Algorithms for Big Data
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Lecture – 03
Example problems

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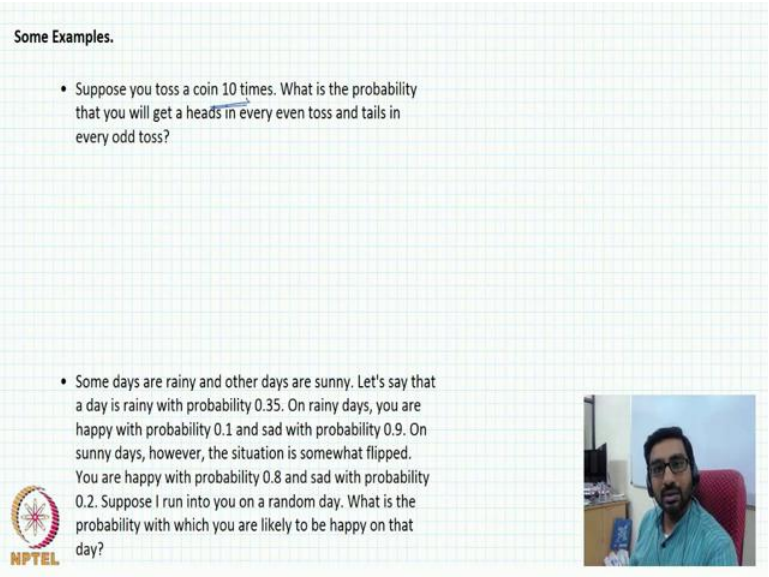

Now, that we looked at independence of events and the law of total probability. It is time we look at a few simple examples, just to get our feet wet.

So, here is a couple of examples let us starts with the first one, suppose you toss a coin 10 times, what is the probability that you will get a heads in every even toss and tails in every odd toss? So, the experiment that we have concerned about is 10 coin tosses. But this experiment has these smaller experiments as a part of it. So, the 10 times that we toss these coins and all of them are done independent of each other.

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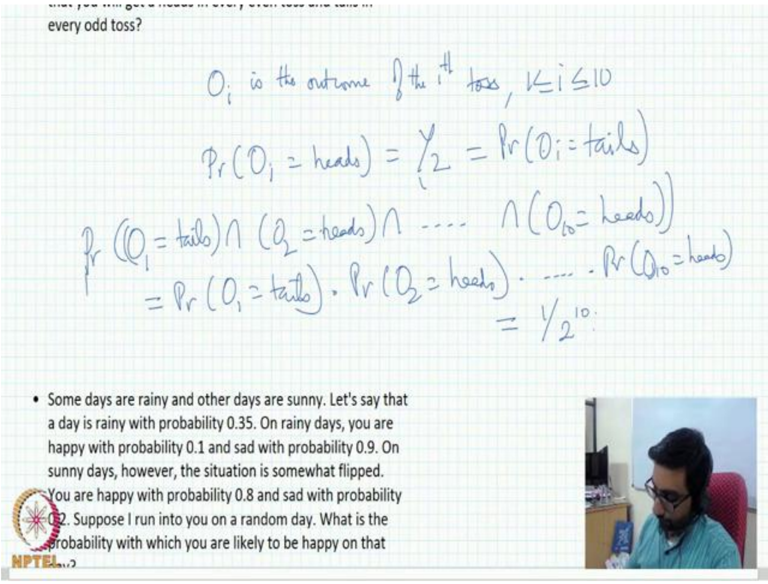

Let us say that, O i is the outcome of the ith toss, and here one is less than equal to i; less than equal to 10. So, in general what is the probability that O i is equal to heads, that is equal to half and that is also equal to the probability that O i is equal to tails. We particular even that we are interested in can be stated as follows, is the interested in the probability that O 1 being and odd toss is tails and, O 2 is a heads and so on. O 10 is equal to a heads.

Now, knowing that these are independent experiments that we played inside of this larger experiment, so we can restate this probability as being probability of O 1 equal to tails times the probability that O 2 is equal to heads times and so on probability that, O 10 is equal to heads as we know that, each one of these individual turns is a half our final answer is 1 by 2 raise to the 10.

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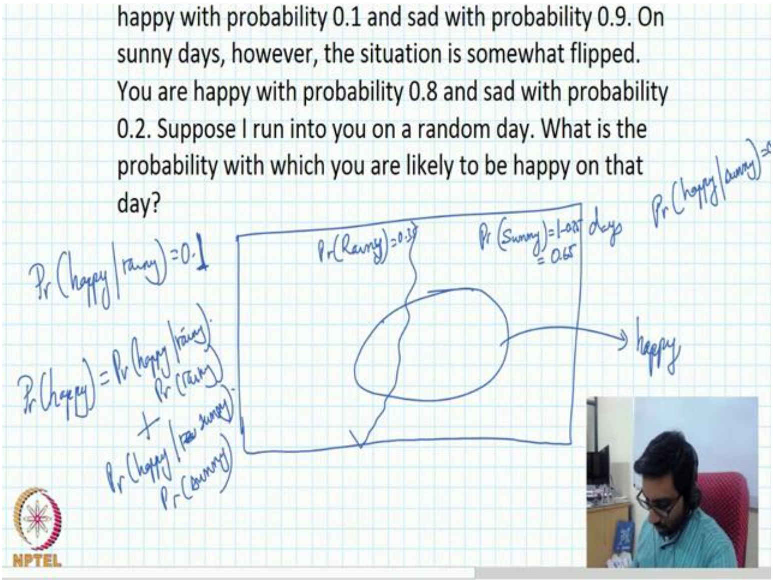

Whereas now, look at to the second problem which will exercise us on the law of total probability. So, in this problem, our days are divided into sunny days and rainy days.

So, these are all the possible days, and about 35 percent of the days are going to be rainy days. So, rainy this will be and the probability of being rainy is a 0.35 and the rest of the days are going to be sunny and the probability of being sunny is of course, equal to 1 minus 0.35 which I believe is equal to 0.65.

Now, I am interested in the event that we are happy. So, that event looks something like this. This is the event that we are happy. Let us understand the probabilities here, on rainy days you are happy with probability 0.1. So, the probability that you are happy, given there it is a rainy day, is 0.1. The probability that you are happy, given there is sunny day is 0.8, and we are interested in the over all probability that you are happy on a random day. So, we are interested in the probability that you are happy. Now, we can apply the law after the probability, this is equal to probability that you are happy, given if there is rainy times the probability that is rainy, plus the probability that you are happy, given there is sunny, times the probability that its sunny and if you plug in all the values and then get the help of Google a little bit, we will see that the probability works out to 0.555.

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