Poisson Distribtuion

Example: Changes in airport procedures require considerable planning. Arrival rates of aircraft are important factors that must be taken into account. Suppose small aircraft arrive at a certain airport, according to a Poisson process, at the rate of 6 per hour. Thus the Poisson parameter for arrivals for a period of hours is λ= 6.

(a) What is the probability that exactly 4 small aircraft arrive during a 1-hour period?

In [1]:

```
from scipy.stats import  poisson
mu = 6                                      # Aveage number of aircrafts arrive per hour

x = 4                                       # Let x deontes number of aircrafts arrive duri
ng a 1-hour period
prob = round(poisson.pmf(x, mu), 4)         # Compute probabilites corresponding to random
variable x
print('Probability that exactly 4 small aircraft arrive during a 1-hour periods :', prob)
```

```
Probability that exactly 4 small aircraft arrive during a 1-hour periods : 0.1339
```

(b) What is the probability that at least 4 arrive during a 1-hour period?

In [2]:

```
x = [0, 1, 2, 3]                                        # Let x deontes number of aircrafts
arrive during a 1-hour period
prob = 1 - round(sum(poisson.pmf(x, mu)), 4)            # Compute probabilites correspondin
g to random variable x
print('Probability that at least 4 arrive during a1-hour period:', prob)
```

```
Probability that at least 4 arrive during a1-hour period: 0.8488
```

(c) If we define a working day as 12 hours, what is the probability that at least 75 small aircraft arrive during a day?

In [3]:

```
mu =  12 * 6
#x = range(0, 75)                                        # Let x deontes number of aircrafts
arrive during a 1-hour period
x = list(range(0, 75))
#print(x)                                                # debugging
prob =1 - round(sum(poisson.pmf(x, mu)), 4)
print('Probability that at least 75 small aircraft arrive during a day:', prob)
```

```
Probability that at least 75 small aircraft arrive during a day: 0.3773
```

Geometric Distribution

Example: In a certain manufacturing process it is known that, on the average, 1 in every 100, items is defective. What is the probability that the fifth item inspected is the first defective item found?

In [4]:

```
from scipy.stats import  geom
p = 1/100                                  # Probability of defective
x = 5                                     # Let x deontes number of attempts to detect firs
t defective item
prob = round(geom.pmf(x, p), 4)          # Compute probabilites corresponding to random vari
able x
```

```
print('The probability that the fifth item inspected is the first defective item found :'
, prob)
```

```
The probability that the fifth item inspected is the first defective item found : 0.0096
```

Example: At “busy time” a telephone exchange is very near capacity, so callers have difficulty placing their calls. It may be of interest to know the number of attempts necessary in order to gain a connection. Suppose that we let p = 0.05 be the probability of a connection during busy time. We are interested in knowing the probability that 5 attempts are necessary for a successful call.

In [5]:

```
p = 0.05                                        # probability of a connection during busy time

x = 5                                           # Let x deontes number of attempts for  first con
ncection
prob = round(geom.pmf(x, p), 4)                 # Compute probabilites corresponding to random va
riable x
print('The probability that 5 attempts are necessary for a successful call :', prob)
```

```
The probability that 5 attempts are necessary for a successful call : 0.0407
```

In [ ]:

```

```