Week 4

February 25, 2020

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*You are currently looking at **version 1.0** of this notebook. To download notebooks and datafiles, as well as get help on Jupyter notebooks in the Coursera platform, visit the Jupyter Notebook FAQ course resource.*

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1 Distributions in Pandas

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

In [2]: np.random.binomial(1, 0.5)

Out[2]: 1

In [3]: np.random.binomial(1000, 0.5)/1000

Out[3]: 0.495

In [4]: chance_of_tornado = 0.01/100
        np.random.binomial(100000, chance_of_tornado)

Out[4]: 14

In [5]: chance_of_tornado = 0.01

        tornado_events = np.random.binomial(1, chance_of_tornado, 1000000)

        two_days_in_a_row = 0
        for j in range(1,len(tornado_events)-1):
            if tornado_events[j]==1 and tornado_events[j-1]==1:
                two_days_in_a_row+=1

        print('{} tornadoes back to back in {} years'.format(two_days_in_a_row, 1000000/365))
```

```
89 tornadoes back to back in 2739.72602739726 years
```

```
In [6]: np.random.uniform(0, 1)
```

```
Out[6]: 0.839300193806948
```

```
In [7]: np.random.normal(0.75)
```

```
Out[7]: 1.1905140721690968
```

Formula for standard deviation

$$\sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \overline{x})^2}$$

```
In [8]: distribution = np.random.normal(0.75,size=1000)

        np.sqrt(np.sum((np.mean(distribution)-distribution)**2)/len(distribution))
```

```
Out[8]: 1.0118041345959743
```

```
In [9]: np.std(distribution)
```

```
Out[9]: 1.0118041345959743
```

```
In [10]: import scipy.stats as stats
         stats.kurtosis(distribution)
```

```
Out[10]: -0.1822190122427556
```

```
In [11]: stats.skew(distribution)
```

```
Out[11]: -0.07170238578696578
```

```
In [12]: chi_squared_df2 = np.random.chisquare(2, size=10000)
         stats.skew(chi_squared_df2)
```

```
Out[12]: 1.9029936498269509
```

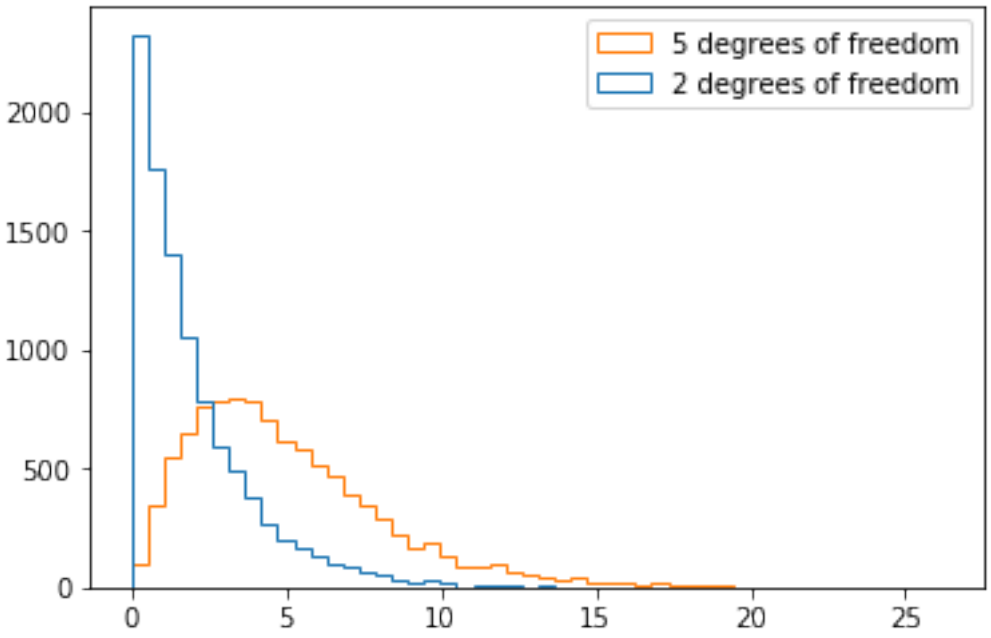
```
In [13]: chi_squared_df5 = np.random.chisquare(5, size=10000)
         stats.skew(chi_squared_df5)
```

```
Out[13]: 1.2738637899865035
```

```
In [14]: %matplotlib inline
         import matplotlib
         import matplotlib.pyplot as plt

         output = plt.hist([chi_squared_df2,chi_squared_df5], bins=50, histtype='step',
                           label=['2 degrees of freedom','5 degrees of freedom'])
         plt.legend(loc='upper right')
```

```
Out[14]: <matplotlib.legend.Legend at 0x7ffac3b59c50>
```



2 Hypothesis Testing

```
In [15]: df = pd.read_csv('grades.csv')

In [16]: df.head()
```

Out[16]:

	student_id	assignment1_grade	assignment1_submission	assignment2_grade	assignment2_submission	assignment3_grade
0	B73F2C11-70F0-E37D-8B10-1D20AFED50B1	92.733946	2015-11-02 06:55:34.282000000	83.030552	2015-11-09 02:22:58.938000000	67.164441
1	98A0FAE0-A19A-13D2-4BB5-CFBFD94031D1	86.790821	2015-11-29 14:57:44.429000000	86.290821	2015-12-06 17:41:18.449000000	69.772657
2	D0F62040-CEB0-904C-F563-2F8620916C4E	85.512541	2016-01-09 05:36:02.389000000	85.512541	2016-01-09 06:39:44.416000000	68.410033
3	FFDF2B2C-F514-EF7F-6538-A6A53518E9DC	86.030665	2016-04-30 06:50:39.801000000	68.824532	2016-04-30 17:20:38.727000000	61.942079
4	5ECBEEB6-F1CE-80AE-3164-E45E99473FB4	64.813800	2015-12-13 17:06:10.750000000	51.491040		

```
4  2015-12-14 12:25:12.056000000          41.932832

          assignment3_submission  assignment4_grade  \
0  2015-11-12 08:58:33.998000000          53.011553
1  2015-12-10 08:54:55.904000000          55.098125
2  2016-01-15 20:22:45.882000000          54.728026
3  2016-05-12 07:47:16.326000000          49.553663
4  2015-12-29 14:25:22.594000000          36.929549

          assignment4_submission  assignment5_grade  \
0  2015-11-16 01:21:24.663000000          47.710398
1  2015-12-13 17:32:30.941000000          49.588313
2  2016-01-11 12:41:50.749000000          49.255224
3  2016-05-07 16:09:20.485000000          49.553663
4  2015-12-28 01:29:55.901000000          33.236594

          assignment5_submission  assignment6_grade  \
0  2015-11-20 13:24:59.692000000          38.168318
1  2015-12-19 23:26:39.285000000          44.629482
2  2016-01-11 17:31:12.489000000          44.329701
3  2016-05-24 12:51:18.016000000          44.598297
4  2015-12-29 14:46:06.628000000          33.236594

          assignment6_submission
0  2015-11-22 18:31:15.934000000
1  2015-12-21 17:07:24.275000000
2  2016-01-17 16:24:42.765000000
3  2016-05-26 08:09:12.058000000
4  2016-01-05 01:06:59.546000000
```

```
In [17]: len(df)
```

```
Out[17]: 2315
```

```
In [18]: early = df[df['assignment1_submission'] <= '2015-12-31']
         late = df[df['assignment1_submission'] > '2015-12-31']
```

```
In [19]: early.mean()
```

```
Out[19]: assignment1_grade    74.972741
         assignment2_grade    67.252190
         assignment3_grade    61.129050
         assignment4_grade    54.157620
         assignment5_grade    48.634643
         assignment6_grade    43.838980
         dtype: float64
```

```
In [20]: late.mean()
```

```
Out[20]: assignment1_grade    74.017429
         assignment2_grade    66.370822
         assignment3_grade    60.023244
         assignment4_grade    54.058138
         assignment5_grade    48.599402
         assignment6_grade    43.844384
         dtype: float64

In [21]: from scipy import stats
         stats.ttest_ind?

In [22]: stats.ttest_ind(early['assignment1_grade'], late['assignment1_grade'])

Out[22]: Ttest_indResult(statistic=1.400549944897566, pvalue=0.16148283016060577)

In [23]: stats.ttest_ind(early['assignment2_grade'], late['assignment2_grade'])

Out[23]: Ttest_indResult(statistic=1.3239868220912567, pvalue=0.18563824610067967)

In [24]: stats.ttest_ind(early['assignment3_grade'], late['assignment3_grade'])

Out[24]: Ttest_indResult(statistic=1.7116160037010733, pvalue=0.087101516341556676)
```