module1_lecture8

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SPEAKERS

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So in the last clip, I presented to you a simple model of the spread of infections. And in this particular clip, I want to use that model in an Excel sheet to see how the numbers of infections actually spread, if you put in particular values of N and P. And in doing that, what we'll also be investigating is the rule of some common policies like lockdowns and vaccinations and how that impacts the numbers of the spread of infections. But before we go there, let us just quickly review the model that I presented in the last clip just to make sure we are all on top of it. So what the model did was it started with on day T equal to one, there was one infection or one infected person. And then on day T equal to two, this person interacted with N people and passed on the infection to a fraction P of them. So the total number of infections on day two became NP. And similarly, now, on day three, we started out with NP, right, each of these individuals, they interact with N and pass on the infection to a fraction P of them. So if we started out with NP, the total number of infections are now NP times NP, which is NP squared.

And this is how the model progresses that if you go from there to T equal to four, then again, you start with the total number of infected people at the beginning of day four is NP squared, each of them interact with N and pass on the infection to fraction P of them. So NP squared of them pass on the infection to these many, so the total number of new infections in the three in sorry, in day four is NP cubed. And this is how the model progresses. And what we ended up is the general formula, that on day T, the number of new infections is given by NP to the power of T minus one. And we borrowed this from here, see, on day four, the number of infections is NP to the power of four minus one. On day three, it's the number of new infections is NP to the power of three minus one, and so on. So the number of new infections on day T is going to be NP to the power of T minus one. And that's the formula that we are going to use in our Excel sheet to actually plot out how the number of infections spread over time. But before going there, what I would like you to do is a clicker question, and this is very much on the lines of what we have done so far. But I've changed one thing in this particular clicker question. In all things that I've done so far, I've started out day one with one infected person. Right, there's one patient zero, but that may not be the case in real life, you start off with a certain number, or a cluster of cases, and then see how the number of infections increase from there. So in this clicker question, what it asks is suppose day T equal to one begins with 10 infections? Now, can we use the same procedure to figure out how many new infections they will be on day T? So what I'd like you to do is stop the video here and attempt this clicker question using the same sort of derivations that I have done before.

So hope you had the chance to do the clicker question. And, and the aim of that was to try and see that you're on top of the model that we have done so far. So let me just solve it quickly before moving on to the Excel sheet. So here now I've said that suppose on day T equal to one, we start with 10 infected people, right? So what happens then on day T equal to two and so each of them interact with N, and pass on the infection to a fraction P of them. So if there are, if I started out with 10 people, that means the total number of new infections will be 10 times NP. Then I go to T equal to three, right, I start out with 10 NP people, right, each of them interacts with N and passes on to fraction P of them. So, the 10 NP passes on to another NP, so, the number of new infections is 10 NP squared. And you can continue this way. And from that, you can figure out that the number of new infections on day T is going to be 10 times NP to the power T minus one.

So, the correct answer to the clicker question is B. So, now, let's use this to actually plot out in an in an Excel sheet, how infection spread if I gave you particular values for P and N. And why is that important? So see, here in this model, right there are two parameters N and P, right. And the number of new infections on day T is given by N times P to the power of T minus one. Now why is a model like this important? A model like this is important because it gives you an idea of the impact of different policies. So in terms of the pandemic, there are two policies which have really been discussed and implemented. One is lockdowns, various levels of lockdown, moderate lockdown, strict lockdown, no lockdown and so on. And the other thing is vaccinations. So, in the model, what do these policies impact? So if we look if you think about what is N, so N is the number of interactions that a person has with other people. So now if you think about the policy of lockdown, what does a lockdown do? By restricting people's movements, it reduces those interactions. So if you think about the impact of lockdowns, right, so, lockdowns, reduce N. And we can look at in the model that suppose N goes down from 25 to 20 to 10 to 5, right, how does that impact the spread of infections?

The other parameter here is P. And remember, P is the probability that if one infected person meets another random person, what's the chance that this infected person is going to pass on his or her infection to the other person? If you think about vaccines, and what do vaccines do, vaccines reduce the risk of that. So vaccines lower the probability that even if you meet an infected person what's the, the chance of you're catching the virus that goes down. So in terms of the model, what vaccinations do is that they are going to reduce, lower P. And what we're going to do in the Excel spreadsheet is try and look at what's the impact of a lowering of N versus the lowering of a P on the spread of infections. And so what we'll be exploring is this sort of question that how do lockdowns affect the spread of infections? How do vaccines affect the spread of infections? So now let's go to the Excel sheet.