**STU22004 – Lab 3 Instruction**

As discussed in lecture, the Poisson distribution model deals with finding the probability of number of events where it is meaningless, impossible or not easy to count when the event does not happen. Examples are like number of births, number of customers, number of failures, etc. The probability function of a Poisson distribution is:

For example, if average number of defective manufactured test kits is about 1 in 1000, probability of finding exactly 4 defectives in the next batch of 3000 kits equals:

R has four in-built functions to generate binomial distribution. They are described below.

1. **dpois**

This function gives the probability at each point, equivalent to .

dpois(x, lambda)

1. **ppois**

This function gives the cumulative probability of an event, .

ppois(x, lambda)

1. **qpois**

This function takes the probability value and gives a number (i.e. which its cumulative probability value matches the given probability. This is to find in the following equation when and are known:

qpois(P, lambda)

1. **rpois**

This function generates required number of random samples (size) of given Poisson distribution with known .

rpois(size, lambda)

Now, you are required to answer the following questions:

1. Find the single probability of exactly events when .
2. Find the probability of 0, 1, 2, …, events when .
3. For a Poisson random variable with when , find:
4. Find the 90th percentile of a Poisson when .
5. Generate 10,000 random samples drawn from the Poisson distribution with . Plot the histogram of your samples. What do you think about the Mode of this distribution?
6. Use the pbinom(x, n, p) syntax as last week, to find probability of exactly successes in 1,000 trials with . Determine the associated lambda in Poisson distribution and find the Poisson approximation probability. Are the Binomial and Poisson probabilities similar?