climate_analysis

March 6, 2018

0.1 Climate Analysis and Exploration

```
In [11]: # Dependencies
         import sqlalchemy
         from sqlalchemy.ext.automap import automap_base
         from sqlalchemy.orm import Session
         from sqlalchemy import create_engine
```

```
In [12]: import pandas as pd
         import numpy as np
         import matplotlib.pyplot as plt
         import seaborn
```

```
In [13]: engine = create_engine("sqlite:///hawaii.sqlite")
```

```
In [14]: Base = automap_base()
         Base.prepare(engine, reflect=True)
         Base.classes.keys()
```

```
Out[14]: ['measurements', 'stations']
```

```
In [15]: # Store tables
         Measurements = Base.classes.measurements
         Stations = Base.classes.stations
```

- Design a query to retrieve the last 12 months of precipitation data.
- Select only the date and prcp values.
- Load the query results into a Pandas DataFrame and set the index to the date column.
- Plot the results using the DataFrame plot method.

```
In [16]: #create session
         session = Session(engine)
```

```
In [17]: #inspect measurement table
         precip_data = session.query(Measurements).first()
         precip_data.__dict__
```

```
Out[17]: {'_sa_instance_state': <sqlalchemy.orm.state.InstanceState at 0x1fde64ab550>,
          'date': datetime.date(2010, 1, 1),
          'meas_id': 1,
          'prcp': 0.08,
          'station': 'USC00519397',
          'tobs': 65.0}
```

```
In [18]: #dynamically creates dates from most recent date to a year before
         from datetime import datetime
         most_current = session.query(Measurements.date).order_by(Measurements.date.desc()).fi
         last_date = most_current[0]
         year_before = last_date.replace(year = (last_date.year - 1))
         year_before = year_before.strftime("%Y-%m-%d")
         year_before
```

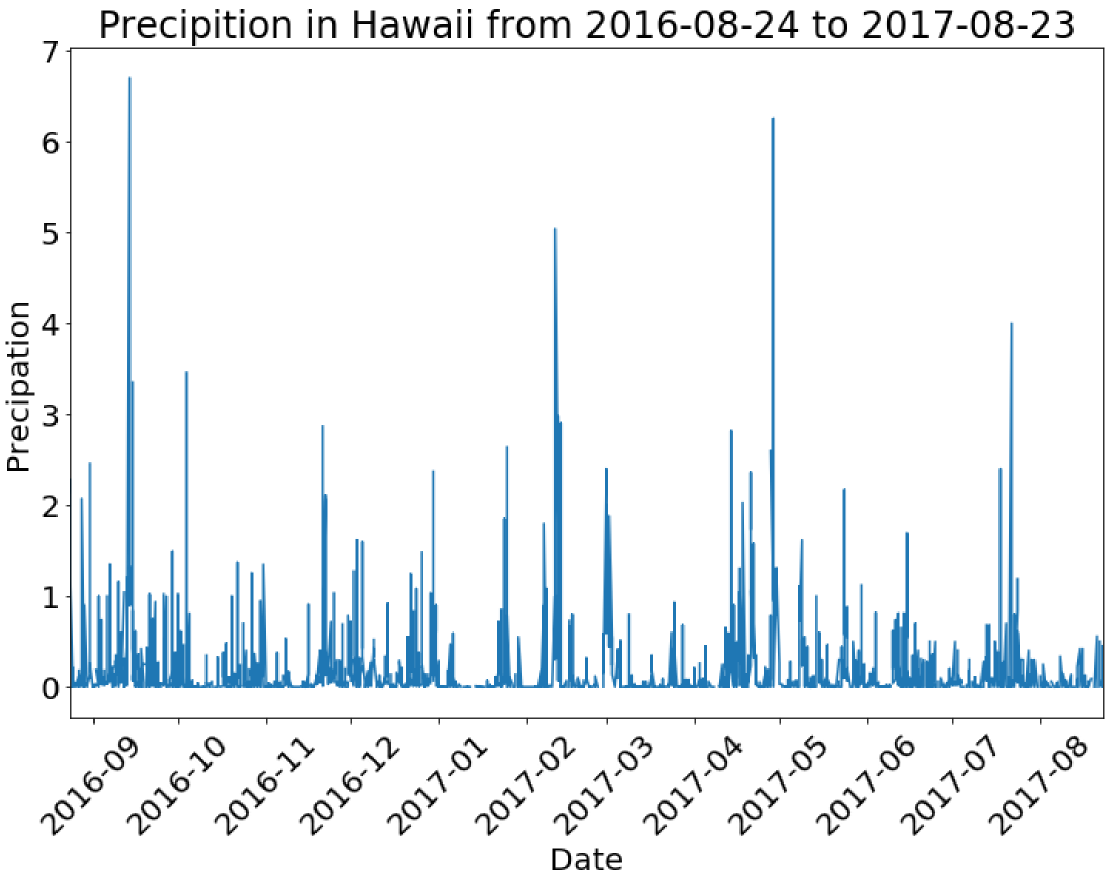
```
Out[18]: '2016-08-23'
```

```
In [19]: #query for precipitation data based on date range from most recent to a year before
         twelve_months = session.query(Measurements.date, Measurements.prcp).filter(Measuremen
         #create data frame from sql query
         twelve_months_prcp = pd.read_sql_query(twelve_months.statement, engine, index_col = 'd
```

```
In [20]: #inspect dataframe
         twelve_months_prcp.head()
```

```
Out[20]:             prcp
         date
         2016-08-24  0.08
         2016-08-25  0.08
         2016-08-26  0.00
         2016-08-27  0.00
         2016-08-28  0.01
```

```
In [21]: twelve_months_prcp.plot(figsize = (12, 8), rot = 45, fontsize=20, use_index = True, le
         plt.ylabel('Precipation', fontsize=20)
         plt.xlabel('Date', fontsize=20)
         plt.title("Precipition in Hawaii from %s to %s" % (twelve_months_prcp.index.min(),twel
         plt.show()
```



- Use Pandas to print the summary statistics for the precipitation data.

```
In [22]: twelve_months_prcp.describe()
```

```
Out[22]:              prcp
         count  2015.000000
         mean      0.176462
         std       0.460288
         min       0.000000
         25%       0.000000
         50%       0.020000
         75%       0.130000
         max       6.700000
```

0.2 Station Analysis

```
In [23]: #inspect station data
         station_data = session.query(Stations).first()
         station_data.__dict__
```

```
Out[23]: {'_sa_instance_state': <sqlalchemy.orm.state.InstanceState at 0x1fde64ec9e8>,
          'elevation': 3.0,
          'id': 1,
          'latitude': 21.2716,
          'longitude': -157.8168,
          'name': 'WAIKIKI 717.2, HI US',
          'station': 'USC00519397'}
```

```
In [24]: #get station count, has been checked with measurement station count
         from sqlalchemy import func
         num_stations = session.query(Stations.station).group_by(Stations.station).count()
```

```
In [25]: num_stations
```

```
Out[25]: 9
```

```
In [26]: #query tables to get count of daily report, all temp data is complete for each record
         #reflects a count of a station giving temp data, prcp data may or may not have been r
         activity = session.query(Stations.station, Stations.name, Measurements.station, func.
```

```
In [27]: activity
```

```
Out[27]: [('USC00519281', 'WAIHEE 837.5, HI US', 'USC00519281', 2772),
          ('USC00519397', 'WAIKIKI 717.2, HI US', 'USC00519397', 2724),
          ('USC00513117', 'KANEOHE 838.1, HI US', 'USC00513117', 2709),
          ('USC00519523', 'WAIMANALO EXPERIMENTAL FARM, HI US', 'USC00519523', 2669),
          ('USC00516128', 'MANOA LYON ARBO 785.2, HI US', 'USC00516128', 2612),
          ('USC00514830',
           'KUALOA RANCH HEADQUARTERS 886.9, HI US',
           'USC00514830',
           2202),
          ('USC00511918', 'HONOLULU OBSERVATORY 702.2, HI US', 'USC00511918', 1979),
          ('USC00517948', 'PEARL CITY, HI US', 'USC00517948', 1372),
          ('USC00518838', 'UPPER WAHIAWA 874.3, HI US', 'USC00518838', 511)]
```

Waihee 837.5 has the highest number of observations

```
In [28]: #most active station
         max_activity = activity[0][0:2]
         max_activity
```

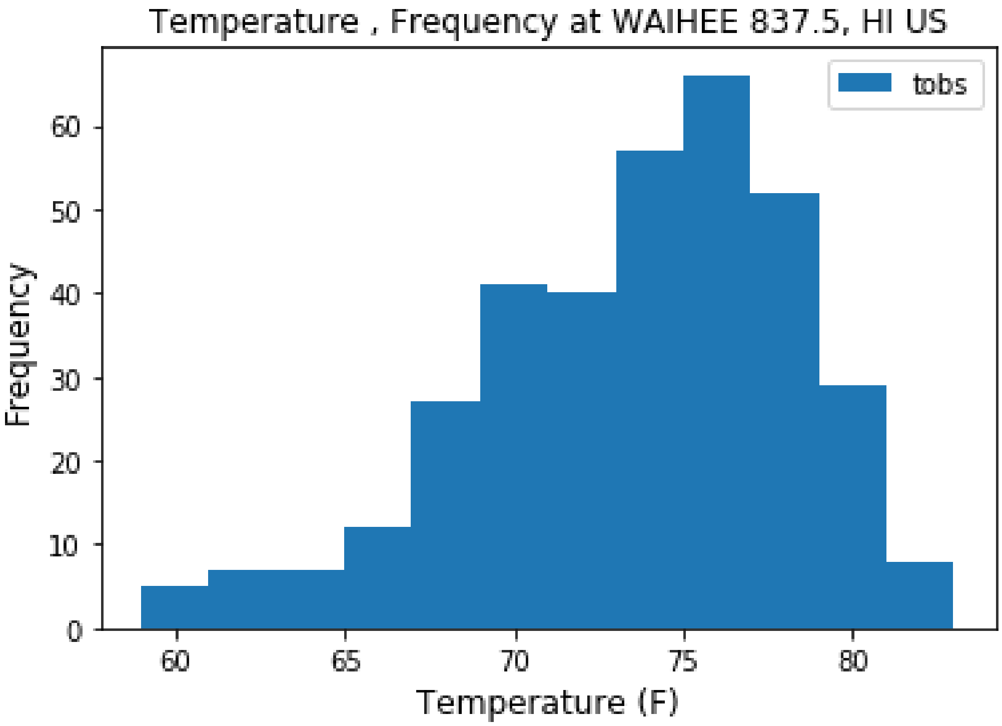
```
Out[28]: ('USC00519281', 'WAIHEE 837.5, HI US')
```

```
In [29]: # the number of reports from the most active station
         temps_maxact = session.query(Measurements.station, Measurements.tobs).filter(Measureme
```

```
In [30]: len(temps_maxact)
```

```
Out[30]: 351
```

```
In [31]: #list created from temperature data query from the most active station
         temps = [x[1] for x in temps_maxact]
         plt.hist(temps, bins=12)
         plt.xlabel("Temperature (F)",fontsize=12)
         plt.ylabel("Frequency", fontsize=12)
         plt.title("Temperature , Frequency at %s" % (max_activity[1]), fontsize=12)
         labels = ['tobs']
         plt.legend(labels)
         plt.show()
```



0.3 Temperature Analysis

- Write a function called calc_temps that will accept a start date and end date in the format %Y-%m-%d and return the minimum, average, and maximum temperatures for that range of dates.
- Use the calc_temps function to calculate the min, avg, and max temperatures for your trip using the matching dates from the previous year (i.e. use "2017-01-01" if your trip start date was "2018-01-01")
- Plot the min, avg, and max temperature from your previous query as a bar chart.
  - Use the average temperature as the bar height.
  - Use the peak-to-peak (tmax-tmin) value as the y error bar (yerr).

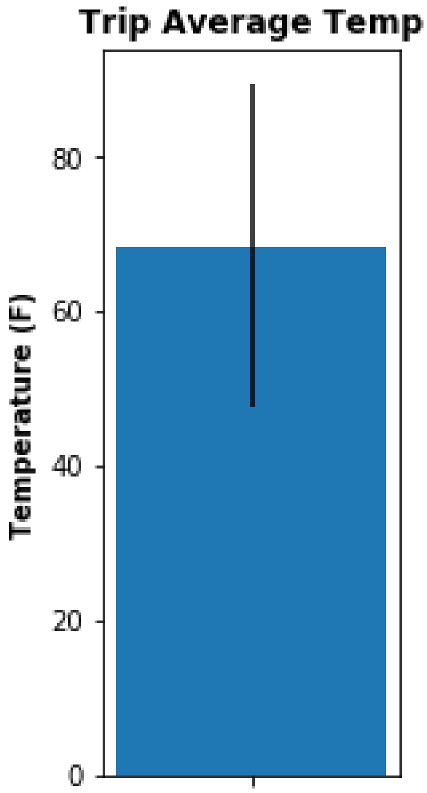
```
In [32]: def calc_temps(start_date, end_date):
             #create dates 1 year prior
             dates = [start_date, end_date]
             new_dates = []
             for date in dates:
                 date_list = date.split("-")
                 date_list[0] = str(int(date_list[0]) - 1)
                 new_date = "-".join(date_list)
                 new_dates.append(new_date)
             print(new_dates)

             #query database for temps from those dates
             temp_values = session.query(Measurements.tobs).filter(Measurements.date >= new_da
             temp_values_list = [x for (x,) in temp_values]
             avg_temp = np.mean(temp_values_list)
             max_temp = max(temp_values_list)
             min_temp = min(temp_values_list)

             # create bar graph
             plt.figure(figsize=(2,5))
             plt.title("Trip Average Temp", weight = "bold")
             plt.ylabel("Temperature (F)",weight = "bold")
             plt.bar(1, avg_temp, yerr = (max_temp - min_temp), tick_label = "")
             plt.show()
```

```
In [33]: calc_temps('2018-01-01', '2018-01-14')
```

```
['2017-01-01', '2017-01-14']
```



0.4 Optional Recommended Analysis

The following are optional challenge queries. These are highly recommended to attempt, but not required for the homework.

- Calcualte the rainfall per weather station using the previous year's matching dates.

Calculate the daily normals. Normals are the averages for min, avg, and max temperatures.

- Create a function called daily_normals that will calculate the daily normals for a specific date. This date string will be in the format %m-%d. Be sure to use all historic tobs that match that date string.
- Create a list of dates for your trip in the format %m-%d. Use the daily_normals function to calculate the normals for each date string and append the results to a list.
- Load the list of daily normals into a Pandas DataFrame and set the index equal to the date.
- Use Pandas to plot an area plot (stacked=False) for the daily normals.

```
In [44]: #query to return list of temps for each date
         def daily_normals(chosen_date):
             temps = session.query(Measurements.tobs).filter(Measurements.date.like('%'+chosen_
             obs = [x for (x), in temps]
             return obs

         start_date = '01-01'
         end_date = '01-07'

         #function to generate list of dates given any start and end date
         def create_date_list(start_date, end_date):
             start_month = start_date.split("-")[0]
             end_month = end_date.split("-")[0]

             start_day = int(start_date.split("-")[1])
             end_day = int(end_date.split("-")[1])

             if start_month == end_month:
                 diff = end_day - start_day
                 days = [start_day + x for x in range(0,diff + 1) ]

             else:
                 diff1 = 31 - start_day
                 days1 = [start_day + x for x in range(0,diff1 + 1)]
                 days2 = [x for x in range(1, end_day + 1)]
                 days = days1 + days2

             days_str = [('%s-%s' % (start_month, str(x))) if len(str(x)) == 2 else ('%s-0%s' %
             return days_str

         #uses functions above to return dictionary of normals, skips dates for which there is
         def query_results(start, end):
             dates = create_date_list(start, end)
             master_dict = {"Date": [], "T_max": [], "T_min": [], "T_avg": []}
             for date in dates:
                 data_list = []
                 observations = daily_normals(date)
                 if observations != []:
                     for temp in observations:
                         data_list.append(temp)
                     master_dict['Date'].append(date)
                     master_dict['T_max'].append(max(data_list))
                     master_dict['T_min'].append(min(data_list))
                     master_dict['T_avg'].append(round(np.mean(data_list),2))
                     master_dict
             return(master_dict)

         normals_df = pd.DataFrame(query_results('01-01', '01-07')).set_index('Date')
         normals_df
```

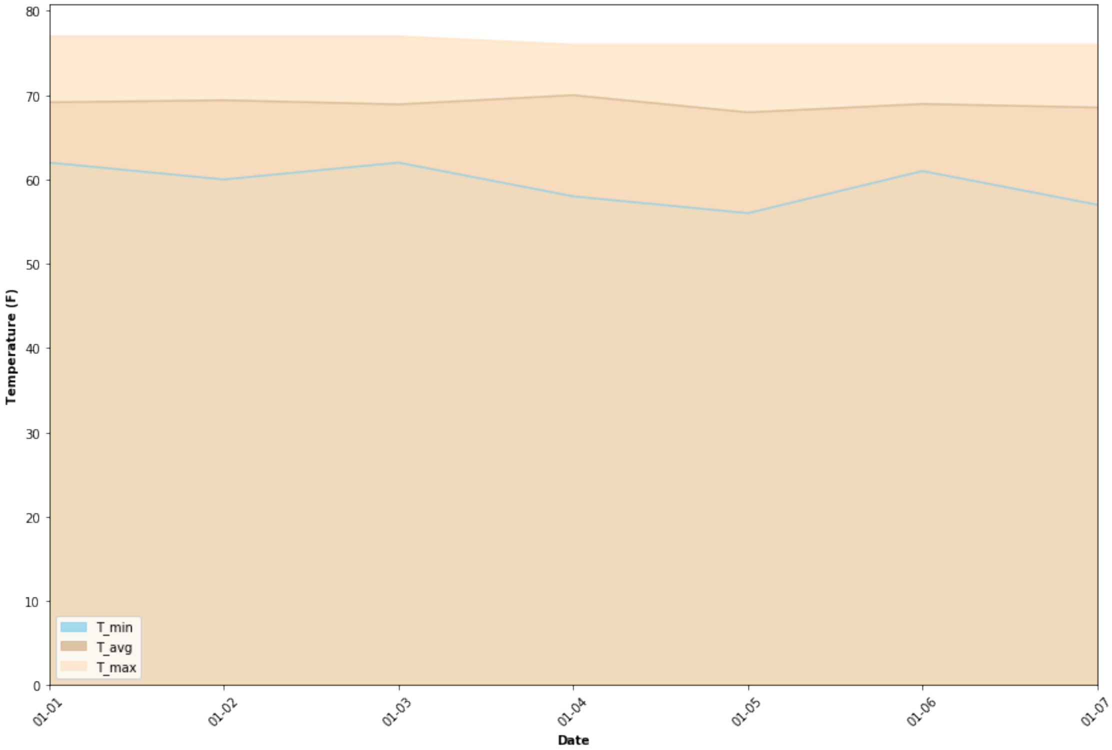
Out[44]:

```
        T_avg  T_max  T_min
```

```
Date
01-01  69.15   77.0   62.0
01-02  69.40   77.0   60.0
01-03  68.91   77.0   62.0
01-04  70.00   76.0   58.0
01-05  67.96   76.0   56.0
01-06  68.96   76.0   61.0
01-07  68.54   76.0   57.0
```

```
In [52]: normals_df = normals_df[['T_min', 'T_avg', 'T_max']]

         normals_df.plot(kind = 'area', stacked = False, alpha = .75, rot = 45, color = ['skyb
         plt.xlabel('Date', weight='bold')
         plt.ylabel('Temperature (F)', weight='bold')
         plt.legend(frameon = True)
         plt.show()
```


Temperature (F)
T_min
T_avg
T_max
Date