In [3]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

In [4]:
```
df=pd.read_csv('911.csv')
```

In [5]:
```
df.info
```

Out[5]:
```
<bound method DataFrame.info of               lat        lng  \
0       40.297876 -75.581294
1       40.258061 -75.264680
2       40.121182 -75.351975
3       40.116153 -75.343513
4       40.251492 -75.603350
...           ...        ...
663517  40.157956 -75.348060
663518  40.136306 -75.428697
663519  40.013779 -75.300835
663520  40.121603 -75.351437
663521  40.015046 -75.299674

                                                     desc      zip  \
0       REINDEER CT & DEAD END;  NEW HANOVER; Station ...  19525.0
1       BRIAR PATH & WHITEMARSH LN;  HATFIELD TOWNSHIP...  19446.0
2       HAWS AVE; NORRISTOWN; 2015-12-10 @ 14:39:21-St...  19401.0
3       AIRY ST & SWEDE ST;  NORRISTOWN; Station 308A;...  19401.0
4       CHERRYWOOD CT & DEAD END;  LOWER POTTSGROVE; S...      NaN
...                                                   ...      ...
663517  SUNSET AVE & WOODLAND AVE; EAST NORRITON; 2020...  19403.0
663518  EAGLEVILLE RD & BUNTING CIR;  LOWER PROVIDENCE...  19403.0
663519  HAVERFORD STATION RD;  LOWER MERION; Station 3...  19041.0
663520  MARSHALL ST & HAWS AVE; NORRISTOWN; 2020-07-29...  19401.0
663521  HAVERFORD STATION RD & W MONTGOMERY AVE; LOWER...  19041.0

                              title            timeStamp                twp  \
0            EMS: BACK PAINS/INJURY  2015-12-10 17:10:52        NEW HANOVER
1           EMS: DIABETIC EMERGENCY  2015-12-10 17:29:21  HATFIELD TOWNSHIP
2               Fire: GAS-ODOR/LEAK  2015-12-10 14:39:21         NORRISTOWN
3            EMS: CARDIAC EMERGENCY  2015-12-10 16:47:36         NORRISTOWN
4                    EMS: DIZZINESS  2015-12-10 16:56:52   LOWER POTTSGROVE
...                             ...                  ...                ...
663517  Traffic: VEHICLE ACCIDENT -  2020-07-29 15:46:51      EAST NORRITON
663518     EMS: GENERAL WEAKNESS  2020-07-29 15:52:19   LOWER PROVIDENCE
663519     EMS: VEHICLE ACCIDENT  2020-07-29 15:52:52       LOWER MERION
663520         Fire: BUILDING FIRE  2020-07-29 15:54:08         NORRISTOWN
663521  Traffic: VEHICLE ACCIDENT -  2020-07-29 15:52:46       LOWER MERION

                                           addr  e
0                       REINDEER CT & DEAD END  1
1                   BRIAR PATH & WHITEMARSH LN  1
2                                     HAWS AVE  1
3                           AIRY ST & SWEDE ST  1
4                     CHERRYWOOD CT & DEAD END  1
...                                        ... ..
663517                  SUNSET AVE & WOODLAND AVE  1
663518                 EAGLEVILLE RD & BUNTING CIR  1
663519                        HAVERFORD STATION RD  1
663520                      MARSHALL ST & HAWS AVE  1
663521  HAVERFORD STATION RD & W MONTGOMERY AVE  1

[663522 rows x 9 columns]>
```

In [6]:
```
df.head()
```

Out[6]:

	lat	lng	desc	zip	title	timeStamp	twp	addr	e
0	40.297876	-75.581294	REINDEER CT & DEAD END; NEW HANOVER; Station ...	19525.0	EMS: BACK PAINS/INJURY	2015-12-10 17:10:52	NEW HANOVER	REINDEER CT & DEAD END	1
1	40.258061	-75.264680	BRIAR PATH & WHITEMARSH LN; HATFIELD TOWNSHIP...	19446.0	EMS: DIABETIC EMERGENCY	2015-12-10 17:29:21	HATFIELD TOWNSHIP	BRIAR PATH & WHITEMARSH LN	1
2	40.121182	-75.351975	HAWS AVE; NORRISTOWN; 2015-12-10 @ 14:39:21-St...	19401.0	Fire: GAS-ODOR/LEAK	2015-12-10 14:39:21	NORRISTOWN	HAWS AVE	1
3	40.116153	-75.343513	AIRY ST & SWEDE ST; NORRISTOWN; Station 308A;...	19401.0	EMS: CARDIAC EMERGENCY	2015-12-10 16:47:36	NORRISTOWN	AIRY ST & SWEDE ST	1
4	40.251492	-75.603350	CHERRYWOOD CT & DEAD END; LOWER POTTSGROVE; S...	NaN	EMS: DIZZINESS	2015-12-10 16:56:52	LOWER POTTSGROVE	CHERRYWOOD CT & DEAD END	1

In [7]:
```
df['zip'].count()
```

Out[7]:
```
583323
```

```
In [8]: df['zip'].value_counts().head(5)  #top 5 zip codes
```

```
Out[8]: 19401.0    45606
        19464.0    43910
        19403.0    34888
        19446.0    32270
        19406.0    22464
        Name: zip, dtype: int64
```

```
In [9]: df['twp'].value_counts().head(5) #top 5 townships
```

```
Out[9]: LOWER MERION    55490
        ABINGTON        39947
        NORRISTOWN      37633
        UPPER MERION    36010
        CHELTENHAM      30574
        Name: twp, dtype: int64
```

```
In [15]: df['title'].nunique() #no. of unique titles
```

```
Out[15]: 148
```

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

```
In [18]: df['Reason']
```

```
Out[18]: 0             EMS
         1             EMS
         2            Fire
         3             EMS
         4             EMS
                     ...
         663517    Traffic
         663518        EMS
         663519        EMS
         663520       Fire
         663521    Traffic
         Name: Reason, Length: 663522, dtype: object
```

```
In [19]: df['Reason'].max()
```

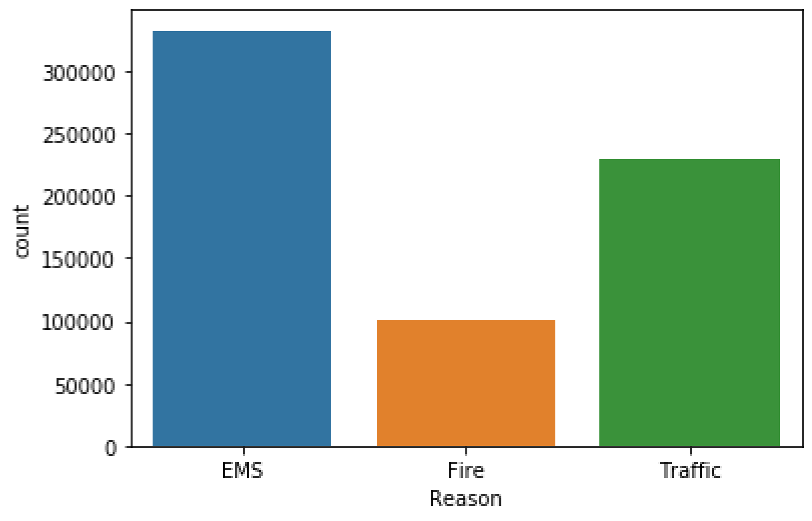
```
Out[19]: 'Traffic'
```

```
In [20]: df['Reason'].value_counts().head(1)
```

```
Out[20]: EMS    332692
         Name: Reason, dtype: int64
```

```
In [22]: sns.countplot(x='Reason',data=df)  #counplot for Reason
```

```
Out[22]: <matplotlib.axes._subplots.AxesSubplot at 0x17c73f94948>
```



```
In [29]: df['timeStamp']=pd.to_datetime(df['timeStamp']);
```

```
In [30]: type(df['timeStamp'])
```

```
Out[30]: pandas.core.series.Series
```

```
In [31]: time=df['timeStamp'].iloc[0]
```

```
In [32]: time.year
```

```
Out[32]: 2015
```

```
In [33]: del(df['timestamp'])
```

```
In [35]: df['hour']=df['timeStamp'].apply(lambda x: x.hour)
```

In [44]:
```
df['Month']=df['timeStamp'].apply(lambda x: x.month)
df['Day of Week']=df['timeStamp'].apply(lambda x: x.dayofweek)
```

In [45]:
```
df.head()
```

Out[45]:

	lat	lng	desc	zip	title	timeStamp	twp	addr	e	Reason	hour	year	Month	D We
0	40.297876	-75.581294	REINDEER CT & DEAD END; NEW HANOVER; Station ...	19525.0	EMS: BACK PAINS/INJURY	2015-12-10 17:10:52	NEW HANOVER	REINDEER CT & DEAD END	1	EMS	17	2015	12	
1	40.258061	-75.264680	BRIAR PATH & WHITEMARSH LN; HATFIELD TOWNSHIP...	19446.0	EMS: DIABETIC EMERGENCY	2015-12-10 17:29:21	HATFIELD TOWNSHIP	BRIAR PATH & WHITEMARSH LN	1	EMS	17	2015	12	
2	40.121182	-75.351975	HAWS AVE; NORRISTOWN; 2015-12-10 @ 14:39:21-St...	19401.0	Fire: GAS-ODOR/LEAK	2015-12-10 14:39:21	NORRISTOWN	HAWS AVE	1	Fire	14	2015	12	
3	40.116153	-75.343513	AIRY ST & SWEDE ST; NORRISTOWN; Station 308A;...	19401.0	EMS: CARDIAC EMERGENCY	2015-12-10 16:47:36	NORRISTOWN	AIRY ST & SWEDE ST	1	EMS	16	2015	12	
4	40.251492	-75.603350	CHERRYWOOD CT & DEAD END; LOWER POTTSGROVE; S...	NaN	EMS: DIZZINESS	2015-12-10 16:56:52	LOWER POTTSGROVE	CHERRYWOOD CT & DEAD END	1	EMS	16	2015	12	

In [38]:
```
dmap = {0:'Mon',1:'Tue',2:'Wed',3:'Thu',4:'Fri',5:'Sat',6:'Sun'}
```

In [46]:
```
df['Day of Week']=df['Day of Week'].map(dmap)    #converting the day into a string day
```

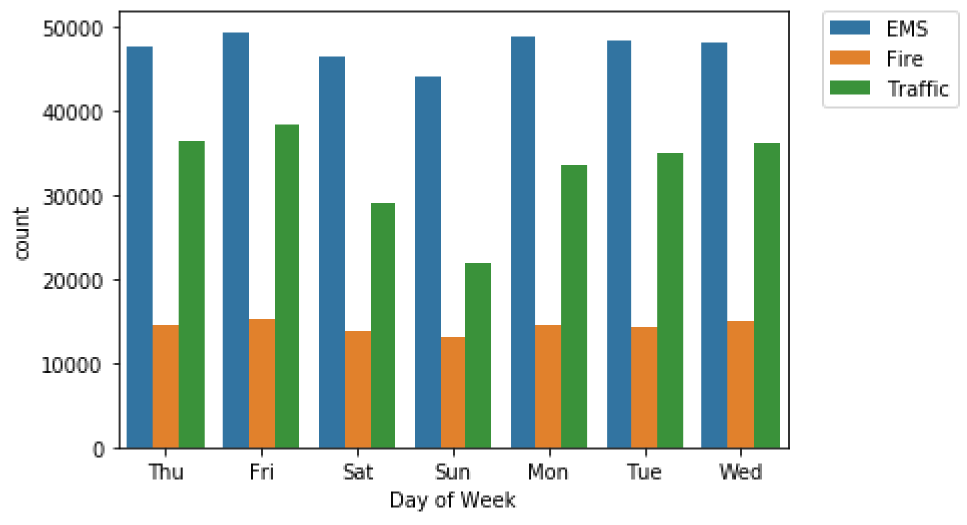
In [47]:
```
df.head()
```

Out[47]:

	lat	lng	desc	zip	title	timeStamp	twp	addr	e	Reason	hour	year	Month	D We
0	40.297876	-75.581294	REINDEER CT & DEAD END; NEW HANOVER; Station ...	19525.0	EMS: BACK PAINS/INJURY	2015-12-10 17:10:52	NEW HANOVER	REINDEER CT & DEAD END	1	EMS	17	2015	12	T
1	40.258061	-75.264680	BRIAR PATH & WHITEMARSH LN; HATFIELD TOWNSHIP...	19446.0	EMS: DIABETIC EMERGENCY	2015-12-10 17:29:21	HATFIELD TOWNSHIP	BRIAR PATH & WHITEMARSH LN	1	EMS	17	2015	12	T
2	40.121182	-75.351975	HAWS AVE; NORRISTOWN; 2015-12-10 @ 14:39:21-St...	19401.0	Fire: GAS-ODOR/LEAK	2015-12-10 14:39:21	NORRISTOWN	HAWS AVE	1	Fire	14	2015	12	T
3	40.116153	-75.343513	AIRY ST & SWEDE ST; NORRISTOWN; Station 308A;...	19401.0	EMS: CARDIAC EMERGENCY	2015-12-10 16:47:36	NORRISTOWN	AIRY ST & SWEDE ST	1	EMS	16	2015	12	T
4	40.251492	-75.603350	CHERRYWOOD CT & DEAD END; LOWER POTTSGROVE; S...	NaN	EMS: DIZZINESS	2015-12-10 16:56:52	LOWER POTTSGROVE	CHERRYWOOD CT & DEAD END	1	EMS	16	2015	12	T

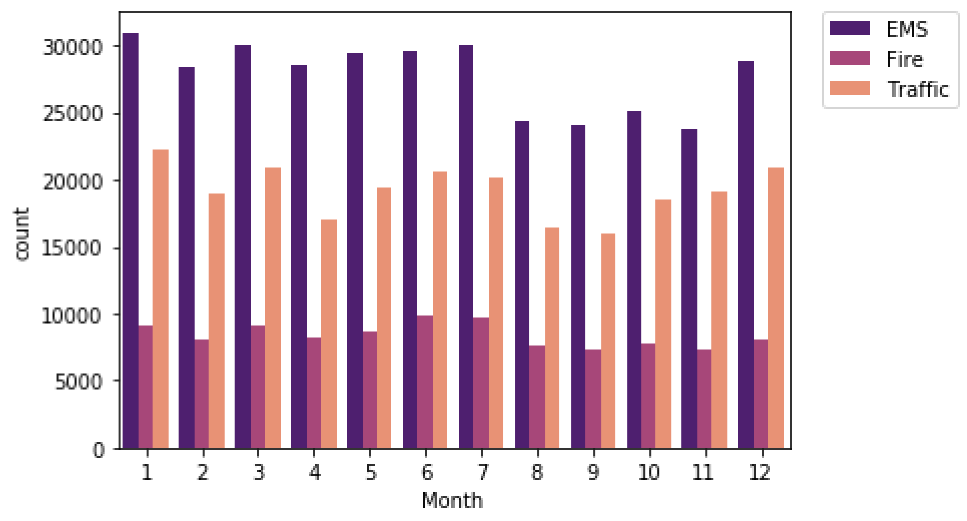
In [50]:
```python
sns.countplot(x='Day of Week',data=df,hue='Reason')
plt.legend(bbox_to_anchor=(1.05,1),loc=2,borderaxespad=0.)  #statement to get the legend out of the box
```

Out[50]:
```
<matplotlib.legend.Legend at 0x17c01490cc8>
```



In [54]:
```python
sns.countplot(x='Month',data=df,hue='Reason',palette='magma')
plt.legend(bbox_to_anchor=(1.05,1),loc=2,borderaxespad=0.)
```

Out[54]:
```
<matplotlib.legend.Legend at 0x17c017b8548>
```



In [55]:
```python
bymonth=df.groupby('Month').count()  #trying to group by a particular coloumn
```

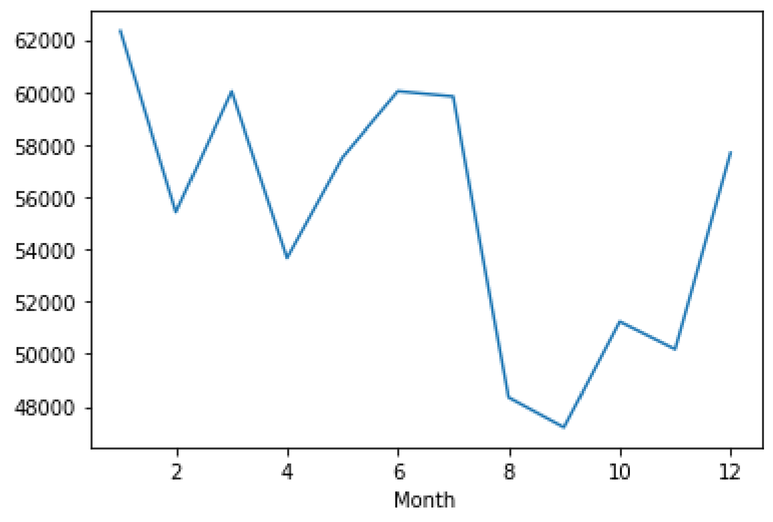
In [56]:
```python
bymonth.head()
```

Out[56]:

	lat	lng	desc	zip	title	timeStamp	twp	addr	e	Reason	hour	year	Day of Week
Month													
1	62336	62336	62336	55294	62336	62336	62312	62336	62336	62336	62336	62336	62336
2	55427	55427	55427	48922	55427	55427	55405	55427	55427	55427	55427	55427	55427
3	60027	60027	60027	53252	60027	60027	60001	60027	60027	60027	60027	60027	60027
4	53671	53671	53671	47349	53671	53671	53655	53671	53671	53671	53671	53671	53671
5	57509	57509	57509	50354	57509	57509	57474	57509	57509	57509	57509	57509	57509

In [57]:
```python
bymonth['lng'].plot()  #plot of count of calls per month, i assumed if there is a longitude of call , the call definit
ely exists
```

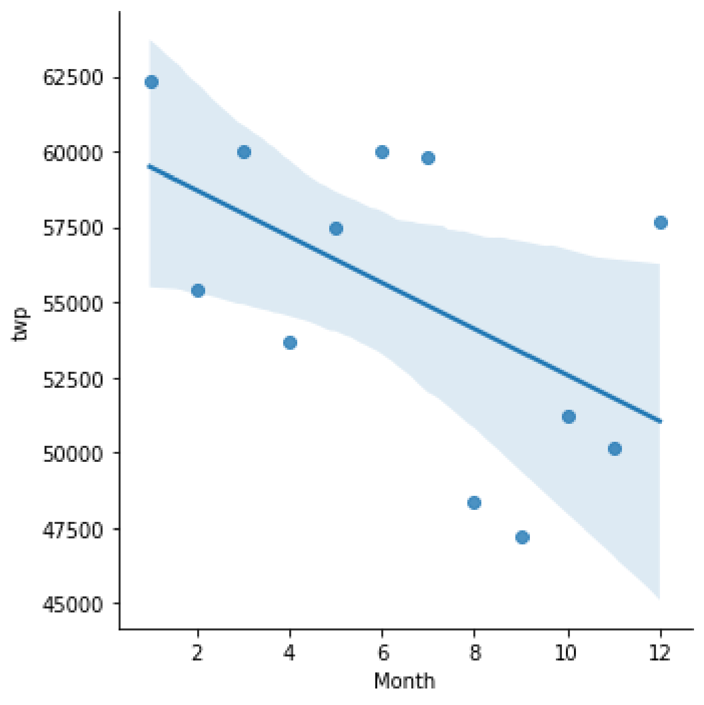
Out[57]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x17c621f0508>
```



In [67]:
```python
#now here i was trying to call a lmplot with x='Month' but thats not actually a column after groupby therefore ill res
et the month as a col using reset index
bymonth.reset_index(inplace=True)
```

```
In [64]: sns.lmplot(x='Month',y='twp',data=bymonth.reset_index()) #now this will work as month is back as a column
```

```
Out[64]: <seaborn.axisgrid.FacetGrid at 0x17c7c4c6288>
```



```
In [68]: t=df['timeStamp'].iloc[0]
```

```
In [69]: t
```

```
Out[69]: Timestamp('2015-12-10 17:10:52')
```

```
In [70]: t.date()
```

```
Out[70]: datetime.date(2015, 12, 10)
```

```
In [71]: df['Date']=df['timeStamp'].apply(lambda x:x.date())
```

```
In [72]: df['Date']
```

```
Out[72]: 0         2015-12-10
         1         2015-12-10
         2         2015-12-10
         3         2015-12-10
         4         2015-12-10
                      ...
         663517    2020-07-29
         663518    2020-07-29
         663519    2020-07-29
         663520    2020-07-29
         663521    2020-07-29
         Name: Date, Length: 663522, dtype: object
```

```
In [73]: df.groupby('Date').count().head()  #grouping by this date colomn with count aggregate to create a plot of counts of 9
         11 calls,i.e this counts all instances per date
```

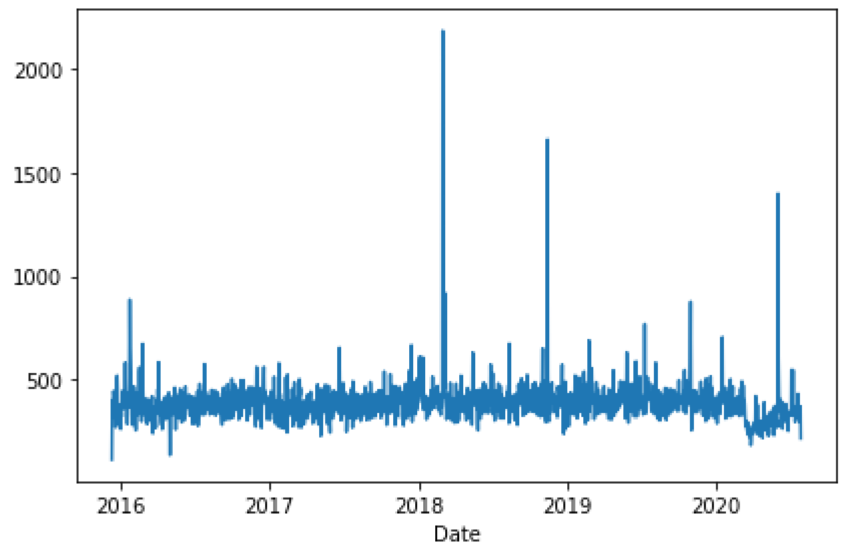
Out[73]:

	lat	lng	desc	zip	title	timeStamp	twp	addr	e	Reason	hour	year	Month	Day of Week
Date														
2015-12-10	114	114	114	100	114	114	114	114	114	114	114	114	114	114
2015-12-11	391	391	391	332	391	391	391	391	391	391	391	391	391	391
2015-12-12	402	402	402	334	402	402	402	402	402	402	402	402	402	402
2015-12-13	316	316	316	279	316	316	316	316	316	316	316	316	316	316
2015-12-14	444	444	444	386	444	444	443	444	444	444	444	444	444	444

```
In [75]: df.groupby('Date').count().head()['lat']
```

```
Out[75]: Date
         2015-12-10    114
         2015-12-11    391
         2015-12-12    402
         2015-12-13    316
         2015-12-14    444
         Name: lat, dtype: int64
```

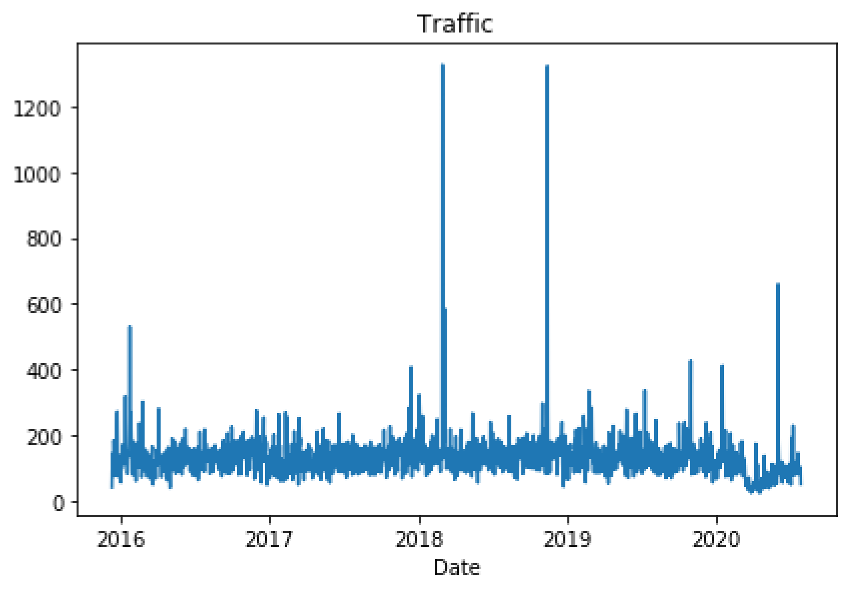
```
In [82]: df.groupby('Date').count()['lat'].plot()
         plt.tight_layout()
```



```
In [83]: #Now my aim is to create three separate plots with eaxh plot representing the reason for the 911 call
```

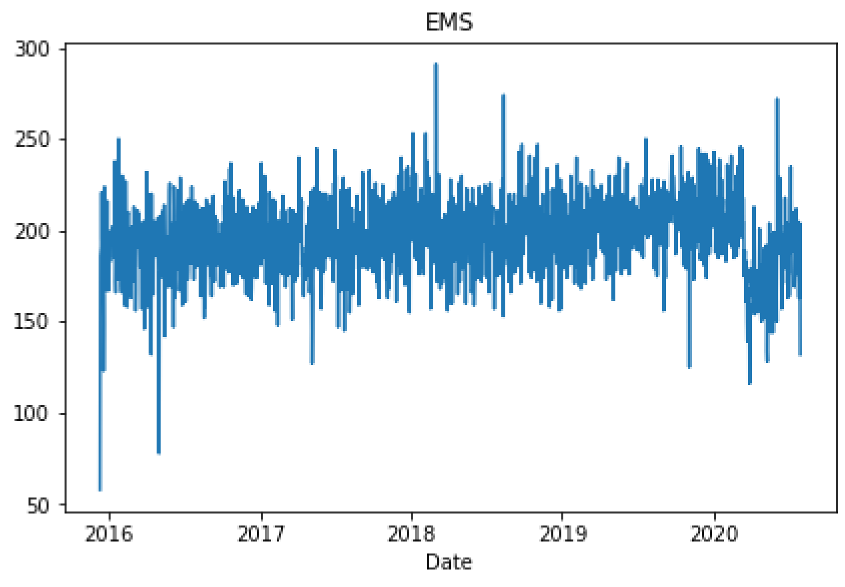
```
In [97]: #therefore for separate reasons i will need conditional selection
         df[df['Reason']=='Traffic'].groupby('Date').count()['lat'].plot()
         plt.tight_layout()
         plt.title('Traffic')
```

```
Out[97]: Text(0.5, 1, 'Traffic')
```



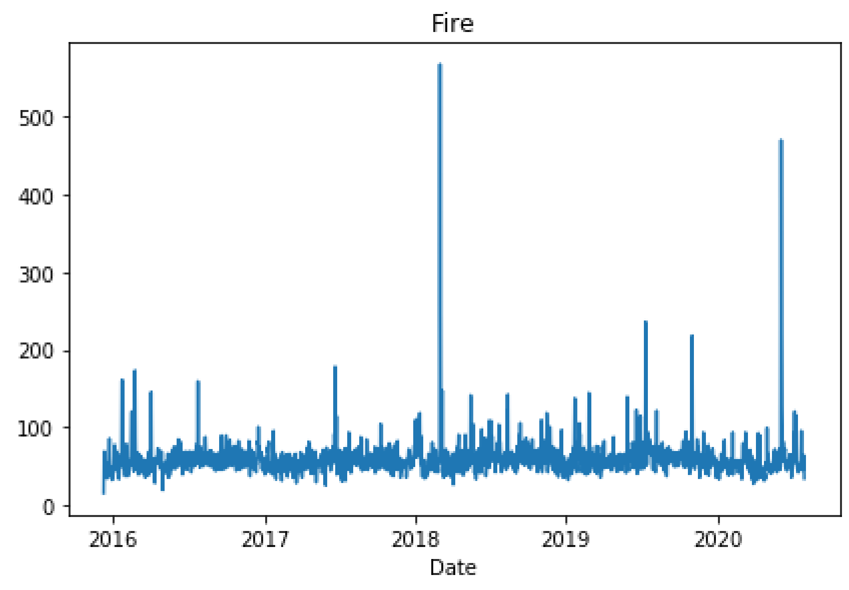
```
In [99]: df[df['Reason']=='EMS'].groupby('Date').count()['lat'].plot()
         plt.tight_layout()
         plt.title('EMS')
```

```
Out[99]: Text(0.5, 1, 'EMS')
```



```
In [100]: df[df['Reason']=='Fire'].groupby('Date').count()['lat'].plot()
          plt.tight_layout()
          plt.title('Fire')
```

```
Out[100]: Text(0.5, 1, 'Fire')
```



```
In [102]: # moving on to creating heatmaps with seaborn and our data. We'll first need to restructure the dataframe so that the
           columns become the Hours and the Index becomes the Day of the Week. There are lots of ways to do this, but I tired  t
          o combine groupby with an unstack method.
          df.groupby(by=['Day of Week','hour']).count()
```

Out[102]:

		lat	lng	desc	zip	title	timeStamp	twp	addr	e	Reason	year	Month	Date
Day of Week	**hour**													
Fri	**0**	1983	1983	1983	1752	1983	1983	1981	1983	1983	1983	1983	1983	1983
	1	1635	1635	1635	1451	1635	1635	1632	1635	1635	1635	1635	1635	1635
	2	1449	1449	1449	1311	1449	1449	1449	1449	1449	1449	1449	1449	1449
	3	1296	1296	1296	1173	1296	1296	1296	1296	1296	1296	1296	1296	1296
	4	1339	1339	1339	1227	1339	1339	1338	1339	1339	1339	1339	1339	1339
...	**...**	...	...	...	...	...	...	...	...	...	...	...	...	...
Wed	**19**	4686	4686	4686	4165	4686	4686	4684	4686	4686	4686	4686	4686	4686
	20	4116	4116	4116	3661	4116	4116	4113	4116	4116	4116	4116	4116	4116
	21	3537	3537	3537	3143	3537	3537	3530	3537	3537	3537	3537	3537	3537
	22	2826	2826	2826	2511	2826	2826	2825	2826	2826	2826	2826	2826	2826
	23	2207	2207	2207	1965	2207	2207	2204	2207	2207	2207	2207	2207	2207

168 rows × 13 columns

```
In [103]: df.groupby(by=['Day of Week','hour']).count()['Reason']
```

```
Out[103]: Day of Week  hour
          Fri          0       1983
                       1       1635
                       2       1449
                       3       1296
                       4       1339
                               ...
          Wed          19      4686
                       20      4116
                       21      3537
                       22      2826
                       23      2207
          Name: Reason, Length: 168, dtype: int64
```

```
In [104]: df.groupby(by=['Day of Week','hour']).count()['Reason'].unstack()  #unstack allows to convert in matrix form
```

Out[104]:

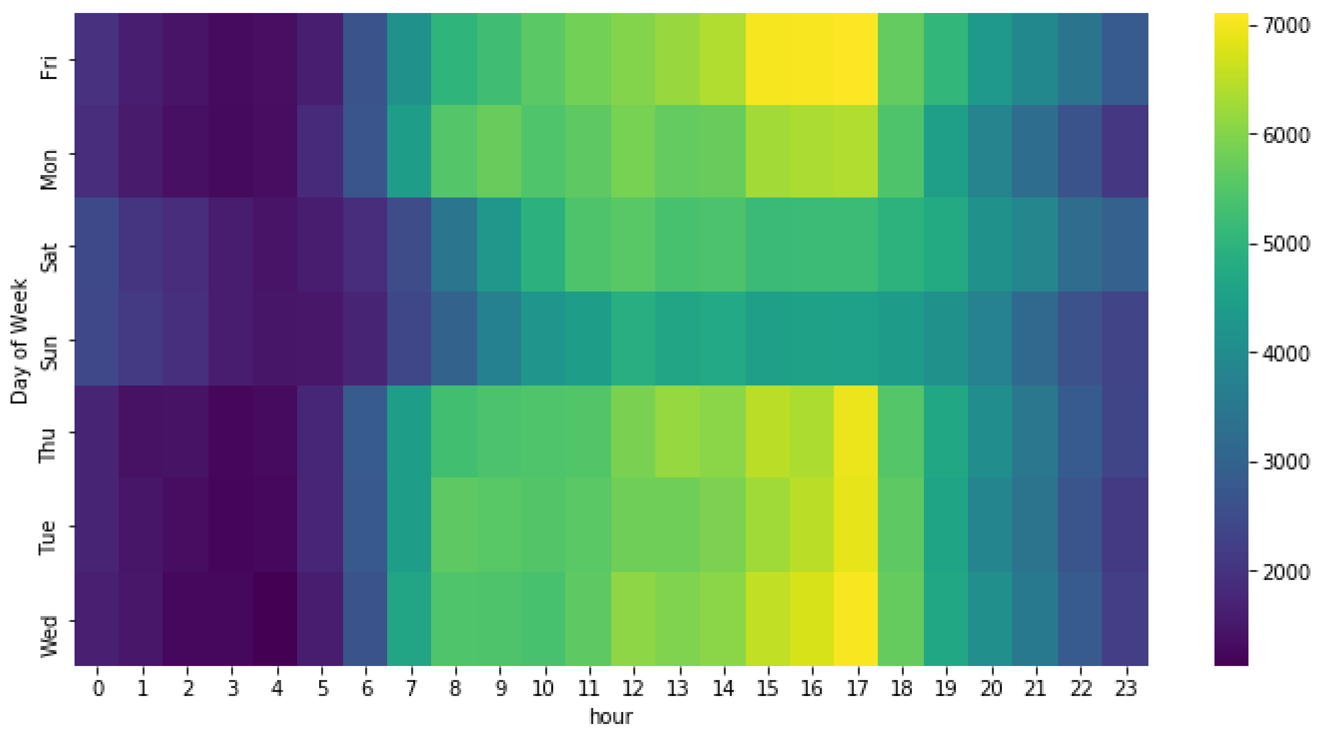
hour	0	1	2	3	4	5	6	7	8	9	...	14	15	16	17	18	19	20	21	22	23
Day of Week																					
Fri	1983	1635	1449	1296	1339	1639	2670	4143	5018	5288	...	6394	7040	7065	7113	5668	5056	4375	3913	3422	2834
Mon	1894	1571	1368	1272	1336	1844	2675	4430	5504	5724	...	5713	6289	6346	6408	5441	4488	3823	3254	2658	2072
Sat	2447	2059	1883	1592	1451	1580	1880	2489	3457	4315	...	5421	5181	5211	5213	4980	4753	4127	3895	3226	2965
Sun	2424	2135	1946	1614	1471	1488	1726	2408	3001	3728	...	4744	4475	4560	4505	4402	4135	3748	3161	2629	2323
Thu	1731	1408	1426	1236	1293	1775	2816	4432	5297	5412	...	6079	6493	6375	6935	5512	4703	4045	3490	2844	2354
Tue	1720	1459	1322	1213	1247	1741	2784	4425	5634	5566	...	5926	6252	6495	6883	5628	4621	3845	3409	2708	2137
Wed	1664	1484	1259	1265	1128	1609	2668	4644	5469	5444	...	6069	6533	6745	7062	5691	4686	4116	3537	2826	2207

7 rows × 24 columns

```
In [105]: day_hour=df.groupby(by=['Day of Week','hour']).count()['Reason'].unstack()
```

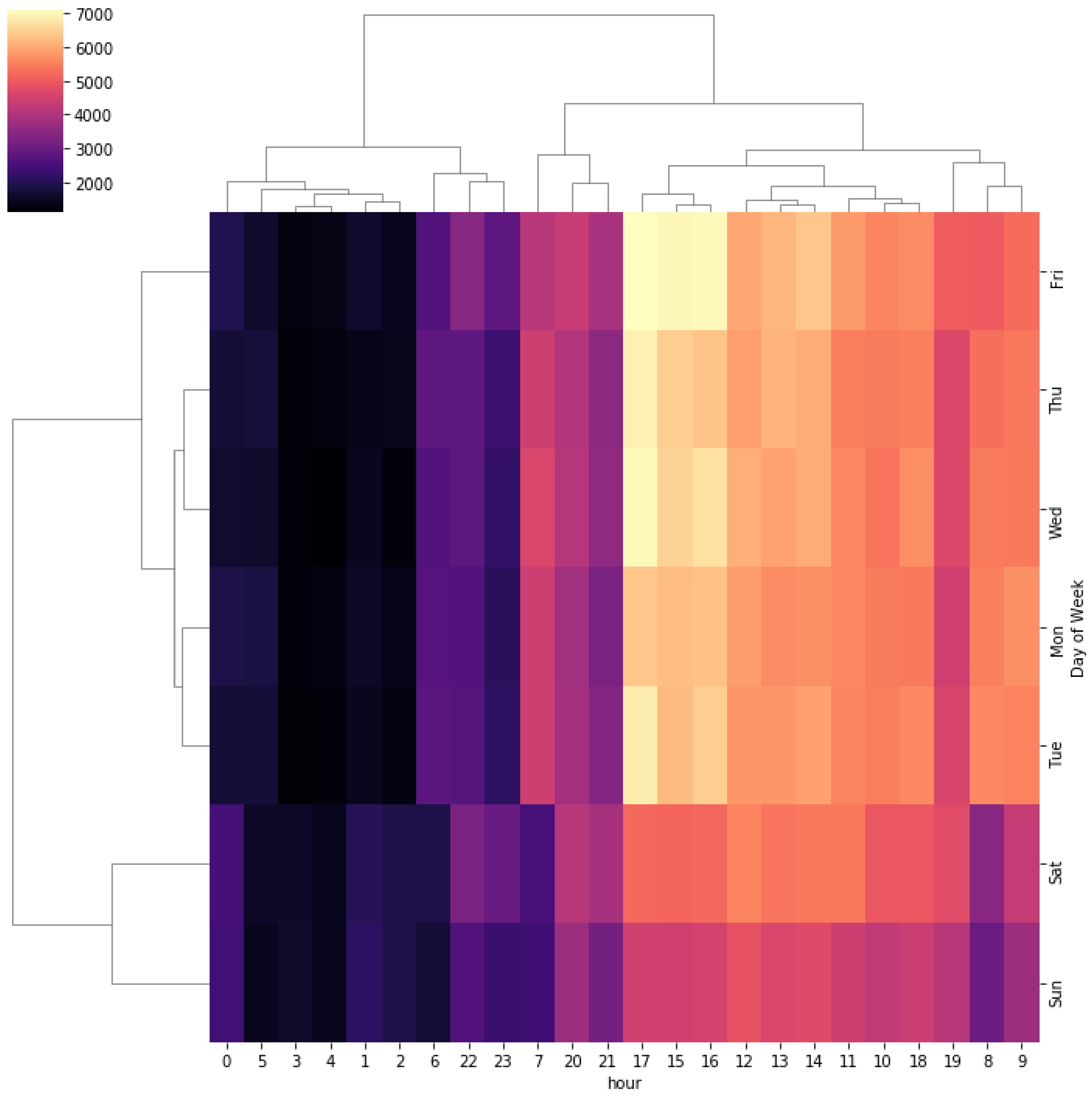
```
In [110]: plt.figure(figsize=(12,6))
          sns.heatmap(day_hour,cmap='viridis')
```

```
Out[110]: <matplotlib.axes._subplots.AxesSubplot at 0x17c087578c8>
```



In [111]:
```
sns.clustermap(day_hour,cmap='magma')
```

Out[111]:
```
<seaborn.matrix.ClusterGrid at 0x17c087924c8>
```



In [112]:
```
df.groupby(by=['Day of Week','Month']).count()  #same thing by month now instead of hour
```

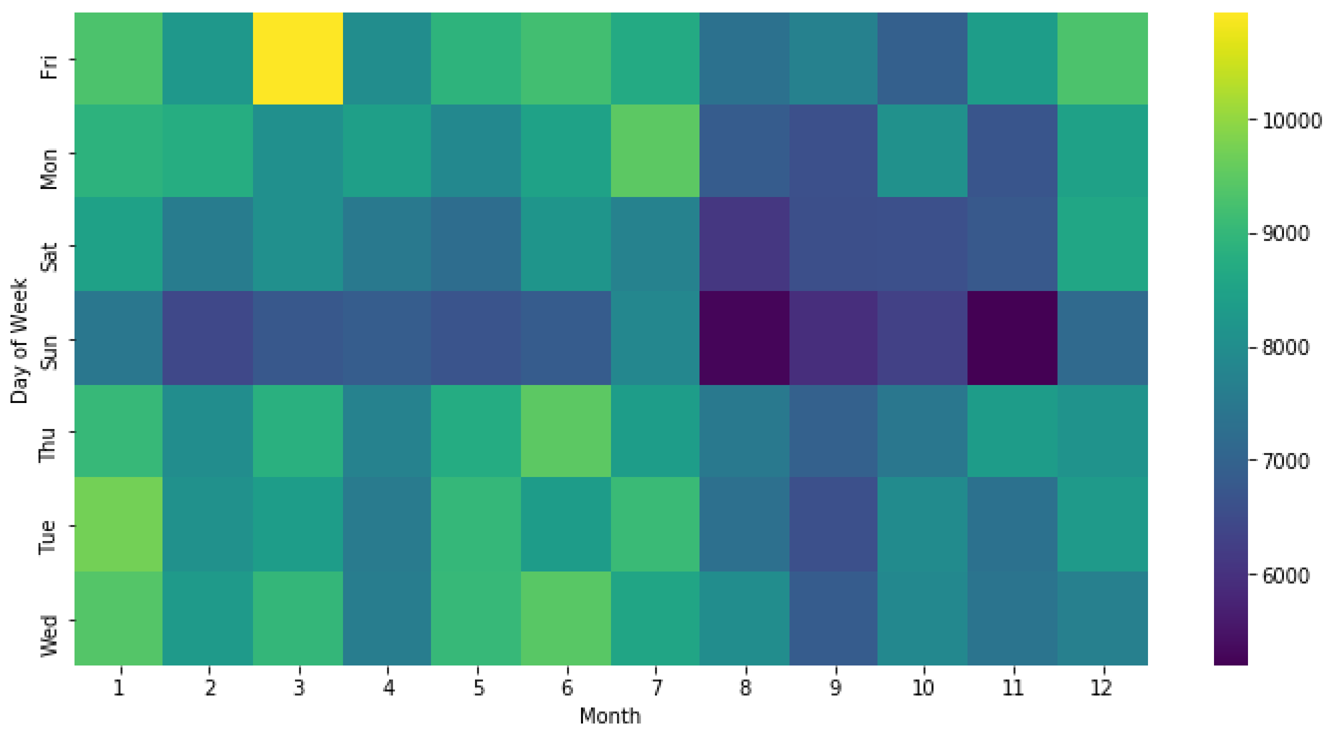
Out[112]:

		lat	lng	desc	zip	title	timeStamp	twp	addr	e	Reason	hour	year	Date
Day of Week	**Month**													
Fri	**1**	9309	9309	9309	8238	9309	9309	9305	9309	9309	9309	9309	9309	9309
	2	8255	8255	8255	7291	8255	8255	8251	8255	8255	8255	8255	8255	8255
	3	10941	10941	10941	9745	10941	10941	10932	10941	10941	10941	10941	10941	10941
	4	7997	7997	7997	7015	7997	7997	7995	7997	7997	7997	7997	7997	7997
	5	8904	8904	8904	7811	8904	8904	8899	8904	8904	8904	8904	8904	8904
...	**...**	...	...	...	...	...	...	...	...	...	...	...	...	...
Wed	**8**	7984	7984	7984	6967	7984	7984	7979	7984	7984	7984	7984	7984	7984
	9	6844	6844	6844	6059	6844	6844	6842	6844	6844	6844	6844	6844	6844
	10	7876	7876	7876	6879	7876	7876	7871	7876	7876	7876	7876	7876	7876
	11	7410	7410	7410	6531	7410	7410	7407	7410	7410	7410	7410	7410	7410
	12	7682	7682	7682	6788	7682	7682	7677	7682	7682	7682	7682	7682	7682

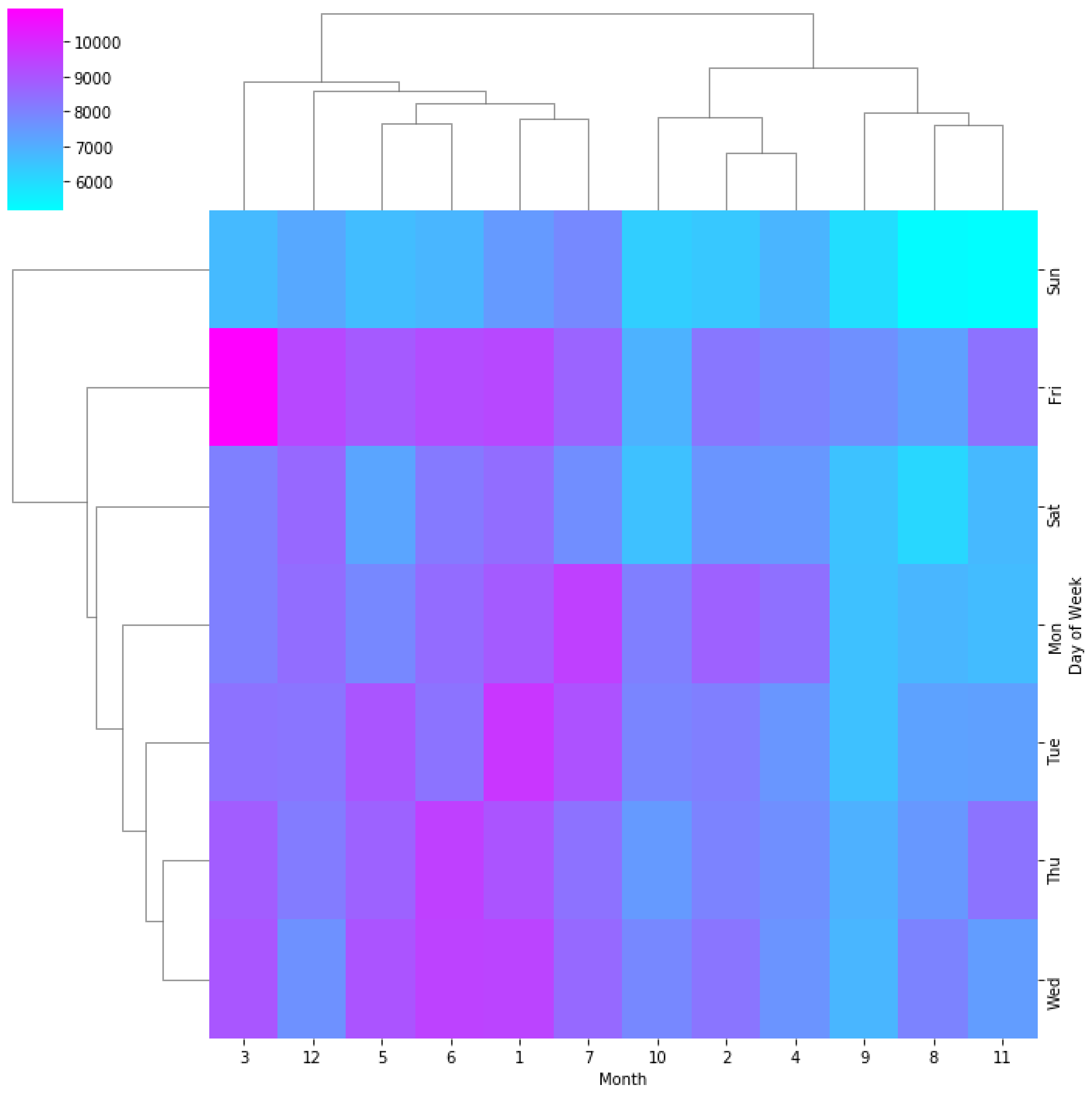
84 rows × 13 columns

In [119]:
```
day_month=df.groupby(by=['Day of Week','Month']).count()['Reason'].unstack()
```

```
In [120]: plt.figure(figsize=(12,6))
          sns.heatmap(day_month,cmap='viridis')

Out[120]: <matplotlib.axes._subplots.AxesSubplot at 0x17c09161a48>
```



```
In [121]: plt.figure(figsize=(12,6))
          sns.clustermap(day_month,cmap='cool')

Out[121]: <seaborn.matrix.ClusterGrid at 0x17c0914aac8>

          <Figure size 864x432 with 0 Axes>
```



```
In [ ]:
```