Database-style Operations on Dataframes About the data In this notebook, we will using daily weather data that was taken from the National Centers for Environmental Information (NCEI) API. The data collection notebook contains the process that was followed to collect the data.

Note: The NCEI is part of the National Oceanic and Atmospheric Administration (NOAA) and, as you can see from the URL for the API, this resource was created when the NCEI was called the NCDC. Should the URL for this resource change in the future, you can search for the NCEI weather API to find the updated one.

Background on the data Data meanings:

PRCP: precipitation in millimeters

SNOW: snowfall in millimeters

SNWD: snow depth in millimeters

TMAX: maximum daily temperature in Celsius

TMIN: minimum daily temperature in Celsius

TOBS: temperature at time of observation in Celsius

WESF: water equivalent of snow in millimeters

Setup

```
import pandas as pd
weather = pd.read_csv('nyc_weather_2018.csv')
weather.head()
```

$\overline{\Rightarrow}$		attributes	datatype	date	station	value	
	0	,,N,	PRCP	2018-01-01T00:00:00	GHCND:US1CTFR0039	0.0	th
	1	,,N,	PRCP	2018-01-01T00:00:00	GHCND:US1NJBG0015	0.0	
	2	,,N,	SNOW	2018-01-01T00:00:00	GHCND:US1NJBG0015	0.0	
	3	,,N,	PRCP	2018-01-01T00:00:00	GHCND:US1NJBG0017	0.0	
	4	,,N,	SNOW	2018-01-01T00:00:00	GHCND:US1NJBG0017	0.0	

Next steps:

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Querying DataFrames

The query() method is an easier way of filtering based on some criteria. For example, we can use it to find all entries where snow was recorded:

```
snowdata = weather.query('datatype == "SNOW" and value > 0')
snowdata.head(5)
```



import sqlite3

```
snowdata.reset_index().drop(columns='index').equals(snow_data_from_db)

True

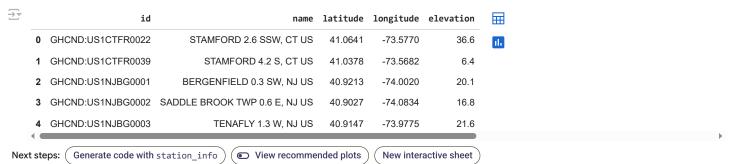
weather[(weather.datatype == 'SNOW') & (weather.value > 0)].equals(snowdata)

True
```

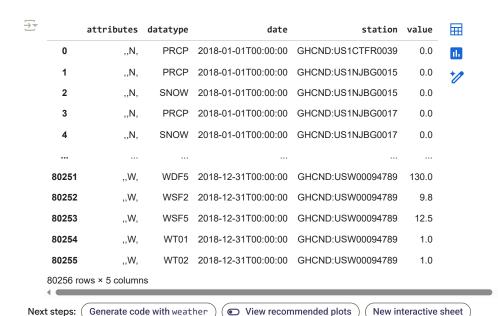
Merging DataFrames

We have data for many different stations each day, however, we don't know what the stations are just their IDs. We can join the data in the data/weather_stations.csv file which contains information from the stations endpoint of the NCEI API. Consult the weather_data_collection.ipynb notebook to see how this was collected. It looks like this:

station_info = pd.read_csv('weather_stations.csv')
station_info.head()



weather





weather.station.describe()

```
        count
        80256

        unique
        109

        top
        GHCND:USW00094789

        freq
        4270
```

dtvpe: object

station_info.shape[0], weather.shape[0]

```
→ (262, 80256)
```

def grc(*dfs):

return [df.shape[0] for df in dfs]
grc(station_info, weather)

→ [262, 80256]

def getinf(attr, *dfs):

return list(map(lambda x: getattr(x, attr), dfs))
getinf('shape', station_info,weather)

∃ [(262, 5), (80256, 5)]

injoin = weather.merge(station_info,left_on='station', right_on='id')
injoin.sample(5, random_state=0)

$\overline{\Rightarrow}$		attributes	datatype	date	station	value	id	name	latitude	longitude	elevati
	27422	,,W,	WDF5	2018-04- 29T00:00:00	GHCND:USW00094741	310.0	GHCND:USW00094741	TETERBORO AIRPORT, NJ US	40.85000	-74.06139	2
	19317	,,W,	WSF5	2018-03- 24T00:00:00	GHCND:USW00094728	8.5	GHCND:USW00094728	NY CITY CENTRAL PARK, NY US	40.77898	-73.96925	42
	13778	W.	PGTM	2018-03-	GHCND:USW00054743	2351.0	GHCND:USW00054743	CALDWELL ESSEX CO	40.87639	-74.28306	52 •

weather.merge(station_info.rename(dict(id='station'),axis=1),on='station').sample(5, random_state=0)

$\overline{\Rightarrow}$		attributes	datatype	date	station	value	name	latitude	longitude	elevation	
	27422	,,W,	WDF5	2018-04- 29T00:00:00	GHCND:USW00094741	310.0	TETERBORO AIRPORT, NJ US	40.85000	-74.06139	2.7	11.
	19317	,,W,	WSF5	2018-03- 24T00:00:00	GHCND:USW00094728	8.5	NY CITY CENTRAL PARK, NY US	40.77898	-73.96925	42.7	
	13778	,,W,	PGTM	2018-03- 01T00:00:00	GHCND:USW00054743	2351.0	CALDWELL ESSEX CO AIRPORT, NJ US	40.87639	-74.28306	52.7	
	4										>

left_join = station_info.merge(weather, left_on='id',right_on='station', how='left')
right_join = weather.merge(station_info, left_on='station',right_on='id', how='right')

right_join.tail()

→		attributes	datatype	date	station	value	id	name	latitude	longitude	elevatio
	80404	,,W,	WDF5	2018-12- 31T00:00:00	GHCND:USW00094789	130.0	GHCND:USW00094789	JFK INTERNATIONAL AIRPORT, NY US	40.6386	-73.7622	3.
	80405	,,W,	WSF2	2018-12- 31T00:00:00	GHCND:USW00094789	9.8	GHCND:USW00094789	JFK INTERNATIONAL AIRPORT, NY	40.6386	-73.7622	3.
	4							110			

```
left_join.sort_index(axis=1).sort_values(['date','station']).reset_index().drop(columns='index').equals(
    right_join.sort_index(axis=1).sort_values(['date','station']).reset_index().drop(columns='index')
₹
    True
getinf('shape', injoin, left_join, right_join)
outer_join = weather.merge(
   station_info[station_info.name.str.contains('NY')],
   left_on='station',right_on='id', how='outer', indicator=True
)
pd.concat([outer_join.sample(4, random_state=0),outer_join[outer_join.station.isna()].head(2)])
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             attributes datatype
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import sqlite3 as sq3
with sq3.connect('weather.db') as connection:
 station_info.to_sql('weather_stations', connection, if_exists='replace', index=False)
with sq3.connect('weather.db') as connection:
 inner_join_from_db = pd.read_sql('SELECT * FROM weather JOIN weather_stations ON weather.station == weather_stations.id', connection)
dirty_data = pd.read_csv('dirty_data2.csv', index_col='date').drop_duplicates().drop(columns='SNWD')
dirty_data.head()
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 Next steps: ( Generate code with dirty_data

    View recommended plots

                                                                       New interactive sheet
valid_station = dirty_data.query('station != "?"').copy().drop(columns=['WESF','station'])
sta_with_wesf = dirty_data.query('station == "?"').copy().drop(columns=['station', 'TOBS', 'TMIN', 'TMAX'])
valid_station.merge(sta_with_wesf, left_index=True, right_index=True).query('WESF>0').head()
```

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valid_station.merge(sta_with_wesf, left_index=True, right_index=True, suffixes = ('','_?')).query('WESF>0').head()
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valid_station.join(sta_with_wesf, rsuffix='_?').query('WESF >0').head()
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weather.set_index('station', inplace=True)
station_info.set_index('id', inplace=True)
weather.index.intersection(station_info.index)
     Index(['GHCND:US1CTFR0039', 'GHCND:US1NJBG0015', 'GHCND:US1NJBG0017',
              'GHCND:US1NJBG0018', 'GHCND:US1NJBG0023', 'GHCND:US1NJBG0030',
             'GHCND:US1NJBG0039', 'GHCND:US1NJBG0044', 'GHCND:US1NJES0018',
             'GHCND:US1NJES0024'
             'GHCND:US1NJMS0047', 'GHCND:US1NYSF0083', 'GHCND:US1NYNY0074', 'GHCND:US1NJPS0018', 'GHCND:US1NJBG0037', 'GHCND:USC00284987',
             'GHCND:US1NJES0031', 'GHCND:US1NJMD0086', 'GHCND:US1NJMS0097',
             'GHCND:US1NJMN0081'],
            dtype='object', length=109)
weather.index.difference(station_info.index)
Index([], dtype='object')
station_info.index.difference(weather.index)
    'GHCND:US1NJBG0011',
                                    'GHCND:US1NJBG0012', 'GHCND:US1NJBG0013',
             'GHCND:US1NJBG0020',
             'GHCND:USC00308322', 'GHCND:USC00308749', 'GHCND:USC00308946'
'GHCND:USC00309117', 'GHCND:USC00309270', 'GHCND:USC00309400'
                                                           'GHCND:USC00308946',
             'GHCND:USC00309466', 'GHCND:USC00309576', 'GHCND:USW00014708',
             'GHCND:USW00014786'],
            dtype='object', length=153)
```