In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [2]:

```
df1=pd.read_csv(r'C:\Users\user\Downloads\6_Salesworkload1.csv')
df1
```

Out[2]:

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

7658 rows × 14 columns

In [3]:

```
df=df1.head(50)
df
```

Out[3]:

	MonthYear	Time index	Country	StoreID	City	Dept_ID	Dept. Name	HoursOwn	HoursL
0	10.2016	1.0	United Kingdom	88253.0	London (I)	1.0	Dry	3184.764	
1	10.2016	1.0	United Kingdom	88253.0	London (I)	2.0	Frozen	1582.941	
2	10.2016	1.0	United Kingdom	88253.0	London (I)	3.0	other	47.205	
3	10.2016	1.0	United Kingdom	88253.0	London (I)	4.0	Fish	1623.852	
4	10.2016	1.0	United Kingdom	88253.0	London (I)	5.0	Fruits & Vegetables	1759.173	
5	10.2016	1.0	United Kingdom	88253.0	London (I)	6.0	Meat	8270.316	
6	10.2016	1.0	United Kingdom	88253.0	London (I)	13.0	Food	16468.251	
7	10.2016	1.0	United Kingdom	88253.0	London (I)	7.0	Clothing	4698.471	
8	10.2016	1.0	United Kingdom	88253.0	London (I)	8.0	Household	1183.272	
9	10.2016	1.0	United Kingdom	88253.0	London (I)	9.0	Hardware	2029.815	
10	10.2016	1.0	United Kingdom	88253.0	London (I)	14.0	Non Food	7911.558	
11	10.2016	1.0	United Kingdom	88253.0	London (I)	15.0	Admin	4308.243	
12	10.2016	1.0	United Kingdom	88253.0	London (I)	12.0	Checkout	5825.097	
13	10.2016	1.0	United Kingdom	88253.0	London (I)	16.0	Customer Services	3320.085	
14	10.2016	1.0	United Kingdom	88253.0	London (I)	11.0	Delivery	0	
15	10.2016	1.0	United Kingdom	88253.0	London (I)	17.0	others	2253.252	
16	10.2016	1.0	United Kingdom	88253.0	London (I)	18.0	all	40086.486	
17	10.2016	1.0	United Kingdom	38976.0	Manchester	1.0	Dry	2583.687	
18	10.2016	1.0	United Kingdom	38976.0	Manchester	2.0	Frozen	5145.345	
19	10.2016	1.0	United Kingdom	38976.0	Manchester	3.0	other	47.205	
20	10.2016	1.0	United Kingdom	38976.0	Manchester	4.0	Fish	3008.532	
21	10.2016	1.0	United Kingdom	38976.0	Manchester	5.0	Fruits & Vegetables	8909.157	
22	10.2016	1.0	United Kingdom	38976.0	Manchester	6.0	Meat	15779.058	
23	10.2016	1.0	United Kingdom	38976.0	Manchester	13.0	Food	35472.984	

	MonthYear	Time index	Country	StoreID	City	Dept_ID	Dept. Name	HoursOwn	HoursL
24	10.2016	1.0	United Kingdom	38976.0	Manchester	7.0	Clothing	7889.529	
25	10.2016	1.0	United Kingdom	38976.0	Manchester	8.0	Household	1762.32	
26	10.2016	1.0	United Kingdom	38976.0	Manchester	9.0	Hardware	2797.683	
27	10.2016	1.0	United Kingdom	38976.0	Manchester	14.0	Non Food	12449.532	
28	10.2016	1.0	United Kingdom	38976.0	Manchester	15.0	Admin	6967.458	
29	10.2016	1.0	United Kingdom	38976.0	Manchester	12.0	Checkout	11719.428	
30	10.2016	1.0	United Kingdom	38976.0	Manchester	16.0	Customer Services	5491.515	
31	10.2016	1.0	United Kingdom	38976.0	Manchester	11.0	Delivery	0	
32	10.2016	1.0	United Kingdom	38976.0	Manchester	17.0	others	2300.457	
33	10.2016	1.0	United Kingdom	38976.0	Manchester	18.0	all	74401.374	
34	10.2016	1.0	United Kingdom	17647.0	Liverpool	1.0	Dry	2341.368	
35	10.2016	1.0	United Kingdom	17647.0	Liverpool	2.0	Frozen	3077.766	1
36	10.2016	1.0	United Kingdom	17647.0	Liverpool	3.0	other	47.205	
37	10.2016	1.0	United Kingdom	17647.0	Liverpool	4.0	Fish	2196.606	2
38	10.2016	1.0	United Kingdom	17647.0	Liverpool	5.0	Fruits & Vegetables	3383.025	
39	10.2016	1.0	United Kingdom	17647.0	Liverpool	6.0	Meat	16493.427	7
40	10.2016	1.0	United Kingdom	17647.0	Liverpool	13.0	Food	27539.397	11
41	10.2016	1.0	United Kingdom	17647.0	Liverpool	7.0	Clothing	8528.37	
42	10.2016	1.0	United Kingdom	17647.0	Liverpool	8.0	Household	1957.434	
43	10.2016	1.0	United Kingdom	17647.0	Liverpool	9.0	Hardware	2580.54	
44	10.2016	1.0	United Kingdom	17647.0	Liverpool	14.0	Non Food	13066.344	
45	10.2016	1.0	United Kingdom	17647.0	Liverpool	15.0	Admin	4947.084	
46	10.2016	1.0	United Kingdom	17647.0	Liverpool	12.0	Checkout	8965.803	6
47	10.2016	1.0	United Kingdom	17647.0	Liverpool	16.0	Customer Services	3584.433	
48	10.2016	1.0	United Kingdom	17647.0	Liverpool	11.0	Delivery	0	

In [4]:

```
df.info()
```

	MonthYear	Time index	Country	StoreID	City	Dept_ID	Dept. Name	HoursOwn	HoursL
49	1.0.2016	1.0	United Kingdom	17647.0	Liverpool	17.0	others	2624.598	

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 50 entries, 0 to 49
Data columns (total 14 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   MonthYear      50 non-null     object 
 1   Time index     50 non-null     float64
 2   Country        50 non-null     object 
 3   StoreID        50 non-null     float64
 4   City           50 non-null     object 
 5   Dept_ID        50 non-null     float64
 6   Dept. Name     50 non-null     object 
 7   HoursOwn       50 non-null     object 
 8   HoursLease     50 non-null     float64
 9   Sales units    50 non-null     float64
 10  Turnover       50 non-null     float64
 11  Customer       0 non-null      float64
 12  Area (m2)      50 non-null     object 
 13  Opening hours  50 non-null     object 
dtypes: float64(7), object(7)
memory usage: 5.6+ KB
```

In [5]:

```
df.describe()
```

Out[5]:

	Time index	StoreID	Dept_ID	HoursLease	Sales units	Turnover	Customer
count	50.0	50.000000	50.000000	50.000000	5.000000e+01	5.000000e+01	0.0
mean	1.0	48904.900000	9.300000	60.960000	1.231844e+06	4.066998e+06	NaN
std	0.0	29839.520941	5.304022	213.640644	2.088301e+06	6.868434e+06	NaN
min	1.0	17647.000000	1.000000	0.000000	0.000000e+00	0.000000e+00	NaN
25%	1.0	17647.000000	5.000000	0.000000	5.504125e+04	1.477058e+05	NaN
50%	1.0	38976.000000	9.000000	0.000000	3.093425e+05	7.400520e+05	NaN
75%	1.0	88253.000000	14.000000	0.000000	9.128262e+05	3.521022e+06	NaN
max	1.0	88253.000000	18.000000	1152.000000	7.476680e+06	2.571973e+07	NaN

In [6]:

```
df.columns
```

Out[6]:

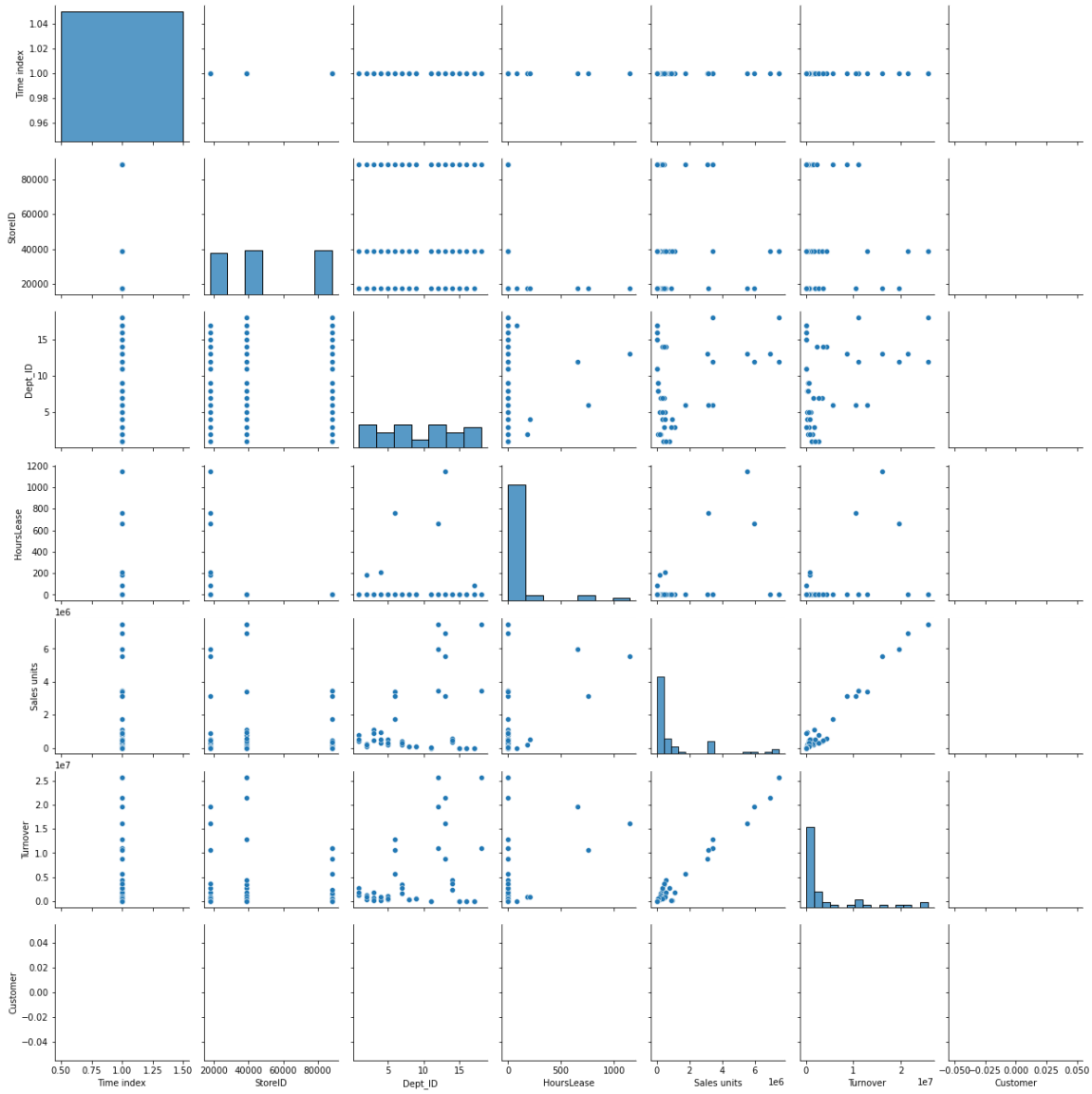
```
Index(['MonthYear', 'Time index', 'Country', 'StoreID', 'City', 'Dept_ID',
       'Dept. Name', 'HoursOwn', 'HoursLease', 'Sales units', 'Turnover',
       'Customer', 'Area (m2)', 'Opening hours'],
      dtype='object')
```

In [7]:

```
sns.pairplot(df)
```

Out[7]:

```
<seaborn.axisgrid.PairGrid at 0x175282a8be0>
```



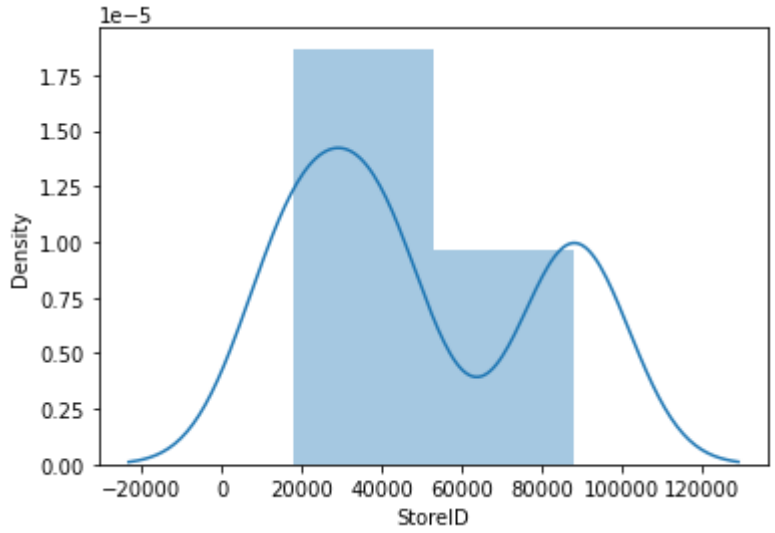
In [8]:

```
sns.distplot(df['StoreID'])
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\distributions.py:2557:
FutureWarning: `distplot` is a deprecated function and will be removed in
a future version. Please adapt your code to use either `displot` (a figure
-level function with similar flexibility) or `histplot` (an axes-level fun
ction for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[8]:

```
<AxesSubplot:xlabel='StoreID', ylabel='Density'>
```

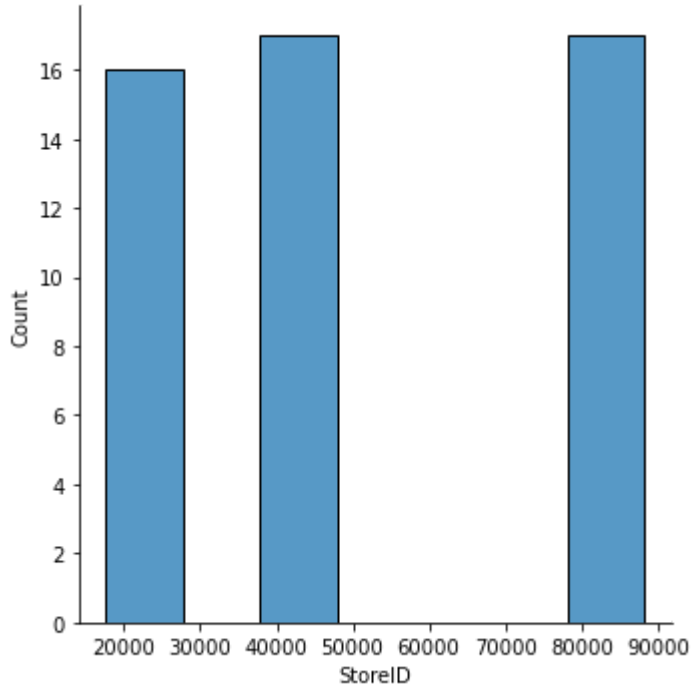


In [9]:

```
sns.displot(df["StoreID"])
```

Out[9]:

```
<seaborn.axisgrid.FacetGrid at 0x1752a10c5b0>
```



In [10]:

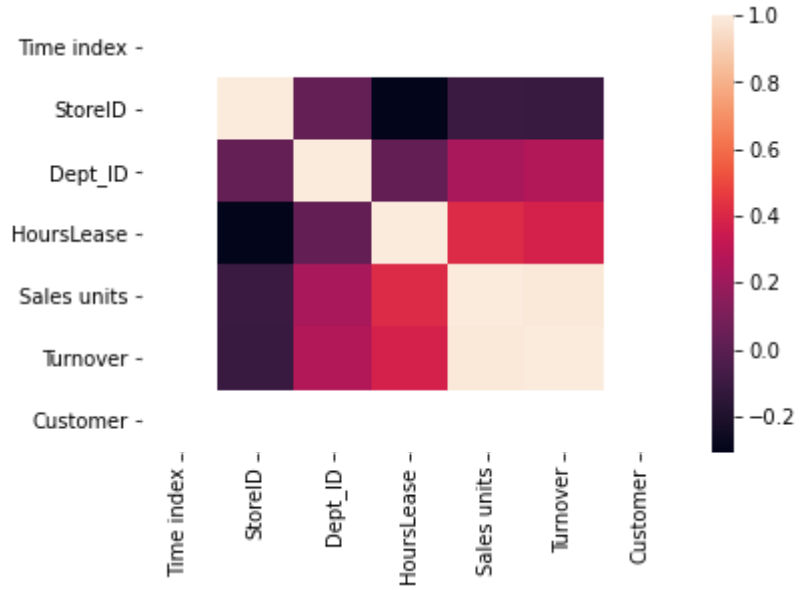
```
df1=df[['MonthYear', 'Time index', 'Country', 'StoreID', 'City', 'Dept_ID',
       'Dept. Name', 'HoursOwn', 'HoursLease', 'Sales units', 'Turnover',
       'Customer', 'Area (m2)', 'Opening hours']]
```

In [11]:

```
sns.heatmap(df1.corr())
```

Out[11]:

```
<AxesSubplot:>
```



In [12]:

```
df2=df.dropna(axis=1)
df2
```

Out[12]:

	MonthYear	Time index	Country	StoreID	City	Dept_ID	Dept. Name	HoursOwn	HoursL
0	10.2016	1.0	United Kingdom	88253.0	London (I)	1.0	Dry	3184.764	
1	10.2016	1.0	United Kingdom	88253.0	London (I)	2.0	Frozen	1582.941	
2	10.2016	1.0	United Kingdom	88253.0	London (I)	3.0	other	47.205	
3	10.2016	1.0	United Kingdom	88253.0	London (I)	4.0	Fish	1623.852	
4	10.2016	1.0	United Kingdom	88253.0	London (I)	5.0	Fruits & Vegetables	1759.173	
5	10.2016	1.0	United Kingdom	88253.0	London (I)	6.0	Meat	8270.316	
6	10.2016	1.0	United Kingdom	88253.0	London (I)	13.0	Food	16468.251	
7	10.2016	1.0	United Kingdom	88253.0	London (I)	7.0	Clothing	4698.471	
8	10.2016	1.0	United Kingdom	88253.0	London (I)	8.0	Household	1183.272	
9	10.2016	1.0	United Kingdom	88253.0	London (I)	9.0	Hardware	2029.815	
10	10.2016	1.0	United Kingdom	88253.0	London (I)	14.0	Non Food	7911.558	
11	10.2016	1.0	United Kingdom	88253.0	London (I)	15.0	Admin	4308.243	
12	10.2016	1.0	United Kingdom	88253.0	London (I)	12.0	Checkout	5825.097	
13	10.2016	1.0	United Kingdom	88253.0	London (I)	16.0	Customer Services	3320.085	
14	10.2016	1.0	United Kingdom	88253.0	London (I)	11.0	Delivery	0	
15	10.2016	1.0	United Kingdom	88253.0	London (I)	17.0	others	2253.252	
16	10.2016	1.0	United Kingdom	88253.0	London (I)	18.0	all	40086.486	
17	10.2016	1.0	United Kingdom	38976.0	Manchester	1.0	Dry	2583.687	
18	10.2016	1.0	United Kingdom	38976.0	Manchester	2.0	Frozen	5145.345	
19	10.2016	1.0	United Kingdom	38976.0	Manchester	3.0	other	47.205	
20	10.2016	1.0	United Kingdom	38976.0	Manchester	4.0	Fish	3008.532	
21	10.2016	1.0	United Kingdom	38976.0	Manchester	5.0	Fruits & Vegetables	8909.157	
22	10.2016	1.0	United Kingdom	38976.0	Manchester	6.0	Meat	15779.058	
23	10.2016	1.0	United Kingdom	38976.0	Manchester	13.0	Food	35472.984	

	MonthYear	Time index	Country	StoreID	City	Dept_ID	Dept. Name	HoursOwn	HoursL
24	10.2016	1.0	United Kingdom	38976.0	Manchester	7.0	Clothing	7889.529	
25	10.2016	1.0	United Kingdom	38976.0	Manchester	8.0	Household	1762.32	
26	10.2016	1.0	United Kingdom	38976.0	Manchester	9.0	Hardware	2797.683	
27	10.2016	1.0	United Kingdom	38976.0	Manchester	14.0	Non Food	12449.532	
28	10.2016	1.0	United Kingdom	38976.0	Manchester	15.0	Admin	6967.458	
29	10.2016	1.0	United Kingdom	38976.0	Manchester	12.0	Checkout	11719.428	
30	10.2016	1.0	United Kingdom	38976.0	Manchester	16.0	Customer Services	5491.515	
31	10.2016	1.0	United Kingdom	38976.0	Manchester	11.0	Delivery	0	
32	10.2016	1.0	United Kingdom	38976.0	Manchester	17.0	others	2300.457	
33	10.2016	1.0	United Kingdom	38976.0	Manchester	18.0	all	74401.374	
34	10.2016	1.0	United Kingdom	17647.0	Liverpool	1.0	Dry	2341.368	
35	10.2016	1.0	United Kingdom	17647.0	Liverpool	2.0	Frozen	3077.766	1
36	10.2016	1.0	United Kingdom	17647.0	Liverpool	3.0	other	47.205	
37	10.2016	1.0	United Kingdom	17647.0	Liverpool	4.0	Fish	2196.606	2
38	10.2016	1.0	United Kingdom	17647.0	Liverpool	5.0	Fruits & Vegetables	3383.025	
39	10.2016	1.0	United Kingdom	17647.0	Liverpool	6.0	Meat	16493.427	7
40	10.2016	1.0	United Kingdom	17647.0	Liverpool	13.0	Food	27539.397	11
41	10.2016	1.0	United Kingdom	17647.0	Liverpool	7.0	Clothing	8528.37	
42	10.2016	1.0	United Kingdom	17647.0	Liverpool	8.0	Household	1957.434	
43	10.2016	1.0	United Kingdom	17647.0	Liverpool	9.0	Hardware	2580.54	
44	10.2016	1.0	United Kingdom	17647.0	Liverpool	14.0	Non Food	13066.344	
45	10.2016	1.0	United Kingdom	17647.0	Liverpool	15.0	Admin	4947.084	
46	10.2016	1.0	United Kingdom	17647.0	Liverpool	12.0	Checkout	8965.803	6
47	10.2016	1.0	United Kingdom	17647.0	Liverpool	16.0	Customer Services	3584.433	
48	10.2016	1.0	United Kingdom	17647.0	Liverpool	11.0	Delivery	0	

In [13]:

```
x=df1[['MonthYear']]
y=df1[['MonthYear']]
```

	MonthYear	Time index	Country	StoreID	City	Dept_ID	Dept. Name	HoursOwn	HoursL
49	2016	1.0	United Kingdom	17647.0	Liverpool	17.0	others	2624.598	

In [14]:

```
from sklearn.model_selection import train_test_split
```

In [15]:

```
x_train,x_test,y_train,y_test = train_test_split(x,y,test_size=0.3)
```

In [16]:

```
from sklearn.linear_model import LinearRegression

lr=LinearRegression()
lr.fit(x_train,y_train)#ValueError: Input contains NaN, infinity or a value too large for
```

Out[16]:

```
LinearRegression()
```

In [17]:

```
print(lr.intercept_)
```

```
[0.]
```

In [18]:

```
coef= pd.DataFrame(lr.coef_)
coef
```

Out[18]:

	0
0	1.0

In [19]:

```
print(lr.score(x_test,y_test))
```

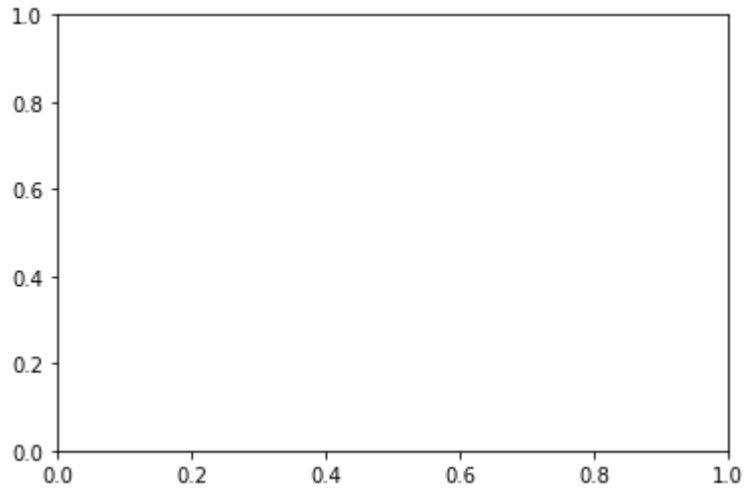
```
1.0
```

In [20]:

```
prediction = lr.predict(x_test)
plt.scatter(y_test,prediction)
```

```
---------------------------------------------------------------------------
-
TypeError                                 Traceback (most recent call las
t)
<ipython-input-20-10d398fd7dc3> in <module>
      1 prediction = lr.predict(x_test)
----> 2 plt.scatter(y_test,prediction)

C:\ProgramData\Anaconda3\lib\site-packages\matplotlib\pyplot.py in scatter
(x, y, s, c, marker, cmap, norm, vmin, vmax, alpha, linewidths, verts, edg
ecolors, plotnonfinite, data, **kwargs)
   2888         verts=cbook.deprecation._deprecated_parameter,
   2889         edgecolors=None, *, plotnonfinite=False, data=None, **kwar
gs):
-> 2890     __ret = gca().scatter(
   2891         x, y, s=s, c=c, marker=marker, cmap=cmap, norm=norm,
   2892         vmin=vmin, vmax=vmax, alpha=alpha, linewidths=linewidths,

C:\ProgramData\Anaconda3\lib\site-packages\matplotlib\__init__.py in inner
(ax, data, *args, **kwargs)
   1445     def inner(ax, *args, data=None, **kwargs):
   1446         if data is None:
-> 1447             return func(ax, *map(sanitize_sequence, args), **kwarg
s)
   1448
   1449         bound = new_sig.bind(ax, *args, **kwargs)

C:\ProgramData\Anaconda3\lib\site-packages\matplotlib\cbook\deprecation.py
in wrapper(*inner_args, **inner_kwargs)
    409                             else deprecation_addendum,
    410                 **kwargs)
--> 411         return func(*inner_args, **inner_kwargs)
    412
    413     return wrapper

C:\ProgramData\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py in sca
tter(self, x, y, s, c, marker, cmap, norm, vmin, vmax, alpha, linewidths,
verts, edgecolors, plotnonfinite, **kwargs)
   4430         # Process **kwargs to handle aliases, conflicts with expli
cit kwargs:
   4431
-> 4432         self._process_unit_info(xdata=x, ydata=y, kwargs=kwargs)
   4433         x = self.convert_xunits(x)
   4434         y = self.convert_yunits(y)

C:\ProgramData\Anaconda3\lib\site-packages\matplotlib\axes\_base.py in _pr
ocess_unit_info(self, xdata, ydata, kwargs)
   2187             return kwargs
   2188
-> 2189         kwargs = _process_single_axis(xdata, self.xaxis, 'xunits',
kwargs)
   2190         kwargs = _process_single_axis(ydata, self.yaxis, 'yunits',
kwargs)
   2191         return kwargs

C:\ProgramData\Anaconda3\lib\site-packages\matplotlib\axes\_base.py in _pr
ocess_single_axis(data, axis, unit_name, kwargs)
   2170                 # We only need to update if there is nothing set y
et.
   2171                 if not axis.have_units():
-> 2172                     axis.update_units(data)
```

```
   2173
   2174             # Check for units in the kwargs, and if present update
axis

C:\ProgramData\Anaconda3\lib\site-packages\matplotlib\axis.py in update_un
its(self, data)
   1464         neednew = self.converter != converter
   1465         self.converter = converter
-> 1466         default = self.converter.default_units(data, self)
   1467         if default is not None and self.units is None:
   1468             self.set_units(default)

C:\ProgramData\Anaconda3\lib\site-packages\matplotlib\category.py in defau
lt_units(data, axis)
    105         # the conversion call stack is default_units -> axis_info
-> convert
    106         if axis.units is None:
--> 107             axis.set_units(UnitData(data))
    108         else:
    109             axis.units.update(data)

C:\ProgramData\Anaconda3\lib\site-packages\matplotlib\category.py in __ini
t__(self, data)
    174         self._counter = itertools.count()
    175         if data is not None:
--> 176             self.update(data)
    177
    178     @staticmethod

C:\ProgramData\Anaconda3\lib\site-packages\matplotlib\category.py in updat
e(self, data)
    207         # check if convertible to number:
    208         convertible = True
--> 209         for val in OrderedDict.fromkeys(data):
    210             # OrderedDict just iterates over unique values in dat
a.
    211             cbook._check_isinstance((str, bytes), value=val)

TypeError: unhashable type: 'numpy.ndarray'
```



In [21]:

```
lr.score(x_test,y_test)
```

Out[21]:

```
1.0
```

In [22]:

```
lr.score(x_train,y_train)
```

Out[22]:

```
1.0
```

In [23]:

```
from sklearn.linear_model import Ridge,Lasso
```

In [24]:

```
rr=Ridge(alpha=10)
rr.fit(x_train,y_train)
```

Out[24]:

```
Ridge(alpha=10)
```

In [25]:

```
rr.score(x_test,y_test)
```

Out[25]:

```
0.75
```

In [26]:

```
la=Lasso(alpha=10)
la.fit(x_train,y_train)
```

Out[26]:

```
Lasso(alpha=10)
```

In [27]:

```
la.score(x_test,y_test)
```

Out[27]:

```
0.75
```

Elastic Net

In [30]:

```
from sklearn.linear_model import ElasticNet
en = ElasticNet()
en.fit(x_train,y_train)
```

Out[30]:

```
ElasticNet()
```

In [31]:

```
print(en.coef_)
```

```
[0.]
```

In [32]:

```
print(en.intercept_)
```

```
[10.2016]
```

In [33]:

```
prediction=en.predict(x_test)
print(prediction)
```

```
[10.2016 10.2016 10.2016 10.2016 10.2016 10.2016 10.2016 10.2016 10.2016
 10.2016 10.2016 10.2016 10.2016 10.2016 10.2016]
```

In [34]:

```
print(en.score(x_test,y_test))
```

```
0.75
```

Evaluation Metrics

In [35]:

```
from sklearn import metrics
```

In [36]:

```
print("Mean Absolute Error:",metrics.mean_absolute_error(y_test,prediction))
```

```
Mean Absolute Error: 1.7763568394002505e-15
```

In [37]:

```
print("Mean Squared Error:",metrics.mean_squared_error(y_test,prediction))
```

```
Mean Squared Error: 3.1554436208840472e-30
```

In [38]:

```
print("Root Mean Squared Error:",np.sqrt(metrics.mean_squared_error(y_test,prediction)))
```

```
Root Mean Squared Error: 1.7763568394002505e-15
```