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
```

```
0.89085467319959 32
```

```
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!

ANALYZING POLICE ACTIVITY WITH PANDAS

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!

ANALYZING POLICE ACTIVITY WITH PANDAS

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()
```

```
0.03556901174077784
```

```
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()
```

```
0.02434908389585342 3
```

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!

ANALYZING POLICE ACTIVITY WITH PANDAS

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()
```

```
0.005096144957012106
```

- 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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