module_prob2_lecture4

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SPEAKERS

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So the last clip we did the law of total probability. And the last most general form of the law that I wrote, it was pretty notation intensive. So what I want to do is begin this clip by going over the law once more, just to make sure you understand the basic concept. And I'll also be mentioning two important points about the law before moving on to a couple of other examples, just to illustrate this lightwork. So the idea again, of the law of total probability is that if you look at the event B, right, and suppose the event B can occur in several through several different channels, right through either through E one, e two, up to a n, right? So you can break down the occurrence of this, of this event B, as its intersection with the one intersection with the two so on up to intersection up with a n, right? And if you look at each of those isolated events, right, so for example, if you look at the probability of E one, intersection B, right, so this is the probability of a one off grid times the probability of B occurring, given that E one has occurred. Same thing, when you look at the intersection of a two and B, it's the probability of a two occurring, and then the multiplied by the probability of B occurring given that A to has happened. And so right, and two important things. And these are two things which I hadn't mentioned in the previous clip, because I didn't want to introduce new elements. They're the two important aspects to these a one, a two a n. Firstly, all of these are disjoint events. Right? So that's why because they're all disjoint. Right? I can, if I want to look at the total probability, I can add up all those individual probabilities, right? So it's important that all of these sets are disjoint. Right? Secondly, write these sets these events, a one a two up to a n, they encompass all the possible ways through which BK because if I haven't in compass, another event through which also B can occur, then I need to add that all. Right, so when you're writing a one through n, right, so these are all the possible ways through which B can occur. And that's important to write down incorporated to this. Okay. But having said that, right, again, the law of total probability is probably like you're breaking up b into many component events, right, and then adding up the probabilities of each of those. So let's use it. Now remember, the previous example that we had done with dry summers and forest fires. So we're going to extend that. And let's encompass not three possibilities that the summer could be dry, it could be normal, or it could be wet. Summer may be dry with probability point four, it could be normal with probability point three, or it could be wet with probability point three. Now, each of these have different consequences for the chances of forest fires. So in a dry summer, the probability of a forest fire is point six. In a normal summer, it's point four, and then a wet summer it's point two. So now let's draw the probability tree. Right. So here, they could be it could be a dry summer with probability .4. It could be a normal summer with probability .3 or it could be a wet summer, that probability .3, right? And in each of these cases, there is some conditional probabilities of fire and no fire, right? So it's .6 in the dry summer .4 in the normal summer and .2 in a wet summer, and the question is, what's the probability of fire? Let's see fire can occur either in a dry summer or in a normal summer or in a wet summer. Right? So if we use the law of total probability, we can write this down in the following week. It's the probability of fire in a dry summer. So it's the probability of dry times the probability of fire in a dry summer. Plus the probability of a normal summer times the probability of fire in a normal summer. Plus the probability that it can be a wet summer, and what's the probability of fire in a wet summer? So this is my law of total probability at work, right? And now all we have to do is write down these numbers. So what's the probability of dry that's .4 times the probability of fire while dry? That's .6. Plus, what's the probability of a normal summer that's .3 times the probability of fire in a normal summer, that's .4. Plus, what's the probability of a wet summer that's .3 times the probability of fire in a wet summer, that's .2. And now we just patiently write down all of these, add up all of these numbers. And that comes to .42. So in this case, the probability of a fire is 42%. Okay, and again, this is the law of total probability at work. Okay, so let's do another interesting example. Or hopefully an interesting example. It's it this is you're picking sandwiches from an unmarked plot. So what I mean, is this, it so suppose here's a Party Platter. And let's say it has three avocado sandwiches, and seven cheese sandwiches. So the problem is that the sandwiches are unmarked. So when you're picking up a sandwich, you don't know what it is. And let's say this is, you know, COVID time, so you don't want to return a sandwich that you've picked. So the question is, right, so. So if you just pick first, right, if you are the person who is picking first, right? What's the probability that you pick an avocado salad? So this is very basic probability, you know? So what's the total number of outcomes? Right? So the total of 10 Sandwiches three plus seven, right? So total ten sandwiches, right? What's the probability of picking an avocado sandwich? So what's the number of favorable outcomes is three? Right? So if you pick first, your probability of picking an avocado sandwich is point three. Now, it becomes more interesting, if you pick second. Right. So now, if you pick second, what's the probability of you picking an avocado sandwich? So if you think about it for a moment, right now, it's interesting because it depends really on what the first person right? So for example, if the first person picked one of the avocado sandwich is already, he's also picking at random, but suppose he lucked out and picked up an avocado sandwich, of course, given that with the assumption that he like avocado, right, so suppose you picked up an avocado sandwich. Now there are only two left, right, so it's enough two out of nine that's left. So so the first is got avocado, then your conditional probability that the second one, the second person who is speaking, picks an avocado sandwich given that the first aspect avocado, right, so now what's the total number of possibilities? So number of sandwiches left is nine. Right? How many avocado are left? Because the first person has picked avocado. So the number left is two, right? So in this case, the probability is two over nine. Right. Now, of course, the other possibility is that this person We could have picked a cheese sandwich, the first person who picked he could have picked the cheese. Right? So, look. So here's a clicker question with exactly that. So you may want to stop the video at this point and try out the clicker question. So hope you got a chance to do the clicker question. Right. So what it asks Is that in this situation, if the first person pick them call the cheese sandwich, right? What is the probability that the second person who picks will get an avocado sandwich? So what's the probability that the second is an avocado? Given that the first is cheese? So now again, see how many possibilities are left on mine? Right, so the first bit cheese, right, so none of the avocado are taken yet. So the probability of getting an avocado sandwich for the second person who picks is three out of nine. So the correct answer here is C. It's three out of nine. So so if you look at the, the probability tree, right, so the probability tree here consists of what the first person chooses, but the second person chooses. Right, so the first person could choose an avocado or a cheese sandwich. And given that the second person could be choosing an avocado, or cheese, avocado cheese. So let me stop the clip here. And I'll give you a chance to try and fill out this probability tree on your own. Try it out, and we'll begin we're going to begin the next clip exactly by trying to fill out this probability tree so you can check your answers against what I do.