Week 4

March 12, 2017

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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 [9]: np.random.binomial(1, 0.5)
```

```
Out[9]: 0
```

```
In [16]: x = np.random.binomial(20, .5, 10000)
         print((x>=15).mean())
```

```
0.0225
```

```
In [11]: np.random.binomial(1000, 0.5)/1000
```

```
Out[11]: 0.474
```

```
In [20]: chance_of_tornado = 0.01/100
         np.random.binomial(100000, chance_of_tornado)
```

```
Out[20]: 11
```

```
In [29]: 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, ir
```

```
109 tornadoes back to back in 2739 years
```

```
In [49]: np.random.uniform(0,1)
```

```
Out[49]: 0.6731137240902735
```

```
In [58]: np.random.normal(0.75)
```

```
Out[58]: 2.1760438859878892
```

Formula for standard deviation

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

```
In [72]: distribution = np.random.normal(0.75,size=1000)

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

```
Out[72]: 0.99956172050787806
```

```
In [69]: np.std(distribution)
```

```
Out[69]: 1.0398981289933258
```

```
In [70]: np.mean(distribution)
```

```
Out[70]: 0.7688421704246986
```

```
In [73]: import scipy.stats as stats
         stats.kurtosis(distribution)
```

```
Out[73]: 0.13575003055195412
```

```
In [74]: stats.skew(distribution)
```

```
Out[74]: 0.0735417132896835
```

```
In [75]: chi_squared_df2 = np.random.chisquare(2, size=10000)   #degree of freedom
         stats.skew(chi_squared_df2)
```

```
Out[75]: 2.0849093237054346
```

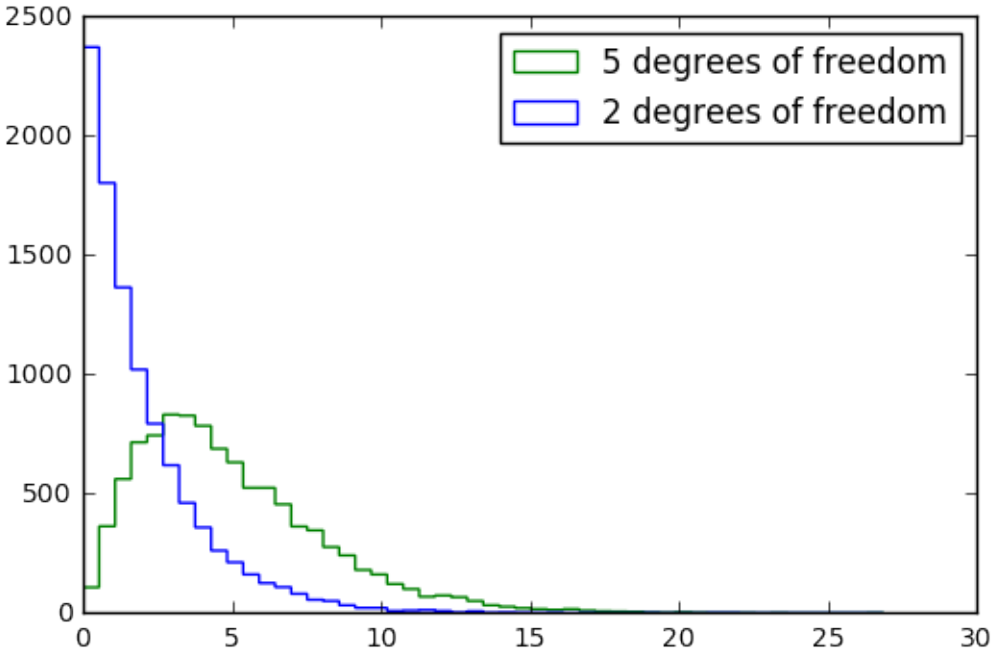
```
In [76]: chi_squared_df5 = np.random.chisquare(5, size=10000)
         stats.skew(chi_squared_df5)
```

```
Out[76]: 1.197817875973165
```

In [83]:
```
%matplotlib inline
import matplotlib
import matplotlib.pyplot as plt

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

Out[83]:
```
<matplotlib.legend.Legend at 0x7ff281d94908>
```



2 Hypothesis Testing

In [84]:
```
df = pd.read_csv('grades.csv')
```

In [85]:
```
df.head()
```

Out[85]:
```
                                student_id  assignment1_grade  \
0  B73F2C11-70F0-E37D-8B10-1D20AFED50B1          92.733946
1  98A0FAE0-A19A-13D2-4BB5-CFBFD94031D1          86.790821
2  D0F62040-CEB0-904C-F563-2F8620916C4E          85.512541
3  FFDF2B2C-F514-EF7F-6538-A6A53518E9DC          86.030665
4  5ECBEEB6-F1CE-80AE-3164-E45E99473FB4          64.813800

           assignment1_submission  assignment2_grade  \
0  2015-11-02 06:55:34.282000000          83.030552
```

```
1  2015-11-29 14:57:44.429000000          86.290821
2  2016-01-09 05:36:02.389000000          85.512541
3  2016-04-30 06:50:39.801000000          68.824532
4  2015-12-13 17:06:10.750000000          51.491040

           assignment2_submission  assignment3_grade  \
0  2015-11-09 02:22:58.938000000          67.164441
1  2015-12-06 17:41:18.449000000          69.772657
2  2016-01-09 06:39:44.416000000          68.410033
3  2016-04-30 17:20:38.727000000          61.942079
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 [86]: len(df)
```

```
Out[86]: 2315
```

```
In [88]: early = df[df['assignment1_submission'] <= '2015-12-31']
         late = df[df['assignment1_submission'] > '2015-12-31']
```

```
In [89]: early.mean()
```

```
Out[89]: 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 [90]: late.mean()

Out[90]: 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 [93]: from scipy import stats
         stats.ttest_ind?

In [94]: stats.ttest_ind(early['assignment1_grade'], late['assignment1_grade'])

Out[94]: Ttest_indResult(statistic=1.400549944897566, pvalue=0.16148283016060577)

In [95]: stats.ttest_ind(early['assignment2_grade'], late['assignment2_grade'])

Out[95]: Ttest_indResult(statistic=1.3239868220912567, pvalue=0.18563824610067967)

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