# Use_PY_in_Advanced_Statstics

June 23, 2018

# 1 Use Python in Advanced Statistics

$python$

## 1.1 Chapter One Probability

### 1.1.1 Random Experiment and Sample Space

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#### Sample Space

- $S$capital S
- $S$ $e$
-

- $A \subseteq B$;
- $A = B$;
-
- $AcupB$
- $A - B$,$AB$
-

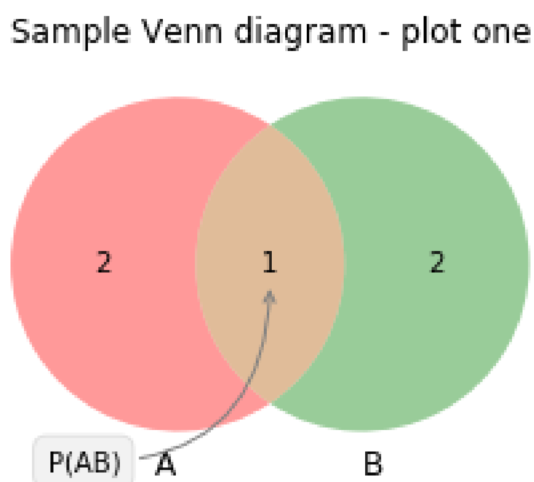
### 1.1.2

01

$ApP(A) = P$ $SAP(A)$ 1. $P(A) \geq 0$; 2. $P(S) = 1$;3.A_1, A_2, $\ldots A_i A_j = \oslash, i \neq j$ $P(\cup A_i) = \sum P(A_i)$

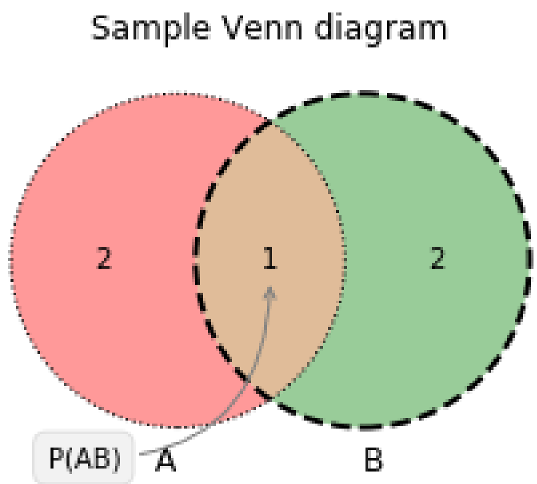
**Conditional Probability:** $P(A|B)BAABSBB$
plot one plot two

In [51]:
```
from matplotlib import pyplot as plt
import numpy as np
import sympy


from matplotlib_venn import venn3, venn3_circles
plt.figure(figsize=(4,4))
v = venn2(subsets=(2,2,1), set_labels = ('A', 'B'))



plt.title("Sample Venn diagram - plot one")
plt.annotate('P(AB)', xy=v.get_label_by_id('11').get_position() - np.array([0, 0.05])
             ha='center', textcoords='offset points', bbox=dict(boxstyle='round,pad=0
             arrowprops=dict(arrowstyle='->', connectionstyle='arc3,rad=0.5',color='g
plt.show()
```




In [52]:
```
from matplotlib import pyplot as plt
import numpy as np
import sympy


from matplotlib_venn import venn3, venn3_circles
plt.figure(figsize=(4,4))
v = venn2(subsets=(2,2,1), set_labels = ('A', 'B'))

c = venn2_circles(subsets=(2, 2, 1), linestyle='dashed')
```

```
c[0].set_lw(1.0)
c[0].set_ls('dotted')
plt.title("Sample Venn diagram")
plt.annotate('P(AB)', xy=v.get_label_by_id('11').get_position() - np.array([0, 0.05])
             ha='center', textcoords='offset points', bbox=dict(boxstyle='round,pad=0
             arrowprops=dict(arrowstyle='->', connectionstyle='arc3,rad=0.5',color='g
plt.show()
```




$P(B|A) = \frac{P(AB)}{P(A)}$ $P(A|B) = \frac{P(AB)}{P(B)}$

```
S = {(,), (,),(,),(,)}<br>
B = {(,), (,),(,)}<br>
A = {(,)}<br>
```

$B$ $A$ $P(A|B) = \frac{1}{3}$ $\frac{1}{3}$ $B$ $A$ $P(A) = \frac{1}{4}$ $P(A) \neq P(A|B)$ $B$ $S$ $S_B = B$

**Random Variable**

- 
- 

> $S$ $S$ $e$ $X(e)$ $X$

- 
- 
- $e$“”1“”0
- $eS$
- $X$
- 

: * * *
* * * *

### 1.1.3 Random Variable

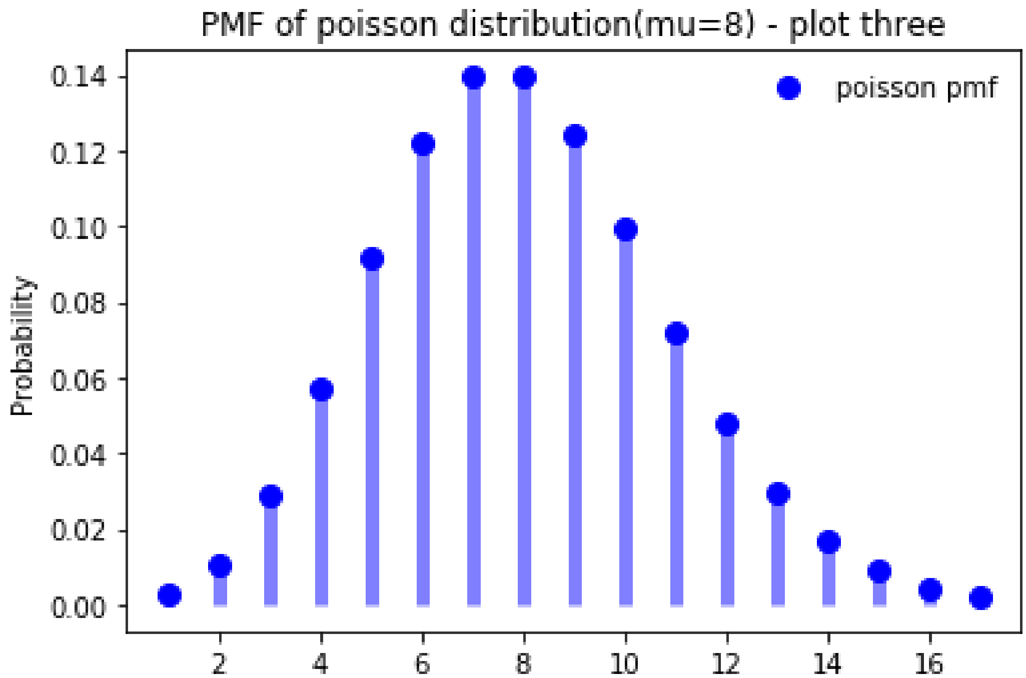
“”“” 1 > 3000$X$ > > >
$X = $

$X\{X > 10000\}\{X < 3000\}$

**The Classification of the Random Variable Discrete Random VariableContinuous Random Variable** ##### Discrete Random Variable

In [66]:
```
import numpy as np
from scipy import stats
import matplotlib.pyplot as plt

def poisson_pmf(mu=3):

    poisson_dis = stats.poisson(mu)
    x = np.arange(poisson_dis.ppf(0.001), poisson_dis.ppf(0.999))
    print(x)

    fig, ax = plt.subplots(1, 1)
    ax.plot(x, poisson_dis.pmf(x), 'bo', ms=8, label='poisson pmf')
    ax.vlines(x, 0, poisson_dis.pmf(x), colors='b', lw=5, alpha=0.5)
    ax.legend(loc='best', frameon=False)
    plt.ylabel('Probability')
    plt.title('PMF of poisson distribution(mu={}) - plot three'.format(mu))
    plt.show()

poisson_pmf(mu=8)
```

```
[  1.   2.   3.   4.   5.   6.   7.   8.   9.  10.  11.  12.  13.  14.  15.
  16.  17.]
```




```
In [65]: def binom_pmf(n=1, p=0.1):
             binom_dis = stats.binom(n, p)
             x = np.arange(binom_dis.ppf(0.0001), binom_dis.ppf(0.9999))
             print(x)

             fig, ax = plt.subplots(1, 1)
             ax.plot(x, binom_dis.pmf(x), 'bo', label='binom pmf')
             ax.vlines(x, 0, binom_dis.pmf(x), colors='b', lw=5, alpha=0.5)
             ax.legend(loc='best', frameon=False)
             plt.ylabel('Probability')
             plt.title('PMF of binomial distribution(n={}, p={}) - plot four'.format(n, p))

             plt.show()


         binom_pmf(n=20, p=0.6)
```

```
[  4.   5.   6.   7.   8.   9.  10.  11.  12.  13.  14.  15.  16.  17.  18.]
```