

In this segment, we go through a quick review of a few properties of the Bernoulli process that we already know. We start by thinking about the number of successes or arrivals in the first n time slots. This is the following quantity. At each time we add a 0 or a 1, depending on whether we've had a success or not, then by adding those numbers, we get the total number of successes.

Now we already know that the number of successes in n trials obeys a binomial distribution, so the probability of having k successes is given by the binomial probabilities. And this is a formula that holds for k equal to 0 up to n , which are the possible numbers for the random variable S .

For this random variable, we know the expected value. It's n times p . And we also know its variance, which is n times p times 1 minus p . Another random variable of interest is the time until the first success or arrival. So this is defined to be the smallest i for which the random variable X_i is equal to 1.

We have done this calculation in the past. The probability that the first success appears at time k is the same as the probability that the first k minus 1 trials resulted in 0's. And then, the k -th trial resulted in a 1. And so the probability of this is 1 minus p , the probability of 0, and we have k minus 1 of them, times p , the probability that the next trial gives us a success.

And this formula is valid for k being 1, 2, and so on, which is the range of possible values of this random variable T_1 . This is the familiar geometric distribution that we have dealt with on several occasions. And in particular, we know the expected value and the variance of the geometric random variable.