

```
In [4]: %matplotlib notebook
        from matplotlib import style
        style.use('fivethirtyeight')
        import matplotlib.pyplot as plt
```

```
In [ ]:
```

```
In [5]: import numpy as np
        import pandas as pd
        from sqlalchemy import func
        from sqlalchemy import desc
```

```
In [6]: import datetime as dt
```

```
In [3]: import os
        from flask import Flask
        from flask_sqlalchemy import SQLAlchemy
        import sqlalchemy
        from sqlalchemy.ext.automap import automap_base
        from sqlalchemy.orm import Session
        from sqlalchemy import create_engine, func
```

```
In [8]: import sqlalchemy
```

```
In [9]: engine = create_engine("sqlite:///hawaii.sqlite")
```

```
In [10]: # reflect an existing database into a new model
        Base = automap_base()
        # reflect the tables
        Base.prepare(engine, reflect=True)
```

```
In [11]: # We can view all of the classes that automap found
        Base.classes.keys()
```

```
Out[11]: ['measurement', 'station']
```

```
In [12]: # Save references to each table
        Measurement = Base.classes.measurement
        Station = Base.classes.station
```

```
In [13]: # Create our session (link) from Python to the DB
        session = Session(engine)
```

```
In [14]: # Calculate the date 1 year ago from today
        yearago=(dt.date.today() - dt.timedelta(days=365*2))
```

```
In [15]: yearago.strftime('%Y/%m/%d')
```

```
Out[15]: '2016/08/28'
```

```
In [16]: # Perform a query to retrieve the data and precipitation scores  
results = session.query(Measurement.date, Measurement.prcp).filter(Measurement
```

```
In [17]: # Save the query results as a Pandas DataFrame and set the index to the date  
df = pd.DataFrame(results)  
df.set_index('date')  
df.head()
```

Out[17]:

	date	prcp
0	2016-08-29	0.00
1	2016-08-30	0.00
2	2016-08-31	0.13
3	2016-09-01	0.00
4	2016-09-02	0.00

```
In [18]: #Sort the dataframe by date  
df.sort_values(by='date',ascending=False)
```

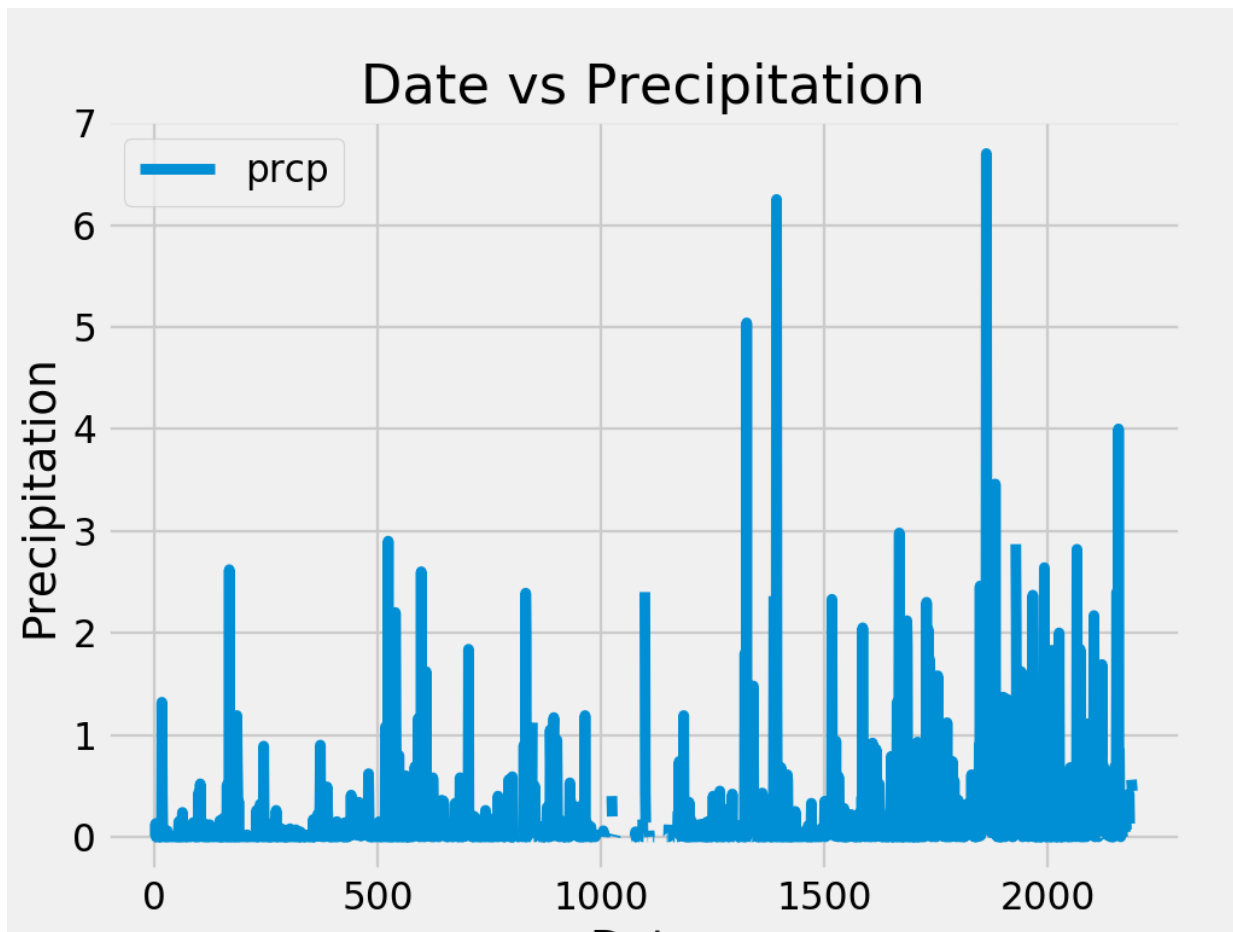
Out[18]:

	date	prcp
2190	2017-08-23	0.45
1500	2017-08-23	0.08
990	2017-08-23	0.00
354	2017-08-23	0.00
1499	2017-08-22	0.00
2189	2017-08-22	0.50
353	2017-08-22	0.00
2188	2017-08-21	0.56
989	2017-08-21	0.02
1498	2017-08-21	NaN
352	2017-08-21	0.00
988	2017-08-20	0.01
2187	2017-08-20	NaN
351	2017-08-20	0.00
2186	2017-08-19	0.09
1497	2017-08-19	NaN
350	2017-08-19	0.00
987	2017-08-19	0.00
986	2017-08-18	0.00
1846	2017-08-18	0.06
349	2017-08-18	0.00
2185	2017-08-18	NaN
1496	2017-08-17	0.05
985	2017-08-17	0.00
1845	2017-08-17	0.01
2184	2017-08-17	0.13
1495	2017-08-16	0.07
2183	2017-08-16	0.42
1844	2017-08-16	0.12
984	2017-08-16	0.00
...
359	2016-09-02	0.02

	date	prcp
1851	2016-09-02	0.03
1173	2016-09-02	NaN
4	2016-09-02	0.00
358	2016-09-01	0.00
694	2016-09-01	0.00
1850	2016-09-01	0.01
3	2016-09-01	0.00
1504	2016-09-01	0.02
994	2016-09-01	NaN
357	2016-08-31	0.10
1849	2016-08-31	2.46
1172	2016-08-31	0.25
1503	2016-08-31	0.24
2	2016-08-31	0.13
993	2016-08-31	NaN
693	2016-08-31	NaN
1	2016-08-30	0.00
1502	2016-08-30	0.00
356	2016-08-30	0.00
1848	2016-08-30	0.05
1171	2016-08-30	0.00
992	2016-08-30	0.02
692	2016-08-29	0.04
1501	2016-08-29	0.35
355	2016-08-29	0.17
1847	2016-08-29	0.90
1170	2016-08-29	0.00
991	2016-08-29	NaN
0	2016-08-29	0.00

2191 rows × 2 columns

```
In [81]: # Use Pandas Plotting with Matplotlib to plot the data
df.plot.line()
plt.title("Date vs Precipitation")
plt.ylabel("Precipitation")
plt.xlabel("Date")
fig.tight_layout()
plt.savefig("Trip_Date_pres.png")
plt.show()
```



```
In [20]: # Use Pandas to calculate the summary statistics for the precipitation data
df['prcp'].describe()
```

```
Out[20]: count      1985.000000
mean         0.172383
std          0.453252
min          0.000000
25%          0.000000
50%          0.020000
75%          0.130000
max          6.700000
Name: prcp, dtype: float64
```

```
In [21]: # How many stations are available in this dataset?
no_stations=session.query(Station.id).count()
no_stations
```

```
Out[21]: 9
```

```
In [22]: # What are the most active stations?
# List the stations and the counts in descending order.
r1=session.query(Measurement.station, func.count(Measurement.tobs)).group_by(
r1
```

```
Out[22]: [('USC00519281', 2772),
('USC00519397', 2724),
('USC00513117', 2709),
('USC00519523', 2669),
('USC00516128', 2612),
('USC00514830', 2202),
('USC00511918', 1979),
('USC00517948', 1372),
('USC00518838', 511)]
```

```
In [23]: # Using the station id from the previous query, calculate the lowest temperature,
# highest temperature recorded, and average temperature most active station.
st_id=r1[0][0]
minmaxavg=session.query(
    func.min(Measurement.tobs).label("min_temperature"),
    func.max(Measurement.tobs).label("max_temperature"),
    func.avg(Measurement.tobs).label("avg_temperature")
).filter(Measurement.station==st_id).one()
minmaxavg
```

```
Out[23]: (54.0, 85.0, 71.66378066378067)
```

```
In [24]: # Choose the station with the highest number of temperature observations.
# Query the last 12 months of temperature observation data for this station.
tem= session.query(Measurement.date,Measurement.tobs).filter(Measurement.station==st_id)
tem
```

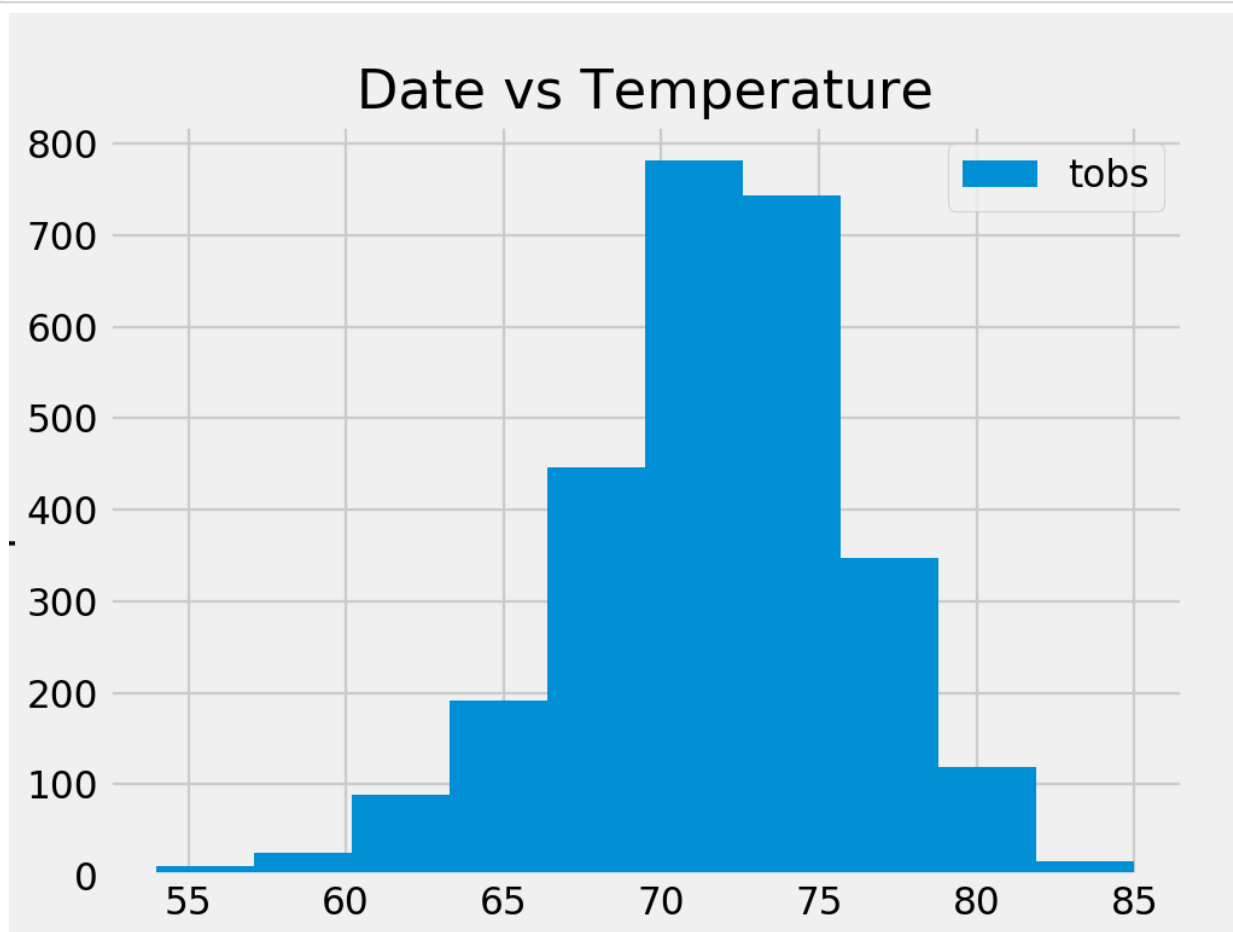
```
Out[24]: [('2010-01-01', 70.0),
('2010-01-02', 62.0),
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('2010-12-31', 67.0)]
```

```
In [25]: df2=pd.DataFrame(tem)
df2.head()
```

Out[25]:

	date	tobs
0	2010-01-01	70.0
1	2010-01-02	62.0
2	2010-01-03	74.0
3	2010-01-04	75.0
4	2010-01-05	74.0

```
In [80]: df2.plot.hist()
plt.title("Date vs Temperature")
plt.ylabel("Temperature")
plt.xlabel("Date")
plt.savefig("Date_vs_temp.png")
plt.show()
```



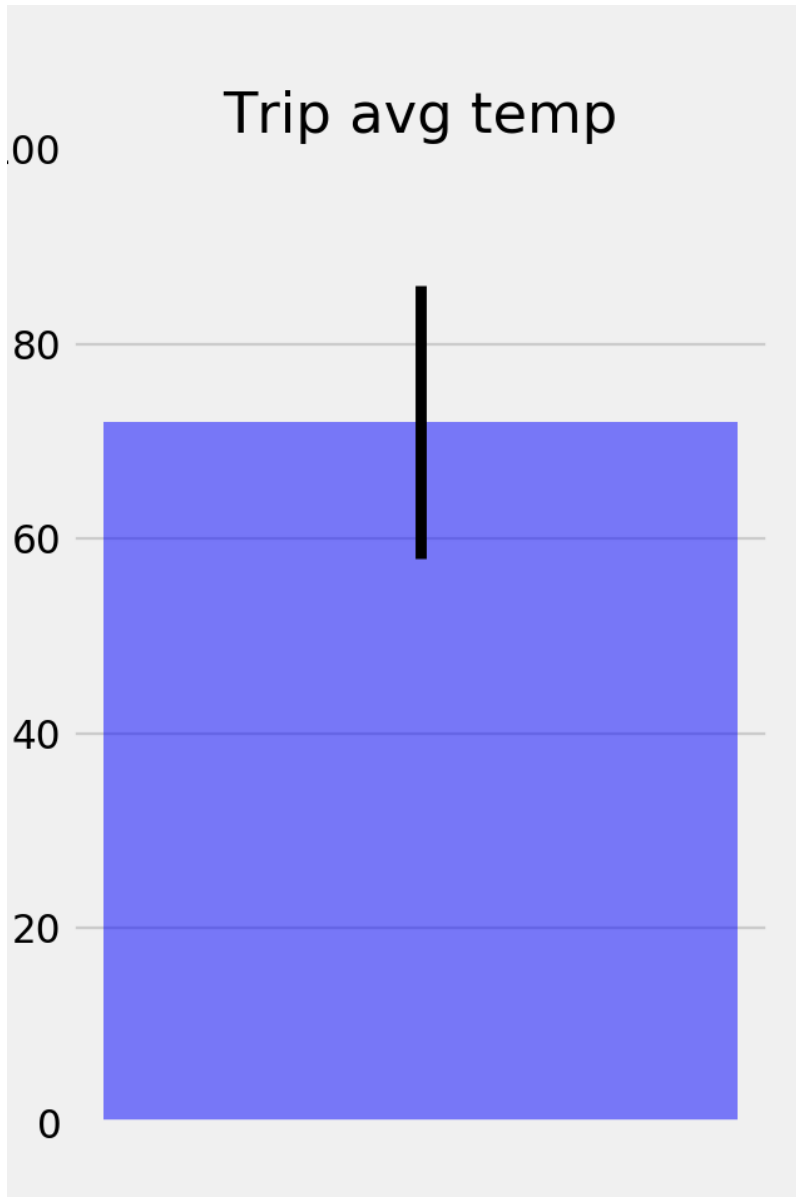
```
In [29]: # Write a function called `calc_temps` that will accept start date and end date  
# and return the minimum, average, and maximum temperatures for that range of dates  
  
def calc_temps(session, start_date, end_date):  
    return session.query(  
        func.min(Measurement.tobs),  
        func.avg(Measurement.tobs),  
        func.max(Measurement.tobs)  
    ).filter(  
        Measurement.date >= start_date  
    ).filter(  
        Measurement.date <= end_date  
    ).all()
```

```
In [75]: # Use your previous function `calc_temps` to calculate the tmin, tavg, and tmax  
# for your trip using the previous year's data for those same dates.  
x = calc_temps(session, '2017-02-28', '2017-03-05')  
x
```

```
Out[75]: [(64.0, 72.02777777777777, 78.0)]
```



```
In [76]: # Plot the results from your previous query as a bar chart.  
# Use "Trip Avg Temp" as your Title  
# Use the average temperature for the y value  
# Use the peak-to-peak (tmax-tmin) value as the y error bar (yerr)  
plt.figure(figsize=(4,6))  
plt.bar(1,height=x[0][1],yerr=x[0][2]-x[0][0],width=0.0001, alpha=0.5,color=  
plt.title("Trip avg temp")  
plt.xticks([])  
plt.ylim(0,100)  
plt.ylabel("Temp(F)")  
plt.savefig("Trip_avg_tem.png")  
plt.show()
```



```
In [77]: # Calculate the rainfall per weather station for your trip dates using the
# Sort this in descending order by precipitation amount and list the station
session.query(Station.station, Station.name, Station.latitude, Station.longi
```

```
Out[77]: [('USC00516128',
'MANOA LYON ARBO 785.2, HI US',
21.3331,
-157.8025,
152.4,
42.480000000000004),
('USC00516128',
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21.3331,
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152.4,
40.05),
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-157.8025,
152.4,
36.629999999999995),
('USC00516128',
'MANOA LYON ARBO 785.2, HI US',
21.3331,
-157.8025,
152.4,
26.8200000000000014),
('USC00516128',
'MANOA LYON ARBO 785.2, HI US',
21.3331,
-157.8025,
152.4,
24.660000000000004),
('USC00516128',
'MANOA LYON ARBO 785.2, HI US',
21.3331,
-157.8025,
152.4,
20.880000000000003),
('USC00516128',
'MANOA LYON ARBO 785.2, HI US',
21.3331,
-157.8025,
152.4,
10.440000000000001)]
```

In [16]: *#Now that you have completed your initial analysis, design a Flask API based*

```
app = Flask(__name__)

@app.route("/api/v1.0/precipitation")
def prcps():
    prcp_results = session.query(Measurement.date, Measurement.prcp).all()
    prcp_dict={}
    for prcp in prcp_results:
        dates=prcp.date
        precipitation=prcp.prcp
        prcp_dict.update({dates:precipitation})
    return jsonify(prcp_dict)

@app.route("/api/v1.0/stations")
def stations():
    station_results = session.query(Station.station).all()
    all_stations = list(np.ravel(station_results))
    return jsonify(all_stations)

@app.route("/api/v1.0/tobs")
def tobs():
    tob_results = session.query(Measurement.tobs).filter(Measurement.date >=
all_tobs = list(np.ravel(tob_results))
    return jsonify(all_tobs)

@app.route("/api/v1.0/start/<start>")
def start(start):
    results = pd.DataFrame(session.query(Measurement.date, Measurement.tobs)
    return jsonify(
        {'min temp': results['tobs'].min(),
        'ave temp': results['tobs'].mean(),
        'max temp': results['tobs'].max()})

@app.route("/api/v1.0/start_end/<start>/<end>")
def start_end(start,end):
    combine_results = pd.DataFrame(session.query(Measurement.date, Measureme
    return jsonify({'min temp': combine_results['tobs'].min(),
        'ave temp': combine_results['tobs'].mean(),
        'max temp': combine_results['tobs'].max()})
```