Problem Statement

Linear Regression

Import Libraries

In [2]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [3]:
```
a=pd.read_csv("Sales.csv")
a
```

Out[3]:

	MonthYear	Time index	Country	StoreID	City	Dept_ID	Dept. Name	HoursOwn	HoursLeas
0	10.2016	1.0	United Kingdom	88253.0	London (l)	1.0	Dry	3184.764	0.
1	10.2016	1.0	United Kingdom	88253.0	London (l)	2.0	Frozen	1582.941	0.
2	10.2016	1.0	United Kingdom	88253.0	London (l)	3.0	other	47.205	0.
3	10.2016	1.0	United Kingdom	88253.0	London (l)	4.0	Fish	1623.852	0.
4	10.2016	1.0	United Kingdom	88253.0	London (l)	5.0	Fruits & Vegetables	1759.173	0.
...	...	...	...	...	...	...	...	...	.
7653	06.2017	9.0	Sweden	29650.0	Gothenburg	12.0	Checkout	6322.323	0.
7654	06.2017	9.0	Sweden	29650.0	Gothenburg	16.0	Customer Services	4270.479	0.
7655	06.2017	9.0	Sweden	29650.0	Gothenburg	11.0	Delivery	0	0.
7656	06.2017	9.0	Sweden	29650.0	Gothenburg	17.0	others	2224.929	0.
7657	06.2017	9.0	Sweden	29650.0	Gothenburg	18.0	all	39652.2	0.

7658 rows × 14 columns

To display top 10 rows

In [4]:
```
c=a.head(15)
c
```

Out[4]:

	MonthYear	Time index	Country	StoreID	City	Dept_ID	Dept. Name	HoursOwn	HoursLease	
0	10.2016	1.0	United Kingdom	88253.0	London (I)	1.0	Dry	3184.764	0.0	39
1	10.2016	1.0	United Kingdom	88253.0	London (I)	2.0	Frozen	1582.941	0.0	8
2	10.2016	1.0	United Kingdom	88253.0	London (I)	3.0	other	47.205	0.0	43
3	10.2016	1.0	United Kingdom	88253.0	London (I)	4.0	Fish	1623.852	0.0	30
4	10.2016	1.0	United Kingdom	88253.0	London (I)	5.0	Fruits & Vegetables	1759.173	0.0	16
5	10.2016	1.0	United Kingdom	88253.0	London (I)	6.0	Meat	8270.316	0.0	171
6	10.2016	1.0	United Kingdom	88253.0	London (I)	13.0	Food	16468.251	0.0	310
7	10.2016	1.0	United Kingdom	88253.0	London (I)	7.0	Clothing	4698.471	0.0	21
8	10.2016	1.0	United Kingdom	88253.0	London (I)	8.0	Household	1183.272	0.0	5
9	10.2016	1.0	United Kingdom	88253.0	London (I)	9.0	Hardware	2029.815	0.0	5
10	10.2016	1.0	United Kingdom	88253.0	London (I)	14.0	Non Food	7911.558	0.0	32
11	10.2016	1.0	United Kingdom	88253.0	London (I)	15.0	Admin	4308.243	0.0	
12	10.2016	1.0	United Kingdom	88253.0	London (I)	12.0	Checkout	5825.097	0.0	343
13	10.2016	1.0	United Kingdom	88253.0	London (I)	16.0	Customer Services	3320.085	0.0	
14	10.2016	1.0	United Kingdom	88253.0	London (I)	11.0	Delivery	0	0.0	

To find Missing values

In [5]:

```
c.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 15 entries, 0 to 14
Data columns (total 14 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   MonthYear      15 non-null     object 
 1   Time index     15 non-null     float64
 2   Country        15 non-null     object 
 3   StoreID        15 non-null     float64
 4   City           15 non-null     object 
 5   Dept_ID        15 non-null     float64
 6   Dept. Name     15 non-null     object 
```

```
 7   HoursOwn       15 non-null     object
 8   HoursLease     15 non-null     float64
 9   Sales units    15 non-null     float64
 10  Turnover       15 non-null     float64
 11  Customer       0 non-null      float64
 12  Area (m2)      15 non-null     object
 13  Opening hours  15 non-null     object
dtypes: float64(7), object(7)
memory usage: 1.8+ KB
```

To display summary of statistics

In [6]:
```
a.describe()
```

Out[6]:

	Time index	StoreID	Dept_ID	HoursLease	Sales units	Turnover	Customer
count	7650.000000	7650.000000	7650.000000	7650.000000	7.650000e+03	7.650000e+03	0.0
mean	5.000000	61995.220000	9.470588	22.036078	1.076471e+06	3.721393e+06	NaN
std	2.582158	29924.581631	5.337429	133.299513	1.728113e+06	6.003380e+06	NaN
min	1.000000	12227.000000	1.000000	0.000000	0.000000e+00	0.000000e+00	NaN
25%	3.000000	29650.000000	5.000000	0.000000	5.457125e+04	2.726798e+05	NaN
50%	5.000000	75400.500000	9.000000	0.000000	2.932300e+05	9.319575e+05	NaN
75%	7.000000	87703.000000	14.000000	0.000000	9.175075e+05	3.264432e+06	NaN
max	9.000000	98422.000000	18.000000	3984.000000	1.124296e+07	4.271739e+07	NaN

To display column heading

In [7]:
```
a.columns
```

Out[7]:
```
Index(['MonthYear', 'Time index', 'Country', 'StoreID', 'City', 'Dept_ID',
       'Dept. Name', 'HoursOwn', 'HoursLease', 'Sales units', 'Turnover',
       'Customer', 'Area (m2)', 'Opening hours'],
      dtype='object')
```

Pairplot

In [8]:
```
s=a.dropna(axis=1)
s
```

Out[8]:

	MonthYear
0	10.2016
1	10.2016
2	10.2016
3	10.2016
4	10.2016
...	...

	MonthYear
7653	06.2017
7654	06.2017
7655	06.2017
7656	06.2017
7657	06.2017

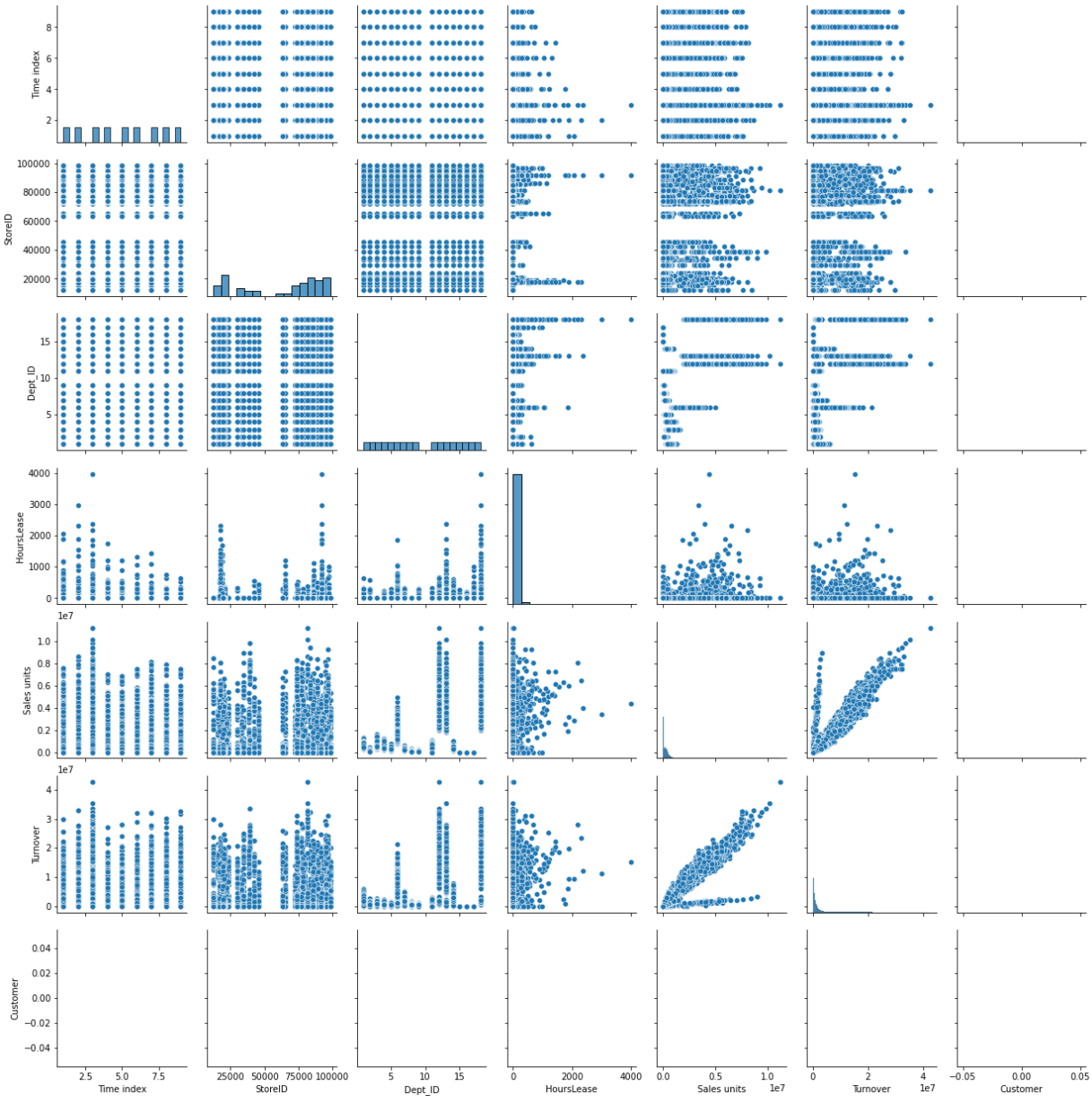
7658 rows × 1 columns

In [9]:
```
s.columns
```

Out[9]:
```
Index(['MonthYear'], dtype='object')
```

In [10]:
```
sns.pairplot(a)
```

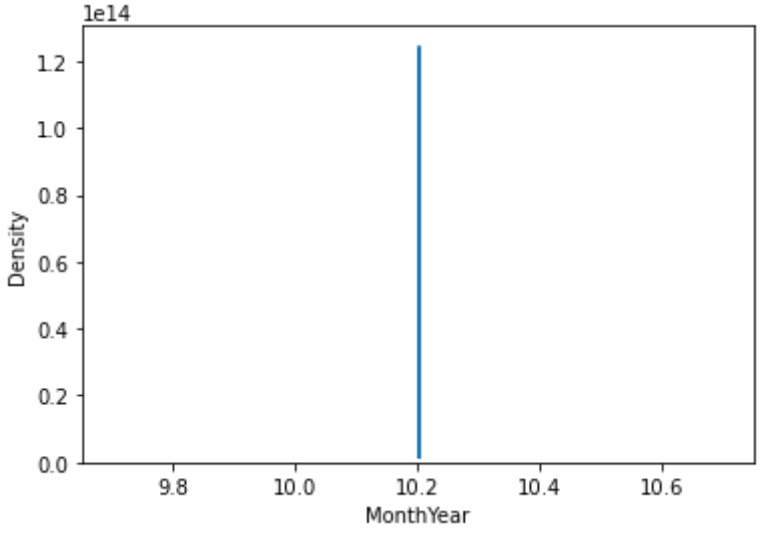
Out[10]:
```
<seaborn.axisgrid.PairGrid at 0x1533f98ba90>
```



Distribution Plot

In [12]:
```
sns.distplot(c['MonthYear'])
```

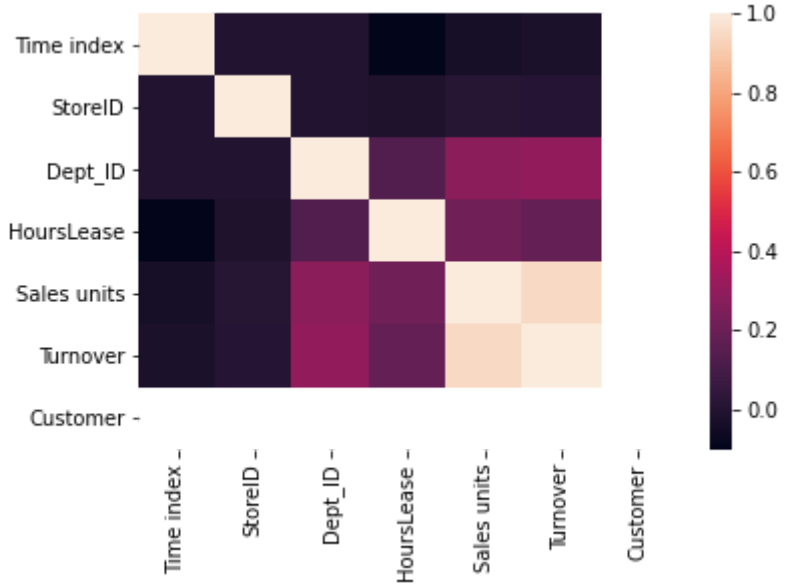
Out[12]: <AxesSubplot:xlabel='MonthYear', ylabel='Density'>



Correlation

In [14]:
```
b=a[['MonthYear', 'Time index', 'Country', 'StoreID', 'City', 'Dept_ID',
       'Dept. Name', 'HoursOwn', 'HoursLease', 'Sales units', 'Turnover',
       'Customer', 'Area (m2)', 'Opening hours']]
sns.heatmap(b.corr())
```

Out[14]: <AxesSubplot:>



Train the model - Model Building

In [15]:
```
g=c[['MonthYear']]
```

```
h=c['MonthYear']
```

To split dataset into training end test

In [16]:
```
from sklearn.model_selection import train_test_split
g_train,g_test,h_train,h_test=train_test_split(g,h,test_size=0.6)
```

To run the model

In [17]:
```
from sklearn.linear_model import LinearRegression
```

In [18]:
```
lr=LinearRegression()
lr.fit(g_train,h_train)
```

Out[18]:
```
LinearRegression()
```

In [19]:
```
print(lr.intercept_)
```

```
10.2016
```

Coeffecient

In [20]:
```
coeff=pd.DataFrame(lr.coef_,g.columns,columns=['Co-effecient'])
coeff
```

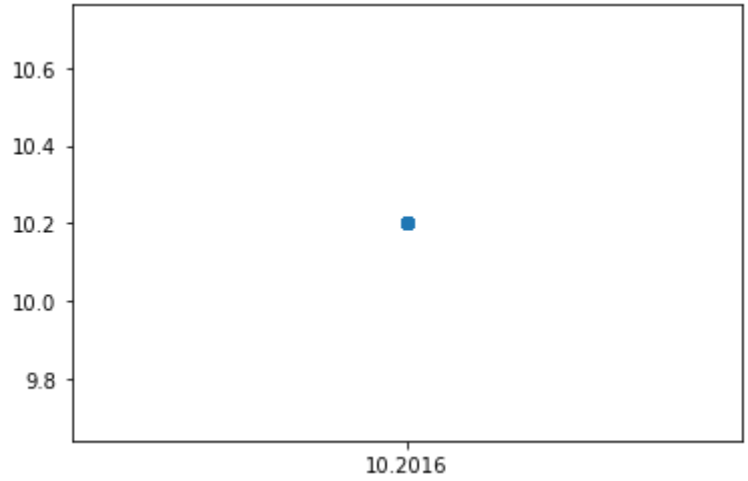
Out[20]:

	Co-effecient
MonthYear	0.0

Best Fit line

In [21]:
```
prediction=lr.predict(g_test)
plt.scatter(h_test,prediction)
```

Out[21]:
```
<matplotlib.collections.PathCollection at 0x15344bac400>
```



To find score

In [22]:
```
print(lr.score(g_test,h_test))
```

```
1.0
```

In [ ]:
```

```