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SPEAKERS

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Okay, welcome to a new module of the course. This is going to be on probability. So probability is the idea of dealing with uncertainty. You know, uncertainty pervades all around us, so simplest question, is it going to rain tomorrow? Now? Another question, which you may be worried about is, am I going to get an A in this course or not? And lots of times, we have to make decisions based on this uncertainty, should I carry an umbrella Should I take this course or some other course. So, what's the idea of probability, it's a formal language to deal with such uncertainty. So I'm sure all of you have dealt with uncertainty in your lives, and perhaps have learnt about it also before. So what my aim in this in this particular module is to introduce you to the formal language of probability how it's actually dealt with in the social sciences, and get you comfortable with that idea. So in particular, I'm going to start out this module by introducing you to the basic idea of probability, how to calculate it in particular contexts. And then I'm going to introduce you to the basic axioms or the basic tenets that form the base of probability. And once you have those basic axioms from that, we can develop rules, which are very useful in calculating probability in lots of different contexts. So that's what's going to come next, the main rules of probability they'll just be to, but which we can make use of, and use it in a lot in a variety of contexts. And then I'm going to end this module with the idea of independence of events, and the opposite of it, which is non independence or dependence. This is a particular concept, which investigates the relationship between different events or different things. So let's get started. So, you know, as I was saying before, uncertainty is ubiquitous, right? It's in the whether it's in the economy, where the economy is going to do better or worse tomorrow. It's in politics. So as I'm recording this module, actually, this is the day of the 2021, Canadian federal election. And the big question, is that, is Prime Minister Trudeau going to get reelected? Is this party going to be able to form the government backstop or not? And if so, with a majority or a minority? So there's also uncertainty with respect to your health. With respect to the pandemic, is there going to be another wave of it or not? Jobs, right, where the job prospects, there's uncertainty in sports, or other blue jays going to be able to make it to the playoffs this year? What's the chance of they're doing so? The stock market uncertainty abounds. And a lot of in a lot of these uncertain situations, we actually have to make real decisions, right? So for example, in the context of a car or your house, buying an insurance, how much of insurance coverage to buy, should I insure against water damage? Or should I

forego that? Should I buy extra coverage or not? Vaccinations right, should I get vaccinated against the flu this year? Again, that's an uncertain situation, right? So there are certain probabilities of you getting the flu without a vaccine versus with the vaccine. Which stocks should I buy? Should I buy stocks at all, or should I put my money in the bank? So these are questions which come up all the time in the social sciences in economics and politics in lots of different areas. So what probability does is give you a formal language to deal with such uncertainty? And then once you have that language, how can you use it for making decisions? So that's, that's what's the important part of learning probability. And that's why probability is not just important in the sciences, it's almost equally important in the social sciences as well. So let me start with a particular example. So this is the context of a die. So suppose a dice roll. So there are six possible outcomes, one, two, up to six. Now, if you want to look at what's the probability that a six comes up. What's the relative chance of a six coming up? So what are the possibilities when you roll this die? So there are six possible outcomes. So 12345, and six. So there are six possible outcomes. And what you're looking at what you're interested in, is this particular outcome, which is of a six. So what's the relative chance of a six coming up? So it's the number of ways that the six comes up is one, versus the number of possibilities is six. So the relative chance of a six coming up? Is $1/6$. The same idea, if you're wondering, what's the probability of a three coming up? Again, what's the relative chance of a three coming up? It's one over six, because there's six possible outcomes. How many ways can your particular outcome that have a three come up? It's one, that so the relative chance of a three coming up is $1/6$. In fact, in the case of this die, then all of these outcomes are equally likely. So the probability of one coming up is one six, the probability of a two coming up is one six, same for four, five and six. Now, you may also be interested in other outcomes, for example, what's the probability that an even number comes up? If we look at the events here, it's two, four, and six. So what's the probability or chance that an even number comes up? So you're looking at the number of so the total number of possibilities? So relative to that, what's the number of, of favorable possibilities? So in this case, so the number of favourable possibilities, suppose you bet on an even number, right? So then number of favourable possibilities is three, it has the three even numbers relative to the number of total possibilities. Maybe I should write this as total possibilities. So that's six. So this is half. What about a different event? What's the probability that the number when you roll the die exceeds four? So here, there are two favorable possibilities that either a five or a six comes up? Because these are the only numbers which exceed four? What's the probability of those two numbers coming up? So, it's two relative to six. So that's one. This is the very basic idea of probabilities, it's the number of favorable possibilities, the number of possibilities that you are interested in relative to the total. Now, let's do another example. So let's say here is an office. In this office, there are two secretaries, four interns, 20, data analysts, two accountants and two managers. And one of them is randomly picked to go to a convention. So now, suppose you're asked the question. So what is the probability that one of the interns gets picked? So now you look back here, so there are four interns. So of your favorable outcomes, that's four, what's the total number of outcomes or the total number of possibilities? So in this office, there are two secretaries for interns, so two plus four 620 data analysts So, 6 plus 2026 plus two accountants 28 plus two managers 30. Right. So there are 30 people in this office. So any of them could be picked to go to the convention. So the total number of possibilities here is 30. And what we're interested in is, what's the probability that one of the interns gets back. So there are four interns. So the relative probabilities for over 30. And if you simplify that, that's to over 15. Now, it could be that, you know, interns are too junior, so maybe this is an important convention, and you don't want to send the interns, right. So you make the rule that no intern is going to get picked. So we're going to pick someone among the rest, right? So no intern. In this case, what's the probability that one of the data analysts get picked up? Okay, so in this case, let's again look back. So if it's no intern, so other than the interns, then there are 26 people in the

office. So here, the total number of possibilities is 26. What's the probability that one of the data analysts gets picked up again, if you go back, there are 20 data analysts. So the probability that the data analyst gets picked up is 20, over 26. And you can simplify this and so this will be 10 over 13. And then you can calculate whatever that is. So this is how you calculate probabilities in context like this. Now in the social sciences write questions which come up quite easily or naturally, something like this, suppose a family is expecting the child is the child going to be a boy or a girl. So typically, we assume that this is half and half. But scientists have actually looked at this problem, and they've looked around the world. And what's interesting is that at birth, this is slightly higher probability of the child being a boy than a girl. Right? In fact, the probability, if you look around the world, the probability of of a boy, the child being a boy, is 52.5%. Which is, which can be written as point five, five, the probability of the child being a girl is 47.5%. Or 0.475. And Scientists have calculated this by looking at data from lots of different countries, over lots of different time periods. So these examples in social sciences, oftentimes, you have to deal with probabilities, which are not as simple as rolling a die tossing a coin, things like that. And you really have to look at data to figure out what those probabilities are. But still, what it does represent is this relative chance, what's the relative chance that if there are 100 babies, what fraction do you think are boys? What fraction do you think are girls? So let's, let's stop this clip here. And we're going to pick up on this and go forward in the next clip.