# 1.Kingston is becoming increasingly known for the potholes in its streets. It seems to me that driving along you encounter on average about one every 50 m of driving, though they are randomly distributed. Most of the potholes are small, but about 10% of them are large enough to be a bit dangerous. Those dangerous ones will flatten a tire about 0.1% of the time (i.e. if hit ‘just right’, which itself is, of course, random.)

## a.I live 1 km from the Kingston campus. If I drive to school and back home, what is the probability that I will encounter more than 3 dangerously large potholes? Be sure to document your relevant assumptions.

driving\_distance <- 1e3\*2  
rate\_large\_pothole <- driving\_distance / 50 \* 0.1

the random variable can be described by

the probability to encounter more than 3 dangerously large potholes is

1-sum(dpois(0:3,lambda = rate\_large\_pothole))

## [1] 0.5665299

Assumptions:

* The number of events that occur in any interval is independent of the number of events that occur in any other interval.
* The probability of an event in an interval is the same for all equal-sized intervals.
* The probability of an event is proportional to the size of the interval.
* The probability of more than one event in an interval approaches 0 as the interval becomes smaller.

**--Nazia:**

Total distance covered = 2km = 2000m

Average no. of potholes = 2000/50 = 40

Large potholes (dangerous ones) = 10% of total potholes = 4

Here, probability of large pothole = 4/40 = 0.1

Probability to encounter more than 3 potholes = P(X>3) = 1-P(X<=3)

So, using Binomial distribution:

Probability to encounter more than 3 potholes = 1-BINOM.DIST(3,40,0.1,TRUE) = **0.576869347**

## b.Suppose I drive to school and back home 200 times in a year. Develop a model to estimate the probability that I will flatten a tire due to a pothole. Be sure to list any necessary and reasonable assumptions, if any.

annual\_drive <- driving\_distance\*200  
flat\_tire\_rate <- annual\_drive/50\*0.1\*0.001

the random variable can be described by

the probability to encounter a flat tire in any year is

1-sum(dpois(0,lambda = flat\_tire\_rate))

## [1] 0.550671

Assumptions:

* The number of events that occur in any interval is independent of the number of events that occur in any other interval.
* The probability of an event in an interval is the same for all equal-sized intervals.
* The probability of an event is proportional to the size of the interval.
* The probability of more than one event in an interval approaches 0 as the interval becomes smaller.

--**Nazia**

Total distance covered = 2km \* 200 = 2000m \* 200 = 400000m

Average no. of potholes encountered= 400000/50 = 8000

Large potholes (dangerous ones) = 10% of total potholes = 800

Probability of tire getting flattened = 0.1% of the time = Tire flattening potholes = 0.1% of 800 = 0.8

Probability of flattening a tire = P(X>=1) = 1- P(X=0)

So, using Binomial distribution:

Probability of flattening a tire = 1-BINOM.DIST(0,800,0.001,TRUE) **=** 0.550851