Strategy: An Introduction to Game Theory
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Lecture – 01

Hello everyone. Welcome to this introductory module in the course Strategy: An Introduction to Game Theory, right. So, let us start this course by first defining what a game is. Of course, all of you have played many games since you were a child. So, all of you intuitively have an understanding of what a game is. Let us try to define it more rigorously and characterize what are the different components of the games that we are going to talk about, right.

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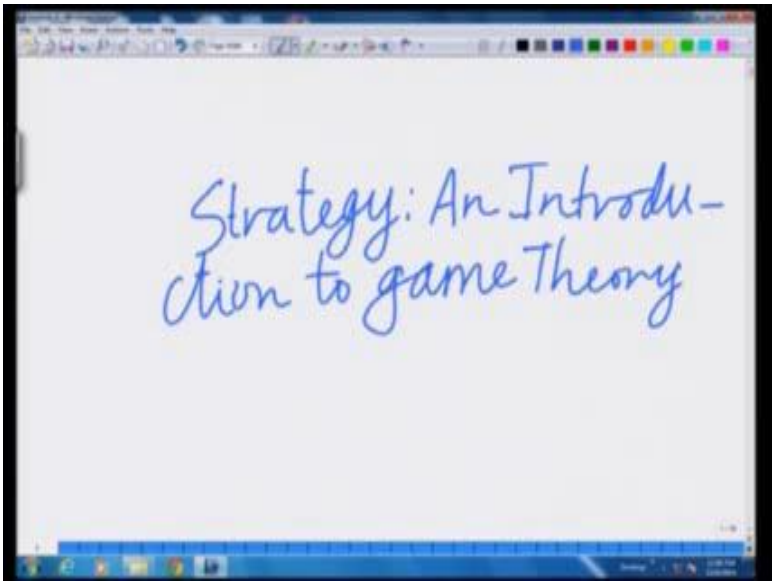

So, the course is Strategy: An Introduction to Game Theory in which we are going to talk about the theory of these games and to understand the theory, therefore we have to first start by understanding what a game is, right.

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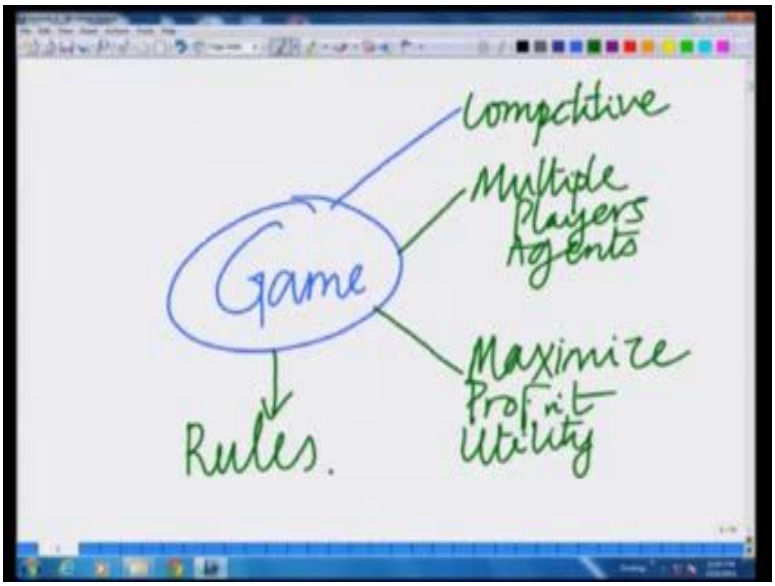

What are the different components of a game? Of course, all of you are familiar that to play a game inherently and intuitively involves some form of a competition. It is a competitive activity, right. So, again fundamentally by its very nature is a competitive activity. There is notion of a competition, there is notion of a strategy, right and of course, another important aspect of a game is that whenever you want to play a game, you look for a partner, you look for a child. You might have looked for someone to play the game with siblings, right. So, game inherently, the notion of the game is, a game involves multiple players, two or more players, multiple players or multiple to concretize this notion multiple agents. So, a game inherently also involves multiple players, multiple parties or multiple or also known in the context of game theory as agents.

So, game is a competitive activity. It involves multiple players or agents and of course, while playing your game, you are looking to win the game. When you are looking to win the game, you are looking to maximize either your points, maximize either your goals or also you are trying to maximize your profit or you are trying to maximize what to derive from the game, or your utility from the game and the aim of the game is to maximize the profit or more generally speaking, maximize your utility. Also, finally everyone knows that each game has to be played according to a set of rules. So, therefore a game is characterized fundamentally by a set of rules. So, these are the different components of game. A game is a competitive activity it involves competition, strategy. Of course game is played by multiple players, right. It is the game between multiple players or agents.

Each agent is looking to maximize his own profit or utility, and fundamentally the game has to be constrained by a set of rules. It has to be played according to a set of rules, right.

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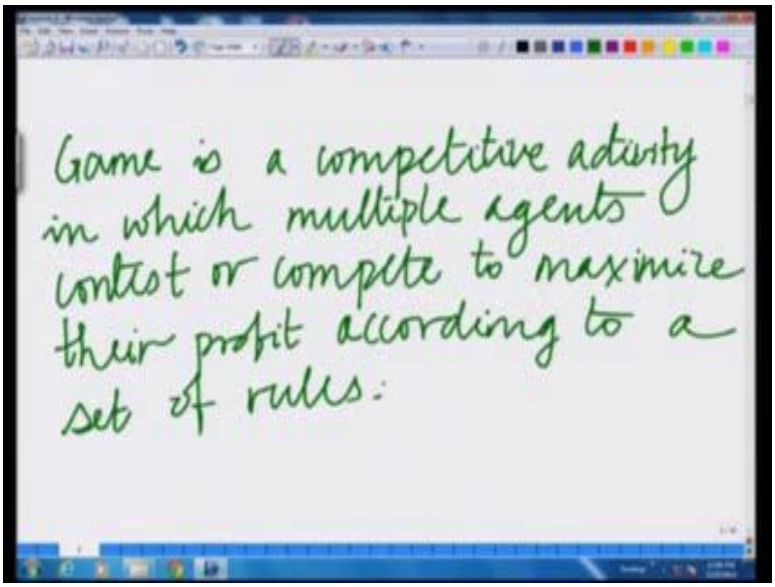

So, a game can be defined, therefore if have to fundamentally define a game or more rigorously define a game, a game can be defined as a competitive activity in which multiple agents contest to maximize their profit or multiple agents contest or compete to maximize their profit according to a set of rules, right. It has to be played according to a fixed set of rules. So, game is a competitive activity between multiple players in which multiple players compete to maximize their profit or utility according to a set of rules.

What do we want to do next is, you want to characterize, you want to now we have an abstract definition of the game. Now, you want to say can you look at a couple of real life scenarios or can you see how they fit into our definition of the game, or in another words we want to look at some of the real life scenarios and better understand how they can be modeled as games.

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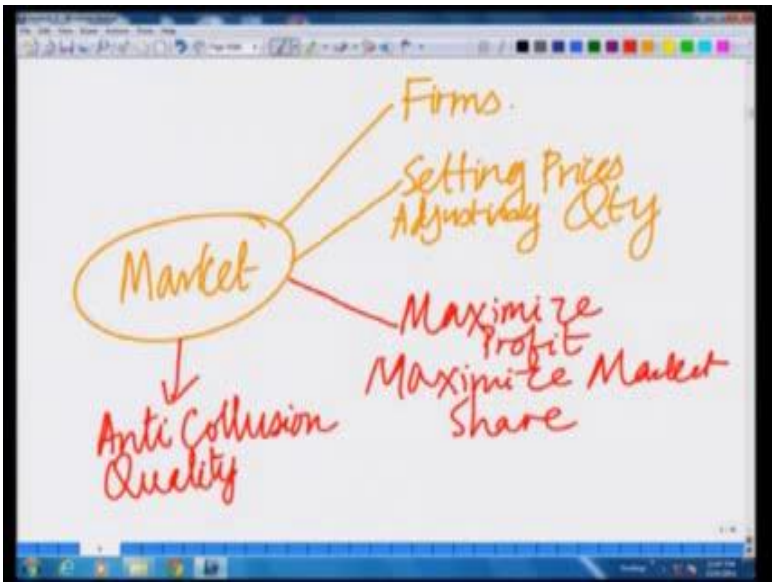

So, let us start with a basic real life scenario in which there is a market. We are all familiar with a market scenario. By a market I mean various firms or various companies, various goods which are available to the consumer. So, who are players in a market scenario? Naturally it will be the players in the competing agents in the market scenario or in the different companies or the different firms. So, the different firms which are producing different goods, right. These might be soft drinks; these might be soaps or whatever. So, these different firms are competing.

How are they competing? They are competing by using the strategy and the strategy can be as diverse as setting prices, adjusting the quantity, increasing or decreasing the quantity, right. What is their aim? Their aim is therefore at the end of the day to maximize their profit. Everyone is maximizing their utility. What is the utility? In this context, the utility can simply be the profit or they might be trying to maximize the market share trying to build brand loyalty. So, they can also be trying to maximize their market share.

What are rules in this context? There are several rules. For instance, there is strict rules on the kinds of goods can be sold in the market. More importantly there is a rule that these different companies cannot collude to artificially fix the prices that is an important rule. This is known as the anti-collusion law. So, the rules with respect to colluding, there are rules with respect to quality of the kind of goods that can be sold alright. So,

this is the market game which is governed by its won set of rules in which the different player or the firms which are setting prices, adjusting the quantities of the goods towards maximizing the profit or maximizing or possibly also maximizing their market share, right.

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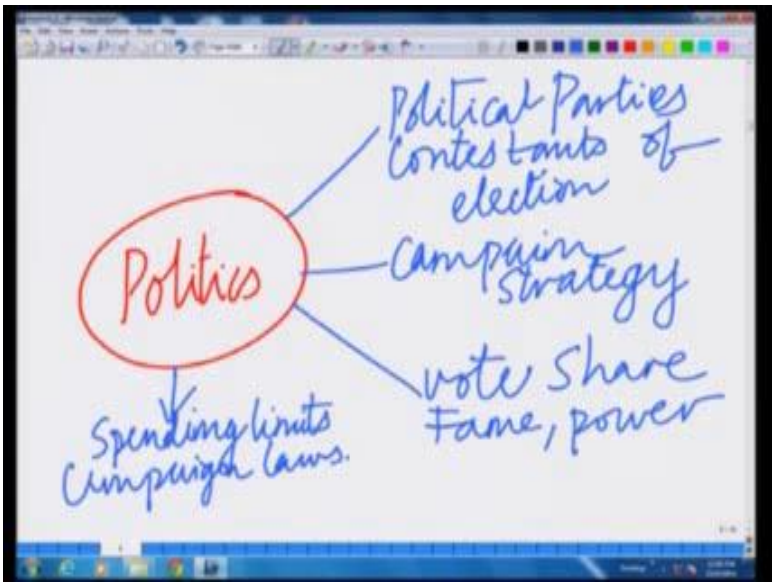

Let us look at a slightly different game. How about the political scenario-Politics? We all hear the term the games politicians play, right. So, politics, this is another important game. So, who are the different agents? The different agents can be either different political parties or the different politicians who are contesting the elections. So, you can say the contestants of elections, right. What are the different strategies? We have different campaigning strategies. You compete in terms of their campaigning strategy which a campaign which either to right or to the left or towards the center, right.

What they seek? They are seeking to maximize their utility which means basically maximize their vote share or win an election and thereby, earning probably fame, responsible opposition of responsibility and power, right. Also, every election has to be played or every election has to be conducted according to set of rules. For instance, there are rules on campaign spending limits, right. So, the rules on spending limits, there cannot be campaigning on certain days. For instance, campaigning is not allowed on the election days, right. So, they are governed by spending limits, campaign laws. So, this is an interesting set of examples looked at market example, where the different agents at

the different firms trying to sell goods to a consumer. We have a political scenario, where the agents are politicians who are trying to campaign towards maximizing their vote share and win an election and of course, each election has to be conducted or the politicians themselves have to play with ambit of certain set of rules under certain frame works, right.

Let us take a totally different example which is also becoming very popular these days. For instance, let us take a wireless communication scenario. Mobile communication is becoming extremely popular or has become extremely popular in the last decade.

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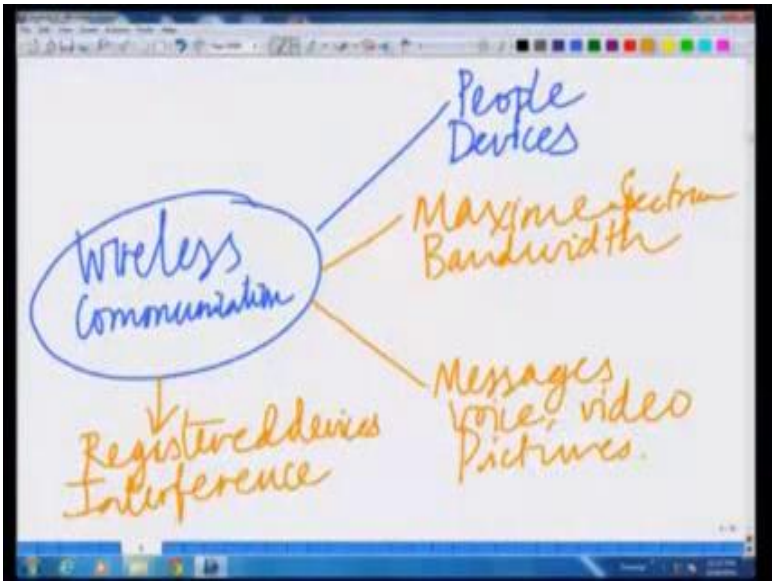

So, if you take example of a wireless communication scenario, then the different competing agents or the different people who own these mobile devices. So, the people, the different competing agents or the people or basically the devices themselves automatically run the program to compete for the resources. What are the resources and what is everyone trying to maximize? The bandwidth or the spectrum or the numbers of channels available to these devices are limited. So, everyone is trying to maximize their bandwidth or the spectrum that is available to the device, so that they can transmit over the radio, the common radio channels. After all the radio channel is common to all these devices.

So, everyone is trying to maximize the spectrum or bandwidth allocation, right. The strategy of the user, the aim is to maximize, to gain access to transmit over the radio

spectrum and ultimately, so that you can transmit either messages or voice or multimedia contents, such as video pictures etcetera. There are several rules according to which this game has been played. For instance, not everyone can be allowed access to the spectra. Only set of registered devices with a cellular operator can be allowed to access the spectrum. Also, there are rules on the kind of interference. For instance, a device cannot cause more than a certain levels of interference to other devices, so probably transmitting on the spectrum.

So, the rules concerning registered devices, the rules concerning interference, so this is an interesting example of a game that can be formulated between these different wireless communication. This game can be programmed between these different wireless devices, so that they compete for the chance to transmit over the radio spectrum, of course according to a certain set of rules, right.

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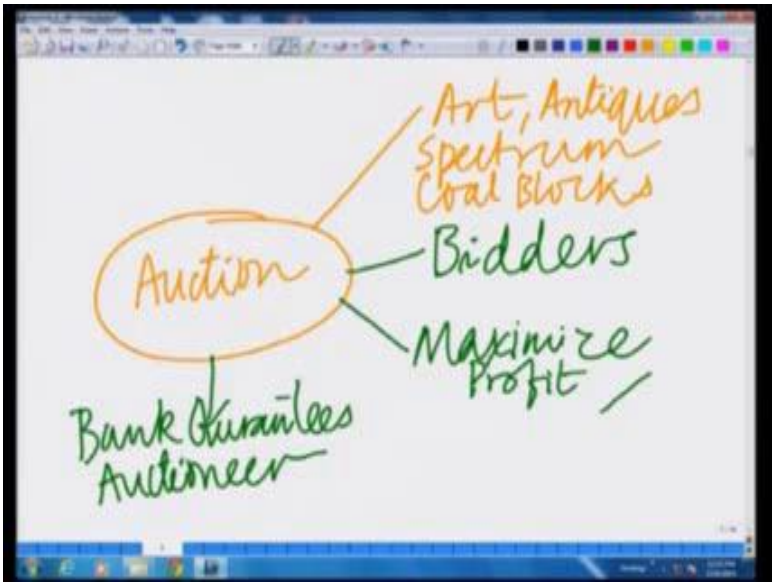

Another totally different example, yet one other totally different example can be in the context of an auction. Of course, an auction scenario we just write this and I am writing to you clearly, auction. Of course, an auction is something that is used to clear or sell items which are very precious. For instance, these kinds can be item, such as either art or antiques and other precious items which are in the public domain which belong to a people of certain countries. For instance, spectrum or mining resources, such as coal

block to mine a particular mineral. These belong to people. So, these have to be auctioned to the highest bidder.

So, who are the competing agents in this game? The competing agents are the different bidders who are bidding for the rights for either these mining rights or bidders who are bidding for the pieces of art or the spectrum. So, these are the competing agents. The agents are the competing players or the bidders who are strategizing through their bids for trying to win or try to win the rights to these different objects or these different resources and so on.

What are they looking? They are trying to maximize the utility, maximize their profit. They are trying to gain the object or trying to gain for instance the spectrum, but not only they are trying to gain the spectrum, they are trying to gain these objects at a reasonable price. Their aim is to gain these rights to these resources at a reasonable price in order to maximize the net profit that they can make out of the auction. So, the aim is ultimately not only to the gain the object, but to gain them at reasonable price, so that you can in turn maximize the net profit or what you can derive from leading these resources. So, the aim is also to maximize the profit while gaining access to these resources.

Of course, what are the rules? There are different set of rules that one has to follow in an auction, right. Of course, the auction is conducted by Auctioneer and everyone is allowed to speak for instance in a normal alt option. Person is allowed to speak only when auctioneer queue that the person is allowed to speak, right and there is a certain minimum bid value, right. For instance, that bid cannot be lower than the certain value and the bid has to be sequentially increasing in value. Also, there are guarantees that if the bit is accepted, then that the buyer indeed has to purchase the object. So, there are purchase guarantees, there are bank guarantees with which people are allowed to bid, all right.

Auction is conducted by an auctioneer who enforces these different set of rules. So, auction which basically can be formulated as an interesting game which is employed frequently to sell art antiques, spectrum and coal blocks and many other things for which either they are in the public domain on the auction. It is difficult to determine the price and different agents or the players or the multiple bidders who are trying to bid for these different objects. They are trying to maximize the utility, they are trying to derive from

this game, they are trying to maximize the profit by gaining access to these resources at a reasonable price and of course, there is a set of rules which is enforced by the auctioneer or the auctioning company or the agency that is conducting these auctions.

So, we have looked at a couple of examples of the games. We have looked at market which is the game between different firms, we have looked at politics which is the game between different politicians or political parties, we looked at wireless communication scenario which can be modeled as a game between these different mobile devices or devices which can transmit over the radio channel, and we have also looked at an auction scenario which is the game between different bidders who are trying to gain access or who are trying to gain control of who are trying to win this different objects, be it art antique and so on.

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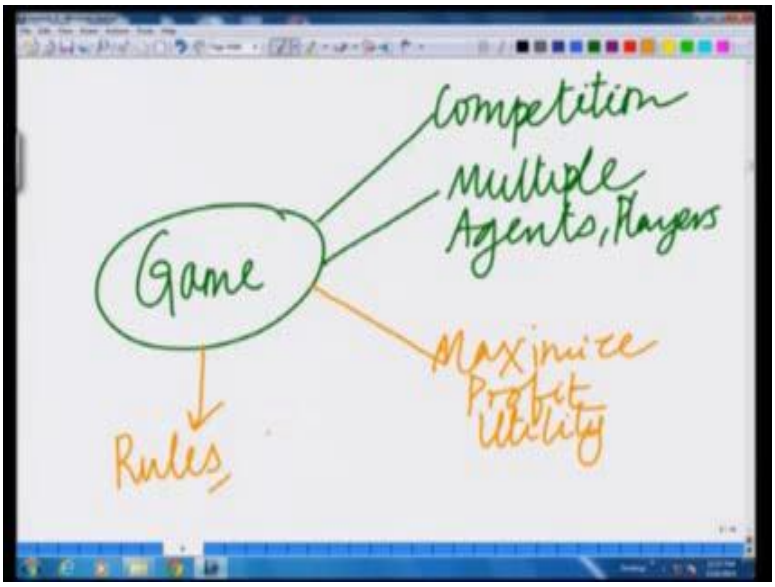

Therefore, to summarize a game, again let us summarize this set of idea. Game is a competitive activity. At the end of the day, a game is a competition. There is no charity, right. It is a competition with different agents or different players and other things that it involves. It involves multiple agents or multiple players, right and also the aim of this multiple agents or multiple players is to maximize their profit or maximize their utility, and a game is played fundamentally according to a set of rules that is a game is played in the ambit of certain set of rules. It is played in a framework that has to be constrained by

a set of certain rules which allows us certain set of possible strategy, the set of possible action for each player, all right.

So, these are the different aspect of a game. This basically completes our definition, a formal definition of a game and sort of several examples of this notion of the game that we have defined can be used to model real life scenarios. In the next module, we are going to look at; we are going to start developing the rudiments of the game theory, so that we can first build modules for these sort of games and try to extract meaningful results and develop, thereby develop intuition about the kind of strategy and about the kind of results or about the kind of behavior that one can expect to see in such games.

Thank you very much.