Week-4

July 3, 2020

*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.*

1 Distributions in Pandas

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

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

[2]:
```
0
```

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

[3]:
```
0.465
```

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

[4]:
```
10
```

[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))
```

```
102 tornadoes back to back in 2739.72602739726 years
```

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

[6]:
```
0.18166351481086707
```

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

[7]:
```
0.8223054969750038
```

Formula for standard deviation

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

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

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

[8]:
```
0.97921342122187627
```

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

[9]:
```
0.97921342122187627
```

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

[10]:
```
-0.08558314879586515
```

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

[11]:
```
-0.08304311562817902
```

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

[12]:
```
2.0239040324254036
```

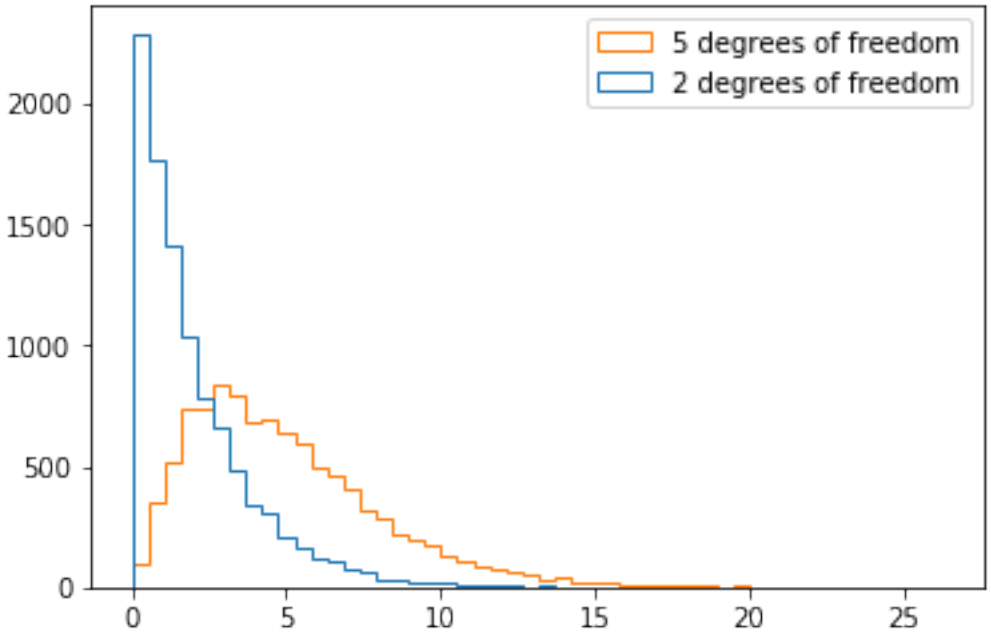
[13]:
```
chi_squared_df5 = np.random.chisquare(5, size=10000)
stats.skew(chi_squared_df5)
```

[13]:
```
1.2220106889488445
```

[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')
```

[14]:
```
<matplotlib.legend.Legend at 0x7f6bda010160>
```



2 Hypothesis Testing

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

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

[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
```

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

[17]:
```
2315
```

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

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

[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
```

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

[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
```

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

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

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

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

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

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

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