Discrete Probability Distribution

Binomial

```
dbinom(x, size, prob)
pbinom(x, size, prob)
qbinom(p, size, prob)
rbinom(n, size, prob)


# Create a sample of 50 numbers which are incremented by 1.

x <- seq(0,50,by = 1)

# Create the binomial distribution.

y <- dbinom(x,50,0.5)

# Plot the graph for this sample.

plot(x,y)


# Probability of getting 26 or less heads from a 51 tosses of a
coin.

x <- pbinom(26,51,0.5)

print(x)


# How many heads will have a probability of 0.25 will come out when
a coin

# is tossed 51 times.

x <- qbinom(0.25,51,1/2)

print(x)


x <- rbinom(8,150,0.4)

print(x)


#Binom(n = 5, p = 0.5) probabilities
> n <- 5; p<- 0.5; x <- 0:n
> dbinom(x,n,p)
#To verify the total probability is 1
> sum(dbinom(x,n,p))
> x <- 0:12
```

```
> prob <- dbinom(x,12,.5)
> barplot(prob,col = "red",ylim = c(0,.2),names.arg=x,
 main="Binomial Distribution\n(n=12,p=0.5)")
```

```
n = 10; p = 0.4; x = 0:n;
> prob = dbinom(x,n,p)
> cdf = pbinom(x,n,p)
> distTable = cbind(x,prob,cdf)
> distTable
```

```
barplot(height = dbinom(0:20, size = 20, p = 0.7),
        names.arg = 0:20,
        main = "Binomial PDF", xlab = 'X', ylab = 'Probability')
barplot(height = pbinom(0:20, size = 20, p = 0.7),
        names.arg = 0:20,
        main = "Binomial CDF", xlab = 'X', ylab = 'Probability')
```

Poisson

```
dpois(x, lambda, log = FALSE)
ppois(q, lambda, lower.tail = TRUE, log.p = FALSE)
qpois(p, lambda, lower.tail = TRUE, log.p = FALSE)
rpois(n, lambda)
```

note:

log, log.p: logical; if TRUE, probabilities p are given as log(p).

lower.tail: If TRUE then left tail is considered otherwise if the FALSE right tail is considered

Problem

If there are twelve cars crossing a bridge per minute on average, find the probability of having seventeen or more cars crossing the bridge in a particular minute.

Solution

The probability of having sixteen or less cars crossing the bridge in a particular minute is given by the function ppois.

```
> ppois(16, lambda=12)   # lower tail
[1] 0.89871
```

Hence the probability of having seventeen or more cars crossing the bridge in a minute is in the upper tail of the probability density function.

```
> ppois(16, lambda=12, lower=FALSE)    # upper tail
[1] 0.10129
```

Exercise

1. The probability of entering students in chartered accountant will graduate is 0.5. Determine the probability that out of 10 students
   i. None
   ii. One
   iii. At least one will graduate

   Write a R program for above problem.
2. Find binomial distribution if the mean is 5 and variance is 10/3.
   Write a R program for above problem. Also write a R program to plot probability distribution and cumulative probability distribution.
3. The number of traffic accidents that occur on a particular stretch of road during a month follows a Poisson distribution with a mean of 7.6. Find the probability that
   i. less than three accidents will occur next month on this stretch of road.
   ii. Exactly three accidents will occur next month on this stretch of road.

   Write a R program for above problem.
4. Telephone calls arrive at an exchange according to the Poisson process at a rate λ= 2/min. Calculate the probability that exactly two calls will be received during each of the first 5 minutes of the hour.
5. Find 8 random values from a sample of 150 with probability of 0.4.
6. How many heads will have a probability of 0.25 will come out when a coin is tossed 51 times. What is the Probability of getting 26 or less heads from a 51 tosses of a coin?