# Exploratory Data Analysis

Understanding your data

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# Exploratory Data Analysis

- Understanding data
- Spotting patterns & relations
- Can be enough
- *“Double-check the Machine Learning”*

# Jupyter notebooks

- Interactive (python) shell
- Browser based
- Code, story & charts

**This is a markdown cell used for documenation**

The above cell was written as: "### This is a markdown cell", followed by Shift+Enter

In [12]:
```
import math
print "This is a code cell... and Pi is = ", math.pi
```

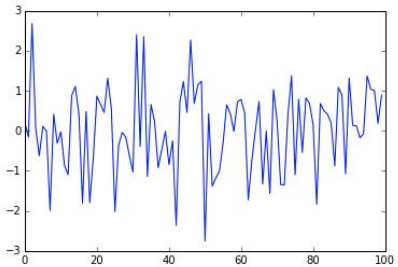
```
This is a code cell... and Pi is =  3.14159265359
```

In [13]:
```
# to enable inline graphs, etc.
%pylab inline

plot(randn(100))
```

```
Populating the interactive namespace from numpy and matplotlib
```

Out[13]:
```
[<matplotlib.lines.Line2D at 0x7fe2a2496cd0>]
```



# Pandas - Data processing

Pandas cheat sheet

- Load, show data
- Concat, join dataframes
- Filter, sort rows
- Summarize data
- Apply functions, calculations
- Create/drop columns
- Group by, aggregate

# Pandas - Data processing

In [1]:
```
import pandas as pd

from matplotlib import pyplot as plt
%matplotlib inline
```

First we load the weather data:

In [2]:
```
df_weather = pd.read_csv('weather.csv', index_col='Date', parse_dates=['Date'])
df_weather.head()
```

Out[2]:

| | Max_Temperature_F | Mean_Temperature_F | Min_TemperatureF | Max_Dew_Point_F | MeanDew_Point_F | Mi |
|---|---|---|---|---|---|---|
| **Date** | | | | | | |
| **2014-10-13** | 71 | 62.0 | 54 | 55 | 51 | 46 |
| **2014-10-14** | 63 | 59.0 | 55 | 52 | 51 | 50 |
| **2014-10-15** | 62 | 58.0 | 54 | 53 | 50 | 46 |
| **2014-10-16** | 71 | 61.0 | 52 | 49 | 46 | 42 |
| **2014-10-17** | 64 | 60.0 | 57 | 55 | 51 | 41 |

# Pandas - Data processing

```
In [6]: df['Mean_Temperature_F'].count()
Out[6]: 688

In [7]: df['Mean_Temperature_F'].min()
Out[7]: 33.0

In [8]: df['Mean_Temperature_F'].max()
Out[8]: 83.0

In [9]: df['Mean_Temperature_F'].describe()
Out[9]: count    688.000000
        mean      56.584302
        std       10.408058
        min       33.000000
        25%       48.000000
        50%       56.000000
        75%       65.000000
        max       83.000000
        Name: Mean_Temperature_F, dtype: float64
```

# Pandas - Data processing

In [8]:
```
df['Month'] = df.index.map(lambda x: x.month)

quarters = { 1: 'Q1', 2: 'Q1', 3: 'Q1', 4: 'Q2', 5: 'Q2', 6: 'Q2',
             7: 'Q3', 8: 'Q3', 9: 'Q3', 10: 'Q4', 11: 'Q4', 12: 'Q4' }

df['Quarter'] = df['Month'].apply(lambda x: quarters[x])
```

# Pandas - Data processing

```
In [9]: df.groupby('Quarter')['Mean_Temperature_F'].mean()
```

```
Out[9]: Quarter
        Q1    48.488889
        Q2    60.851648
        Q3    68.461039
        Q4    49.906977
        Name: Mean_Temperature_F, dtype: float64
```

```
In [10]: df.groupby('Quarter')['Precipitation_In'].mean()
```

```
Out[10]: Quarter
         Q1    0.155967
         Q2    0.031209
         Q3    0.020195
         Q4    0.205640
         Name: Precipitation_In, dtype: float64
```

# Pandas - Data processing

```
In [11]: df[df['Quarter'] == 'Q1']['Precipitation_In'].mean()
```

```
Out[11]: 0.1559668508287293
```

```
In [12]: df[df['Quarter'] == 'Q4'].groupby('Month')['Mean_Temperature_F'].mean()
```

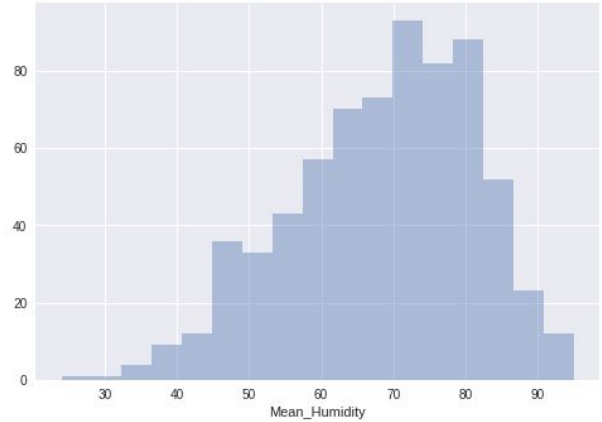
```
Out[12]: Month
         10    58.840000
         11    46.800000
         12    45.709677
         Name: Mean_Temperature_F, dtype: float64
```

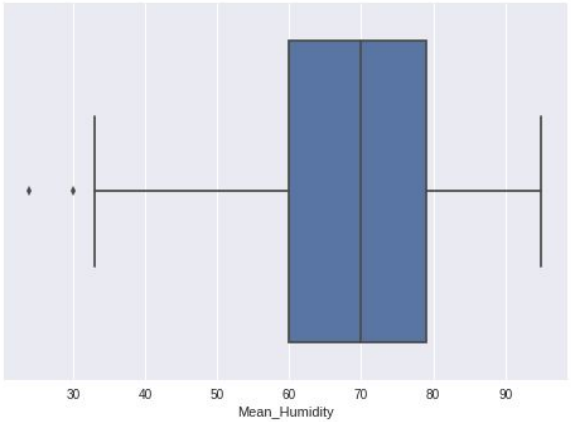
# Pandas - Summary

- Load & manipulate data
- Understand data
  - Individual variables
    - Types (numerical, categorical)
    - Range
    - Distribution shape
  - Relations
    - Grouping
    - Correlation

# Seaborn - Data Visualization

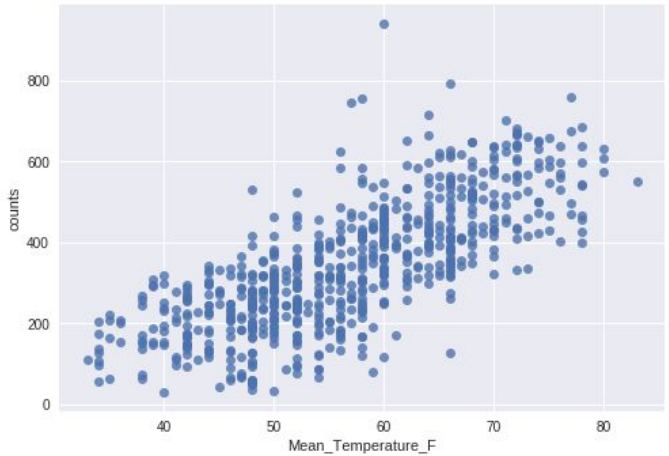
- Plot one variable
  - Histogram & boxplot

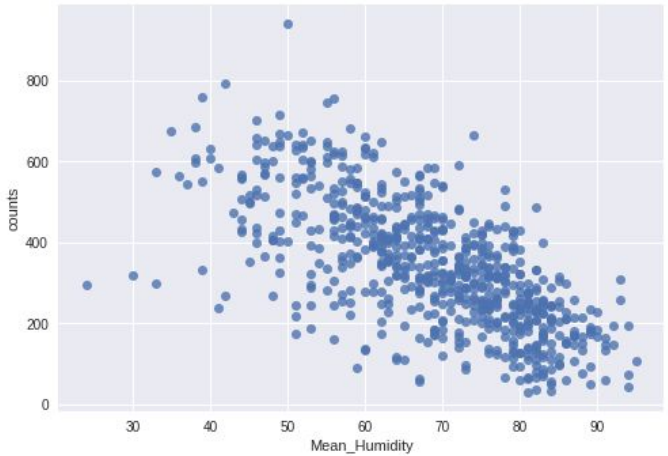


# Seaborn - Data Visualization

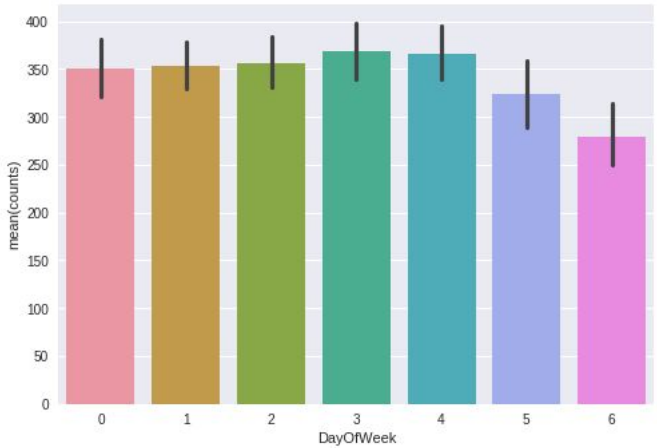
- Plot relations between (numerical) variables
  - Scatterplot

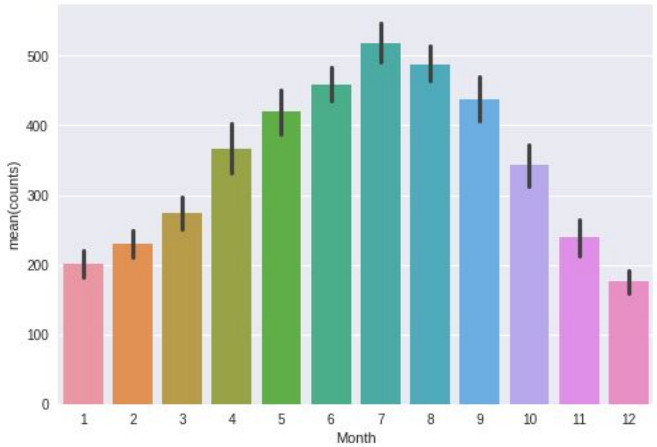


# Seaborn - Data Visualization

- Plot relations between (categorical) variables
  - Barplots



# Seaborn - Summary

- Visualize & understand data
  - Individual variables
  - Relations

# Example

- Data Analysis Titanic Survivors

# Hackathon

- Dataset: Cycle sharing

- Understand the data
- Find some research questions
  - Popular weekdays of stations (any differences?)
  - Popular stations (Why?)
  - Trends in station usage?
  - Be creative!
- See if data supports your ideas

# Questions ?

- Let’s start hacking !

# Advanced topics

- 3D plot of multi-variable relations ?
- Geo visualization: Plotting on a map ?
- Be creative !