01-911 Calls Data Capstone Project

March 23, 2024

1 911 Calls Capstone Project

For this capstone project we will be analyzing some 911 call data from Kaggle. The data contains the following fields:

- lat : String variable, Latitude
- lng: String variable, Longitude
- desc: String variable, Description of the Emergency Call
- zip: String variable, Zipcode
- title: String variable, Title
- timeStamp: String variable, YYYY-MM-DD HH:MM:SS
- twp: String variable, Township
- addr: String variable, Address
- e: String variable, Dummy variable (always 1)

1.1 Data and Setup

[1]:
```
import numpy as np
import pandas as pd
```

[4]:
```
import matplotlib.pyplot as ply
import seaborn as sns
%matplotlib inline
```

[6]:
```
df = pd.read_csv(r'C:\Users\Asus\Desktop\course materials\portela data␣
 ↪science\Refactored_Py_DS_ML_Bootcamp-master\10-Data-Capstone-Projects\911.
 ↪csv')
```

** Check the info() of the df **

[7]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 99492 entries, 0 to 99491
Data columns (total 9 columns):
 #   Column     Non-Null Count  Dtype
---  ------     --------------  -----
 0   lat        99492 non-null  float64
 1   lng        99492 non-null  float64
 2   desc       99492 non-null  object 
 3   zip        86637 non-null  float64
 4   title      99492 non-null  object 
 5   timeStamp  99492 non-null  object 
 6   twp        99449 non-null  object 
 7   addr       98973 non-null  object 
 8   e          99492 non-null  int64  
dtypes: float64(3), int64(1), object(5)
memory usage: 6.8+ MB
```

[ ]:

[10]:

```
df.head(3)
```

[10]:

```
         lat        lng                                               desc  \
0  40.297876 -75.581294  REINDEER CT & DEAD END;  NEW HANOVER; Station …   
1  40.258061 -75.264680  BRIAR PATH & WHITEMARSH LN;  HATFIELD TOWNSHIP…   
2  40.121182 -75.351975  HAWS AVE; NORRISTOWN; 2015-12-10 @ 14:39:21-St…   

       zip                    title            timeStamp                twp  \
0  19525.0   EMS: BACK PAINS/INJURY  2015-12-10 17:40:00        NEW HANOVER   
1  19446.0  EMS: DIABETIC EMERGENCY  2015-12-10 17:40:00  HATFIELD TOWNSHIP   
2  19401.0      Fire: GAS-ODOR/LEAK  2015-12-10 17:40:00         NORRISTOWN   

                         addr  e  
0      REINDEER CT & DEAD END  1  
1  BRIAR PATH & WHITEMARSH LN  1  
2                    HAWS AVE  1  
```

[ ]:

1.2 Basic Questions

** What are the top 5 zipcodes for 911 calls? **

[12]:

```
df['zip'].value_counts().head(5)
```

[12]:

```
zip
19401.0    6979
19464.0    6643
19403.0    4854
19446.0    4748
19406.0    3174
Name: count, dtype: int64
```

[ ]:

** What are the top 5 townships (twp) for 911 calls? **

```
[13]: df['twp'].value_counts().head(5)
```

```
[13]: twp
      LOWER MERION    8443
      ABINGTON        5977
      NORRISTOWN      5890
      UPPER MERION    5227
      CHELTENHAM      4575
      Name: count, dtype: int64
```

```
[ ]:
```

** We take a look at the 'title' column, how many unique title codes are there? **

```
[14]: df['title'].nunique()
```

```
[14]: 110
```

1.3 Creating new features

** In the titles column there are "Reasons/Departments" specified before the title code. These are EMS, Fire, and Traffic. Use .apply() with a custom lambda expression to create a new column called "Reason" that contains this string value.**

For example, if the title column value is EMS: BACK PAINS/INJURY , the Reason column value would be EMS.

```
[15]: df.head(3)
```

```
[15]:          lat        lng                                                desc  \
      0  40.297876 -75.581294  REINDEER CT & DEAD END;  NEW HANOVER; Station …
      1  40.258061 -75.264680  BRIAR PATH & WHITEMARSH LN;  HATFIELD TOWNSHIP…
      2  40.121182 -75.351975  HAWS AVE; NORRISTOWN; 2015-12-10 @ 14:39:21-St…

             zip                    title            timeStamp                twp  \
      0  19525.0   EMS: BACK PAINS/INJURY  2015-12-10 17:40:00        NEW HANOVER
      1  19446.0  EMS: DIABETIC EMERGENCY  2015-12-10 17:40:00  HATFIELD TOWNSHIP
      2  19401.0      Fire: GAS-ODOR/LEAK  2015-12-10 17:40:00         NORRISTOWN

                               addr  e
      0      REINDEER CT & DEAD END  1
      1  BRIAR PATH & WHITEMARSH LN  1
      2                    HAWS AVE  1
```

```
[17]: df['Reason'] = df['title'].apply(lambda title: title.split(':')[0])
```

```
[18]: df.head(2)
```

```
[18]:          lat        lng                                                desc  \
      0  40.297876 -75.581294  REINDEER CT & DEAD END;  NEW HANOVER; Station …
      1  40.258061 -75.264680  BRIAR PATH & WHITEMARSH LN;  HATFIELD TOWNSHIP…

             zip                    title            timeStamp                twp  \
      0  19525.0   EMS: BACK PAINS/INJURY  2015-12-10 17:40:00        NEW HANOVER
      1  19446.0  EMS: DIABETIC EMERGENCY  2015-12-10 17:40:00  HATFIELD TOWNSHIP

                               addr  e Reason
      0      REINDEER CT & DEAD END  1    EMS
      1  BRIAR PATH & WHITEMARSH LN  1    EMS
```

** What is the most common Reason for a 911 call based off of this new column? **

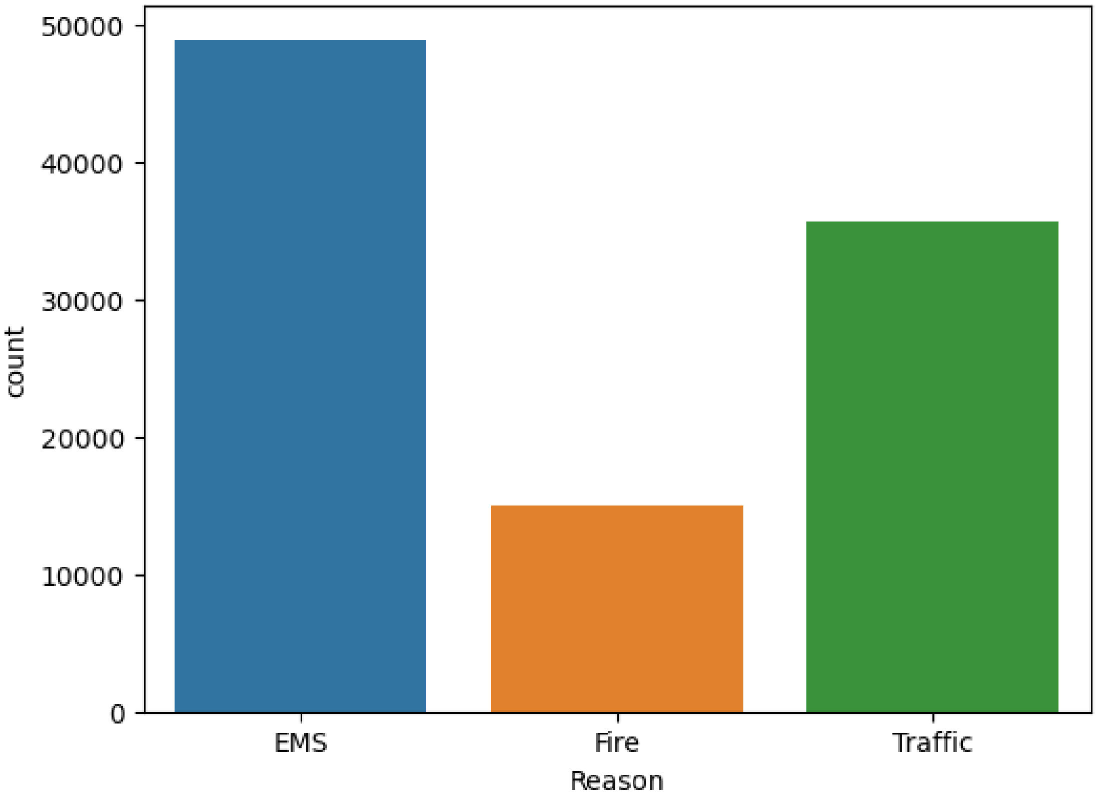
```
[19]: df['Reason'].value_counts().head()
```

```
[19]: Reason
      EMS        48877
      Traffic    35695
      Fire       14920
      Name: count, dtype: int64
```

** Now we use seaborn to create a countplot of 911 calls by Reason. **

```
[20]: sns.countplot(x ='Reason' ,data = df )
```

```
[20]: <Axes: xlabel='Reason', ylabel='count'>
```



** Now let us begin to focus on time information. What is the data type of the objects in the timeStamp column? **

```
[23]: type(df['timeStamp'].iloc[0])
```

```
[23]: str
```

** we have seen that these timestamps are still strings. Use [pd.to_datetime] to convert the column from strings to DateTime objects. **

```
[24]: df['timeStamp'] = pd.to_datetime(df['timeStamp'])
```

```
[25]: df['Month'] = df['timeStamp'].apply(lambda time : time.month)
      df['Hour'] = df['timeStamp'].apply(lambda time : time.hour)
      df['day_of_week'] = df['timeStamp'].apply(lambda time : time.dayofweek)
```

```
[26]: df.head(2)
```

```
[26]:          lat        lng                                                desc  \
      0  40.297876 -75.581294  REINDEER CT & DEAD END;  NEW HANOVER; Station …
      1  40.258061 -75.264680  BRIAR PATH & WHITEMARSH LN;  HATFIELD TOWNSHIP…
```

```
       zip                  title           timeStamp                twp  \
0  19525.0   EMS: BACK PAINS/INJURY 2015-12-10 17:40:00        NEW HANOVER
1  19446.0  EMS: DIABETIC EMERGENCY 2015-12-10 17:40:00  HATFIELD TOWNSHIP

                         addr  e Reason  Month  Hour  day_of_week
0      REINDEER CT & DEAD END  1    EMS     12    17            3
1  BRIAR PATH & WHITEMARSH LN  1    EMS     12    17            3
```

** Notice how the Day of Week is an integer 0-6. Use the .map() with this dictionary to map the actual string names to the day of the week: **

dmap = {0:'Mon',1:'Tue',2:'Wed',3:'Thu',4:'Fri',5:'Sat',6:'Sun'}

[27]:

```
dmap = {0 :'Mon' ,1 : 'Tue', 2: 'Wed' ,4 : 'Fri' , 5 : 'sat' , 6 :'sun'}
```

[28]:

```
df['day_of_week'] = df['day_of_week'].map(dmap)
```

** Now use seaborn to create a countplot of the Day of Week column with the hue based off of the Reason column. **

[29]:

```
df.head(1)
```

[29]:

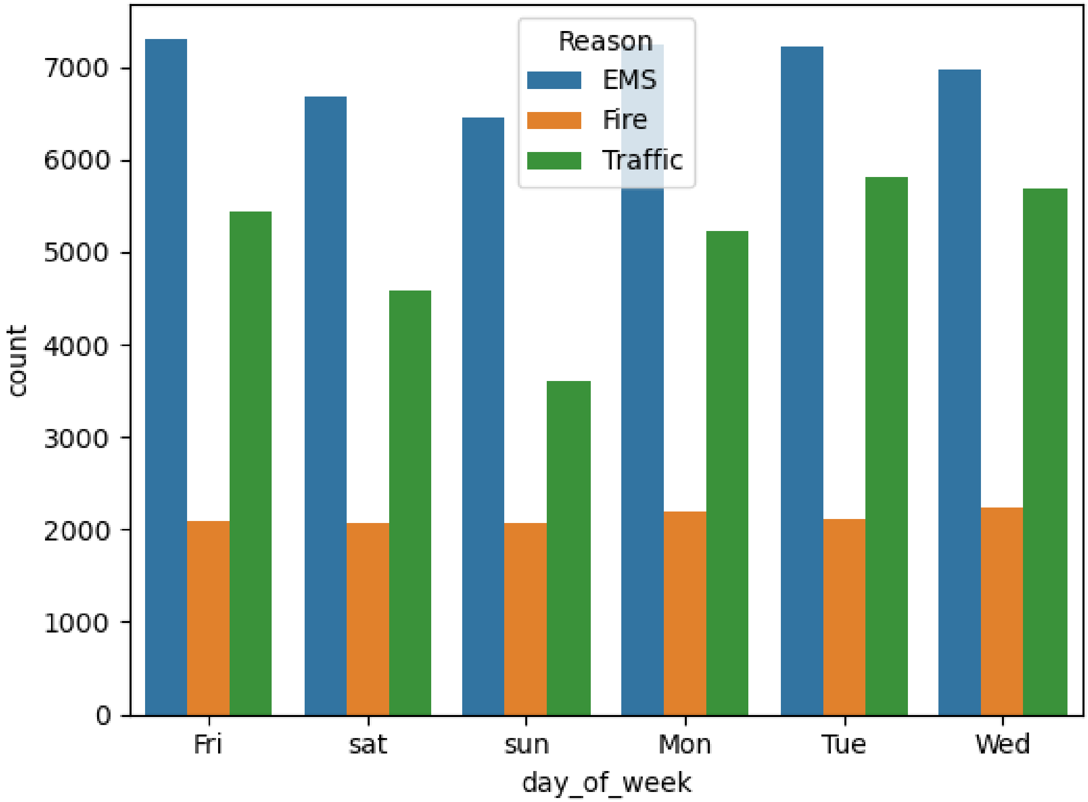
```
         lat        lng                                                desc  \
0  40.297876 -75.581294  REINDEER CT & DEAD END;  NEW HANOVER; Station …

       zip                  title           timeStamp          twp  \
0  19525.0  EMS: BACK PAINS/INJURY 2015-12-10 17:40:00  NEW HANOVER

                     addr  e Reason  Month  Hour day_of_week
0  REINDEER CT & DEAD END  1    EMS     12    17         NaN
```

[30]:

```
sns.countplot(x='day_of_week' , data = df , hue = 'Reason')
```

[30]:

```
<Axes: xlabel='day_of_week', ylabel='count'>
```

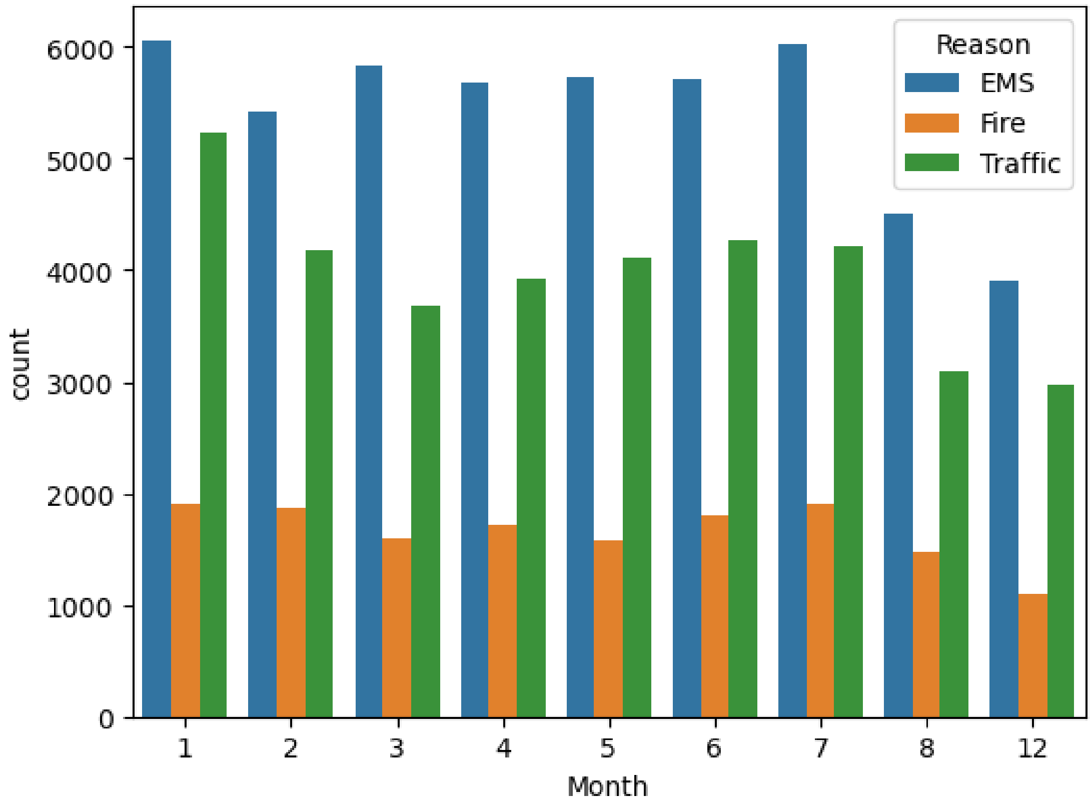


```
[ ]:
```

Now we do the same for Month:

```
[31]: sns.countplot(x='Month' , data = df , hue = 'Reason')
```

```
[31]: <Axes: xlabel='Month', ylabel='count'>
```



```
[ ]:
```

```
[33]: byMonth = df.groupby('Month').count()
      byMonth.head()
```

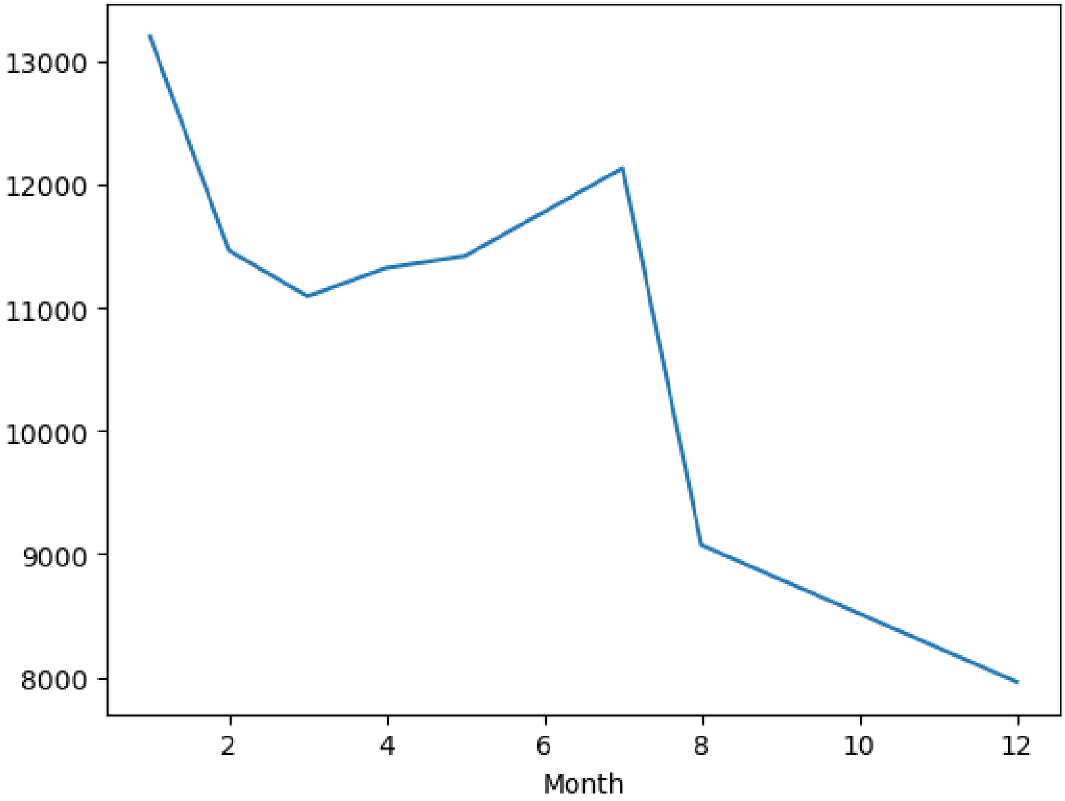
```
[33]:          lat    lng   desc    zip  title  timeStamp    twp   addr      e  \
      Month
      1      13205  13205  13205  11527  13205      13205  13203  13096  13205
      2      11467  11467  11467   9930  11467      11467  11465  11396  11467
      3      11101  11101  11101   9755  11101      11101  11092  11059  11101
      4      11326  11326  11326   9895  11326      11326  11323  11283  11326
      5      11423  11423  11423   9946  11423      11423  11420  11378  11423

             Reason   Hour  day_of_week
      Month
      1       13205  13205        11621
      2       11467  11467         9871
      3       11101  11101         9201
      4       11326  11326         9725
      5       11423  11423         9833
```

```
[ ]:
```

** Now we create a simple plot off of the dataframe indicating the count of calls per month. **

```
[35]: byMonth['twp'].plot()
```

```
[35]: <Axes: xlabel='Month'>
```

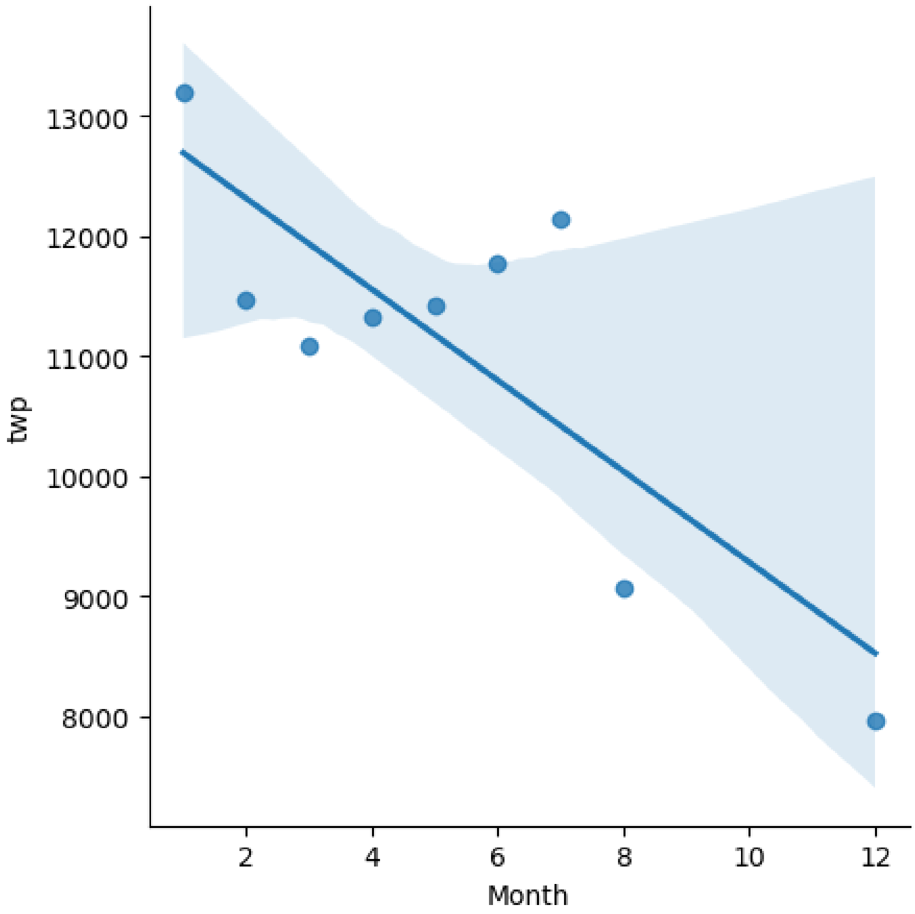


```
[ ]:
```

** Now we see if you can use seaborn's lmplot() to create a linear fit on the number of calls per month. Keep in mind you may need to reset the index to a column. **

```
[40]: sns.lmplot(x='Month' , y = 'twp' , data = byMonth.reset_index())
```

```
[40]: <seaborn.axisgrid.FacetGrid at 0x1e066b12310>
```



```
[ ]:
```

** We create a new column called 'Date' that contains the date from the timeStamp column. You'll need to use apply along with the .date() method. **

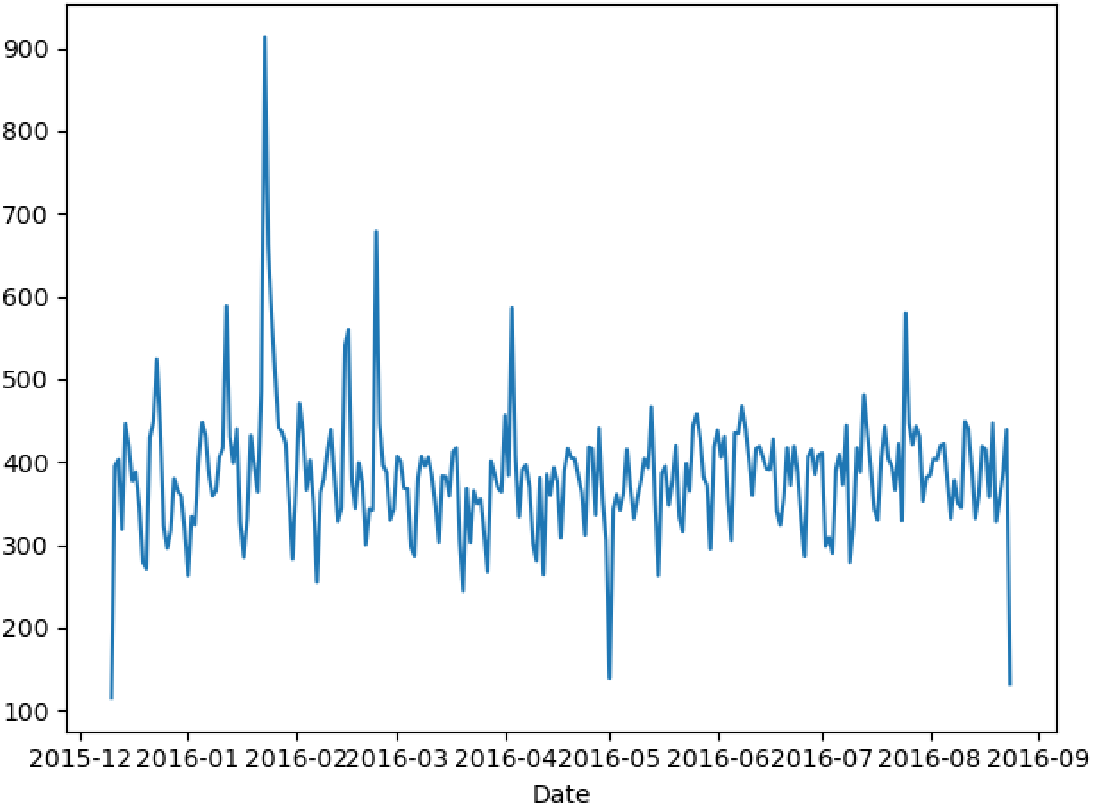
```
[41]: df['Date'] = df['timeStamp'].apply(lambda te : te.date())
```

```
[42]: df.head(1)
```

```
[42]:         lat        lng                                               desc  \
   0  40.297876 -75.581294  REINDEER CT & DEAD END;  NEW HANOVER; Station …

          zip                   title           timeStamp          twp  \
   0  19525.0  EMS: BACK PAINS/INJURY 2015-12-10 17:40:00  NEW HANOVER

                         addr  e Reason  Month  Hour day_of_week        Date
   0  REINDEER CT & DEAD END  1    EMS     12    17         NaN  2015-12-10
```

** Now we groupby this Date column with the count() aggregate and create a plot of counts of 911 calls.**

[45]:
```
df.groupby('Date').count()['twp'].plot()
ply.tight_layout()
```



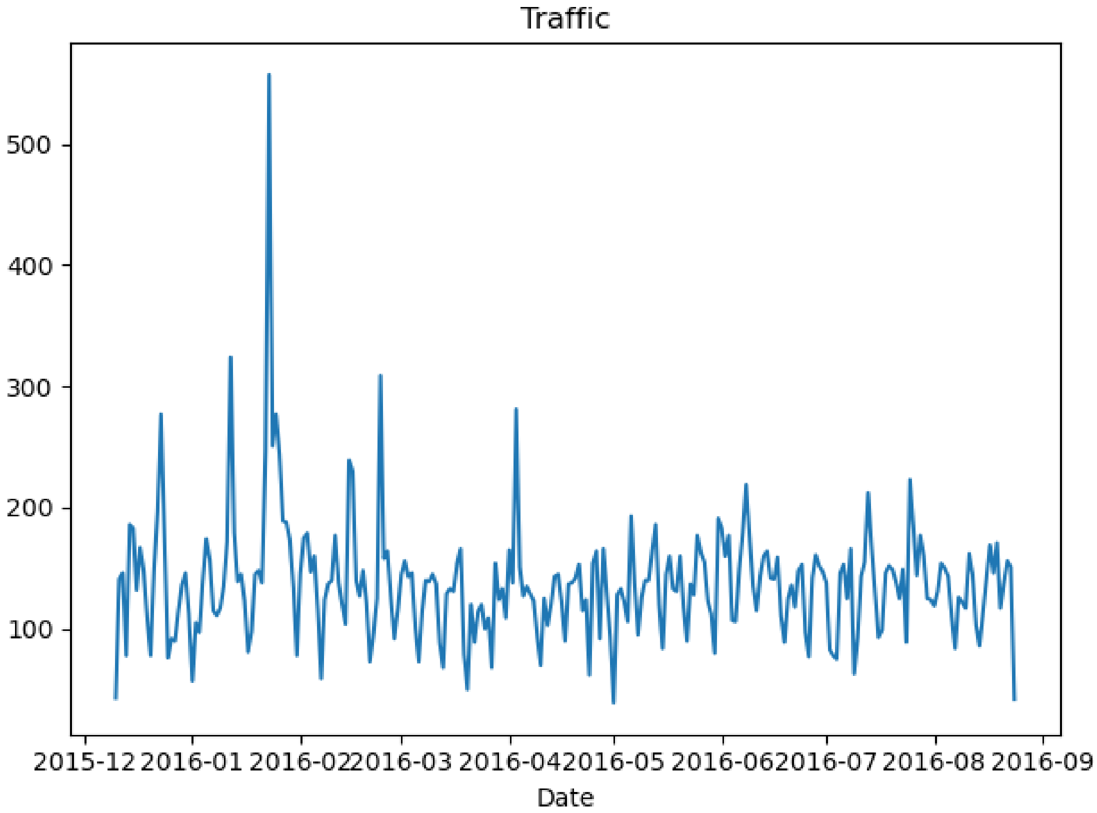
[51]:
```
df['Reason']
```

[51]:
```
0             EMS
1             EMS
2            Fire
3             EMS
4             EMS
           …
99487    Traffic
99488    Traffic
99489        EMS
99490        EMS
99491    Traffic
Name: Reason, Length: 99492, dtype: object
```

** Now we recreate this plot but create 3 separate plots with each plot representing a Reason for the 911 call**

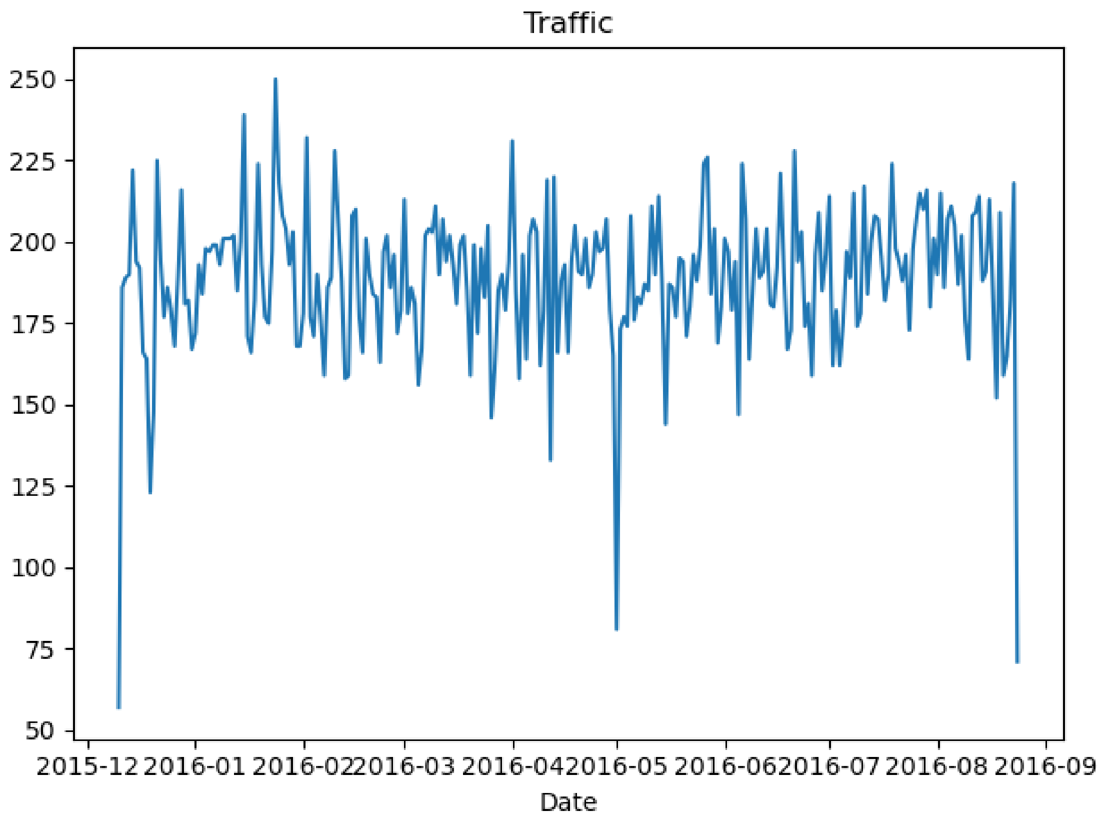
[52]:

```
df[df['Reason'] == 'Traffic'].groupby('Date').count()['twp'].plot()
ply.title('Traffic')
ply.tight_layout()
```

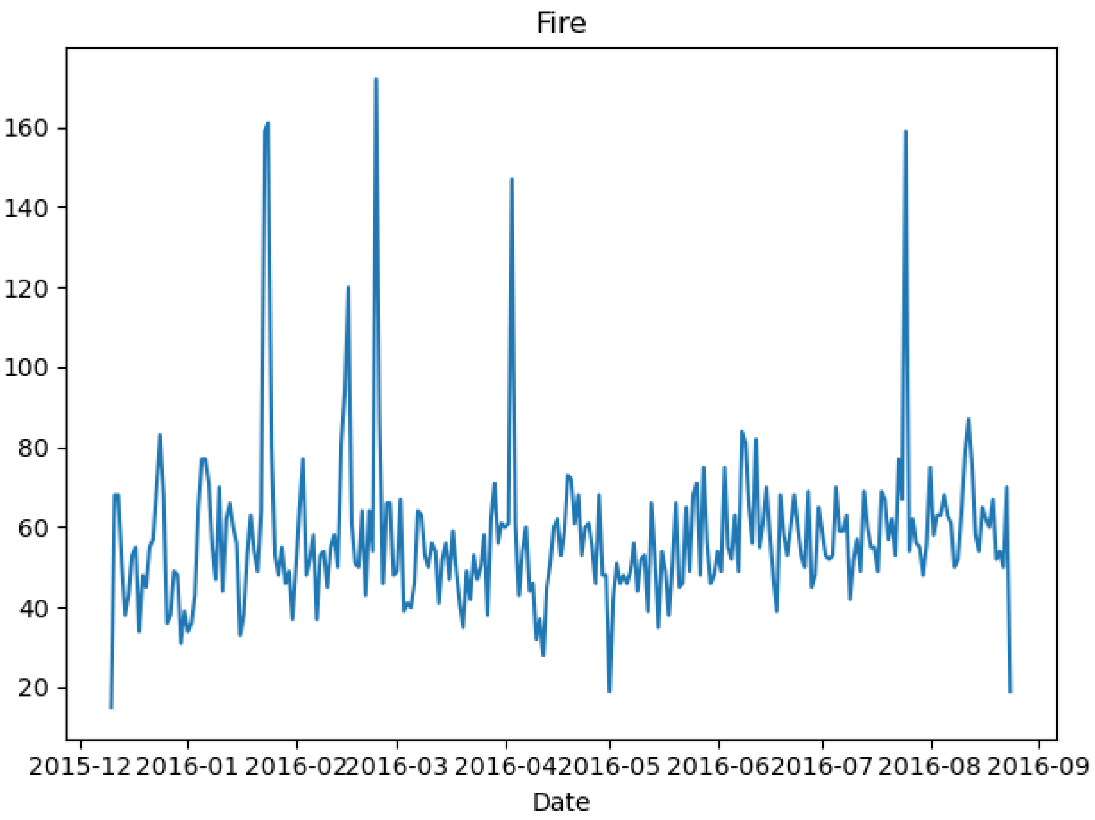


[53]:

```
df[df['Reason'] == 'EMS'].groupby('Date').count()['twp'].plot()
ply.title('EMS')
ply.tight_layout()
```



```
[54]: df[df['Reason'] == 'Fire'].groupby('Date').count()['twp'].plot()
      ply.title('Fire')
      ply.tight_layout()
```



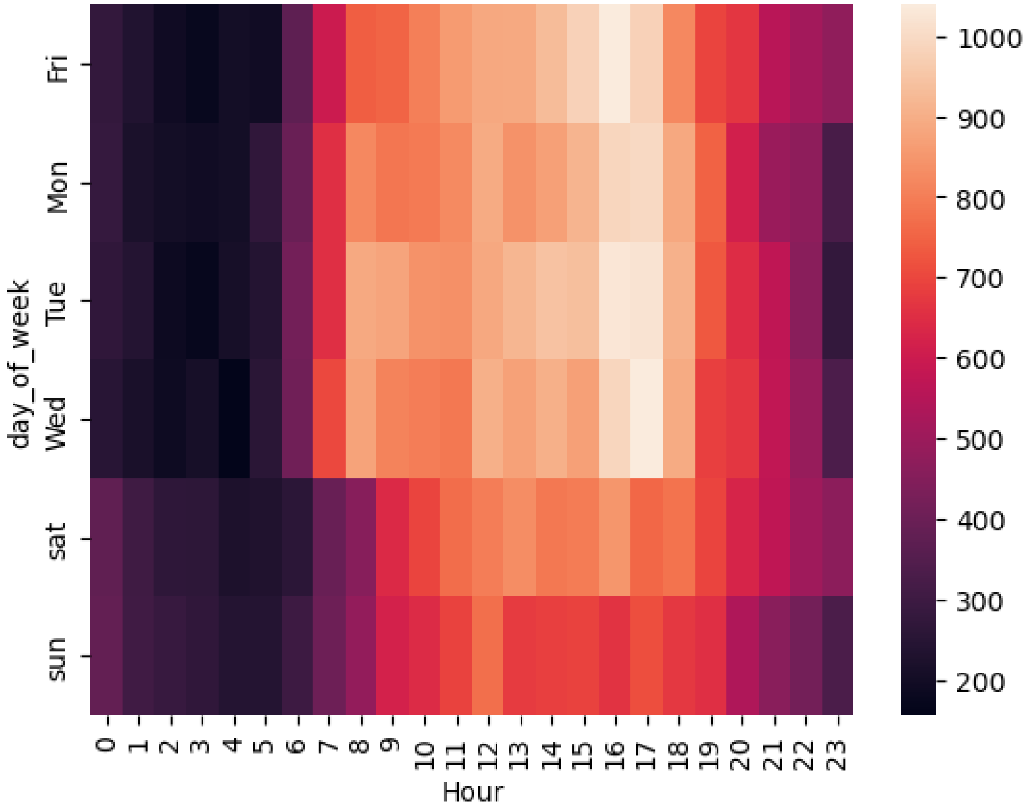
```
[58]: dayHour = df.groupby(by=['day_of_week','Hour']).count()['Reason'].unstack()
      dayHour.head()
```

```
[58]: Hour            0    1    2    3    4    5    6    7    8    9  ...   14   15  \
      day_of_week                                                    ...
      Fri           275  235  191  175  201  194  372  598  742  752  ...  932  980
      Mon           282  221  201  194  204  267  397  653  819  786  ...  869  913
      Tue           269  240  186  170  209  239  415  655  889  880  ...  943  938
      Wed           250  216  189  209  156  255  410  701  875  808  ...  904  867
      sat           375  301  263  260  224  231  257  391  459  640  ...  789  796

      Hour           16    17   18   19   20   21   22   23
      day_of_week
      Fri          1039   980  820  696  667  559  514  474
      Mon           989   997  885  746  613  497  472  325
      Tue          1026  1019  905  731  647  571  462  274
      Wed           990  1037  894  686  668  575  490  335
      sat           848   757  778  696  628  572  506  467

      [5 rows x 24 columns]
```

** Now we create a HeatMap using this new DataFrame. **

```
[60]: sns.heatmap(dayHour)
```

```
[60]: <Axes: xlabel='Hour', ylabel='day_of_week'>
```

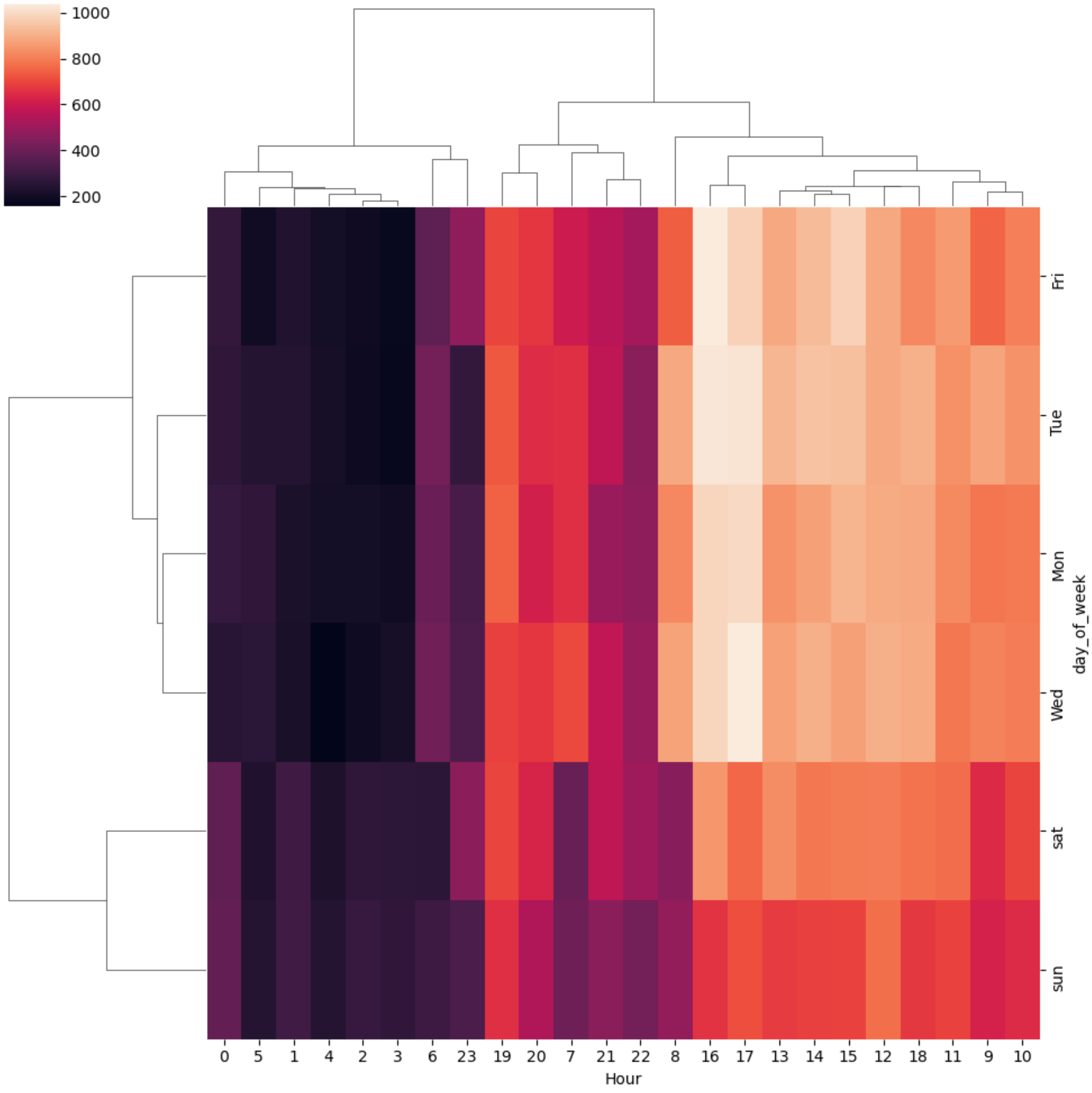


```
[ ]:
```

** Now we create a clustermap using this DataFrame. **

```
[61]: sns.clustermap(dayHour)
```

```
[61]: <seaborn.matrix.ClusterGrid at 0x1e06eee9550>
```



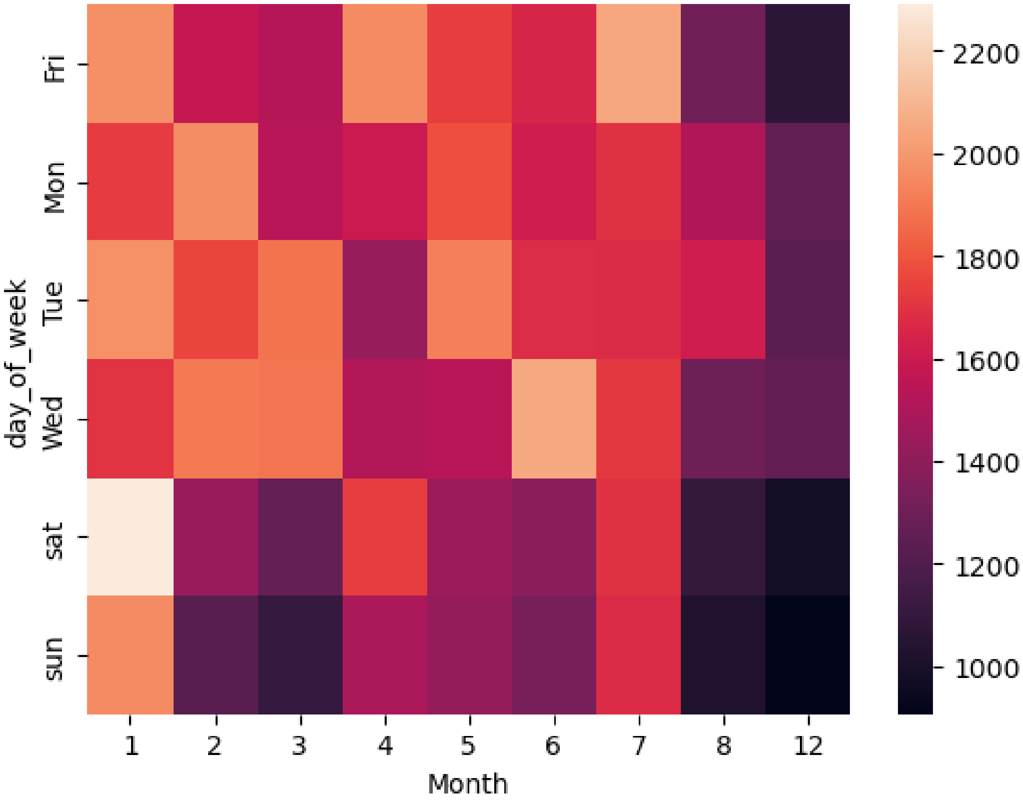
** Now we repeat these same plots and operations, for a DataFrame that shows the Month as the column. **

[65]:
```
dayMonth = df.groupby(by=['day_of_week','Month']).count()['Reason'].unstack()
dayMonth.head(3)
```

[65]:
```
Month           1     2     3     4     5     6     7     8     12
day_of_week
Fri          1970  1581  1525  1958  1730  1649  2045  1310  1065
Mon          1727  1964  1535  1598  1779  1617  1692  1511  1257
Tue          1973  1753  1884  1430  1918  1676  1670  1612  1234
```

[66]:
```
sns.heatmap(dayMonth)
```

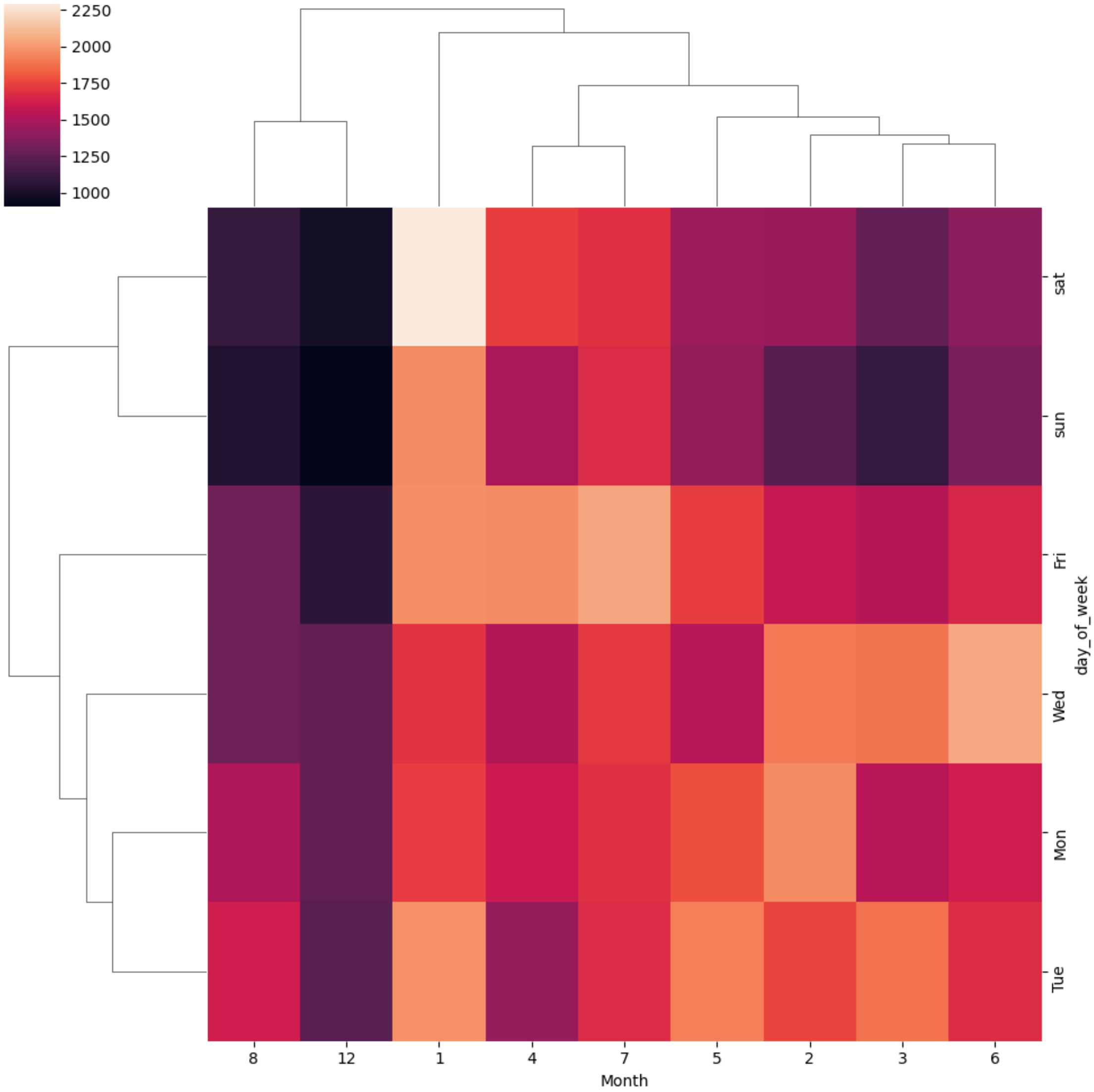
```
[66]: <Axes: xlabel='Month', ylabel='day_of_week'>
```



```
[ ]:
```

```
[67]: sns.clustermap(dayMonth)
```

```
[67]: <seaborn.matrix.ClusterGrid at 0x1e070592910>
```


2250
2000
1750
1500
1250
1000
sat
sun
Fri
Wed
Mon
Tue
day_of_week
8
12
1
4
7
5
2
3
6
Month

2 Thank You

```
[ ]:
```