

# KEY\_Lesson15\_Basic\_Stats\_II

August 15, 2019

## 1 Introduction to Statistics Part II

Now that we have learned how to use the mean and median, we'll talk about some more advanced statistics.

```
[1]: # import pandas and numpy
import numpy as np
import pandas as pd
# mount Google Drive
from google.colab import drive
drive.mount('/content/gdrive')
path = '/content/gdrive/My Drive/SummerExperience-master/'
```

Drive already mounted at /content/gdrive; to attempt to forcibly remount, call drive.mount("/content/gdrive", force\_remount=True).

### 1.1 Count Statistics

*Count variables* are variables which represent the number of events that occur of a specific category. This can be anything, like the number of dogs in a park or how many people went to a concert. For both of these examples, each of the counts must be *whole numbers*, i.e. `int` data type.

Run the cell below to load a listing of the weather in Detroit for every day since 1950:

```
[0]: data_table = pd.read_csv(path + 'SampleData/detroit_weather.csv') # Data from ↵
↵Mathematica WeatherData, 2019
```

Take a look at the contents of `data_table`:

```
[3]: # Run head on data_table to look at its contents
data_table.head(10)
```

```
[3]: Unnamed: 0  YEAR  MONTH  DAY  Rain  Snow
0           0  1950      1    1   True  False
1           1  1950      1    2   True  False
2           2  1950      1    3   True  False
3           3  1950      1    4   True   True
4           4  1950      1    5  False  False
```

5	5	1950	1	6	False	True
6	6	1950	1	7	False	True
7	7	1950	1	8	False	True
8	8	1950	1	9	False	False
9	9	1950	1	10	True	False

```
[4]: # Run tail on data_table to look at its contents
data_table.tail(10)
```

```
[4]:      Unnamed: 0  YEAR  MONTH  DAY  Rain  Snow
25304      25304  2019      4   22  False  False
25305      25305  2019      4   23  False  False
25306      25306  2019      4   24  False  False
25307      25307  2019      4   25  False  False
25308      25308  2019      4   26   True  False
25309      25309  2019      4   27  False  False
25310      25310  2019      4   28   True  False
25311      25311  2019      4   29  False  False
25312      25312  2019      4   30   True  False
25313      25313  2019      5    1   True  False
```

This table contains if it was snowing and if it was raining for each day in Detroit since 1950. We will use this as an example dataset.

```
[5]: # Lookup the weather for May 1, 2019:
data_table.query('YEAR == 2019 and MONTH == 5 and DAY == 1')
```

```
[5]:      Unnamed: 0  YEAR  MONTH  DAY  Rain  Snow
25313      25313  2019      5    1   True  False
```

```
[6]: # another way to do the same thing is chain together multiple calls to query
data_table.query('YEAR == 2019').query('MONTH == 5').query('DAY == 1')
```

```
[6]:      Unnamed: 0  YEAR  MONTH  DAY  Rain  Snow
25313      25313  2019      5    1   True  False
```

As we can see, it was raining, but not snowing that day!

Now, let's create some count statistics! To do this, we will use the **Counter module** from the **collections package**. Let's import it!

```
[0]: # Import the Counter class from collections to help us do the counting

from collections import Counter
```

**Counter** summarizes any **list** with the counts of all its unique variables:

```
[8]: # Create a list and count it using Counter
Counter([1,1,1,1,1,2,2,2,2,2])
```

```
[8]: Counter({1: 5, 2: 5})
```

Now, let's count the weather data!

```
[9]: # Count how many days it has snowed in Detroit since 1950:
snow_days = Counter(data_table["Snow"])
snow_days
```

```
[9]: Counter({False: 21079, True: 4235})
```

It looks like it has snowed 4,235 days in that time period, that is a lot!

This `Counter` variable functions a lot like a dictionary object - we haven't talked about this data type in this course, but essentially its a way of mapping **keys** to **values**. We can access the **values** associated with each **key** in a similar way that we index lists. For example, if we wanted to get the total number of snow days in our data set:

```
[10]: snow_days[True]
```

```
[10]: 4235
```

Let's break this down a little more granularly. How are these 4235 total snow days distributed across our 12 months?

```
[11]: # Count how many days *per month* it has snowed since 1950:
snow_days_by_month = Counter(data_table.query('Snow')['MONTH'])
print(snow_days_by_month)
```

```
Counter({1: 1110, 12: 933, 2: 903, 3: 648, 11: 369, 4: 227, 10: 34, 5: 10, 8: 1})
```

What about the days that is *has not* snowed per month?

```
[12]: # How many days *per month* has it NOT snowed since 1950?
not_snow_days_by_month = Counter(data_table.query('not Snow')['MONTH'])
print(not_snow_days_by_month)
```

```
Counter({7: 2139, 8: 2137, 5: 2130, 10: 2105, 6: 2070, 9: 2069, 4: 1873, 11: 1701, 3: 1522, 12: 1199, 2: 1074, 1: 1060})
```

## 1.2 Percentages

A *percentage* is a number between 0 and 1 which represents the fraction of a given variable that meets a given condition. i.e. if there are 28 dogs and 45 cats at the humane society, the percentage of adoptable animals that are dogs is:

```
[13]: 28/(28 + 45)
```

```
[13]: 0.3835616438356164
```

First, let's calculate the percentage of all days since 1950 that have been snow days using the variable `snow_days` from above.

```
[14]: snow_days[True]/(snow_days[True]+snow_days[False])
```

```
[14]: 0.16729872797661374
```

Now, let's calculate the percent of January days that have had snow since 1950. To do this, we first need the total number of January days since 1950.

```
[15]: # How many days TOTAL have there been in each month since 1950?

days_by_month = Counter(data_table["MONTH"])
print(days_by_month)
```

```
Counter({1: 2170, 3: 2170, 5: 2140, 7: 2139, 10: 2139, 8: 2138, 12: 2132, 4: 2100, 6: 2070, 11: 2070, 9: 2069, 2: 1977})
```

Now let's use the `snow_days_by_month` and `days_by_month` variables to isolate the **values** associated with the **key** for January to calculate the percentage.

```
[16]: # Find the percentage of days in January where it snowed:

snow_days_by_month[1] / days_by_month[1]
```

```
[16]: 0.511520737327189
```

A percentage of 51% means that half the January days since 1950 have seen snowfall.

Now let's do the same for June.

```
[17]: # Now do the same for June:

snow_days_by_month[6] / days_by_month[6]
```

```
[17]: 0.0
```

It shouldn't come as much surprise that it doesn't snow much in summer!

In this lesson you learned how to:

- Calculate count statistics using data from `pandas`
- Calculate percentages from count statistics

Now, lets continue to practice with your partner!