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SPEAKERS

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So so far we've talked about the basics of probability of events. Now, let me talk about relationship between events. So they could be different. random events run different uncertain events. And what's the relationship between them? Does one influence the other or not? So that's the idea behind this next topic, which is independence and dependence of events. So let's start with the simplest one, which is independence. So the independence between two events, A and B is this idea that one does not influence the other, that the occurrence of one event has no influence on the probability of occurrence of the other. So. So if you take two events, A and B, right? If A occurs, then it does not influence in any way, whether B occurs or not. In that case, we'll say that events A and B are independent. Now, what's an example? So the easiest example is a coin toss, right? So suppose you toss a coin, and the first one comes up heads, right? So this is the first. Now in the second, whether a head or tail will come up, is not influenced by what happened in the first, right. In the second one, the probability of a head is still going to be half, and the probability of a tail is going to be so half. Right? Regardless of whether the first one was a head, or a tail, right, this probability is unchanged. So should the outcome of the second toss be independent of the outcome of the first another way of some people's refer it to as the coin has no memory. So same thing with the gender of children, right? So suppose your family has two children, right? Whether the first one is a male, or a female has no influence of whether the second child is going to be a male or a female? Right? So there is no influence between these two, right? So it's not that that there was the first child was a girl has any impact on the probability of whether the second child is a girl or a boy? Right? So these are independent. So let me give you another example, which kind of highlights this even more. So. So for example, right? So suppose you draw a card from a deck of 52 cards. So those of you probably know what, what are the cards right? In cards, there are four decks, right? So there are the clubs, diamonds, hearts, and spades. Right. And let's say the first one that you draw is a king of hearts. Okay, and then you'll note that and you replace it back into the, into the deck, right? And then you draw a second card. So the question is, does there any effect on the second card by the fact that the first one drawn was a king of hearts? Right? If you replace the card back into the deck, right, it's the same deck as was the first one, right. So in this case, there is no effect or impact on the second card, which is drawn, right. So here there is no impact. So in this case, the two events have between what the first card is drawn and what the second card is drawn. Those are independent. On the other hand, right, so

suppose you draw the first card and it is a king of hearts, right? And then you don't replace it. So you don't replace it. Right? And then you draw a second card. Now in this case, does it have any? Now, if you think about it for a minute, right, you'll see that it does, right? So for example, in the second draw, right, you cannot come up with another king of hearts. And also, because you haven't replaced it, this king is out. Right? So there you have one fewer hearts as compared to all the other suits. Right? So the probability of drawing another heart now comes down. Right? So what happened in the first does have an impact on the card drawn a second, if you don't replace that first card, right? So in this case, the two events are dependent. So that's the idea of independent and dependent events. Okay, so let me because this is an important idea, let me go over this one's more, right. So independent means that there is no relationship between the events. So what I have the fact that A has occurred, there's no or not occurred has no impact on whether B can occur. So some other examples, so so far, I've talked about first card and second card first child, second child, right. So independence can be talked about, irrespective of the element of time as well, right? So two events are independent, basically, if they have no relationship between each other, so for other examples, suppose a person whether a person has a pet or not, and owns a car or not, right, so there is no relationship between these two events. Right? The fact that a person has a pet has no influence on whether that person has owns a car or not. Similarly, if you take the event that a person wins a lottery ticket, and on the same day finds \$10 lying on the street, right? These two events are independent. It's you, you would think of this as a my lucky day. But but the fact that you've won a lottery has no relationship to your finding \$10 on the street, or vice versa, that that you found \$10 on the street doesn't mean that this increases or decreases your chances of winning the lottery. Right? So these two are independent events. Similarly, if you look at the weather, for example, in New York and the weather in Toronto, right, you think that whether it's raining in Toronto has no influence on whether it's raining in New York. So these are all examples of independent events, there is no relationship between that. On the other hand, again, dependent events is that there is some relationship between the events. So again, for example, so suppose you look at the probability that a person has a pet, and the fact that he owns a vacuum, these two are probably related. Because if you own a pet, you you worry about it, especially if it's a dog or fluffy dog, right, you worry about shedding a lot of hair, so you're more likely to own a vacuum. Let's say if you have a pet, then you're more likely to own vacuum. So one influences the other. Right? Similarly, the fact that if you take the even the driving of the speed limit, and gets a ticket, that these two are related, and because if you're not driving over the speed limit, you're not going to get it. Right, if you're driving over the speed limit, it really increases your chances of getting a speeding ticket. Right? So these two are dependent events. Similarly, if it's snowy, right, and the flights in the local airport are delayed, these two are connected right. So one, if it is snowing, then the probability of flights getting delayed goes up, right. So these are examples of dependent effects. So and in real life, right. So one of the very classic examples and again, this is a theory. This is called the random walk theory of stock prices. This first was a was propounded in a book in 1970s. By by a person called Barton Mulcair. Right, and his theory was this that what happened in for in terms of a stock price yesterday has no impact on whether the stock price is going to go up or go down today. So the fact that the stock price went up yesterday has no impact on whether the stock price will go up or go down today. Right. So in other words, movements and stock price, or independent movements and stock prices are independent. So when it came out, right, so people didn't quite believe it. But then more and more, there was more and more data coming out. And some of the data seem to support this theory. And the most classical example, where this happened was, because, because think about the implication of this, right, so if what happened yesterday, has no impact on the price today. Right? It almost makes a lot of the investment experts, our stock market analysts redundant, right, because they look at what happened to the stock yesterday. And based on that they make you a recommendation of whether you should buy the

stock today or not. Because they're making a prediction about whether the stock is going to go up or go down. Right. Now, if there is no relationship between what happened yesterday, and what's going to happen tomorrow, then the advice of the stock brokers is redundant. Right. And the most famous story of this surrounds the Wall Street Journal. And you may have heard of this, what they did is that they compared the recommendation of some stock brokers or stock analysts, versus what would happen if you invested just by throwing darts at a stock board and picking up buying stocks based on where the Dart. And in fact, what they found was that there was no conclusive there was some difference let's analysts did slightly better, but they were not conclusively that. So that does seem to support a little bit of this theory, that stock market movements right are independent of what happened yesterday. So this is an example of independence in the real world. Right. But of course, it's much more harder to establish, then, you know, coin toss, it's easy to see that you know, what happened, the client has no memory, right? But if you want to establish something that there's no impact of what happened on stock prices yesterday on stock prices tomorrow, right, that's a lot harder to establish, even in terms of the examples that have given of dependent and independent events. I've said that weather in New York is not and weather in Toronto are unrelated. Now you can think about, about certain cases where they may be related. So for example, if there is a big storm system passing through the East Coast, right, or the eastern part of North America, these two could get connected. Similarly, if there is a big snowstorm coming that way, coming from New York and ending up in Toronto, those two could get connected, right. So the question is that, but overall, right is the probability of one event connected with the probability. So in real life, it's much harder to actually test and establish whether these two events are completely unrelated or not. So having introduced you to this idea of independent and dependent events, in the next clip, I'll tell you what it implies in terms of probabilities.