

Name: Gaurav Raut 2038584

West Midlands Street Crime Data August 2017

This notebook processes data taken from Police Data UK. Initially it does some explorations to understand the data then tries to answer the research question: "What are the chances of you going to prison if you undertake a robbery?"

Dr Kevan Buckley, University of Wolverhampton, 12/10/2018

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

Load the data

Before doing this make sure the file has been edited so that there are no spaces or punctuation in the column names.

```
In [2]: df1 = pd.read_csv('2017-08-west-midlands-street-edited.csv')
df1.head()
```

```
Out[2]:
```

	Longitude	Latitude	Location	LSOA	Crime	Outcome
0	-1.851382	52.591757	On or near Walsall Road	Birmingham 001A	Anti-social behaviour	NaN
1	-1.850056	52.591108	On or near Walsall Road	Birmingham 001A	Other theft	Investigation complete; no suspect identified
2	-1.851038	52.593177	On or near Longdon Drive	Birmingham 001A	Vehicle crime	Investigation complete; no suspect identified
3	-1.845780	52.593827	On or near Hook Drive	Birmingham 001B	Anti-social behaviour	NaN
4	-1.840641	52.598270	On or near Badgers Bank Road	Birmingham 001B	Criminal damage and arson	Investigation complete; no suspect identified

How many records are there?

```
In [3]: total_crimes = df1.shape[0]
total_crimes
```

```
Out[3]: 24971
```

What different crimes were reported?

```
In [4]: crimes = df1.Crime.unique()
crimes
```

```
Out[4]: array(['Anti-social behaviour', 'Other theft', 'Vehicle crime',
              'Criminal damage and arson', 'Violence and sexual offences',
              'Robbery', 'Burglary', 'Shoplifting', 'Public order',
              'Other crime', 'Possession of weapons', 'Bicycle theft',
              'Theft from the person', 'Drugs'], dtype=object)
```

What different outcomes were there?

```
In [5]: outcomes = df1.Outcome.unique()
outcomes
```

```
Out[5]: array([nan, 'Investigation complete; no suspect identified',
              'Unable to prosecute suspect', 'Local resolution',
              'Offender given a caution', 'Offender sent to prison',
              'Court result unavailable', 'Offender ordered to pay compensation',
              'Status update unavailable',
              'Suspect charged as part of another case',
              'Court case unable to proceed',
              'Formal action is not in the public interest', 'Offender fined',
              'Defendant found not guilty',
              'Further investigation is not in the public interest',
              'Offender given suspended prison sentence',
              'Offender given community sentence',
              'Offender given conditional discharge', 'Awaiting court outcome',
              'Action to be taken by another organisation',
              'Offender given a drugs possession warning',
              'Offender otherwise dealt with', 'Offender deprived of property',
              'Offender given penalty notice', 'Defendant sent to Crown Court'],
              dtype=object)
```

What happened at New Street, Birmingham?

```
In [6]: df1[df1.Location == 'On or near New Street']
```

```
Out[6]:
```

	Longitude	Latitude	Location	LSOA	Crime	Outcome
1063	-1.838563	52.525000	On or near New Street	Birmingham 023D	Burglary	Investigation complete; no suspect identified
8717	-2.010818	52.404302	On or near New Street	Birmingham 125G	Drugs	Offender given a drugs possession warning
10011	-1.899834	52.479273	On or near New Street	Birmingham 138A	Anti-social behaviour	NaN
10025	-1.899834	52.479273	On or near New Street	Birmingham 138A	Anti-social behaviour	NaN
10035	-1.899834	52.479273	On or near New Street	Birmingham 138A	Anti-social behaviour	NaN
10037	-1.899834	52.479273	On or near New Street	Birmingham 138A	Anti-social behaviour	NaN
10066	-1.899834	52.479273	On or near New Street	Birmingham 138A	Anti-social behaviour	NaN

	Longitude	Latitude	Location	LSOA	Crime	Outcome
10075	-1.899834	52.479273	On or near New Street	Birmingham 138A	Anti-social behaviour	NaN
10120	-1.899834	52.479273	On or near New Street	Birmingham 138A	Criminal damage and arson	Offender given conditional discharge
10121	-1.899834	52.479273	On or near New Street	Birmingham 138A	Criminal damage and arson	Unable to prosecute suspect
10131	-1.899834	52.479273	On or near New Street	Birmingham 138A	Drugs	Offender given conditional discharge
10181	-1.899834	52.479273	On or near New Street	Birmingham 138A	Public order	Offender given conditional discharge
10182	-1.899834	52.479273	On or near New Street	Birmingham 138A	Public order	Local resolution
10255	-1.899834	52.479273	On or near New Street	Birmingham 138A	Shoplifting	Investigation complete; no suspect identified
10261	-1.899834	52.479273	On or near New Street	Birmingham 138A	Shoplifting	Investigation complete; no suspect identified
10290	-1.899834	52.479273	On or near New Street	Birmingham 138A	Shoplifting	Unable to prosecute suspect
10291	-1.899834	52.479273	On or near New Street	Birmingham 138A	Shoplifting	Offender given a caution
10313	-1.899834	52.479273	On or near New Street	Birmingham 138A	Theft from the person	Investigation complete; no suspect identified
10320	-1.899834	52.479273	On or near New Street	Birmingham 138A	Theft from the person	Investigation complete; no suspect identified
10321	-1.899834	52.479273	On or near New Street	Birmingham 138A	Theft from the person	Investigation complete; no suspect identified
10336	-1.899834	52.479273	On or near New Street	Birmingham 138A	Vehicle crime	Investigation complete; no suspect identified
10342	-1.899834	52.479273	On or near New Street	Birmingham 138A	Vehicle crime	Investigation complete; no suspect identified
10354	-1.899834	52.479273	On or near New Street	Birmingham 138A	Violence and sexual offences	Investigation complete; no suspect identified
10366	-1.899834	52.479273	On or near New Street	Birmingham 138A	Violence and sexual offences	Offender given community sentence
10384	-1.899834	52.479273	On or near New Street	Birmingham 138A	Violence and sexual offences	Investigation complete; no suspect identified
10391	-1.899834	52.479273	On or near New Street	Birmingham 138A	Violence and sexual offences	Court result unavailable
10409	-1.899834	52.479273	On or near New Street	Birmingham 138A	Violence and sexual offences	Investigation complete; no suspect identified
13754	-2.081718	52.511012	On or near New Street	Dudley 006C	Anti-social behaviour	NaN

	Longitude	Latitude	Location	LSOA	Crime	Outcome
13764	-2.081718	52.511012	On or near New Street	Dudley 006C	Anti-social behaviour	NaN
13767	-2.081718	52.511012	On or near New Street	Dudley 006C	Anti-social behaviour	NaN
13772	-2.081718	52.511012	On or near New Street	Dudley 006C	Burglary	Investigation complete; no suspect identified
13773	-2.081718	52.511012	On or near New Street	Dudley 006C	Burglary	Investigation complete; no suspect identified
13777	-2.081718	52.511012	On or near New Street	Dudley 006C	Criminal damage and arson	Investigation complete; no suspect identified
13778	-2.082765	52.511452	On or near New Street	Dudley 006C	Other theft	Investigation complete; no suspect identified
13791	-2.081718	52.511012	On or near New Street	Dudley 006C	Public order	Court result unavailable
13792	-2.081718	52.511012	On or near New Street	Dudley 006C	Public order	Court result unavailable
13797	-2.081718	52.511012	On or near New Street	Dudley 006C	Shoplifting	Local resolution
13800	-2.081718	52.511012	On or near New Street	Dudley 006C	Shoplifting	Court result unavailable
13802	-2.081718	52.511012	On or near New Street	Dudley 006C	Shoplifting	Offender given a caution
13803	-2.081718	52.511012	On or near New Street	Dudley 006C	Shoplifting	Offender given community sentence
13804	-2.081718	52.511012	On or near New Street	Dudley 006C	Shoplifting	Court result unavailable
13816	-2.082765	52.511452	On or near New Street	Dudley 006C	Violence and sexual offences	Unable to prosecute suspect
14384	-2.177554	52.504479	On or near New Street	Dudley 014D	Anti-social behaviour	NaN
14682	-2.169686	52.489001	On or near New Street	Dudley 019E	Vehicle crime	Investigation complete; no suspect identified
16816	-2.066862	52.527833	On or near New Street	Sandwell 015F	Burglary	Investigation complete; no suspect identified
16818	-2.066862	52.527833	On or near New Street	Sandwell 015F	Criminal damage and arson	Offender given a caution
20678	-2.006707	52.618118	On or near New Street	Walsall 008A	Robbery	Investigation complete; no suspect identified
20696	-2.006707	52.618118	On or near New Street	Walsall 008A	Vehicle crime	Investigation complete; no suspect identified
21631	-2.067889	52.582131	On or near New Street	Walsall 025C	Anti-social behaviour	NaN

What happened at New Street, Birmingham?

The previous search found some occurrences of the wrong New Street

In [7]: `df1[df1.Location.str.contains('New Street') & df1.LSOA.str.contains('Birmingham')]`

Out[7]:	Longitude	Latitude	Location	LSOA	Crime	Outcome
1063	-1.838563	52.525000	On or near New Street	Birmingham 023D	Burglary	Investigation complete; no suspect identified
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10025	-1.899834	52.479273	On or near New Street	Birmingham 138A	Anti-social behaviour	NaN
10035	-1.899834	52.479273	On or near New Street	Birmingham 138A	Anti-social behaviour	NaN
10037	-1.899834	52.479273	On or near New Street	Birmingham 138A	Anti-social behaviour	NaN
10066	-1.899834	52.479273	On or near New Street	Birmingham 138A	Anti-social behaviour	NaN
10075	-1.899834	52.479273	On or near New Street	Birmingham 138A	Anti-social behaviour	NaN
10120	-1.899834	52.479273	On or near New Street	Birmingham 138A	Criminal damage and arson	Offender given conditional discharge
10121	-1.899834	52.479273	On or near New Street	Birmingham 138A	Criminal damage and arson	Unable to prosecute suspect
10131	-1.899834	52.479273	On or near New Street	Birmingham 138A	Drugs	Offender given conditional discharge
10181	-1.899834	52.479273	On or near New Street	Birmingham 138A	Public order	Offender given conditional discharge
10182	-1.899834	52.479273	On or near New Street	Birmingham 138A	Public order	Local resolution
10255	-1.899834	52.479273	On or near New Street	Birmingham 138A	Shoplifting	Investigation complete; no suspect identified
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10290	-1.899834	52.479273	On or near New Street	Birmingham 138A	Shoplifting	Unable to prosecute suspect
10291	-1.899834	52.479273	On or near New Street	Birmingham 138A	Shoplifting	Offender given a caution
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10354	-1.899834	52.479273	On or near New Street	Birmingham 138A	Violence and sexual offences	Investigation complete; no suspect identified
10366	-1.899834	52.479273	On or near New Street	Birmingham 138A	Violence and sexual offences	Offender given community sentence
10384	-1.899834	52.479273	On or near New Street	Birmingham 138A	Violence and sexual offences	Investigation complete; no suspect identified
10391	-1.899834	52.479273	On or near New Street	Birmingham 138A	Violence and sexual offences	Court result unavailable
10409	-1.899834	52.479273	On or near New Street	Birmingham 138A	Violence and sexual offences	Investigation complete; no suspect identified

How many offenders overall were sent to prison?

The results show only a fraction of offenders ended up in prison.

```
In [8]: offenders_in_prison = df1[df1.Outcome == 'Offender sent to prison'].shape[0]
offenders_in_prison
```

```
Out[8]: 264
```

```
In [9]: print('%6.2f percent of crimes resulted in a prison sentence' % (100 * (offenders_in_prison / df1.shape[0])))
1.06 percent of crimes resulted in a prison sentence
```

Addressing the Research Question

How many robberies were there and what were the outcomes?

```
In [10]: robberies = df1[df1.Crime.str.contains("Robbery")]
number_of_robberies = robberies.shape[0]
number_of_robberies
```

```
Out[10]: 661
```

```
In [11]: robbery_outcomes = robberies.Outcome.unique()
```

```
In [12]: for ro in robbery_outcomes:
         occurrences = robberies[robberies.Outcome == ro]
         print('%4d %s' % (occurrences.shape[0], ro))

466 Investigation complete; no suspect identified
44 Status update unavailable
85 Unable to prosecute suspect
27 Court result unavailable
5 Offender given community sentence
10 Awaiting court outcome
7 Defendant found not guilty
11 Offender sent to prison
1 Court case unable to proceed
2 Suspect charged as part of another case
2 Local resolution
1 Formal action is not in the public interest
```

Robbery outcomes as a dataframe

This will enable the results to be sorted

```
In [13]: cols_df2 = ['Outcome', 'Occurrences']
         df2 = pd.DataFrame(columns=cols_df2)
         df2
```

```
Out[13]: Outcome Occurrences
```

```
In [14]: for ro in robbery_outcomes:
         occurrences = robberies[robberies.Outcome == ro]
         df2 = df2.append({'Outcome':ro, 'Occurrences': occurrences.shape[0]}, ignore_index=True)
         df2
```

```
Out[14]:
```

	Outcome	Occurrences
0	Investigation complete; no suspect identified	466
1	Status update unavailable	44
2	Unable to prosecute suspect	85
3	Court result unavailable	27
4	Offender given community sentence	5
5	Awaiting court outcome	10
6	Defendant found not guilty	7
7	Offender sent to prison	11
8	Court case unable to proceed	1
9	Suspect charged as part of another case	2
10	Local resolution	2
11	Formal action is not in the public interest	1

```
In [15]: df3 = df2.sort_values('Occurences')
df3
```

```
Out[15]:
```

	Outcome	Occurences
8	Court case unable to proceed	1
11	Formal action is not in the public interest	1
9	Suspect charged as part of another case	2
10	Local resolution	2
4	Offender given community sentence	5
6	Defendant found not guilty	7
5	Awaiting court outcome	10
7	Offender sent to prison	11
3	Court result unavailable	27
1	Status update unavailable	44
2	Unable to prosecute suspect	85
0	Investigation complete; no suspect identified	466

```
In [16]: 11 / 661
```

```
Out[16]: 0.01664145234493192
```

Conclusion

There is little chance of getting a prison sentence for committing robbery in the West Midlands. A prison sentence only occurred in 1.6% of cases. However, you are more likely to be sentenced to prison for robbery than crimes in general.

Further Work

Which crime are you most likely to go to prison for?

```
In [17]: cols_df3 = ['Crime', 'Occurences', 'Prison', 'Ratio']
df3 = pd.DataFrame(columns=cols_df3, dtype='str', index=None)

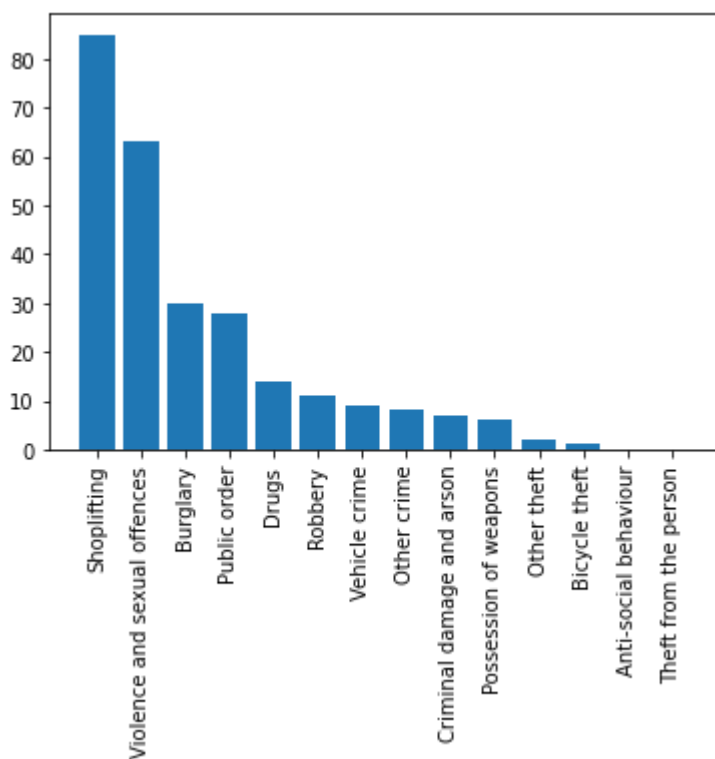
for crime in crimes:
    crime_count = df1[df1.Crime == crime].shape[0]
    crime_prison_count = df1[(df1.Crime == crime) & (df1.Outcome == 'Offender sent to p
ratio = crime_prison_count / crime_count
    df3 = df3.append({'Crime':crime, 'Occurences':crime_count, 'Prison':crime_prison_co
df3
```

```
Out[17]:
```

	Crime	Occurences	Prison	Ratio
0	Anti-social behaviour	5719	0	0.000000

	Crime	Occurences	Prison	Ratio
1	Other theft	2189	2	0.000914
2	Vehicle crime	3132	9	0.002874
3	Criminal damage and arson	2260	7	0.003097
4	Violence and sexual offences	4951	63	0.012725
5	Robbery	661	11	0.016641
6	Burglary	2152	30	0.013941
7	Shoplifting	1667	85	0.050990
8	Public order	958	28	0.029228
9	Other crime	286	8	0.027972
10	Possession of weapons	130	6	0.046154
11	Bicycle theft	339	1	0.002950
12	Theft from the person	222	0	0.000000
13	Drugs	305	14	0.045902

```
In [18]: df4 = df3.sort_values('Prison', ascending=False)
plt.xticks(rotation=90)
plt.bar(df4.Crime, df4.Prison)
plt.show()
```



```
In [19]: df5 = df3.sort_values('Ratio', ascending=False)
plt.xticks(rotation=90)
plt.bar(df5.Crime, df5.Ratio)
plt.show()
```

