Strategy: An Introduction to Game Theory
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Lecture - 55

Hello and welcome to mooc lectures on Strategy, An Introduction to Game Theory.

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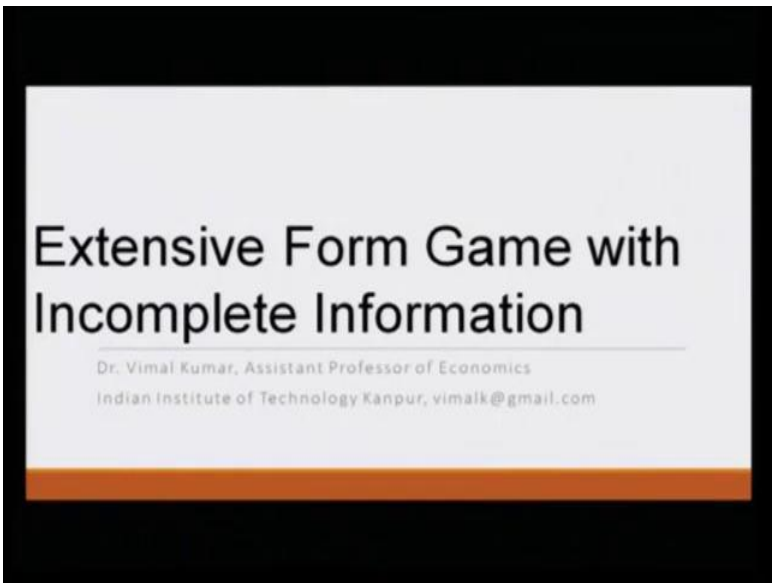

We are in the final week and today, I am going to start the final topic of this course. The topic is Extensive Form Game with Incomplete Information.

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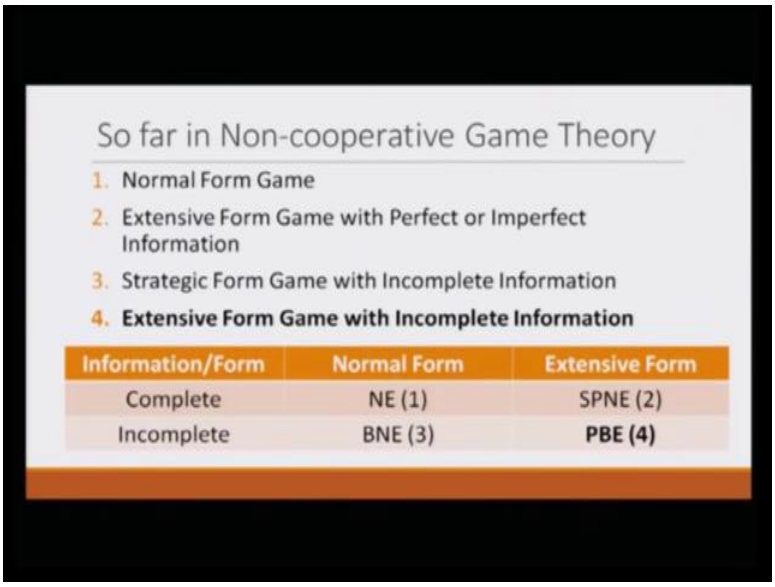

So, far let us look at we have done in this course, we have talked about normal form

game, we studied that how to model strategic interaction when players are moving simultaneously and the solution concept that we used was Nash equilibrium. After that we realized that in some of the scenarios, strategic form game is not adequate. So, we also talked about extensive form game and we represented an extensive form game using game tree and then, we learn the solution concept first, backward induction technique and then, the equilibrium that we came to know was sub game perfect equilibrium.

After that, Aditya talked about strategic form game again, but this time in incomplete setting and there you learn the concept of be any that is, Bayesian Nash equilibrium. The fourth that we are going to talk about starting today or starting from this module is extensive form game with incomplete information and there, we will learn a new solution concept called perfect Bayesian equilibrium. So, here is the table that gives a nice summary.

Let us look on the rows, there are two rows, it talks about complete information or incomplete information and in the column, we have normal form and extensive form game. Then, if we take complete information with normal form, then we get normal form game and there the solution concept is Nash equilibrium. And similarly, if you look at the second row second column, then you have incomplete information in extensive form game and there you learn, there you will learn perfect Bayesian equilibrium.

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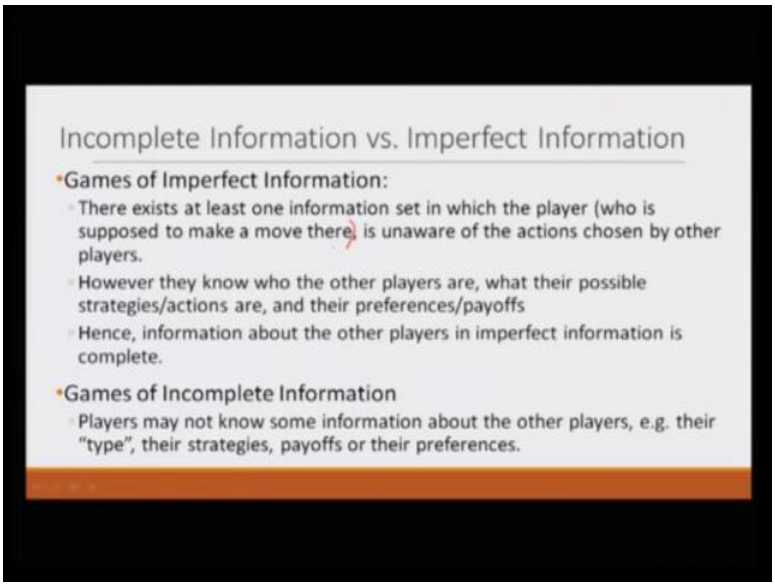

So, before we get into details, it is good time to clear if there is any doubt between incomplete information and imperfect information. What do we mean by games of

imperfect information? Remember, when we are talking about extensive form game, we learned something about information set and there we learned about games of imperfect information. And what did we see? That, if there exist at least one information set in which the player, who is supposed to make move in that information set is unaware of the actions chosen by other players.

There should be a bracket here; however, that player, all the players know who the other players are, what are their possible strategies, what are their preferences and what are their payoffs. The only thing they are not aware of is that the actual move made by the player. They do not observe some of the moves made by other players, that comes into the category of games of imperfect information.

Just to submit up that, here information about other player in imperfect information case is complete, the only thing that is unknown is that strategic uncertainty that player does not know, what action the other player has taken. As oppose to games of imperfect information, we talk about game of complete information, here players may not know some information about the other players, they may not know their type.

You now, you must be familiar with what do we mean by type when you studied Bayesian games with Aditya, you must have learned about types. Players may not know the strategies of other player or the payoffs, so that is how incomplete information game is different from imperfect information game. If I may say, I should add that games of imperfect information may, as I describe the games of imperfect information maybe of complete information, but games of incomplete information is always of imperfect information.

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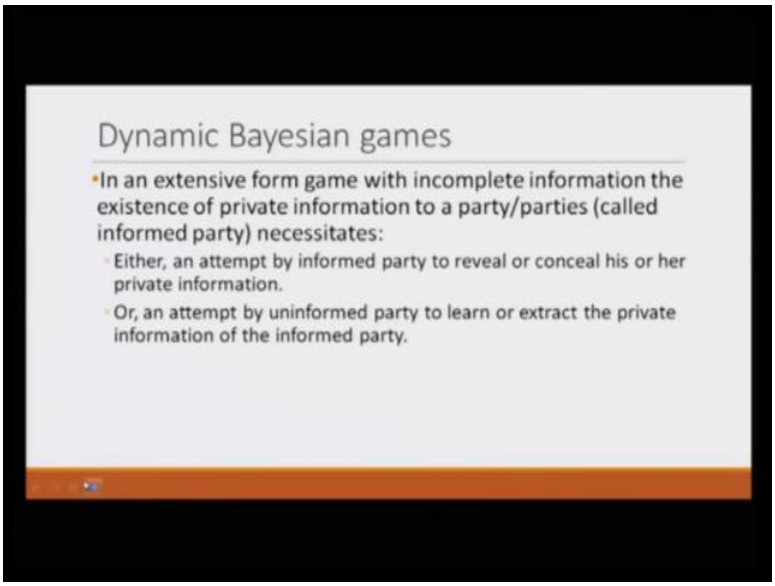

So, dynamic Bayesian game is the other name that we give to the extensive form game with incomplete information. What happens here, that there are different parties and different players, players may have different type and let us say one of them, one of the players may have some private information. So, what happens in this case?

Either the informed party, the party which has private information will try to reveal or conceal that private information depending on what it wants, how, what is his strategic interest or uninformed party may attempt to learn or extract the private information from informed party.

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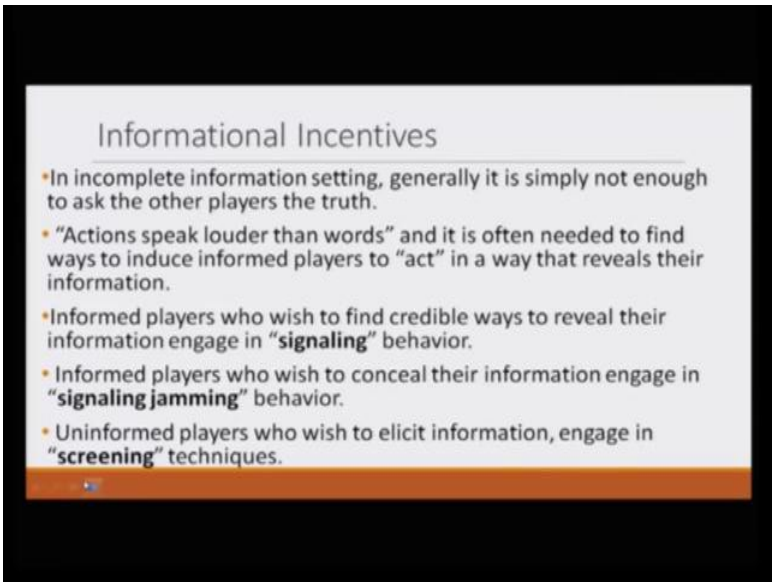

To look at it little bit more detail, let us look at the informational incentive, through that player would either try to reveal or conceal the information. So, you may simply say that when players are of different types and some of may have some private information, why do not you just ask the other player that, what is your private information, that is simply not credible here, that cannot be done. Here, what we have to believe in is that actions speak louder than words and it is often needed to find ways to induce informed players to act in a way that reveals their information.

For example, if lying is beneficial for let us say the informed player, then informed player would lie, informed player would not reveal that information. But, if it is beneficial for that informed player to reveal that information, it will try to find a way to reveal that information. But, why I am saying find the way, why cannot he say directly? Because, if he says so directly the other player may not believe, so he has to figure out ways to give that information to other player.

So, informed player who wish to find credible ways to reveal their information engage in activity called signaling. For example, let us say there are two types of students, one hard working student; second is the lazy students who do not want to work. Now, when a company comes to interview you for a job and if you are hard working students, you would try to reveal that you are a hard working students and how would you reveal, you will try to signal it to the other party.

How would you signal it? You would say, so that this course is difficult, not all students have taken it, I took this course, because I am a good students. Not in the word, but your transcript may say so, so this is a kind of signaling. Because, you are informed party, you know your quality, the company which is trying to hire you does not know your quality, so company is uninformed party. So, your informed party would signal this to uninformed party.

If we continue with the same case, let us say that you are a lazy students, then what would you do, you would try to manipulate you will try to conceal the information that you are the lazy students and how would you do that, you would do it through signal jamming. Your take would be, if this is widely known that a particular course a is a difficult course, then you would say that you did not take that course, because of timetable, class or so on, some something some reason you would come up with, so that would be signal jamming.

Now, that is also possible, it is also possible that uninformed party gets to move first. So, uninformed player who wish to elicit information to get that information, engage in screening technique like IIT system conducts JE exam to screen good quality students from bad quality students. So, IIT system uses a screening device that is JE.

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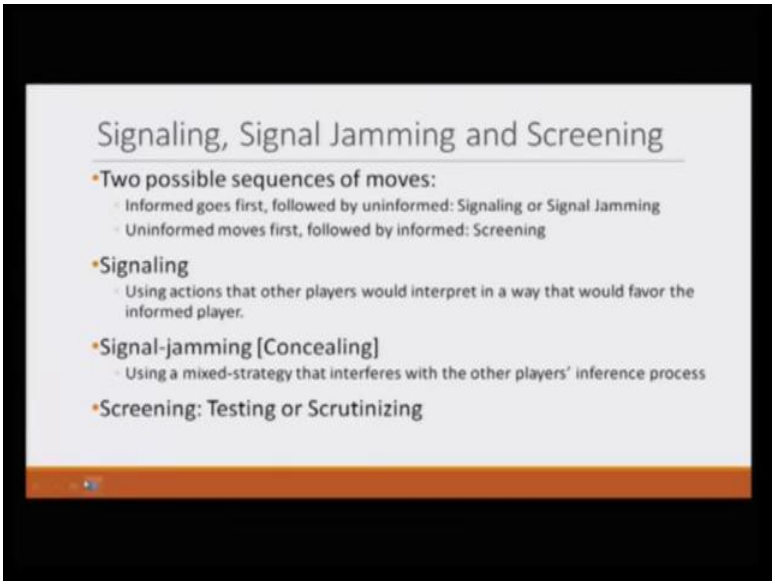

So, little bit more details on signaling, signal jamming and screening. Before, we close this module let us reemphasize these three concepts that we just learnt, one is signaling, second is signal jamming and third is screening. There are two possible sequences of moves, which is very, very important. We should not, that we do not confuse between signaling and screening. What happens? They are two possible sequences of move, first that informed party goes first.

What informed party would try to do depending on the strategy consideration? Either, it will try to reveal the information or conceal the information that it has. So, when informed party move first, then only we can talk about signaling or signal jamming. When it is trying to reveal the information, then it is signaling; when it is trying to conceal the information, then it is signal jamming.

If uninformed party moves first, then we have we call it screening, because what informed parties is trying to do, informed party is trying to separate good quality worker from bad quality worker. So, uninformed party is coming up with the screening device, which would separate these two different types of workers in two different groups, so signaling is about using action.

Remember, in a game theory we have been talking about all the players are different in formation notes, can have possibly different action and they take a particular action. So, signaling is using an action that other players would interpret in a way that would favor the informed player, so it is for the benefit of informed player. Signal jamming typically what happens? Because, here player would typically play a mixed strategy, why, because as we have already seen, if one action says that worker is of good quality, then automatically taking other action would say that worker is of bad quality.

I am just going with the analogy of good worker and bad worker, but it maybe applies to several other scenarios also. What the bad worker would do? For signal jamming that he would typically play mixed strategy, so that would confuse the uninformed party and uninformed party would not be able to inform the quality of worker and in screening, we have talked about it. Screening is testing or scrutinizing and it is done by uninformed party to gather information about informed party.

Thank you.