Does time of day affect arrest rate?

ANALYZING POLICE ACTIVITY WITH PANDAS

Kevin Markham
Founder, Data School

Analyzing datetime data

```
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
```

Accessing datetime attributes (1)

```
apple.dtypes
```

```
price                    float64
volume                     int64
date_and_time    datetime64[ns]
```

```
apple.date_and_time.dt.month
```

```
0    1
1    1
2    2
3    2
...
```

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=No
```

```
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(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

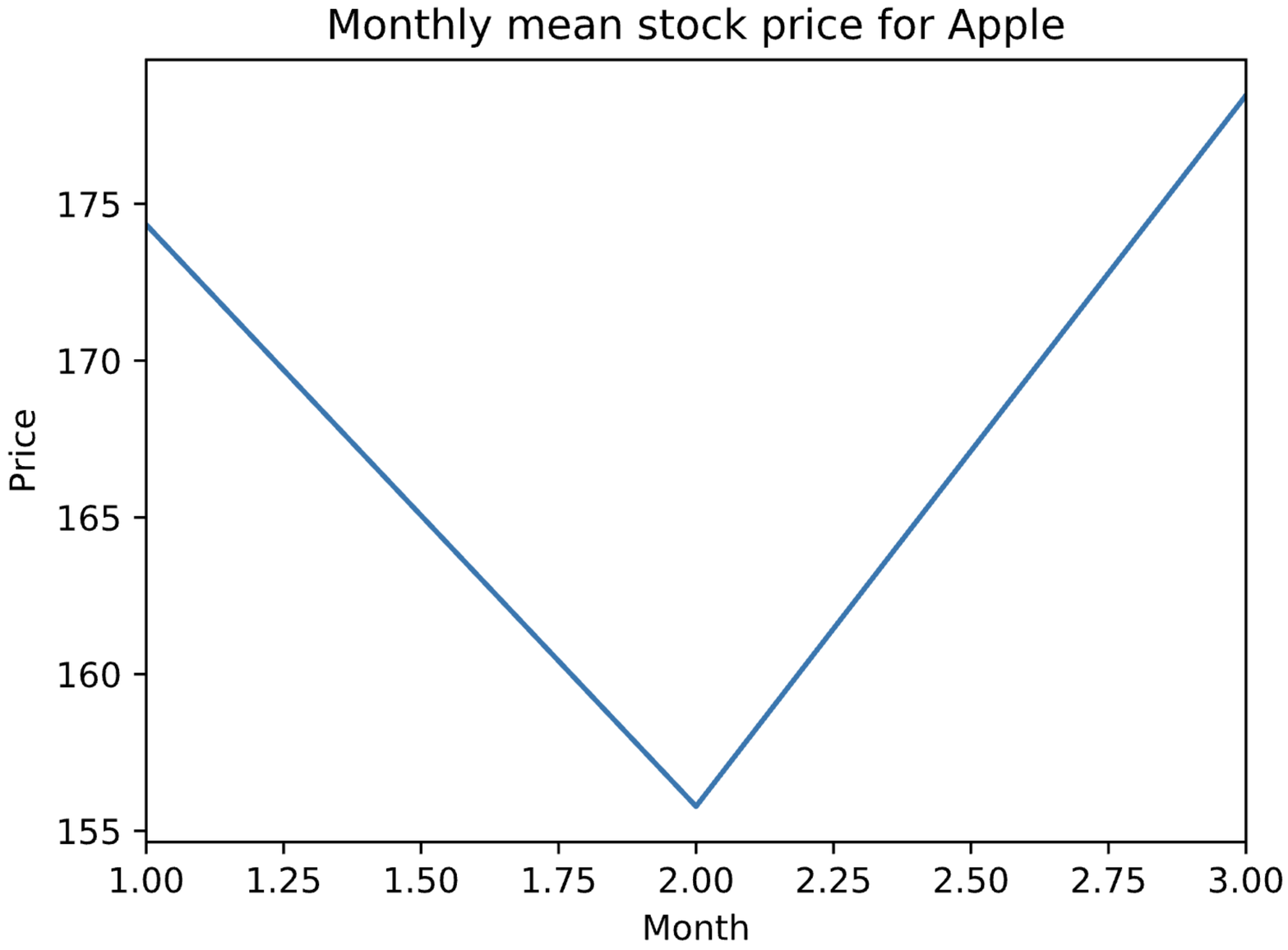
```
import matplotlib.pyplot as plt
```

```
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

Let's practice!

ANALYZING POLICE ACTIVITY WITH PANDAS

Are drug-related stops on the rise?

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Resampling the price

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

```
date_and_time
1    174.34
2    155.78
3    178.46
```

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

```
date_and_time
2018-01-31    174.34
2018-02-28    155.78
2018-03-31    178.46
```

Resampling the volume

```
apple
```

```
date_and_time          price    volume
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
...                     ...       ...
```

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

```
date_and_time
2018-01-31    21075900
2018-02-28    62531550
2018-03-31    27979650
```

Concatenating price and volume

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

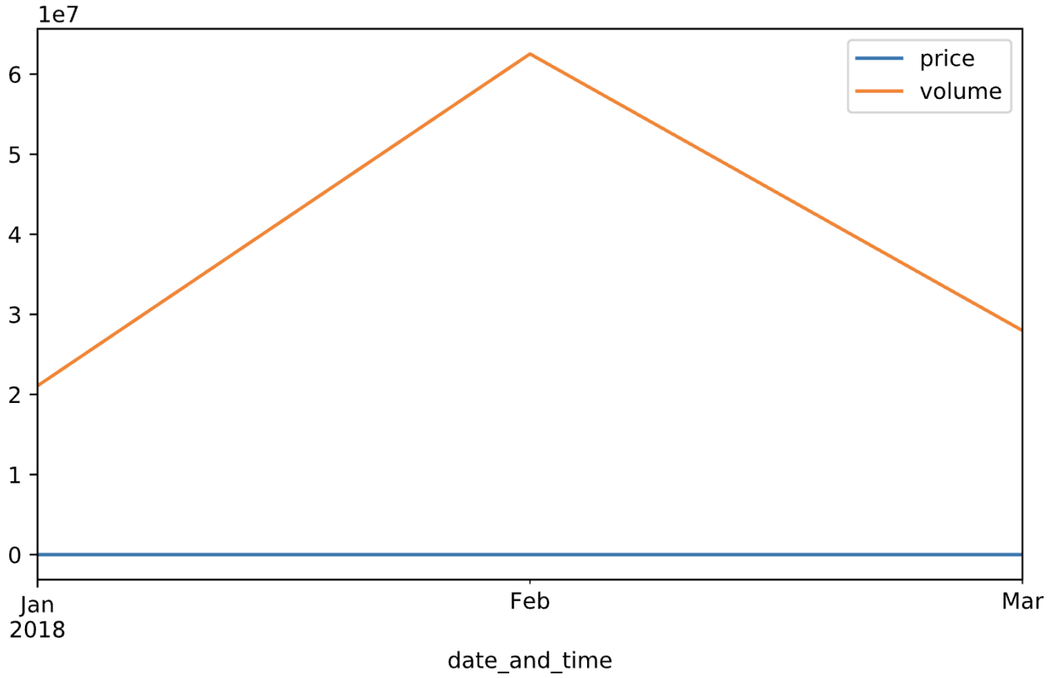
```
pd.concat([monthly_price, monthly_volume], axis='columns')
```

```
date_and_time   price    volume
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')
```

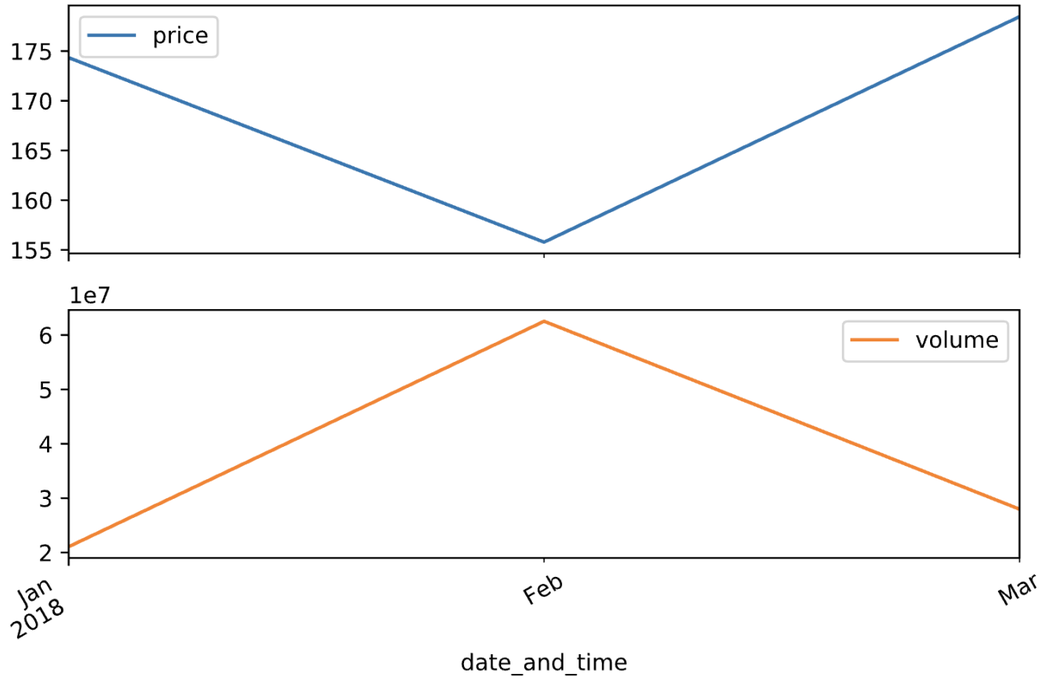
Plotting price and volume (1)

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



Plotting price and volume (2)

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



Let's practice!

ANALYZING POLICE ACTIVITY WITH PANDAS

What violations are caught in each district?

ANALYZING POLICE ACTIVITY WITH PANDAS

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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
```

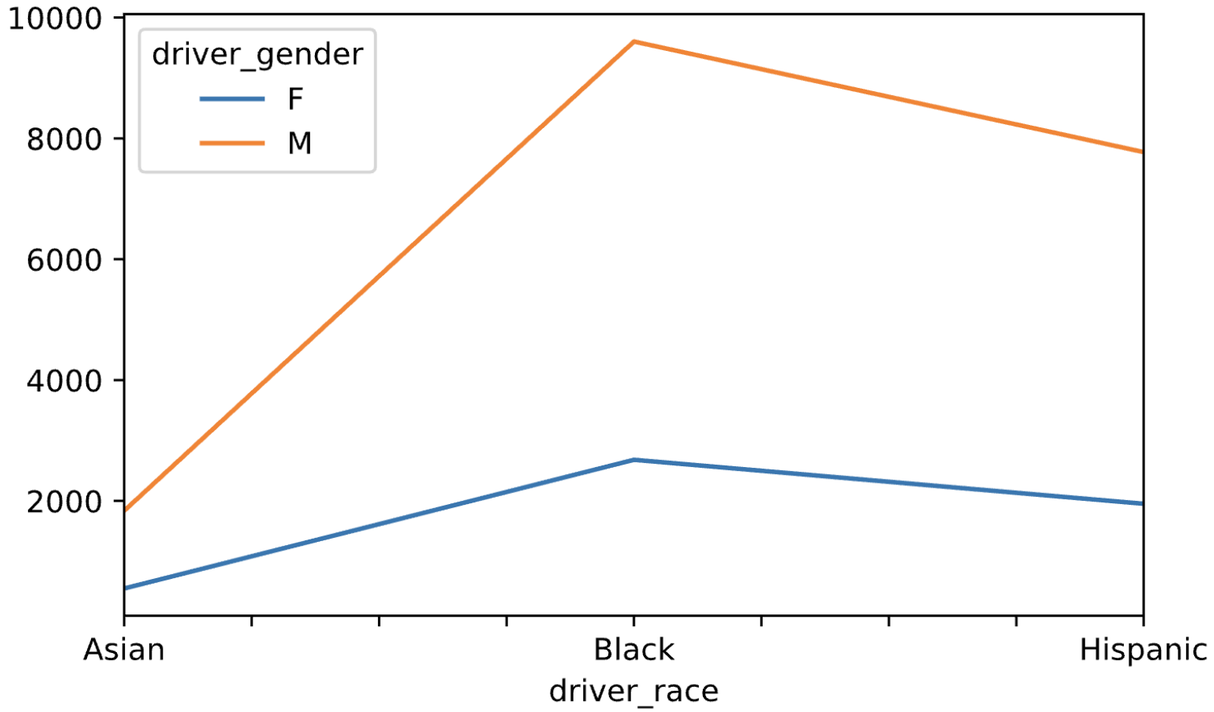
```
table.loc['Asian':'Hispanic']
```

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

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

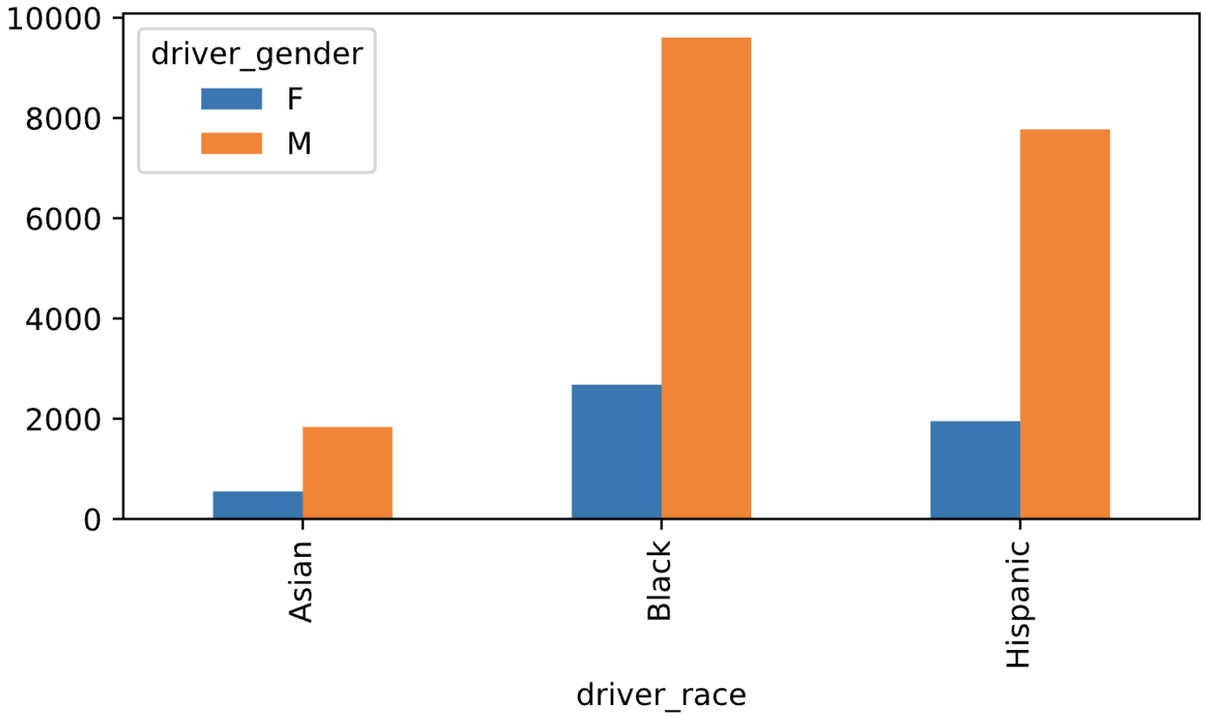
Creating a line plot

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



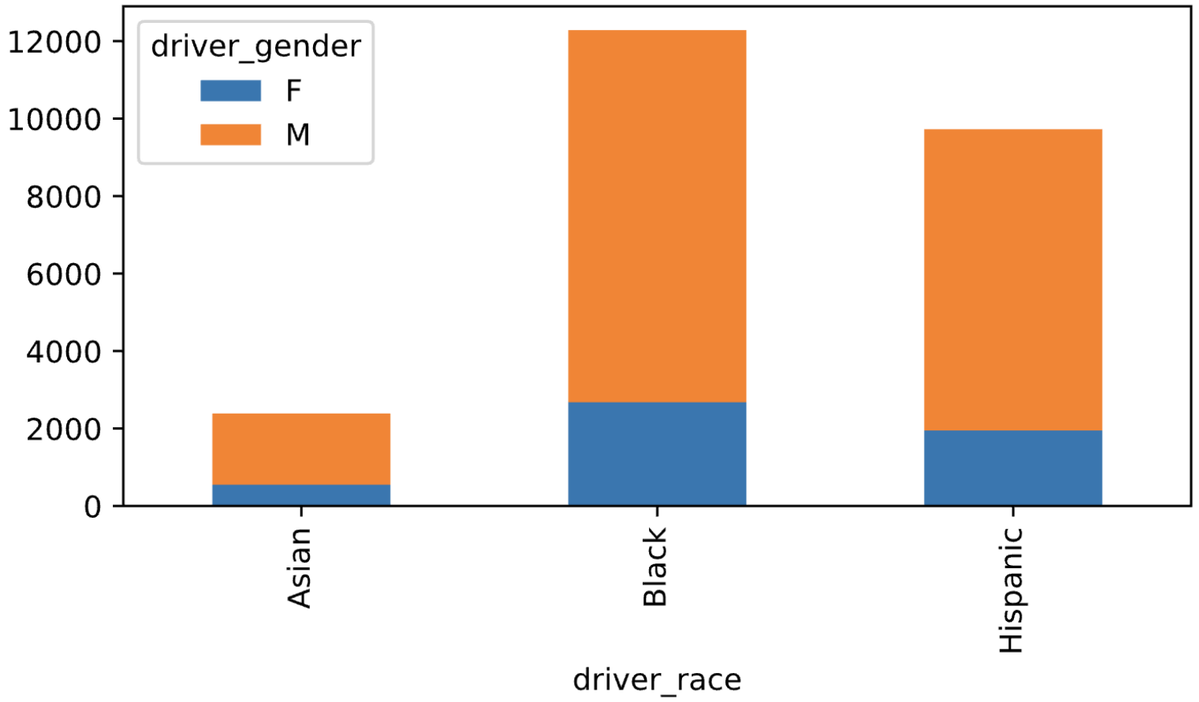
Creating a bar plot

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



Stacking the bars

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



Let's practice!

ANALYZING POLICE ACTIVITY WITH PANDAS

How long might you be stopped for a violation?

ANALYZING POLICE ACTIVITY WITH PANDAS

Kevin Markham
Founder, Data School

Analyzing an object column

```
apple
```

```
date_and_time          price    volume  change
2018-01-08 16:00:00  174.35  20567800    down
...                     ...       ...     ...
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
```

```
date_and_time          price    volume change  is_up
2018-01-08 16:00:00  174.35  20567800   down  False
...                     ...       ...    ...    ...
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 done after each violation type

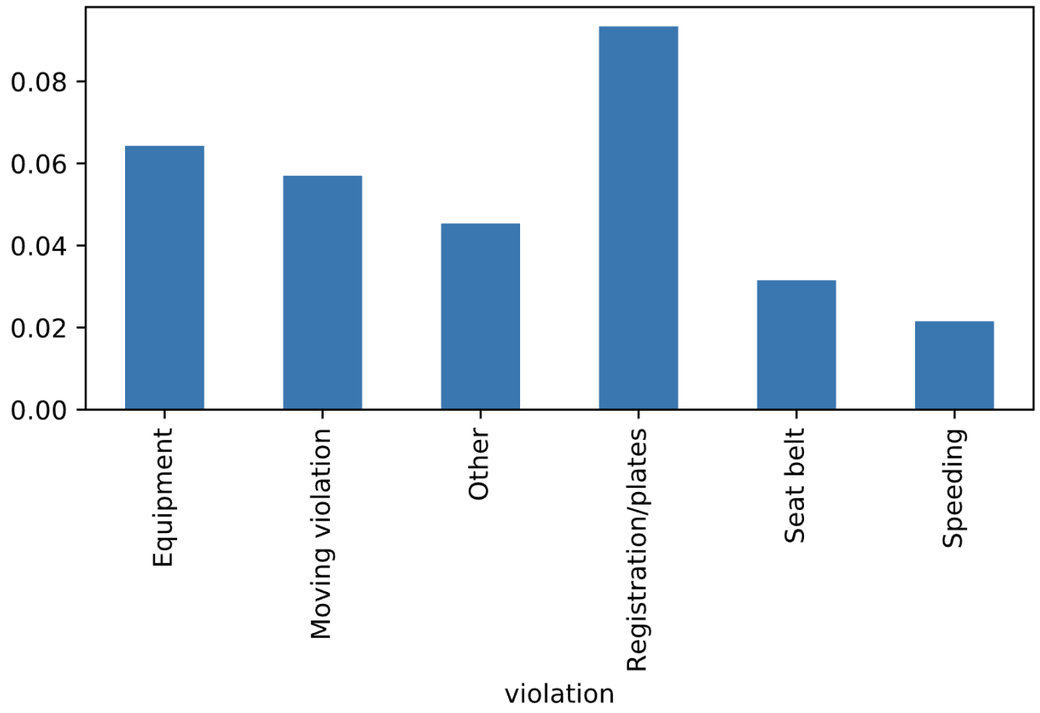
```
ri.groupby('violation').search_conducted.mean()
```

```
violation
Equipment               0.064280
Moving violation        0.057014
Other                   0.045362
Registration/plates     0.093438
Seat belt               0.031513
Speeding                0.021560
```

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

Creating a bar plot

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



Ordering the bars (1)

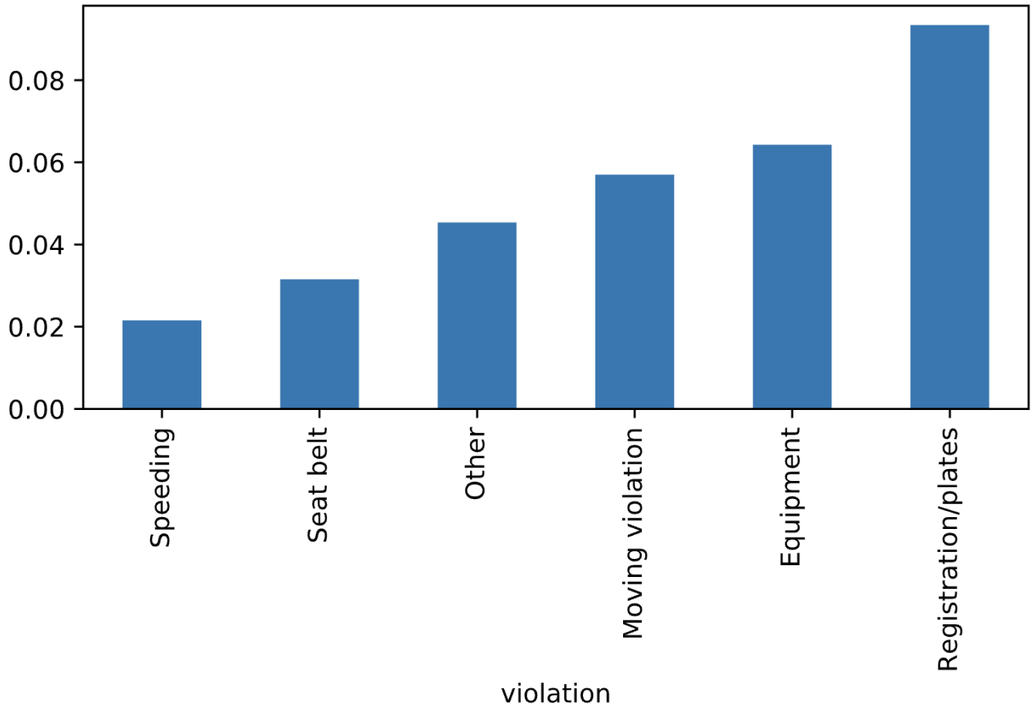
- Order the bars from left to right by size

```
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
```

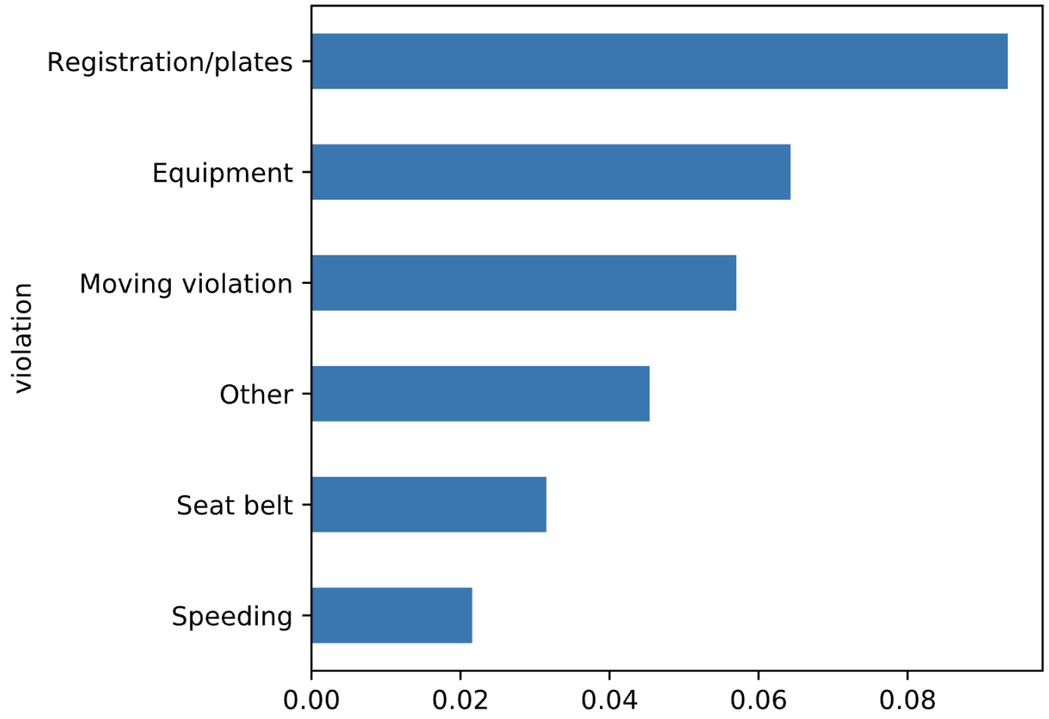
Ordering the bars (2)

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



Rotating the bars

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



Let's practice!

ANALYZING POLICE ACTIVITY WITH PANDAS