	10.186
sorting_time	1.6490	0.258	6.387	0.000	1.109	2.189

Omnibus:	3.649	**Durbin-Watson:**	1.248
Prob(Omnibus):	0.161	**Jarque-Bera (JB):**	2.086
Skew:	0.750	**Prob(JB):**	0.352

Kurtosis:	3.367	**Cond. No.**	18.3

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

In [15]:

```
# here p is less than 0.05 but r-squared less than 0.75 .it is not strong model

# then take log
```

In [16]:

```
import statsmodels.formula.api as smf
data["logsorting_time"]=np.log(data.sorting_time)
model_log1=smf.ols("delivery_time~logsorting_time",data=data).fit()
model_log1.summary()
```

Out[16]:

OLS Regression Results

Dep. Variable:	delivery_time	**R-squared:**	0.695
Model:	OLS	**Adj. R-squared:**	0.679
Method:	Least Squares	**F-statistic:**	43.39
Date:	Tue, 22 Feb 2022	**Prob (F-statistic):**	2.64e-06
Time:	18:22:48	**Log-Likelihood:**	-50.912
No. Observations:	21	**AIC:**	105.8
Df Residuals:	19	**BIC:**	107.9
Df Model:	1		
Covariance Type:	nonrobust		

	coef	**std err**	**t**	**P>|t|**	**[0.025**	**0.975]**
Intercept	1.1597	2.455	0.472	0.642	-3.978	6.297
logsorting_time	9.0434	1.373	6.587	0.000	6.170	11.917

Omnibus:	5.552	**Durbin-Watson:**	1.427
Prob(Omnibus):	0.062	**Jarque-Bera (JB):**	3.481
Skew:	0.946	**Prob(JB):**	0.175
Kurtosis:	3.628	**Cond. No.**	9.08

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

In [17]:

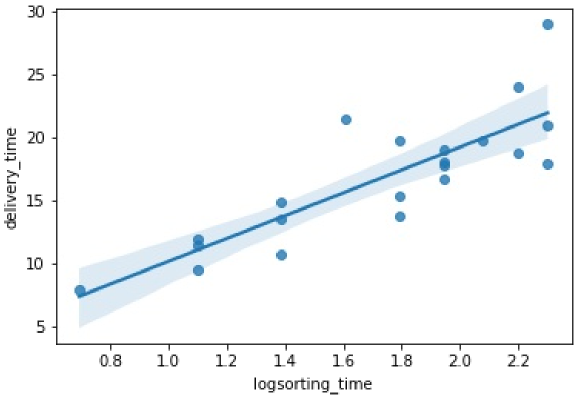
```
# as the above model is less than0.05 and r-squared >0.75
```

In [18]:

```
sns.regplot(x="logsorting_time",y="delivery_time",data=data)
```

Out[18]:

```
<AxesSubplot:xlabel='logsorting_time', ylabel='delivery_time'>
```



In [19]:

```
model_log1.params
```

Out[19]:

```
Intercept          1.159684
logsorting_time    9.043413
dtype: float64
```

r values

(model_log1.rsquared,model_log1_adj)

Prediction

In [20]:

```
new_data=pd.Series([5,8])
new_data
```

Out[20]:

```
0    5
1    8
dtype: int64
```

In [21]:

```
data_pred=pd.DataFrame(new_data,columns=['sorting_time'])
data_pred
```

Out[21]:

	sorting_time
0	5
1	8

In [22]:

```
model.resid.mean()
```

Out[22]:

```
-3.891067362495787e-15
```

In [23]:

```
model.predict(data_pred)
```

Out[23]:

```
0    14.827833
1    19.774893
dtype: float64
```

In [ ]:

Loading [MathJax]/jax/output/CommonHTML/fonts/TeX/fontdata.js