Binomial Distribution

The binomial distribution is a discrete probability distribution. It describes the outcome of n independent trials in an experiment. Each trial is assumed to have only two outcomes, either success or failure. If the probability of a successful trial is p, then the probability of having x successful outcomes in an experiment of n independent trials is as follows.

      (    )
        n    x      (nâ x)
f(x) =  x   p (1â p)      where x = 0,1,2,...,n


**Problem**

Suppose there are **twelve multiple choice questions** in an English class quiz. Each question has **five possible answers**, and only **one of them is correct**. Find the probability of **having four or less correct answers** if a student attempts to answer every question at random.

#### Solution

Since only one out of five possible answers is correct, the probability of answering a question correctly by random is 1/5=0.2. We can find the probability of having exactly 4 correct answers by random attempts as follows.

dbinom(4, size=12, prob=0.2)

To find the probability of having four or less correct answers by random attempts, we apply the function dbinom with *x*= 0*,…,*4.

dbinom(0, size=12, prob=0.2) +   
+ dbinom(1, size=12, prob=0.2) +   
+ dbinom(2, size=12, prob=0.2) +   
+ dbinom(3, size=12, prob=0.2) +   
+ dbinom(4, size=12, prob=0.2)

Alternatively, we can use the **cumulative probability function** for binomial distribution pbinom.

> pbinom(4, size=12, prob=0.2)   
[1] 0.92744

The probability of four or less questions answered correctly by random in a twelve question multiple choice quiz is 92.7%.