ANALYZING POLICE ACTIVITY WITH PANDAS

Does time of day affect arrest rate?

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Accessing datetime attributes (1)

```
apple

    price    volume       date_and_time
0  174.35  20567800 2018-01-08 16:00:00
1  174.33  21584000 2018-01-09 16:00:00
2  155.15  54390500 2018-02-08 16:00:00
3  156.41  70672600 2018-02-09 16:00:00
4  176.94  23774100 2018-03-08 16:00:00
5  179.98  32185200 2018-03-09 16:00:00

apple.dtypes

price                   float64
volume                    int64
date_and_time    datetime64[ns]
dtype: object

apple.date_and_time.dt.month

0    1
1    1
2    2
3    2
4    3
5    3
```

Accessing datetime attributes (2)

```
apple.set_index('date_and_time', inplace=True)

apple.index

DatetimeIndex(['2018-01-08 16:00:00', '2018-01-09 16:00:00',
               '2018-02-08 16:00:00', '2018-02-09 16:00:00',
               '2018-03-08 16:00:00', '2018-03-09 16:00:00'],
              dtype='datetime64[ns]', name='date_and_time', freq=None)

apple.index.month
Int64Index([1, 1, 2, 2, 3, 3], dtype='int64', name='date_and_time')
```

- dt accessor is not used with a DatetimeIndex

Calculating the monthly mean price

```
apple.price.mean()
169.52666666666667
```

- apple.groupby('month').price.mean() is invalid

```
apple.groupby(apple.index.month).price.mean()

date_and_time
1    174.34
2    155.78
3    178.46
Name: price, dtype: float64

monthly_price = apple.groupby(apple.index.month).price.mean()
```

Plotting the monthly mean price

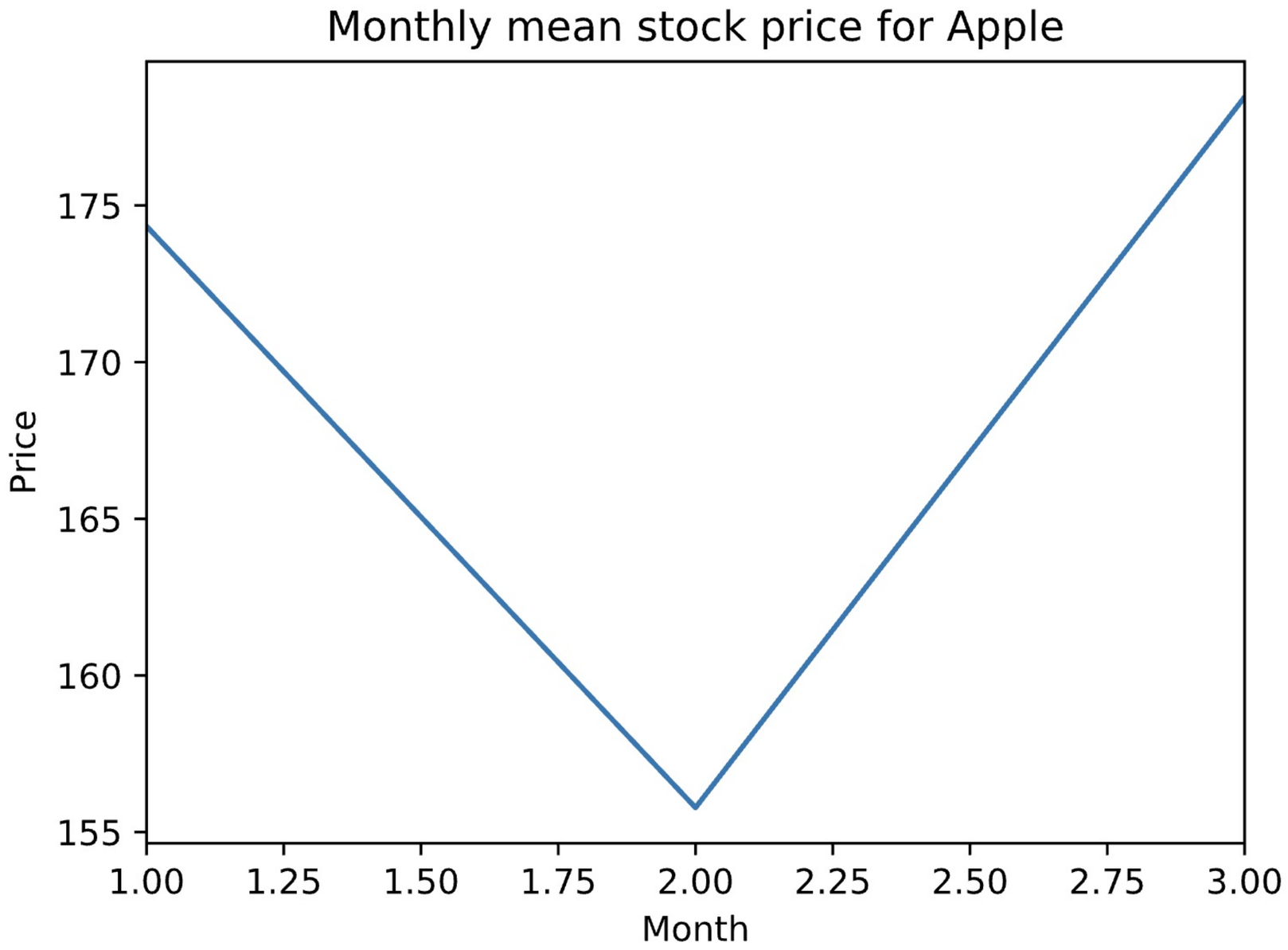
```
import matplotlib.pyplot as plt

monthly_price.plot()
```

- Line plot: Series index on x-axis, Series values on y-axis

```
plt.xlabel('Month')
plt.ylabel('Price')
plt.title('Monthly mean stock price for Apple')

plt.show()
```


Monthly mean stock price for Apple
Price
175
170
165
160
155
1.00
1.25
1.50
1.75
2.00
2.25
2.50
2.75
3.00
Month

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Let's practice!

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Are drug-related stops on the rise?

Resampling the price

```
apple
                     price    volume
date_and_time
2018-01-08 16:00:00  174.35  20567800
2018-01-09 16:00:00  174.33  21584000
2018-02-08 16:00:00  155.15  54390500
2018-02-09 16:00:00  156.41  70672600
2018-03-08 16:00:00  176.94  23774100
2018-03-09 16:00:00  179.98  32185200

apple.groupby(apple.index.month).price.mean()

date_and_time
1    174.34
2    155.78
3    178.46
Name: price, dtype: float64

apple.price.resample('M').mean()

date_and_time
2018-01-31    174.34
2018-02-28    155.78
2018-03-31    178.46
Freq: M, Name: price, dtype: float64
```

Resampling the volume

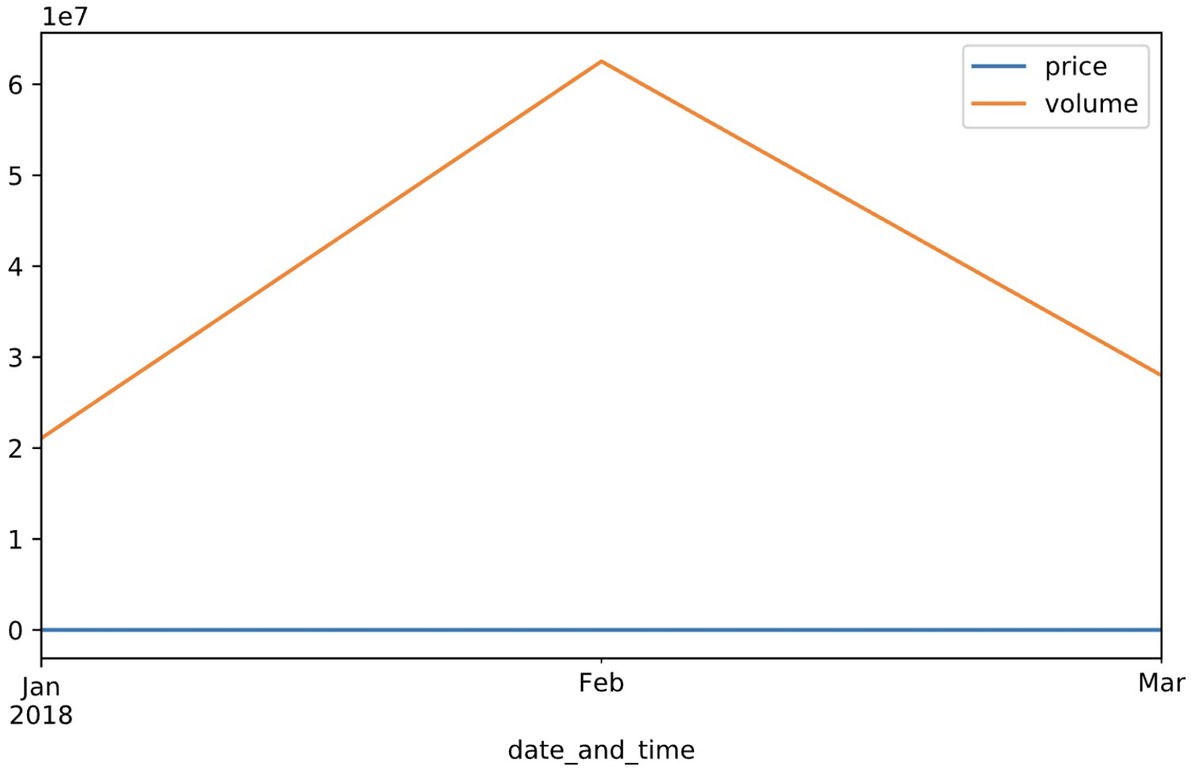
```
apple
                     price    volume
date_and_time
2018-01-08 16:00:00  174.35  20567800
2018-01-09 16:00:00  174.33  21584000
2018-02-08 16:00:00  155.15  54390500
2018-02-09 16:00:00  156.41  70672600
2018-03-08 16:00:00  176.94  23774100
2018-03-09 16:00:00  179.98  32185200

apple.volume.resample('M').mean()

date_and_time
2018-01-31    21075900
2018-02-28    62531550
2018-03-31    27979650
Freq: M, Name: volume, dtype: int64
```

Concatenating price and volume

```
monthly_price = apple.price.resample('M').mean()

monthly_volume = apple.volume.resample('M').mean()

pd.concat([monthly_price, monthly_volume], axis='columns')

                price    volume
date_and_time
2018-01-31     174.34  21075900
2018-02-28     155.78  62531550
2018-03-31     178.46  27979650

monthly = pd.concat([monthly_price, monthly_volume], axis='columns')
```

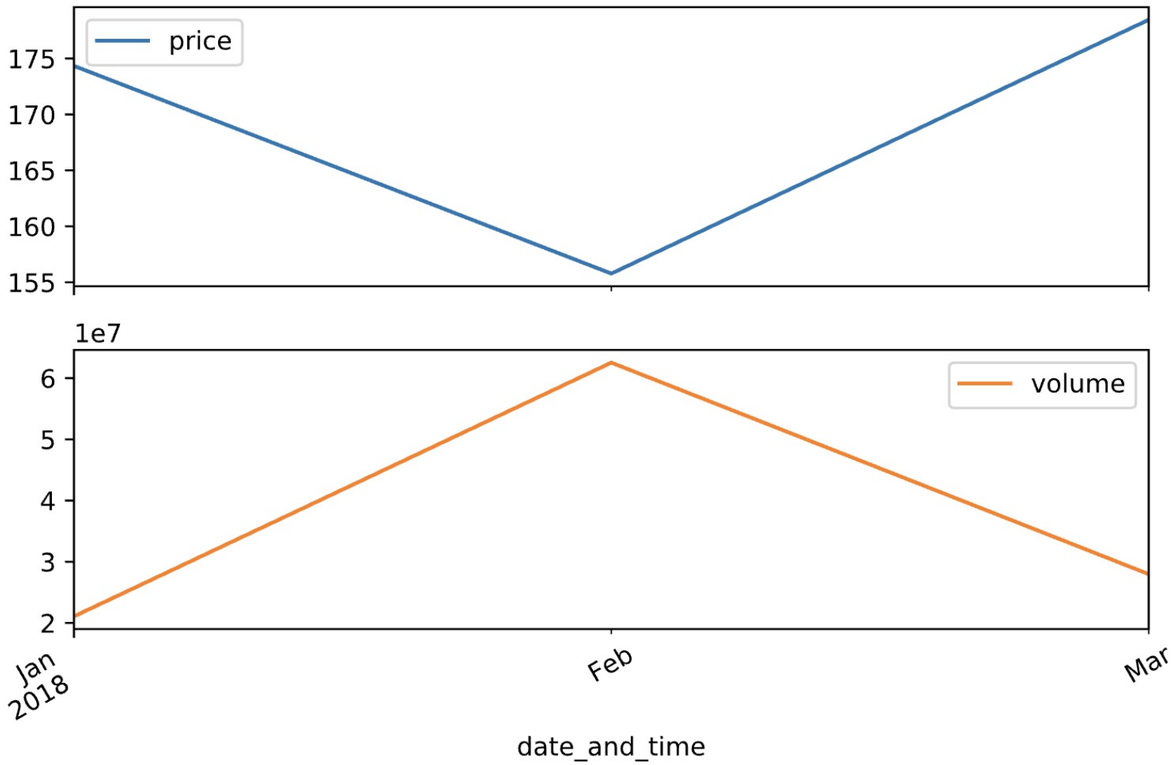
Plotting price and volume (1)

```
monthly.plot()
plt.show()
```



Plotting price and volume (2)

```
monthly.plot(subplots=True)
plt.show()
```



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What violations are caught in each district?

Computing a frequency table

```
pd.crosstab(ri.driver_race, ri.driver_gender)

driver_gender      F      M
driver_race
Asian            551   1838
Black           2681   9604
Hispanic        1953   7774
Other             53    212
White          18536  43334
```

- Frequency table: Tally of how many times each combination of values occurs

```
ri[(ri.driver_race == 'Asian') & (ri.driver_gender == 'F')].shape
(551, 14)
```

- driver_race is along the index, driver_gender is along the columns

```
table = pd.crosstab(ri.driver_race, ri.driver_gender)
```

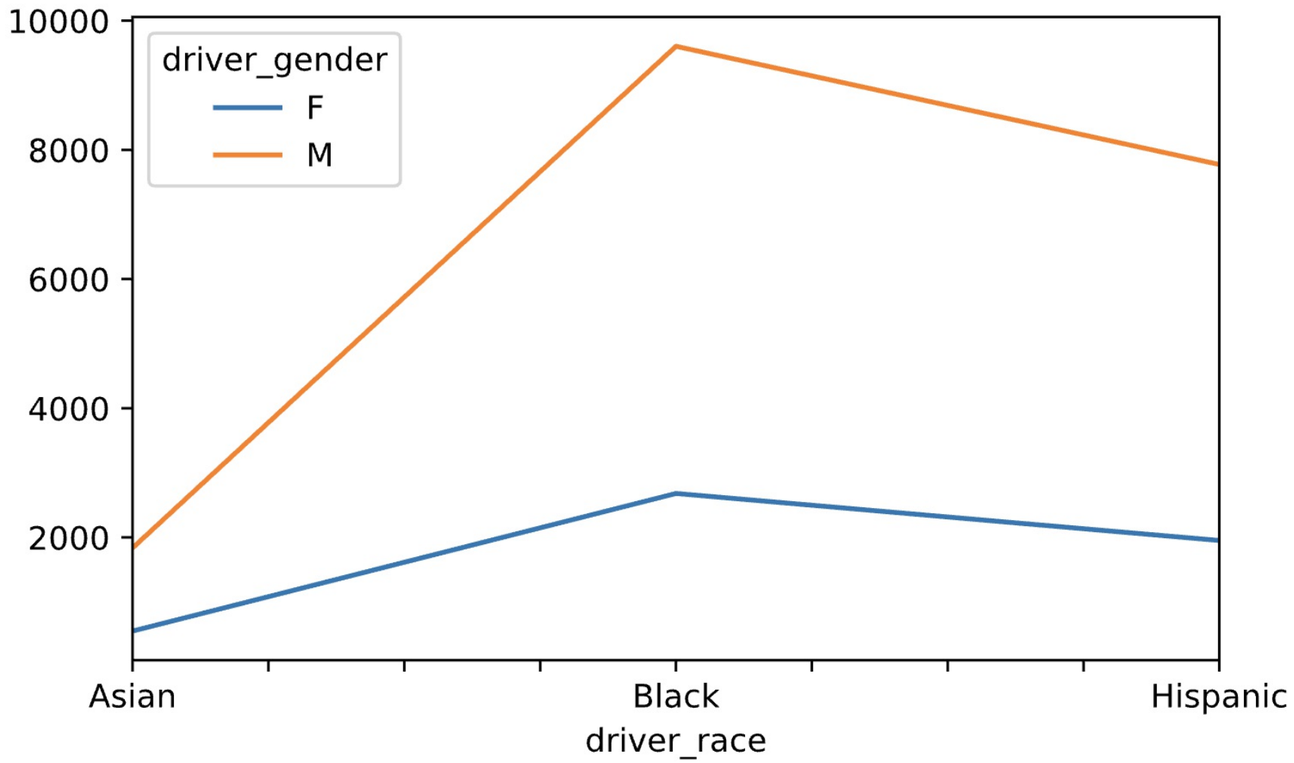
Selecting a DataFrame slice

- loc accessor: Select from a DataFrame by label

```
table

driver_gender      F      M
driver_race
Asian            551   1838
Black           2681   9604
Hispanic        1953   7774
Other             53    212
White          18536  43334

table.loc['Asian':'Hispanic']

driver_gender     F     M
driver_race
Asian           551  1838
Black          2681  9604
Hispanic       1953  7774

table = table.loc['Asian':'Hispanic']
```

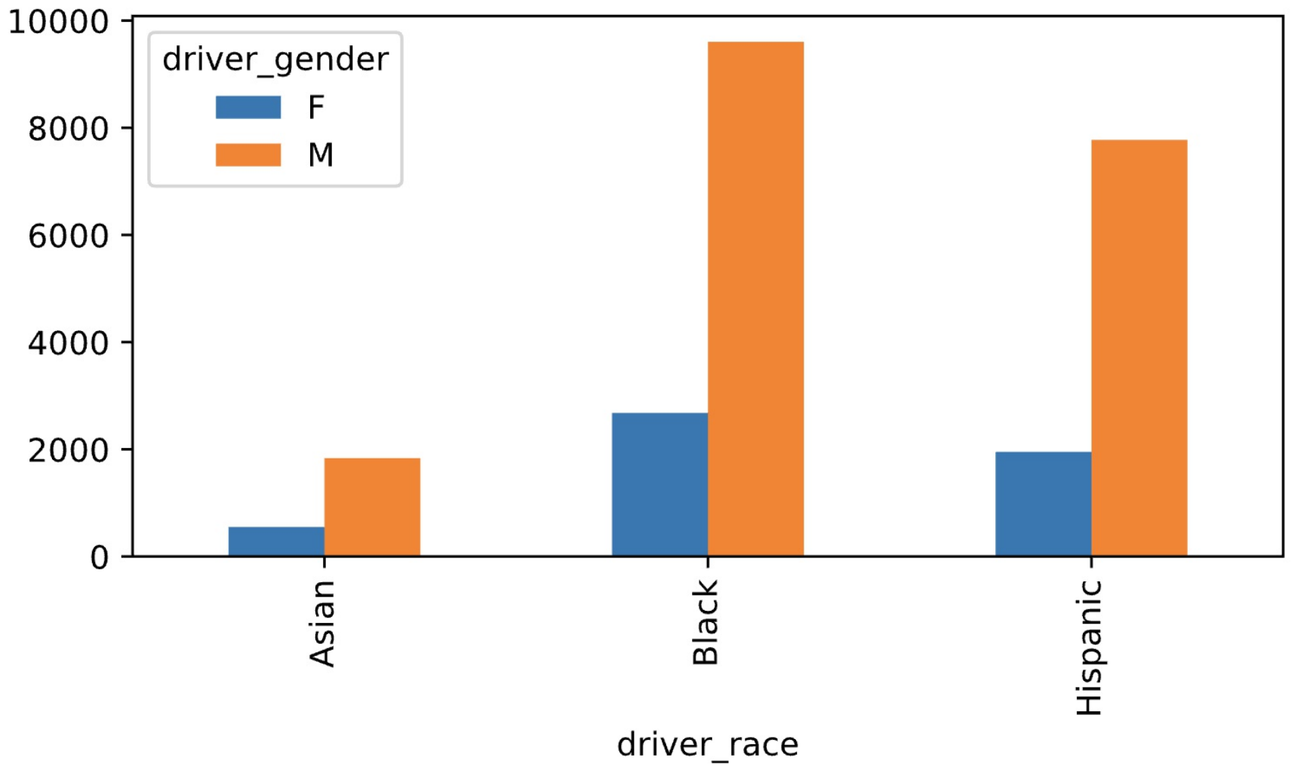
Creating a line plot

```
table.plot()
plt.show()
```



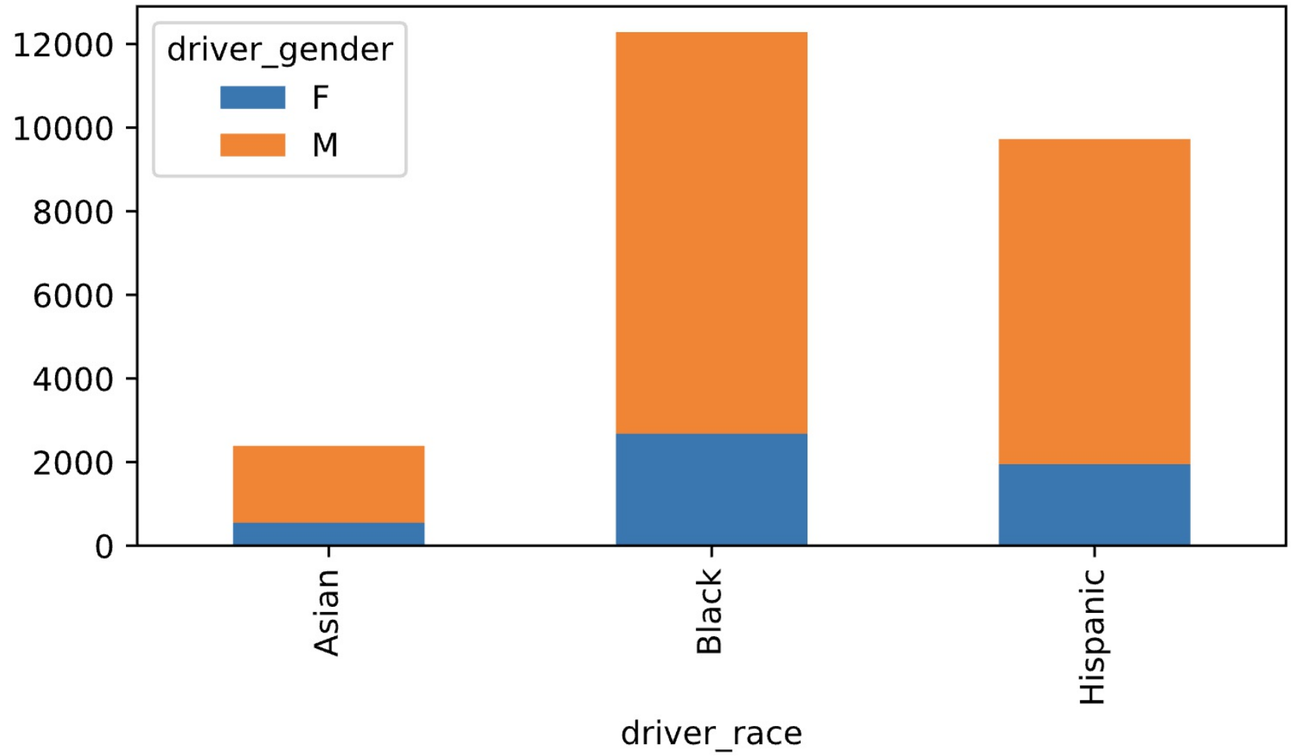
Creating a bar plot

```
table.plot(kind='bar')
plt.show()
```



Stacking the bars

```
table.plot(kind='bar', stacked=True)
plt.show()
```



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ANALYZING POLICE ACTIVITY WITH PANDAS

How long might you be stopped for a violation?

Analyzing an object column

```
apple

                     price    volume change
date_and_time
2018-01-08 16:00:00  174.35  20567800   down
2018-01-09 16:00:00  174.33  21584000   down
2018-02-08 16:00:00  155.15  54390500   down
2018-02-09 16:00:00  156.41  70672600     up
2018-03-08 16:00:00  176.94  23774100     up
2018-03-09 16:00:00  179.98  32185200     up
```

- Create a Boolean column: `True` if the price went up, and `False` otherwise
- Calculate how often the price went up by taking the column mean

```
apple.change.dtype
dtype('O')
```

- `astype()` can't be used in this case

Mapping one set of values to another

- Dictionary maps the values you have to the values you want

```
mapping = {'up':True, 'down':False}

apple['is_up'] = apple.change.map(mapping)

apple

                     price    volume change  is_up
date_and_time
2018-01-08 16:00:00  174.35  20567800   down  False
2018-01-09 16:00:00  174.33  21584000   down  False
2018-02-08 16:00:00  155.15  54390500   down  False
2018-02-09 16:00:00  156.41  70672600     up   True
2018-03-08 16:00:00  176.94  23774100     up   True
2018-03-09 16:00:00  179.98  32185200     up   True

apple.is_up.mean()
0.5
```

Calculating the search rate

- Visualize how often searches were performed after each type of violation

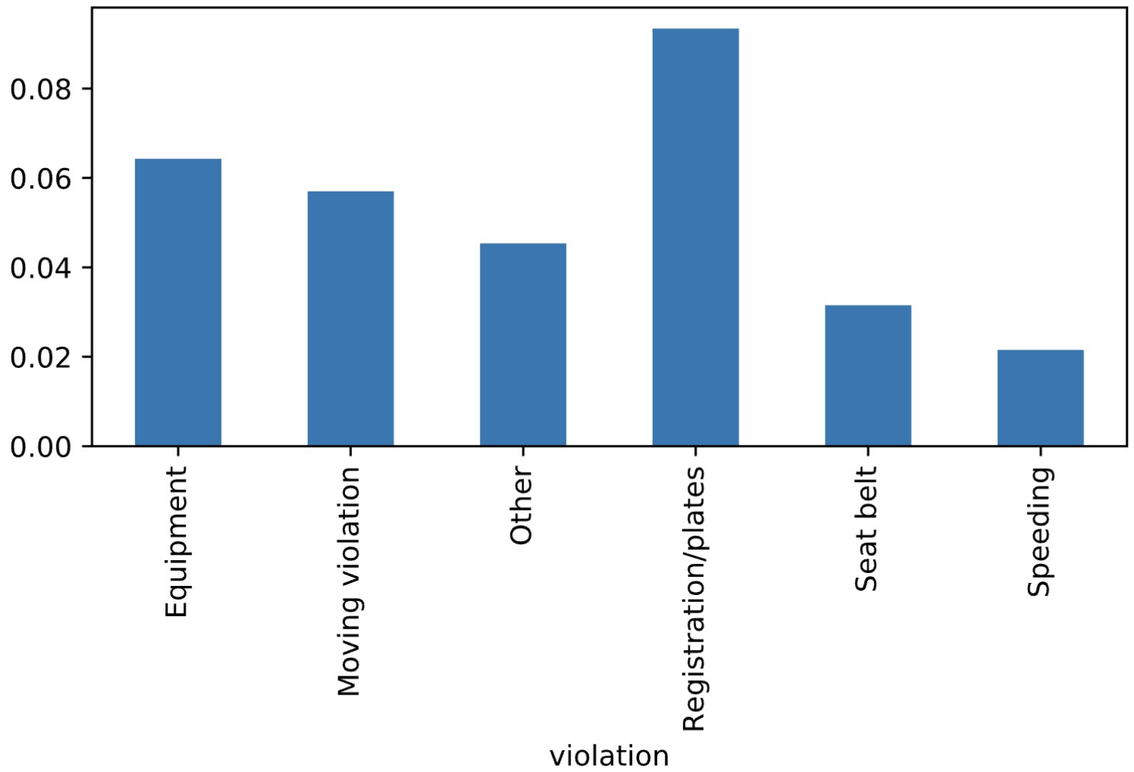
```
ri.groupby('violation').search_conducted.mean()

violation
Equipment              0.064280
Moving violation       0.057014
Other                  0.045362
Registration/plates    0.093438
Seat belt              0.031513
Speeding               0.021560
Name: search_conducted, dtype: float64
```

- Returns a Series sorted in alphabetical order

```
search_rate = ri.groupby('violation').search_conducted.mean()
```

Creating a bar plot

```
search_rate.plot(kind='bar')
plt.show()
```



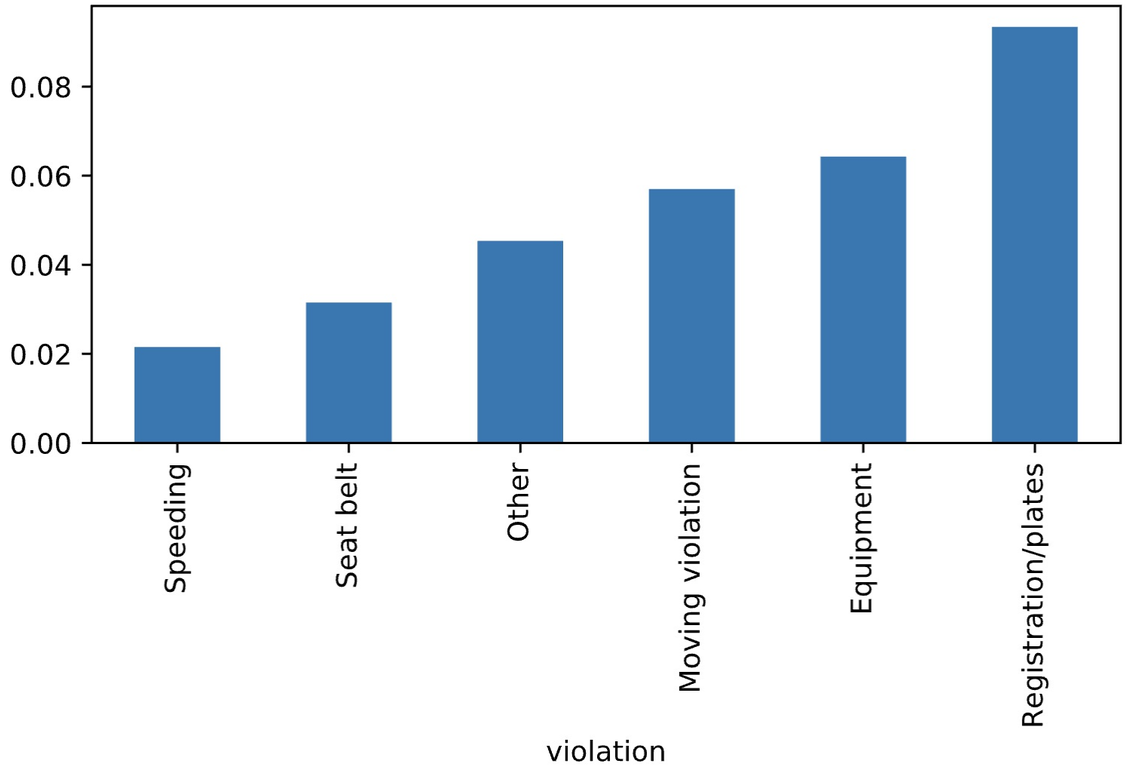
Ordering the bars (1)

- Order the bars from left to right by size

```
search_rate.sort_values()

violation
Speeding               0.021560
Seat belt              0.031513
Other                  0.045362
Moving violation       0.057014
Equipment              0.064280
Registration/plates    0.093438
Name: search_conducted, dtype: float64
```

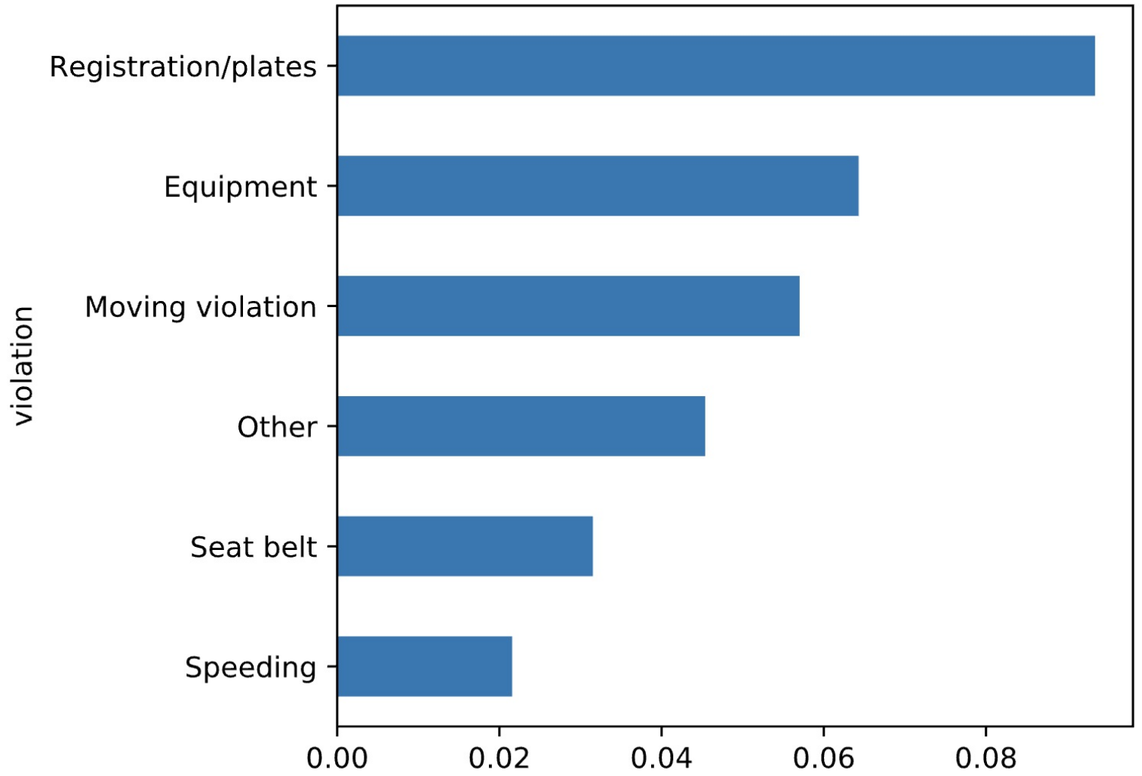
Ordering the bars (2)

```
search_rate.sort_values().plot(kind='bar')
plt.show()
```



Rotating the bars

```
search_rate.sort_values().plot(kind='barh')
plt.show()
```



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