Crime Analytics: Visualization of Incident Reports

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Project Description

In this assignment, you will analyze criminal incident data from Seattle or San Francisco to visualize patterns and, if desired, contrast and compare patterns across the two cities.

You will produce a blog-post-style visual narrative consisting of a series of visualizations interspersed with sufficient descriptive text to make a convincing argument.

Data Dictionary

Field	Description

Data sources used

You will use real crime data from Summer 2014 one or both of two US cities: Seattle and/or San Francisco

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Import Libraries

In [1]:
```
import numpy as np
from numpy import count_nonzero, median, mean
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import random
```

```
import datetime
from datetime import datetime, timedelta, date


#import os
#import zipfile
import scipy
from scipy import stats
from scipy.stats.mstats import normaltest # D'Agostino K^2 Test
from scipy.stats import boxcox
from collections import Counter

%matplotlib inline
#sets the default autosave frequency in seconds
%autosave 60
sns.set_style('dark')
sns.set(font_scale=1.2)
#sns.set(rc={'figure.figsize':(14,10)})

plt.rc('axes', titlesize=9)
plt.rc('axes', labelsize=14)
plt.rc('xtick', labelsize=12)
plt.rc('ytick', labelsize=12)

import warnings
warnings.filterwarnings('ignore')

pd.set_option('display.max_columns',None)
#pd.set_option('display.max_rows',None)
pd.set_option('display.width', 1000)
pd.set_option('display.float_format','{:.2f}'.format)

random.seed(0)
np.random.seed(0)
np.set_printoptions(suppress=True)
```

```
Autosaving every 60 seconds
```

==========

Import Data

In [2]:
```
df = pd.read_csv("sanfrancisco_incidents_summer_2014.csv", parse_dates=["Date"])
```

Data Quick Glance

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

Out[3]:

	IncidntNum	Category	Descript	DayOfWeek	Date	Time	PdDistrict	Resolut
0	140734311	ARSON	ARSON OF A VEHICLE	Sunday	2014-08-31	23:50	BAYVIEW	NC
1	140736317	NON-CRIMINAL	LOST PROPERTY	Sunday	2014-08-31	23:45	MISSION	NC
2	146177923	LARCENY/THEFT	GRAND THEFT FROM LOCKED AUTO	Sunday	2014-08-31	23:30	SOUTHERN	NC
3	146177531	LARCENY/THEFT	GRAND THEFT FROM LOCKED AUTO	Sunday	2014-08-31	23:30	RICHMOND	NC
4	140734220	NON-CRIMINAL	FOUND PROPERTY	Sunday	2014-08-31	23:23	RICHMOND	NC

In [4]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 28993 entries, 0 to 28992
Data columns (total 13 columns):
 #   Column      Non-Null Count  Dtype         
---  ------      --------------  -----         
 0   IncidntNum  28993 non-null  int64         
 1   Category    28993 non-null  object        
 2   Descript    28993 non-null  object        
 3   DayOfWeek   28993 non-null  object        
 4   Date        28993 non-null  datetime64[ns]
 5   Time        28993 non-null  object        
 6   PdDistrict  28993 non-null  object        
 7   Resolution  28993 non-null  object        
 8   Address     28993 non-null  object        
 9   X           28993 non-null  float64       
 10  Y           28993 non-null  float64       
 11  Location    28993 non-null  object        
 12  PdId        28993 non-null  int64         
dtypes: datetime64[ns](1), float64(2), int64(2), object(8)
memory usage: 2.9+ MB
```

In [5]:
```
df.dtypes.value_counts()
```

Out[5]:
```
object            8
int64             2
float64           2
datetime64[ns]    1
dtype: int64
```

In [6]:
```
# Descriptive Statistical Analysis
df.describe(include="all")
```

Out[6]:

	IncidntNum	Category	Descript	DayOfWeek	Date	Time	PdDistrict
count	28993.00	28993	28993	28993	28993	28993	28993
unique	NaN	34	368	7	92	1379	10
top	NaN	LARCENY/THEFT	GRAND THEFT FROM LOCKED AUTO	Friday	2014-08-09 00:00:00	12:00	SOUTHERN
freq	NaN	9466	3766	4451	410	784	5739
first	NaN	NaN	NaN	NaN	2014-06-01 00:00:00	NaN	NaN
last	NaN	NaN	NaN	NaN	2014-08-31 00:00:00	NaN	NaN
mean	142017280.02	NaN	NaN	NaN	NaN	NaN	NaN
std	18533669.20	NaN	NaN	NaN	NaN	NaN	NaN
min	10284385.00	NaN	NaN	NaN	NaN	NaN	NaN
25%	140545607.00	NaN	NaN	NaN	NaN	NaN	NaN
50%	140632022.00	NaN	NaN	NaN	NaN	NaN	NaN
75%	140719664.00	NaN	NaN	NaN	NaN	NaN	NaN
max	990367398.00	NaN	NaN	NaN	NaN	NaN	NaN

In [7]:
```
# Descriptive Statistical Analysis
df.describe(include=["int", "float"])
```

Out[7]:

	IncidntNum	X	Y	PdId
count	28993.00	28993.00	28993.00	28993.00
mean	142017280.02	-122.42	37.77	14201728029635.63
std	18533669.20	0.03	0.02	1853366920256.57
min	10284385.00	-122.51	37.71	1028438573000.00
25%	140545607.00	-122.43	37.76	14054560772000.00
50%	140632022.00	-122.42	37.78	14063202264085.00
75%	140719664.00	-122.41	37.79	14071966462050.00
max	990367398.00	-122.37	37.82	99036739868020.00

In [8]:
```
# Descriptive Statistical Analysis
df.describe(include="object")
```

Out[8]:

	Category	Descript	DayOfWeek	Time	PdDistrict	Resolution	Address
count	28993	28993	28993	28993	28993	28993	28993
unique	34	368	7	1379	10	16	8055
top	LARCENY/THEFT	GRAND THEFT FROM LOCKED AUTO	Friday	12:00	SOUTHERN	NONE	800 Block of BRYANT ST
freq	9466	3766	4451	784	5739	19139	948

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

Out[9]:
```
Index(['IncidntNum', 'Category', 'Descript', 'DayOfWeek', 'Date', 'Time', 'PdDistr
ict', 'Resolution', 'Address', 'X', 'Y', 'Location', 'PdId'], dtype='object')
```

In [10]:
```
df.shape
```

Out[10]:
```
(28993, 13)
```

In [11]:
```
df.isnull().sum()
```

Out[11]:
```
IncidntNum    0
Category      0
Descript      0
DayOfWeek     0
Date          0
Time          0
PdDistrict    0
Resolution    0
Address       0
X             0
Y             0
Location      0
PdId          0
dtype: int64
```

In [12]:
```
df.duplicated().sum()
```

Out[12]:
```
0
```

==========

Exploratory Data Analysis

Exploratory Data Analysis (EDA) is the crucial process of using summary statistics and graphical representations to perform preliminary investigations on data to uncover patterns,

detect anomalies, test hypotheses, and verify assumptions.

Sample a smaller dataset

In [13]:
```
df = df.sample(frac=0.2)
```

In [14]:
```
df
```

Out[14]:

	IncidntNum	Category	Descript	DayOfWeek	Date	Time	PdDistric
23114	140513535	LARCENY/THEFT	PETTY THEFT FROM LOCKED AUTO	Friday	2014-06-20	22:07	MISSION
25165	140492224	NON-CRIMINAL	FIRE REPORT	Friday	2014-06-13	22:12	SOUTHERN
21675	140527796	OTHER OFFENSES	PROBATION VIOLATION	Wednesday	2014-06-25	19:48	MISSION
21172	120510937	WARRANTS	ENROUTE TO OUTSIDE JURISDICTION	Friday	2014-06-27	12:50	NORTHERN
17487	140568693	VEHICLE THEFT	STOLEN AUTOMOBILE	Tuesday	2014-07-08	23:00	MISSION
...	...	...	...	...	...	...	..
22428	140520132	OTHER OFFENSES	PROBATION VIOLATION	Monday	2014-06-23	10:30	TENDERLOIN
1373	146174684	LARCENY/THEFT	PETTY THEFT BICYCLE	Wednesday	2014-08-27	18:40	BAYVIEW
16205	140580625	ASSAULT	BATTERY	Sunday	2014-07-13	02:05	CENTRAL
5916	146164754	LARCENY/THEFT	GRAND THEFT FROM LOCKED AUTO	Wednesday	2014-08-13	19:23	NORTHERN
17918	14056336	WARRANTS	ENROUTE TO DEPARTMENT OF CORRECTIONS	Monday	2014-07-07	14:27	MISSION

5799 rows × 13 columns

In [15]:
```
df.reset_index(drop=True, inplace=True)
```

In [16]:
```
df
```

Out[16]:

	IncidntNum	Category	Descript	DayOfWeek	Date	Time	PdDistrict
0	140513535	LARCENY/THEFT	PETTY THEFT FROM LOCKED AUTO	Friday	2014-06-20	22:07	MISSION
1	140492224	NON-CRIMINAL	FIRE REPORT	Friday	2014-06-13	22:12	SOUTHERN
2	140527796	OTHER OFFENSES	PROBATION VIOLATION	Wednesday	2014-06-25	19:48	MISSION
3	120510937	WARRANTS	ENROUTE TO OUTSIDE JURISDICTION	Friday	2014-06-27	12:50	NORTHERN
4	140568693	VEHICLE THEFT	STOLEN AUTOMOBILE	Tuesday	2014-07-08	23:00	MISSION
...	...	...	...	...	...	...	...
5794	140520132	OTHER OFFENSES	PROBATION VIOLATION	Monday	2014-06-23	10:30	TENDERLOIN
5795	146174684	LARCENY/THEFT	PETTY THEFT BICYCLE	Wednesday	2014-08-27	18:40	BAYVIEW
5796	140580625	ASSAULT	BATTERY	Sunday	2014-07-13	02:05	CENTRAL
5797	146164754	LARCENY/THEFT	GRAND THEFT FROM LOCKED AUTO	Wednesday	2014-08-13	19:23	NORTHERN
5798	14056336	WARRANTS	ENROUTE TO DEPARTMENT OF CORRECTIONS	Monday	2014-07-07	14:27	MISSION

5799 rows × 13 columns

In [17]:
```
df.shape
```

Out[17]:
```
(5799, 13)
```

==========

Groupby

Most commonly, we use `groupby()` to split the data into groups,this will apply some function to each of the groups (e.g. mean, median, min, max, count), then combine the results into a data structure. For example, let's select the 'VALUE' column and calculate the

mean of the gasoline prices per year. First, we specify the 'Year" column, following by the 'VALUE' column, and the `mean()` function.

In [18]:
```
df.columns
```

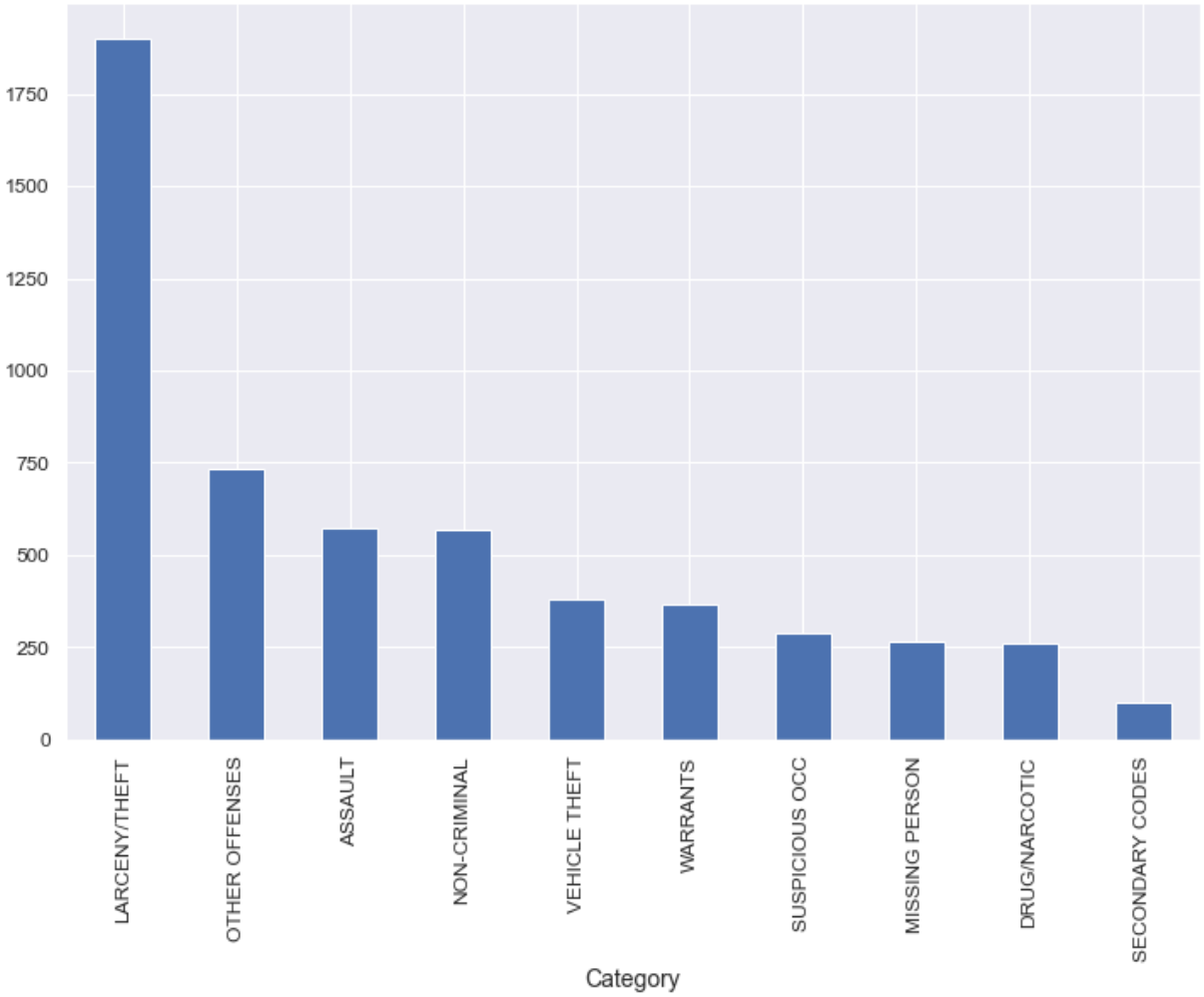
Out[18]:
```
Index(['IncidntNum', 'Category', 'Descript', 'DayOfWeek', 'Date', 'Time', 'PdDistr
ict', 'Resolution', 'Address', 'X', 'Y', 'Location', 'PdId'], dtype='object')
```

In [19]:
```
df_category = df.groupby(["Category"], as_index=True)["IncidntNum"].count()
df_category.to_frame()
```

Out[19]:

Category	IncidntNum
ARSON	9
ASSAULT	572
BURGLARY	1
DISORDERLY CONDUCT	10
DRIVING UNDER THE INFLUENCE	11
DRUG/NARCOTIC	260
DRUNKENNESS	29
EMBEZZLEMENT	2
EXTORTION	1
FAMILY OFFENSES	2
FORGERY/COUNTERFEITING	4
FRAUD	53
KIDNAPPING	21
LARCENY/THEFT	1902
LIQUOR LAWS	10
MISSING PERSON	265
NON-CRIMINAL	570
OTHER OFFENSES	732
PROSTITUTION	15
ROBBERY	50
RUNAWAY	15
SECONDARY CODES	100
STOLEN PROPERTY	1
SUICIDE	4
SUSPICIOUS OCC	287
TRESPASS	53
VANDALISM	1
VEHICLE THEFT	381
WARRANTS	365
WEAPON LAWS	73

In [20]:
```
df_category.nlargest(10).plot(kind = "bar", figsize=(12,8))
plt.show()
```



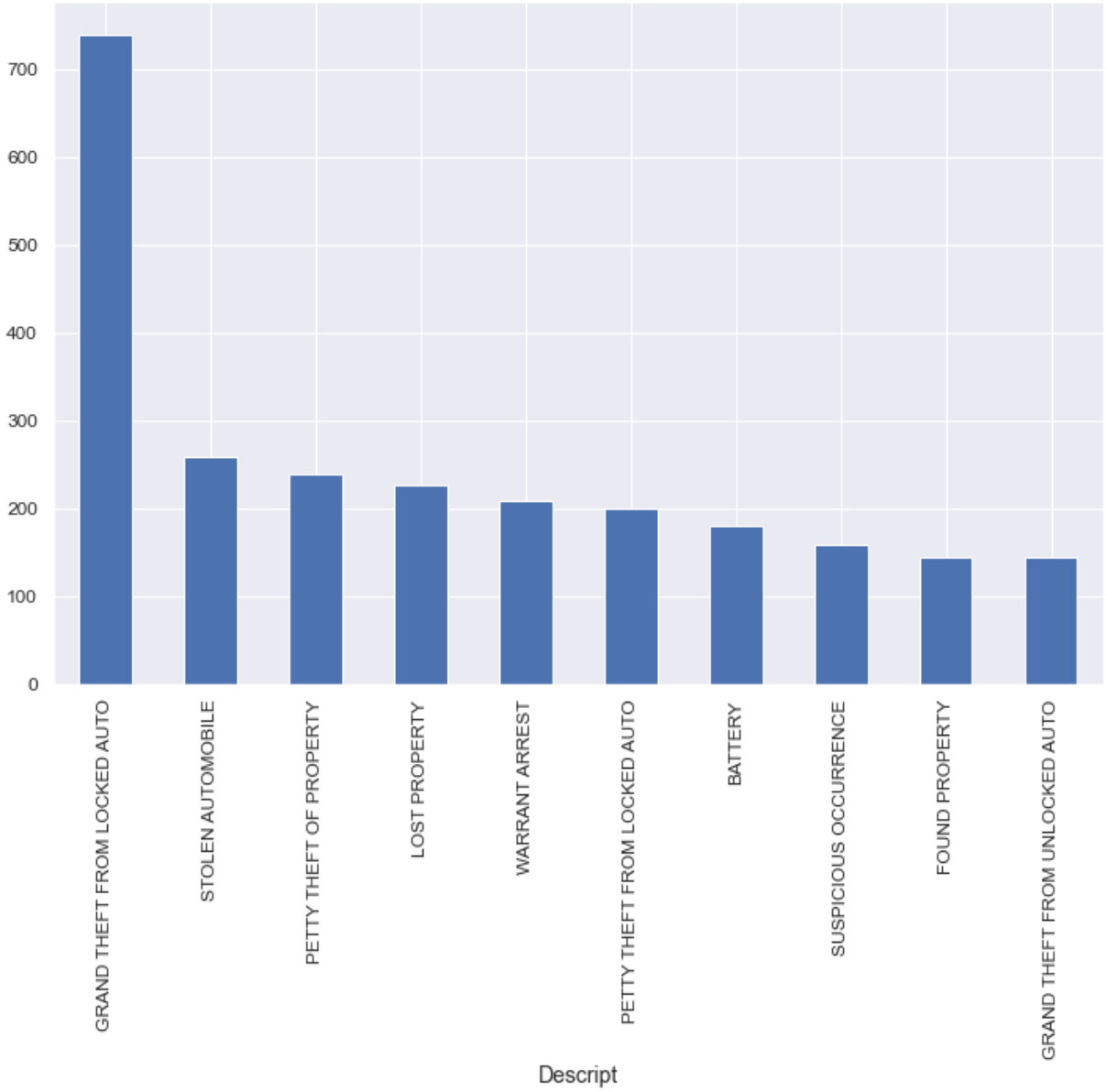
In [21]:
```
df_des = df.groupby(["Descript"], as_index=True)["IncidntNum"].count()
df_des.to_frame()
```

Out[21]:

Descript	IncidntNum
ACTS AGAINST PUBLIC TRANSIT	1
AGGRAVATED ASSAULT WITH A DEADLY WEAPON	63
AGGRAVATED ASSAULT WITH A GUN	6
AGGRAVATED ASSAULT WITH A KNIFE	22
AGGRAVATED ASSAULT WITH BODILY FORCE	46
...	...
VIOLATION OF PARK CODE	5
VIOLATION OF RESTRAINING ORDER	26
VIOLATION OF STAY AWAY ORDER	5
WARRANT ARREST	209
WILLFUL CRUELTY TO CHILD	1

260 rows × 1 columns

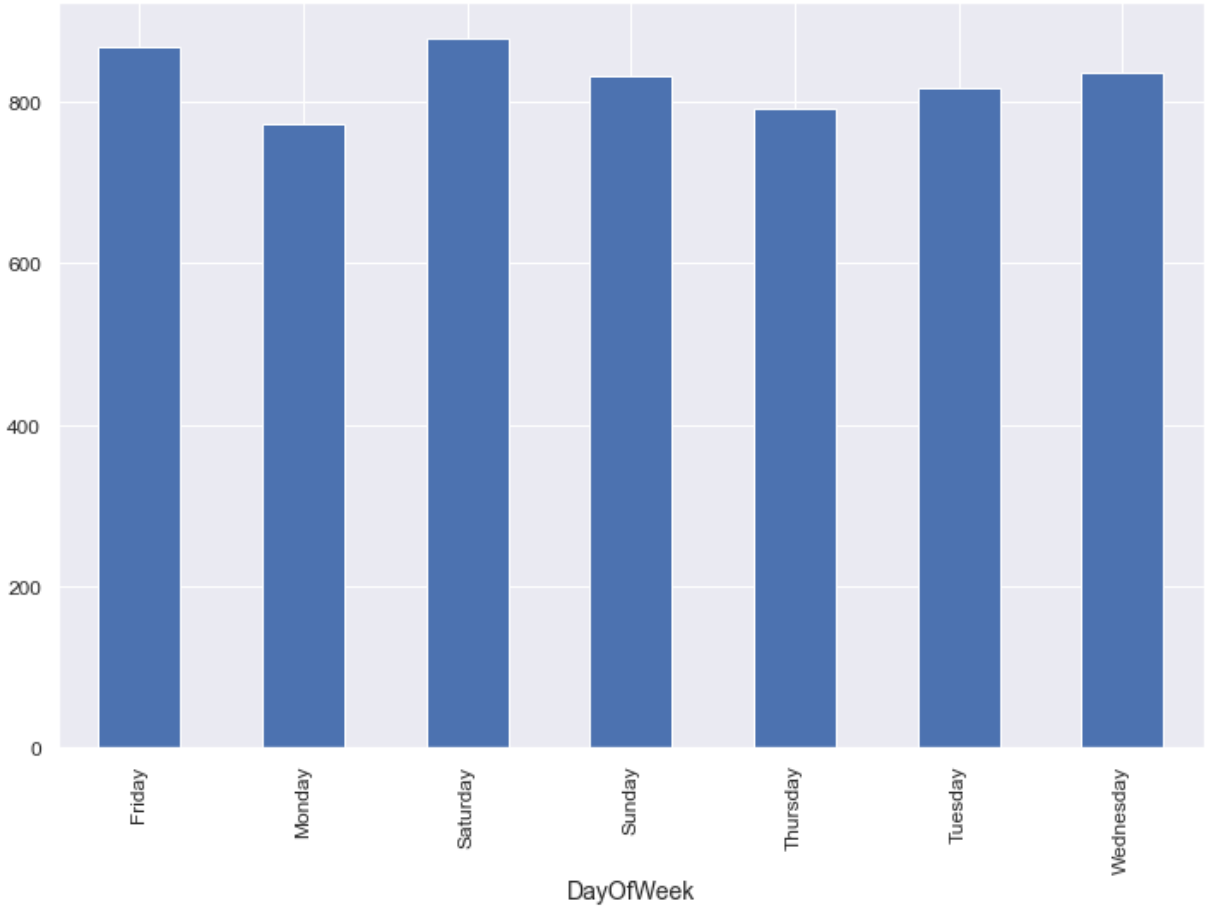
In [22]:
```
df_des.nlargest(10).plot(kind = "bar", figsize=(12,8))
plt.show()
```



In [23]:
```
df_day = df.groupby(["DayOfWeek"], as_index=True)["IncidntNum"].count()
df_day
```

Out[23]:
```
DayOfWeek
Friday       868
Monday       773
Saturday     879
Sunday       832
Thursday     793
Tuesday      818
Wednesday    836
Name: IncidntNum, dtype: int64
```

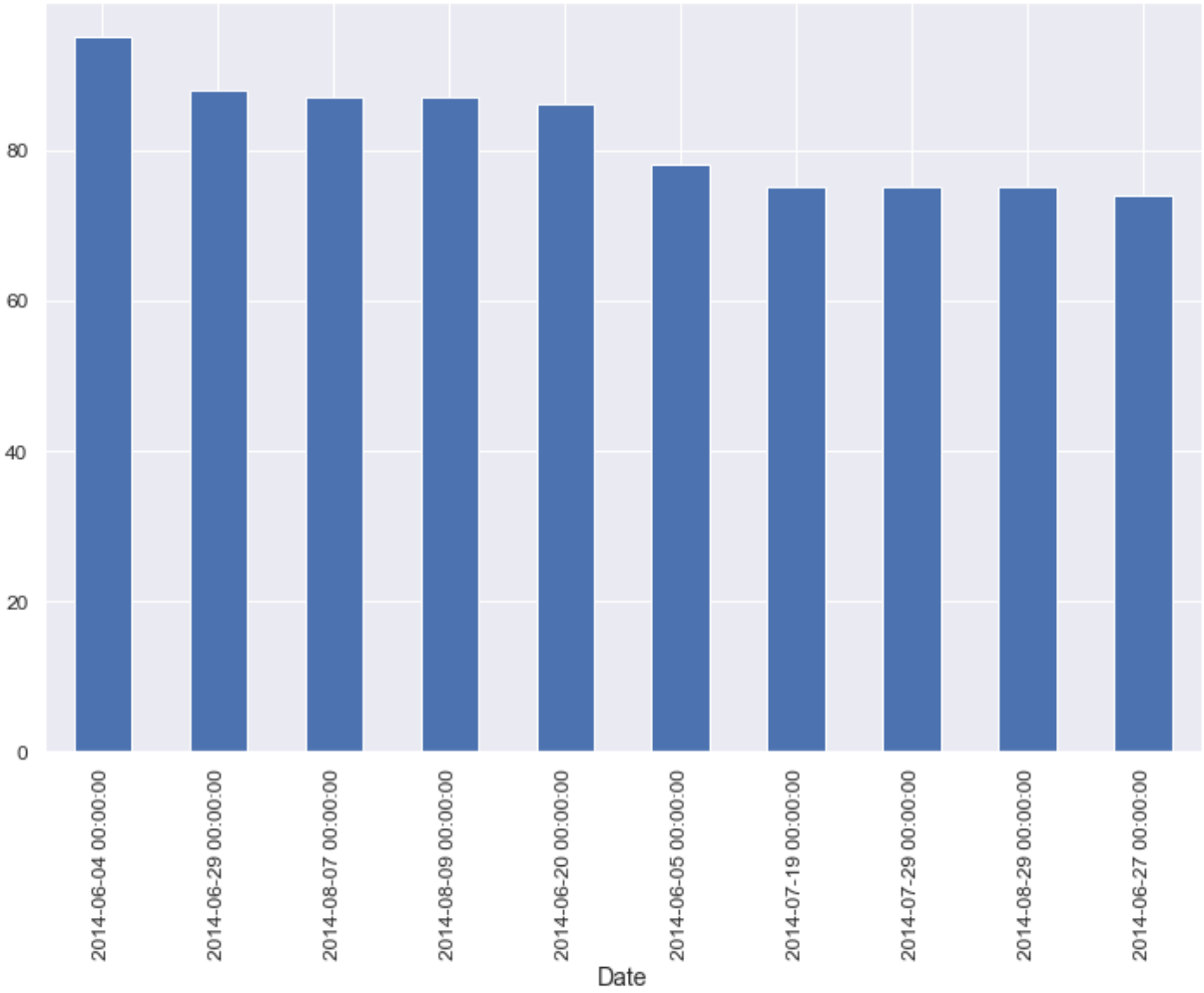
In [24]:
```
df_day.plot(kind = "bar", figsize=(12,8))
plt.show()
```



In [25]:
```
df_date = df.groupby(["Date"], as_index=True)["IncidntNum"].count()
df_date
```

Out[25]:
```
Date
2014-06-01    63
2014-06-02    67
2014-06-03    57
2014-06-04    95
2014-06-05    78
              ..
2014-08-27    65
2014-08-28    50
2014-08-29    75
2014-08-30    64
2014-08-31    54
Name: IncidntNum, Length: 92, dtype: int64
```

In [26]:
```
df_date.nlargest(10).plot(kind = "bar", figsize=(12,8))
plt.show()
```



In [27]:
```
df.groupby(["Time"], as_index=True)["IncidntNum"].count()
```

Out[27]:
```
Time
00:01    126
00:02      4
00:03      2
00:05      5
00:06      1
        ...
23:54      3
23:55      5
23:56      2
23:58      1
23:59      3
Name: IncidntNum, Length: 1037, dtype: int64
```

In [28]:
```
# df_des.nlargest(10).plot(kind = "bar", figsize=(12,8))
# plt.show()
```

In [29]:
```
df.groupby(["PdDistrict"], as_index=True)["IncidntNum"].count()
```

Out[29]:
```
PdDistrict
BAYVIEW        552
CENTRAL        687
INGLESIDE      449
MISSION        758
NORTHERN       739
PARK           329
RICHMOND       290
SOUTHERN      1124
TARAVAL        391
TENDERLOIN     480
Name: IncidntNum, dtype: int64
```

In [30]:
```
# df_des.nlargest(10).plot(kind = "bar", figsize=(12,8))
# plt.show()
```

In [31]:
```
df.groupby(["Resolution"], as_index=True)["IncidntNum"].count()
```

Out[31]:
```
Resolution
ARREST, BOOKED                          1293
ARREST, CITED                            280
CLEARED-CONTACT JUVENILE FOR MORE INFO     3
COMPLAINANT REFUSES TO PROSECUTE          17
DISTRICT ATTORNEY REFUSES TO PROSECUTE     6
EXCEPTIONAL CLEARANCE                     14
JUVENILE ADMONISHED                        1
JUVENILE BOOKED                           23
JUVENILE CITED                            18
JUVENILE DIVERTED                          1
LOCATED                                  222
NONE                                    3828
NOT PROSECUTED                             7
PROSECUTED BY OUTSIDE AGENCY               9
PSYCHOPATHIC CASE                         19
UNFOUNDED                                 58
Name: IncidntNum, dtype: int64
```

In [32]:
```
# df_des.nlargest(10).plot(kind = "bar", figsize=(12,8))
# plt.show()
```

In [ ]:

In [ ]: