Reading date and time data in Pandas

WORKING WITH DATES AND TIMES IN PYTHON

Max Shron
Data Scientist and Author

datacamp

A simple Pandas example

```
# Load Pandas
import pandas as pd
# Import W20529's rides in Q4 2017
rides = pd.read_csv('capital-onebike.csv')
```

A simple Pandas example

```
# See our data
print(rides.head(3))
```

```
            Start date             End date                    Start station  \
0 2017-10-01 15:23:25 2017-10-01 15:26:26              Glebe Rd & 11th St N
1 2017-10-01 15:42:57 2017-10-01 17:49:59  George Mason Dr & Wilson Blvd
2 2017-10-02 06:37:10 2017-10-02 06:42:53  George Mason Dr & Wilson Blvd

                           End station Bike number Member type
0         George Mason Dr & Wilson Blvd      W20529      Member
1         George Mason Dr & Wilson Blvd      W20529      Casual
2  Ballston Metro / N Stuart & 9th St N      W20529      Member
```

A simple Pandas example

```
rides['Start date']
```

```
0     2017-10-01 15:23:25
1     2017-10-01 15:42:57
...
Name: Start date, Length: 290, dtype: object
```

```
rides.iloc[2]
```

```
Start date                  2017-10-02 06:37:10
End date                    2017-10-02 06:42:53
...
Name: 1, dtype: object
```

Loading datetimes with parse_dates

```
# Import W20529's rides in Q4 2017
rides = pd.read_csv('capital-onebike.csv',
                    parse_dates = ['Start date', 'End date'])
# Or:
rides['Start date'] = pd.to_datetime(rides['Start date'],
                                     format = "%Y-%m-%d %H:%M:%S")
```

Loading datetimes with parse_dates

```
# Select Start date for row 2
rides['Start date'].iloc[2]
```

```
Timestamp('2017-10-02 06:37:10')
```

Timezone-aware arithmetic

```
# Create a duration column
rides['Duration'] = rides['End date'] - rides['Start date']
# Print the first 5 rows
print(rides['Duration'].head(5))
```

```
0   00:03:01
1   02:07:02
2   00:05:43
3   00:21:18
4   00:21:17
Name: Duration, dtype: timedelta64[ns]
```

Loading datetimes with parse_dates

```
rides['Duration']\
  .dt.total_seconds()\
  .head(5)
```

```
0     181.0
1    7622.0
2     343.0
3    1278.0
4    1277.0
Name: Duration, dtype: float64
```

Reading date and time data in Pandas

WORKING WITH DATES AND TIMES IN PYTHON

Summarizing datetime data in Pandas

WORKING WITH DATES AND TIMES IN PYTHON

Max Shron
Data Scientist and Author

datacamp

Summarizing data in Pandas

```
# Average time out of the dock
rides['Duration'].mean()
```

```
Timedelta('0 days 00:19:38.931034')
```

```
# Total time out of the dock
rides['Duration'].sum()
```

```
Timedelta('3 days 22:58:10')
```

Summarizing data in Pandas

```
# Percent of time out of the dock
rides['Duration'].sum() / timedelta(days=91)
```

```
0.043484177859177786
```

Summarizing data in Pandas

```
# Count how many time the bike started at each station
rides['Member type'].value_counts()
```

```
Member    236
Casual     54
Name: Member type, dtype: int64
```

```
# Percent of rides by member
rides['Member type'].value_counts() / len(rides)
```

```
Member    0.813793
Casual    0.186207
Name: Member type, dtype: float64
```

Summarizing datetime in Pandas

```
# Add duration (in seconds) column
rides['Duration seconds'] = rides['Duration'].dt.total_seconds()
# Average duration per member type
rides.groupby('Member type')['Duration seconds'].mean()
```

```
Member type
Casual    1994.666667
Member     992.279661
Name: Duration seconds, dtype: float64
```

Summarizing datetime in Pandas

```
# Average duration by month
rides.resample('M', on = 'Start date')['Duration seconds'].mean()
```

```
Start date
2017-10-31    1886.453704
2017-11-30     854.174757
2017-12-31     635.101266
Freq: M, Name: Duration seconds, dtype: float64
```

Summarizing datetime in Pandas

```
# Size per group
rides.groupby('Member type').size()
```

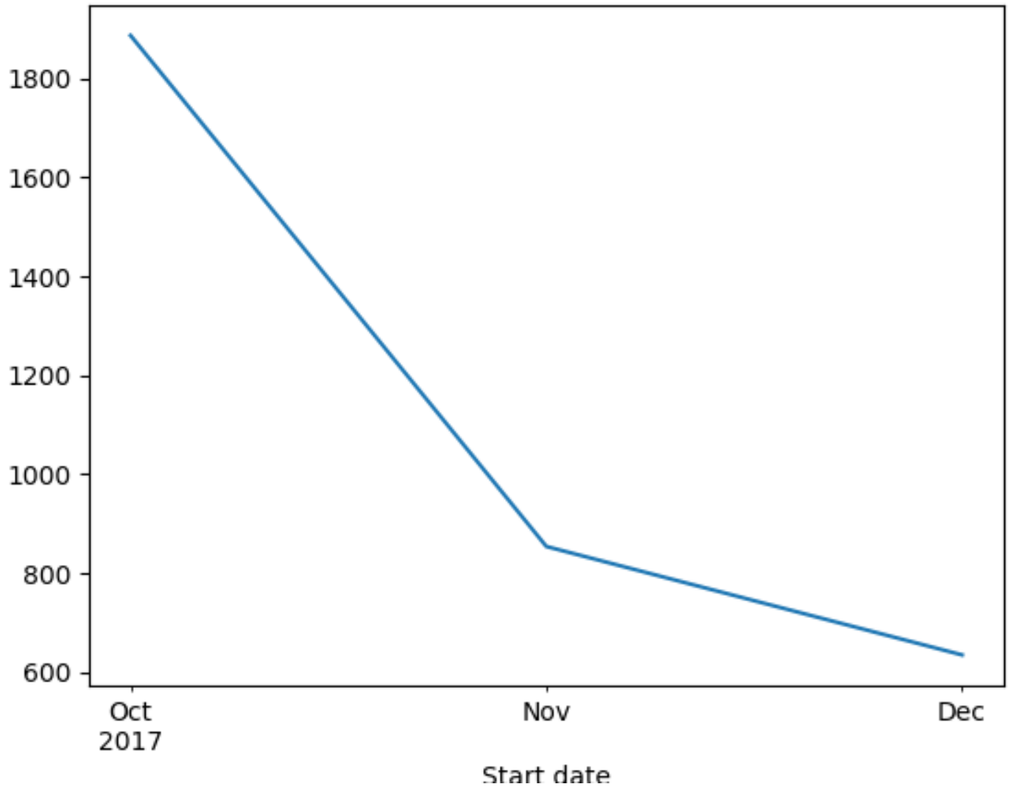
```
Member type
Casual     54
Member    236
dtype: int64
```

```
# First ride per group
rides.groupby('Member type').first()
```

```
                Duration     ...
Member type                  ...
Casual        02:07:02       ...
Member        00:03:01       ...
```

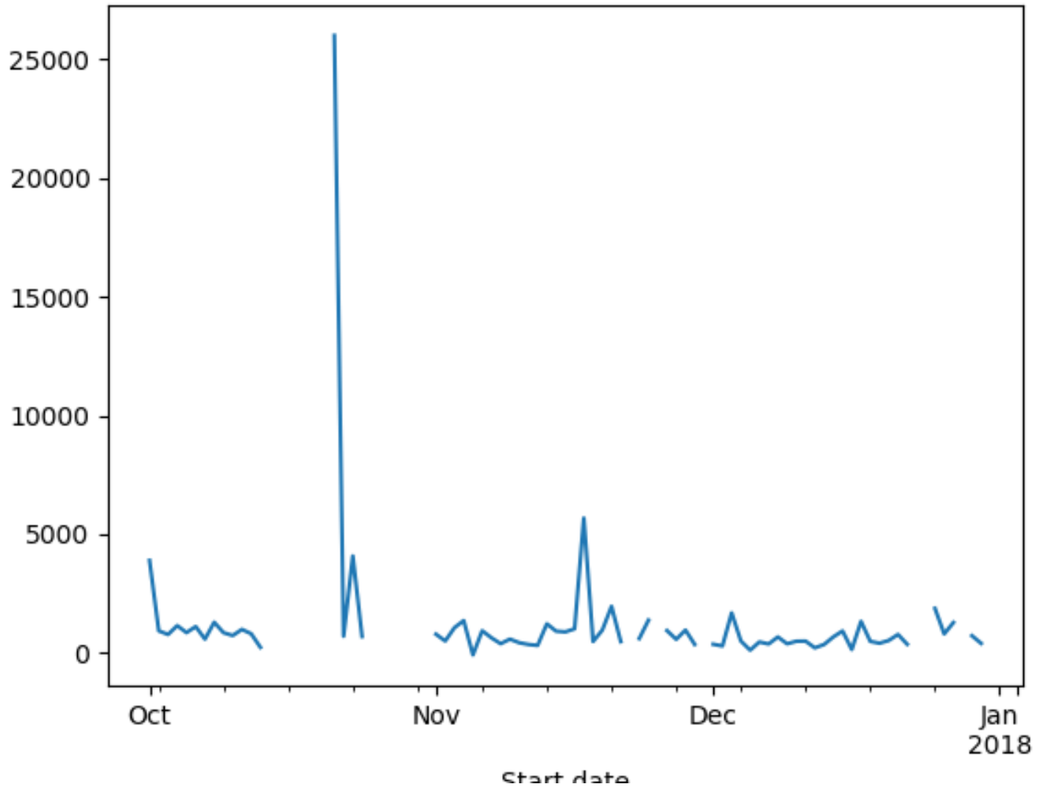
Summarizing datetime in Pandas

```
rides\
  .resample('M', on = 'Start date')\
  ['Duration seconds']\
  .mean()\
  .plot()
```



Summarizing datetime in Pandas

```
rides\
  .resample('D', on = 'Start date')\
  ['Duration seconds']\
  .mean()\
  .plot()
```



Summarizing datetime data in Pandas

WORKING WITH DATES AND TIMES IN PYTHON

Additional datetime methods in Pandas

WORKING WITH DATES AND TIMES IN PYTHON

Max Shron
Data Scientist & Author

datacamp

Timezones in Pandas

```
rides['Duration'].dt.total_seconds().min()
```

```
-3346.0
```

Timezones in Pandas

```
rides['Start date'].head(3)
```

```
0   2017-10-01 15:23:25
1   2017-10-01 15:42:57
2   2017-10-02 06:37:10
Name: Start date, dtype: datetime64[ns]
```

```
rides['Start date'].head(3)\
  .dt.tz_localize('America/New_York')
```

```
0   2017-10-01 15:23:25-04:00
1   2017-10-01 15:42:57-04:00
2   2017-10-02 06:37:10-04:00
Name: Start date, dtype: datetime64[ns, America/New_York]
```

Timezones in Pandas

```
# Try to set a timezone...
rides['Start date'] = rides['Start date']\
  .dt.tz_localize('America/New_York')
```

```
AmbiguousTimeError: Cannot infer dst time from '2017-11-05 01:56:50',
try using the 'ambiguous' argument
```

```
# Handle ambiguous datetimes
rides['Start date'] = rides['Start date']\
  .dt.tz_localize('America/New_York', ambiguous='NaT')

rides['End date'] = rides['End date']\
  .dt.tz_localize('America/New_York', ambiguous='NaT')
```

Timezones in Pandas

```
# Re-calculate duration, ignoring bad row
rides['Duration'] = rides['Start date'] - rides['End date']
# Find the minimum again
rides['Duration'].dt.total_seconds().min()
```

```
116.0
```

Timezones in Pandas

```
# Look at problematic row
rides.iloc[129]
```

```
Duration                          NaT
Start date                        NaT
End date                          NaT
Start station          6th & H St NE
End station            3rd & M St NE
Bike number                   W20529
Member type                   Member
Name: 129, dtype: object
```

Other datetime operations in Pandas

```
# Year of first three rows
rides['Start date']\
  .head(3)\
  .dt.year
```

```
0    2017
1    2017
2    2017
Name: Start date, dtype: int64
```

```
# See weekdays for first three rides
rides['Start date']\
  .head(3)\
  .dt.weekday_name
```

```
0    Sunday
1    Sunday
2    Monday
Name: Start date, dtype: object
```

Other parts of Pandas

```
# Shift the indexes forward one, padding with NaT
rides['End date'].shift(1).head(3)
```

```
0                          NaT
1   2017-10-01 15:26:26-04:00
2   2017-10-01 17:49:59-04:00
Name: End date, dtype: datetime64[ns, America/New_York]
```

Additional datetime methods in Pandas

WORKING WITH DATES AND TIMES IN PYTHON

Wrap-up

WORKING WITH DATES AND TIMES IN PYTHON

Max Shron
Data Scientist and Author

Recap: Dates and Calendars

- The `date()` class takes a year, month, and day as arguments
- A `date` object has accessors like `.year`, and also methods like `.weekday()`
- `date` objects can be compared like numbers, using `min()`, `max()`, and `sort()`
- You can subtract one `date` from another to get a `timedelta`
- To turn `date` objects into strings, use the `.isoformat()` or `.strftime()` methods

Recap: Combining Dates and Times

- The `datetime()` class takes all the arguments of `date()`, plus an hour, minute, second, and microsecond
- All of the additional arguments are optional; otherwise, they're set to zero by default
- You can replace any value in a `datetime` with the `.replace()` method
- Convert a `timedelta` into an integer with its `.total_seconds()` method
- Turn strings into dates with `.strptime()` and dates into strings with `.strftime()`

Recap: Timezones and Daylight Saving

- A `datetime` is "timezone aware" when it has its `tzinfo` set. Otherwise it is "timezone naive"
- Setting a timezone tells a `datetime` how to align itself to UTC, the universal time standard
- Use the `.replace()` method to change the timezone of a `datetime`, leaving the date and time the same
- Use the `.astimezone()` method to shift the date and time to match the new timezone
- `dateutil.tz` provides a comprehensive, updated timezone database

Recap: Easy and Powerful Timestamps in Pandas

- When reading a csv, set the `parse_dates` argument to be the list of columns which should be parsed as datetimes
- If setting `parse_dates` doesn't work, use the `pd.to_datetime()` function
- Grouping rows with `.groupby()` lets you calculate aggregates per group. For example, `.first()`, `.min()` or `.mean()`
- `.resample()` groups rows on the basis of a `datetime` column, by year, month, day, and so on
- Use `.tz_localize()` to set a timezone, keeping the date and time the same
- Use `.tz_convert()` to change the date and time to match a new timezone

Congratulations!

WORKING WITH DATES AND TIMES IN PYTHON