

## binomialchapter14

Probably success for you right now is getting an A or a B on an exam. Let's suppose you have a 90% chance of that on any given exam.

What is the probability that in three exams you get three A's or B's? Write S for success, F for failure. Let X be the number of successes. n be the number tries. We want X=3. P(first exam is good and second exam is good and third exam is good ). Assume they are independent. Then above is  $P(\text{first exam is good})P(\text{second exam is good})P(\text{third exam is good}) = .9^3$

$$.9^3$$

```
## [1] 0.729
```

What is the probability that in three exams you get exactly two A's or B's? (S,S,F), (S,F,S), (F,S,S) (matter of where have a failure).  $3 \times .9^2 \times .1$

$$3 \times .9^2 \times .1$$

```
## [1] 0.243
```

What is the probability that you don't get any A's or B's?

What is the probability that you get exactly one A or B?

What is the probability that you get at least one A or B?

Suppose instead you had six exams- What is the probability of getting exactly one A or B?

Let's call getting an A or B on a given exam a success and denote that outcome as S and the alternative as F.

If we have six exams there are many outcomes for those six exams.

List a few:

Then what is the probability of one of those?

Now what ones give you exactly one success and what is the probability of each one of those? Are each of those outcomes independent? So what is the probability of exactly one success in six exams?

Let's try this for exactly four successes in six exams. How many different ways can you get this and what is the probability of each?

Counting gets interesting!

How many different ways can you arrange yourselves in your row? Think about it

n factorial

Take three people from your group and stand them up at the front of class in a row-how many ways can you do that?  $n!/(n-k)!$

Now just choose three people from your row -how many ways can you do that?

$n$  choose  $k$

6 choose 4

probability of exactly 4 successes.

probability of four or fewer successes in 6 trials

prob(more than four successes)

Formula for  $P(X=k)$ .

Suppose instead you had 10 exams. Ask and answer questions similar to the above.

```
dbinom(8,10,.90) # P(X=8)
```

```
## [1] 0.1937102
```

```
pbinom(1,10,.9) #P(X<=1)
```

```
## [1] 9.1e-09
```

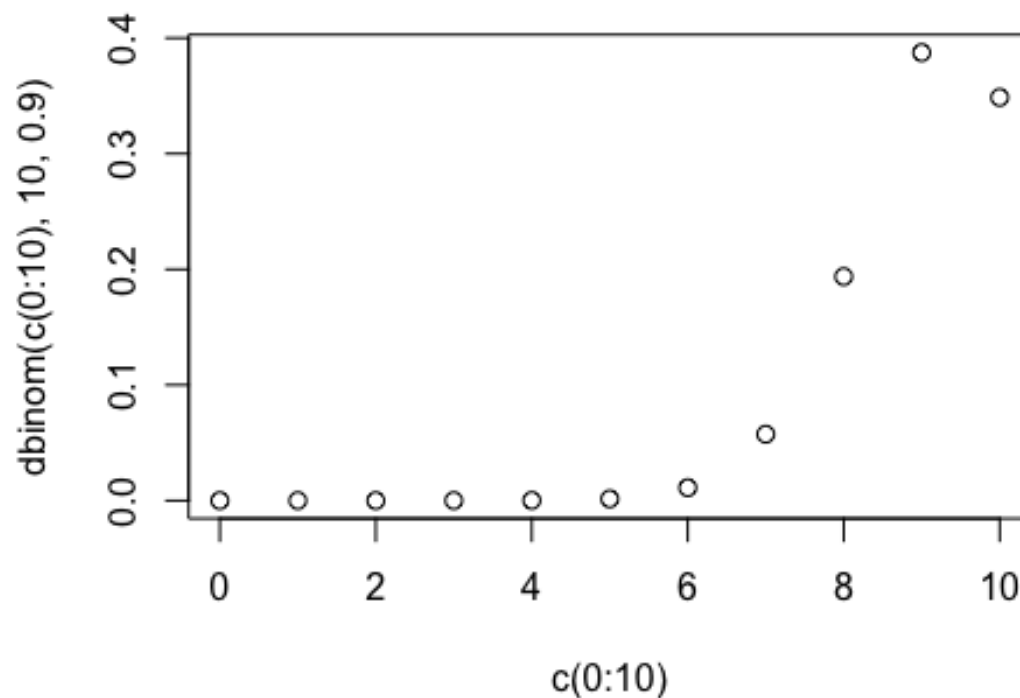
```
1-pbinom(7,10,.80) #P(X>=8) explain
```

```
## [1] 0.6777995
```

```
#do some more
```

binomial distribution for the probability of  $k$  successes in  $n$  independent trials where the probability of success in one trial is  $p$ : parameters are  $n$  and  $p$ , the values  $k$  can take on are:

```
plot(c(0:10),dbinom(c(0:10),10,.9)) #try different values for p
```



```
sum(c(0:100)*dbinom(c(0:100),100,.6)) #this sum gives the mean
```

```
## [1] 60
```

binomial distribution for  $n$  trials where success on one has probability  $p$  has mean  $np$  and standard deviation  $\sqrt{np(1 - p)}$ .

Example : Success is having a child live to be 5. Take different countries.(Randomly assign) What is  $p$  for your country? What is  $P(X=4)$  when number of trials (kids) is 5? Try some other types of questions.

Suppose the random variable  $X$  has a binomial distribution for  $n$  trials where success on one has probability  $p$ . Then for  $n$  large ( $np \geq 10$ ,  $n(1-p) \geq 10$ ) the distribution of  $X$  is approximately  $N(np, \sqrt{np(1 - p)})$  This will be very important in the NEAR future. Try different values for  $n$  and  $p$  in the above graph.