

# Do the genders commit different violations?

ANALYZING POLICE ACTIVITY WITH PANDAS



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# Counting unique values (1)

- `.value_counts()` : Counts the unique values in a Series
- Best suited for categorical data

```
ri.stop_outcome.value_counts()
```

```
Citation          77091
Warning           5136
Arrest Driver     2735
No Action         624
N/D              607
Arrest Passenger  343
Name: stop_outcome, dtype: int64
```

# Counting unique values (2)

```
ri.stop_outcome.value_counts().sum()
```

```
86536
```

```
ri.shape
```

```
(86536, 13)
```

# Expressing counts as proportions

```
ri.stop_outcome.value_counts()
```

77091/86536

0.8908546731995932

```
ri.stop_outcome.value_counts(  
    normalize=True)
```

Citation	77091
Warning	5136
Arrest Driver	2735
No Action	624
N/D	607
Arrest Passenger	343

Citation	0.890855
Warning	0.059351
Arrest Driver	0.031605
No Action	0.007211
N/D	0.007014
Arrest Passenger	0.003964

# Filtering DataFrame rows

```
ri.driver_race.value_counts()
```

```
White      61870  
Black      12285  
Hispanic    9727  
Asian      2389  
Other       265
```

```
white = ri[ri.driver_race == 'White']  
white.shape
```

```
(61870, 13)
```

# Comparing stop outcomes for two groups

```
white.stop_outcome.value_counts(  
    normalize=True)
```

Citation	0.902263
Warning	0.057508
Arrest Driver	0.024018
No Action	0.007031
N/D	0.006433
Arrest Passenger	0.002748

```
asian = ri[ri.driver_race ==  
           'Asian']  
asian.stop_outcome.value_counts(  
    normalize=True)
```

Citation	0.922980
Warning	0.045207
Arrest Driver	0.017581
No Action	0.008372
N/D	0.004186
Arrest Passenger	0.001674

# Let's practice!

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# Does gender affect who gets a ticket for speeding?

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# Filtering by multiple conditions (1)

```
female = ri[ri.driver_gender == 'F']  
female.shape
```

```
(23774, 13)
```

# Filtering by multiple conditions (2)

```
female_and_arrested = ri[(ri.driver_gender == 'F') &
                          (ri.is_arrested == True)]
```

- Each condition is surrounded by parentheses
- Ampersand ( & ) represents the and operator

```
female_and_arrested.shape
```

```
(669, 13)
```

- Only includes female drivers who were arrested

# Filtering by multiple conditions (3)

```
female_or_arrested = ri[(ri.driver_gender == 'F') |  
                        (ri.is_arrested == True)]
```

- Pipe ( `|` ) represents the `or` operator

```
female_or_arrested.shape
```

```
(26183, 13)
```

- Includes all females
- Includes all drivers who were arrested

# Rules for filtering by multiple conditions

- Ampersand ( `&` ): only include rows that satisfy both conditions
- Pipe ( `|` ): include rows that satisfy either condition
- Each condition must be surrounded by parentheses
- Conditions can check for equality ( `==` ), inequality ( `!=` ), etc.
- Can use more than two conditions

# Correlation, not causation

- Analyze the relationship between gender and stop outcome
  - Assess whether there is a correlation
- Not going to draw any conclusions about causation
  - Would need additional data and expertise
  - Exploring relationships only

# Let's practice!

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# Does gender affect whose vehicle is searched?

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# Math with Boolean values

```
ri.isnull().sum()
```

```
stop_date      0
stop_time      0
driver_gender   0
driver_race     0
violation_raw   0
...
```

- `True` = 1, `False` = 0

```
import numpy as np
np.mean([0, 1, 0, 0])
```

```
0.25
```

```
np.mean([False, True,
          False, False])
```

```
0.25
```

- Mean of Boolean Series  
represents percentage of  
`True` values



# Taking the mean of a Boolean Series

```
ri.is_arrested.value_counts(normalize=True)
```

```
False    0.964431  
True     0.035569
```

```
ri.is_arrested.mean()
```

```
0.0355690117407784
```

```
ri.is_arrested.dtype
```

```
dtype('bool')
```

# Comparing groups using groupby (1)

- Study the arrest rate by police district

```
ri.district.unique()
```

```
array(['Zone X4', 'Zone K3', 'Zone X1', 'Zone X3',  
      'Zone K1', 'Zone K2'], dtype=object)
```

```
ri[ri.district == 'Zone K1'].is_arrested.mean()
```

```
0.024349083895853423
```

# Comparing groups using groupby (2)

```
ri[ri.district == 'Zone K2'].is_arrested.mean()
```

```
0.030800588834786546
```

```
ri.groupby('district').is_arrested.mean()
```

```
district
Zone K1    0.024349
Zone K2    0.030801
Zone K3    0.032311
Zone X1    0.023494
Zone X3    0.034871
Zone X4    0.048038
```

# Grouping by multiple categories

```
ri.groupby(['district', 'driver_gender']).is_arrested.mean()
```

```
district  driver_gender
Zone K1    F           0.019169
           M           0.026588
Zone K2    F           0.022196
...         ...         ...
```

```
ri.groupby(['driver_gender', 'district']).is_arrested.mean()
```

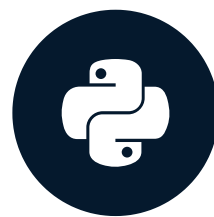
```
driver_gender  district
F             Zone K1    0.019169
              Zone K2    0.022196
...           ...         ...
```

# Let's practice!

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# Does gender affect who is frisked during a search?

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```
ri.search_conducted.value_counts()
```

```
False    83229  
True      3307
```

```
ri.search_type.value_counts(dropna=False)
```

```
NaN                83229  
Incident to Arrest    1290  
Probable Cause        924  
Inventory              219  
Reasonable Suspicion  214  
Protective Frisk      164  
Incident to Arrest, Inventory  123  
...
```

- `.value_counts()`  
excludes missing values by default
- `dropna=False`  
displays missing values

# Examining the search types

```
ri.search_type.value_counts()
```

```
Incident to Arrest      1290
Probable Cause          924
Inventory               219
Reasonable Suspicion    214
Protective Frisk        164
Incident to Arrest,Inventory  123
Incident to Arrest,Probable Cause  100
...
```

- Multiple values are separated by commas
- 219 searches in which "Inventory" was the only search type
- Locate "Inventory" among multiple search types



# Searching for a string (1)

```
ri['inventory'] = ri.search_type.str.contains('Inventory', na=False)
```

- `str.contains()` returns `True` if string is found, `False` if not found
- `na=False` returns `False` when it finds a missing value

# Searching for a string (2)

```
ri.inventory.dtype
```

```
dtype('bool')
```

- `True` means inventory was done, `False` means it was not

```
ri.inventory.sum()
```

```
441
```

# Calculating the inventory rate

```
ri.inventory.mean()
```

```
0.0050961449570121106
```

- 0.5% of all traffic stops resulted in an inventory

```
searched = ri[ri.search_conducted == True]  
searched.inventory.mean()
```

```
0.13335349259147264
```

- 13.3% of searches included an inventory

# Let's practice!

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