Game Theory and Economics

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Module No.# 01
Introduction to Game Theory
Lecture No.# 01
Definition of Game Theory and Rational Choice

Welcome to this course, game theory and economics. My name is Debarshi Das. I am a faculty member in the department of humanities and social sciences, IITGuwahati.This is part of the NPTEL2 initiative that has been taken.This course is called game theory and economics and obviously, as the name suggests it deals with various aspects of game theory -what it means, what are the various aspects of this game theory and its interaction with subjects like economics or subjects like political science, biology,auction theory.

We shall be dealing with all these aspects of game theory,which we can use in these different subjects.By way of introduction,we shall startwith a definition of game theory.Let me justtake you over the entire syllabus that we are going to coverin this course.

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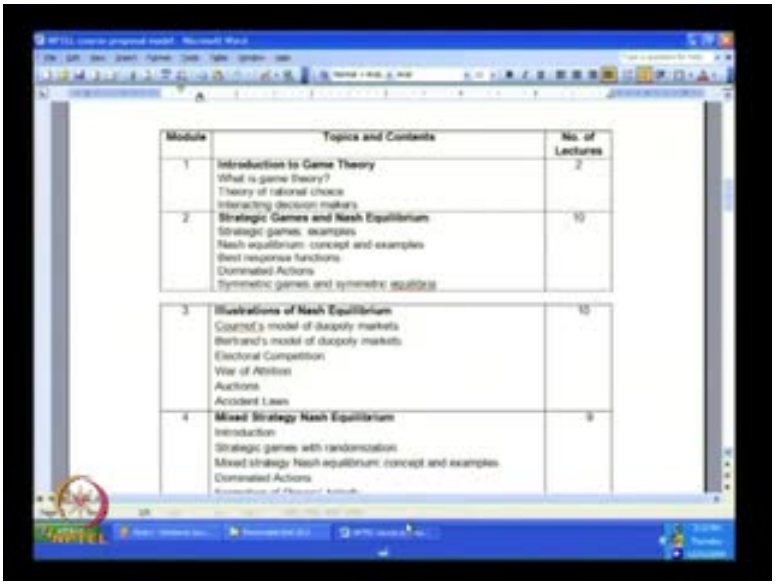

So, here is the syllabus. We start with introduction of game theory, what is a game, what it essentially deals with and then we talk about the theorem, rational choice which basically forms the founding stone of the game theory.

We then talk about strategic games and Nash equilibrium - the idea of Nash equilibrium because you should see that Nash equilibrium -the concept of Nash equilibrium can be taken as the starting point of the theory of games. So, this is the second module which is strategic games and Nash equilibrium.

We shall talk about various examples of Nash equilibrium. Then we go to best response function, dominated action, symmetric games and symmetric equilibria. So, second module basically deals with the theory of Nash equilibrium and strategic games. Then in the third module, we shall deal with various illustrations of Nash equilibrium- in real life or in different parts of economic theory and how we can use Nash equilibrium.

So, the specific examples that we shall take are Cournot’s equilibrium of duopoly markets,Bertrand's equilibrium model of duopoly markets.Then we also talk about political science use of game theorypolitical science.

We shall talk about electoral competition.How we can use the tools of game theory in understanding how elections take place and what are the stands that parties take?

We also talk about war of attrition after that and auction and accident loss; that takes care of the third module. After that, we have fourth module where we talk about mixed strategic Nash equilibrium.Why it is not sure what action, theplayer takes at a particular point of time; theplayers may randomize between different actions and if that is the casethen what are the ideas of equilibrium that can be generated.

Then in the fifth module we talk about extensive games and Nash equilibrium.Here, in extensive form game, we basicallytry to extend themodule of extend ofsimultaneous spoke game in two cases, where there is an element of time.People may take decisions one after another in the sequential form.In the previous form of game, that is, in the strategic form of game, the elementof time was missing.

Finally, in the sixth module, we shall be taking aboutillustrations of extensive form games and Nash equilibrium.

You can see that there is a pattern in all these. First we shall start with strategic form game, the theory and then theillustrations.Then we talk about mixed strategy Nash equilibrium its illustrations and finally, extensive form game and its illustrations.So, that is more or less road map for this course.

About the references: the books that we shall be following in this course.The most important book that I shall be more or less sticking with of course, we are going toget our material from other sources also.The most important reference isan introduction to game theory.There is the text book of game theory written by Martin Osbornefrom OUPand there are some secondary references.One is micro economic theory; though this book is on micro economic theory, there is a section on game.

So, one can refer to that part of that book.This book is written by Mas-Colell,Whinston andGreen.It is a standard reference for economics in masters level.

The third reference isa primer in game theory;this is a relatively easier book written by Givens.

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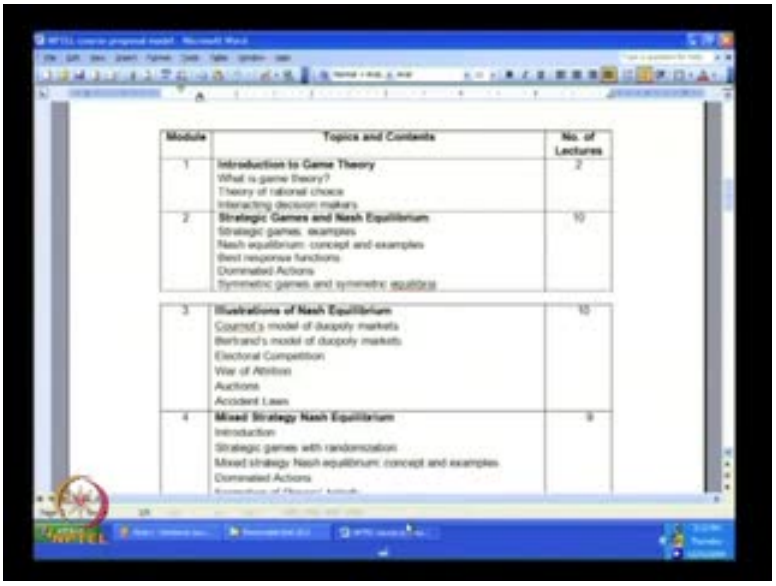

So, this is more or less the road map and the references.Thoughin this course,there is no prerequisite, in the sense that, you are not supposedto know anything beforehand to understand this course, but nevertheless some basic knowledge about mathematics, algebra,calculus, differential calculus will be helpfulin understanding this course and apart from that if you have some previous knowledge about economics, how the basic economic theory builds up; that will again help you in understanding the course.

So without much ado, let me start with the course and the first topic as you may have remembered isthe definition of games.What one means by games and what does game theory deal with.

So, game theoryActually, if I want to define the idea of game theory and the idea of games as such, game theory helps us to understand situations where decision makers interact.In many real life situations,as we shall see, people interact with each other and your decision will affect what I shall get out of that situation.

In game theory, wetrytofigure out, how this interaction takes place and what are the possible outcomes that can be generated from such interactions.So, per say when people hear, the lay person hears that there is a game.People generally associate game with plays, where maybe there are two contending parties, who arecompeting with each other according to certain rules. That is what, one means by games.

But here, you can see that we are using the idea of games in a more general sense.It is not just like two football teams are playing with each other; it is more than that.

For example let me give you some examples.Take the case of two firms - two companies for example.Suppose, there is a company A and there is a company B.Maybe both of them are selling soft drinks in the market.Maybe one is Pepsi Cola and the other isCoca Cola company.

Now, in such a situation, it is obvious that what Pepsi Cola company will be doing will be affecting what Coca Cola company - the other company gets out of the situation.For example, both the companies may be interested in maximizing their profit.

Now,when Pepsi Cola company announces certain price for its products, that affects its profit, but the price announced by Coca Cola company also affects Pepsi Cola's profits because if Pepsi Colaoffers a lower price for its products, that means the Coca Cola consumers might like to consume Pepsi rather than Coca Cola and in which case, the other company will get affected.

So,here we have a situation of interaction.What I am doingwith my actions, is affecting other players and vice versa.Their action also affects what I get out of that situation.

So, game theory tries to find out in such situation, what are the possible likely outcomes and if there is a way to mold the situation such that better outcomes can be generated from this entireinteraction.

So, this is one example where companies are fighting with each other and we try to figure out what will happen through the theory of games, but this is not the only case.This is if you remember is a case of economics because in economics, we deal with firms who are competing with each other, but in game theory we go beyond economics.

We also talk about for example, how parties - political parties interact with each other because political parties also like firms do interact with each other.Let megive you an example againfrom India.For example, suppose, there are two political partiesCongress party and BJP.

Now, whatever policy Congress party announces before the elections is going to affect its chances of winning the elections.Obviously, if Congress party says that I am going to

spend 1000 crore rupees after I get elected, that may help the voters to choose Congress party because they will think that so much money is going to be spent; we are going to get some benefit out of it.

But whenever Congress party does so, it basically affects the chances of BJP to get elected because if Congress party gets elected BJP does not.

So, in such a situation,BJP would like to do something else by maybe announcing some more money it will spend, if it getselected, to raise its possibility of winning.

So, here also you see that the parties in an indirect manner are interacting with each other and trying to get the best out of the situation.Here also,in this kind of situations, we want to figure out what happens in such casesthrough the theory of games through the tool of games.

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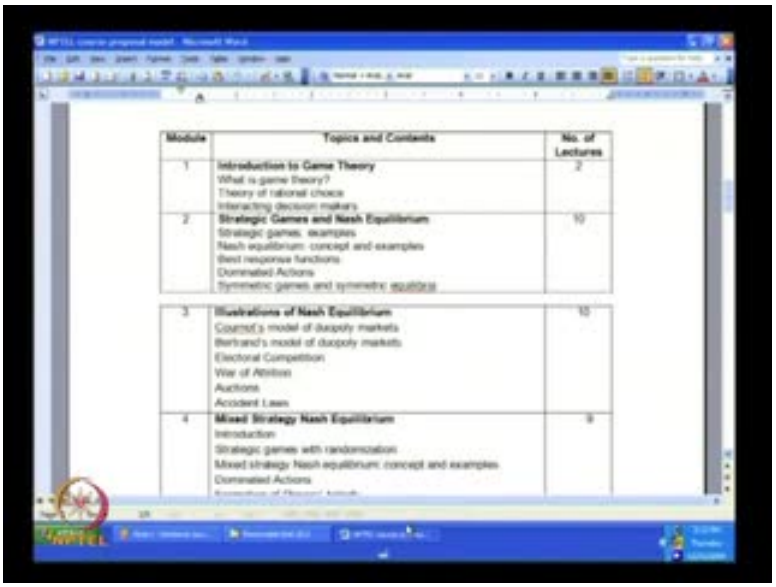

One can go on and sight other examples.For example, take the case of bidding.Suppose, a very valuable piece ofart is going to be auctioned.

Now, in auction what happens is that different players come to the bidding and they try to buy that good by offering more and more price.Which player will ultimately get the object and what is his financial capability?All these things can be modelled through thetheory of games.

So,there is a separate theory within economics which is called the auction theory and we are going to look into auction theory also, in this course.

We are going to see that game theory indeed tells us some certain, very significantabout what will be theoutcome in auctions, like which player will be able to finally,win the object and which player will lose the object or will not get the object.

So, this is more or less, the idea of games.Tocontinue this discussion further, what we are going to do in this course is that we are going to present a series of models.What is a model?If you are familiar with economics, you have seen what a model is.Let me give you a simple example.This is an example from economics, but I am going to explain each and every step in thisexample of a model.

This is a model about a market.So, in the market basically, we see that there are two sides: one is the side of the buyers; people who demand goods from the market and the other side is the side of the seller, who sells goods - who are the suppliers.

Now, since there arethese twosides in the market, we can represent the behaviour of the buyers or the demanders and the sellers or the suppliers through two basic equations; these are called behavioural equations.

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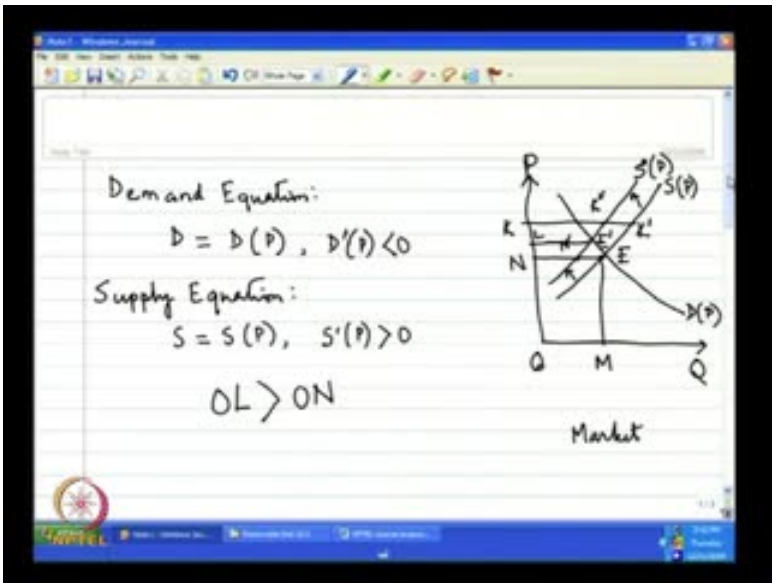

The starting point of a model is this assumption regarding the behaviour.Let me write it down.First is the demand, what we call the demand equation.This demand equation

captures, how the people who are buying goods in the market are going to behave, if the price in the market changes.This is represented by D,suppose.D is the total quantity of the good that they are demanding.D is a function ofP;P is the price of the good.

So, this functional relationship tells me that if price of the good changes, the quantity that the demanders will buy from the market or they will demand from the market is going to change, but how is it going to change.Suppose, price rises, is the quantity demanded rises, does it fall or does it remain constant?Well, we have again one behavioural assumption there, which is known as the law of demand, that says thatif price rises, demand declines and vice-versa. If price falls, demand rises.

This is called the law of demand and we write it very simply as,D prime P is less than 0D prime P, again I have used calculushere, differential calculus.That is, if I take the derivative of the demand function with respect to P which is the independent variable, it is going to be a negative quantity which isa very brief way of saying that demand is inversely related with price.

Now, this relationship of quantity demanded and price in the market is written here mathematically, but the same thing can be shown diagrammatically also and here we are trying to do that.So, in this diagram along the horizontal axis, we are representing the quantity of goods demanded and supplied.This is represented by Q;Q for quantity and along the vertical axis, we are representing the price in the market.Mind you, price is the independent variable here.Though in generalin mathematics, we represent price,if it is an independent variable, along the horizontal axis, but here it is convention in economics that price is represented along the vertical axis.

Now, given the demand function equation that we have written here, obviously, if I want to represent it geometrically, it will look like this.A downward sloping linebecause the slope is negative -D prime P is less than 0.So, the total demand in the market and how it varies as the price of the good changesis a downward sloping line.

This is just one side of the market.On the other hand, there is the supply side.On the supply side, we have this supply side equation which is S as a function of P.What kind of function is it?

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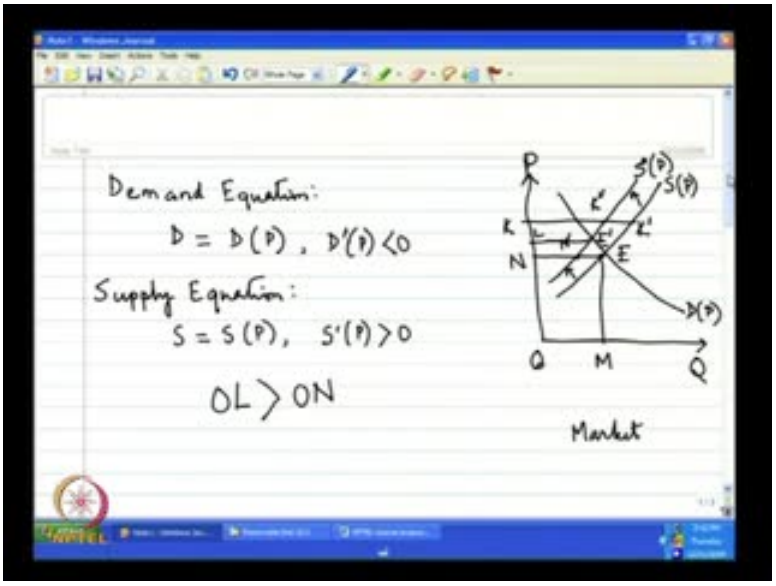

Now, with reasonable justification,it can be argued that S prime P is positive, which means that if price in the market rises,it is most likely that the people who are selling goods in the market, they will offer more goods to be sold.This is just the opposite of the demand side.If price rises, obviously, the buyers are going to buy less.It is not very worth why to buy goods, when there are very costly.

But if the goods are costly, for the suppliers, the sellers, they will be very keen to sell more in the market.That is why S prime P is positive.If P rises,S also rises.S represents the quantity supplied;D represents the quantity demanded.

Nowsimilarly, as just as we have represented D, we can represent S and it will be an upward rising function like I have drawn in the diagram.

So, this is the model.This is the model of a market.You can see that I am starting from some basic equations, the demand equation and supply side equation. I am representing them mathematically, geometrically, but what is the purpose.The purpose is that I want to say something about, what the equilibrium market price will be.What is meant by equilibrium market price?It can be defined as a price in the market which will prevail in the marketwith reasonable stability.Obviously, if the demand side equation changes drastically then price will change, but as long as the demand side remains same and supply side remains same, the price will be stable at that particular value.

So, that is that price we want to predict from this model and in this model,the model will tell us that the equilibrium price in the market will be that price where demand and supply are equal, which is happening at the point of intersection E.E is the point ofintersection or the equilibrium point.

So,E is the equilibrium point. From E, we draw to perpendiculars on two axisand suppose the perpendiculars are EM and EN.Our conclusion will be that in this market the equilibrium price will be ON and the equilibrium quantity that will be bought and sold in the market will be OM. ON is the per unit price and OM is the total quantity of goods bought and sold.

Now, this is a model through which I can figure out what the price will be, what quantity will be transacted from some basic assumption.It can tell me further.It can tell mehow we canvisualize a situation where for example, I am just givingan illustration.Suppose, there is a government and the government has put some restriction on export of a particular good.This good is this good that I am taking about.The market for a good I am taking about and on that good,there is a restriction on the export of that good.

Now, suppose, it so happens that the government has lifted restriction on the export of that good and it is observed in the domestic economy that after the government has lifted the restriction on the export of that good, the price of the good in the market has gone up.The question is, can that observation in real life be seen through this model that I havepresented and the answer isyes.

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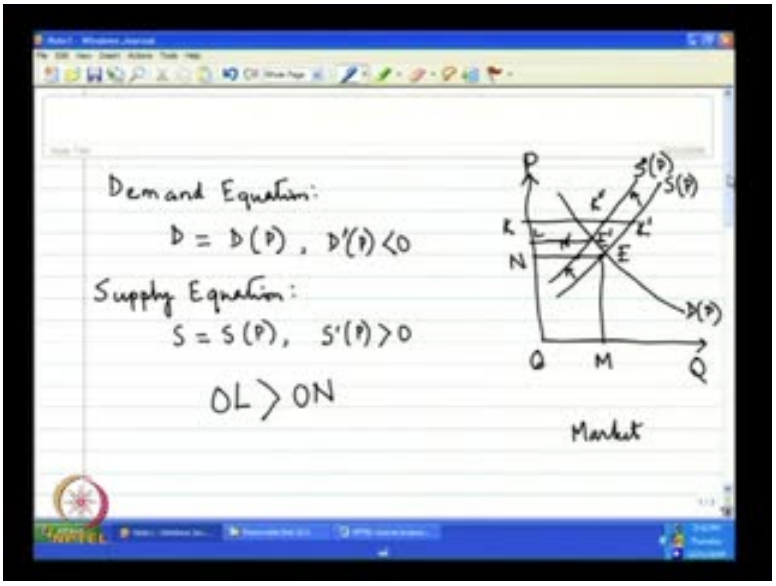

When government has lifted restriction on exports of that good in the market, it is likely that the people who are producing that good now, instead of selling them in the domestic market, may like to sell them in the foreign market and as a result, the supply of that good in the domestic market will decline because thesellers or the suppliers will be more interested to sell the good abroad, where the prices might be higher.

Now, if less good is sold in the domestic market, what will happen to the supply curve here, the SP??It will fall.It will decline.So, at each price let at any priceSupposeON is the price, atON price, any amount of good was being supplied before.

Now, suppose the supply is less.Suppose, it is N dashednow. ( ) It is N,N dashed, when more export has taken place.

Similarly, take any other price.(Refer Slide Time: 23:17) Suppose, it is K andat OK price, suppose previously the supply was, but now after more exports suppose it has come down toSo, these points N dashedK double dashed, if I join all these points I get the new supply curve.

Let us call this S dashed P.Now,S dashedP is the supply curve which is taking place because the suppliers are now supplying more goods abroad and selling less goods in the domestic market.

So, that supply curve is actually shifting to the left andyou can see that as the supply curve has shifted to the left, the new point of equilibriumwill not be E, it will now be E dashed and you can see that at E dashed, the equilibrium price is higher.Suppose this point is, I have already used N dashed, let us called this point to be L.

So OL is the new price.O L is higher than O N that is, the new price is higher than the old price because the supply has gone down, because the suppliers have exported more goods to the foreign market and they have sold less goods in the domestic market.

So, through this model, you can see that the real life incidents, the real lifephenomena can be representedthrough some conceptual tools likegeometric tools or mathematical tools.So, this is the purpose of a model.Itbasically helps us to figure out what is happening in the real world through some basic principles.Here, the basic principles were the demand equation and the supply equations.

Now, there can bean underlying justification, why demand curve is downward sloping and supply curve is upward sloping. I am not going to go into those details; that will be an economics course and that is not the purpose of the game theory course, but the main thing is that in any model we want to explain reality.We want to see what the world is, can be explained through some basic principles and also, if we want to change something in the real world, then how it can be changed.Can something be done with the demand function and the supply function here such that theequilibrium price in the market is changed?So, that is also another purpose.

Now, having said that, it is true that the interaction between model and the real life, the real worldis a two way process.First, I want to capture the real life through my model, but in many cases it may happen that my endeavour was wrong.Maybe I predicted something through my model which is not matching with reality then what do I do.Well, I come back to my model and try to see where I went wrong.Maybe I have to change my assumptions which was not correct and which did not match with reality. So, it is a two way process.The real world basically acts as a check on what I am building as a model.

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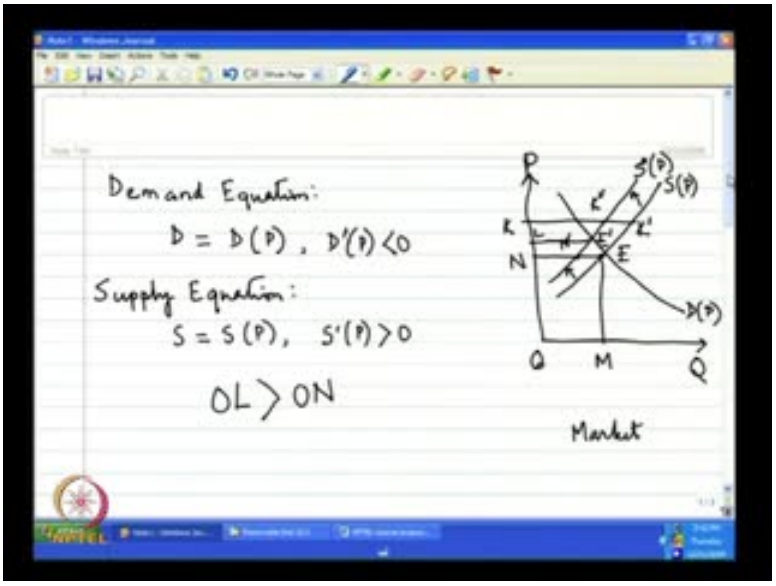

In thiscourse also, what I am trying to do or what we shall do is thatthere will be series of models.They will try to capture thereal world through some basic principles and try to see if some of the phenomena that we observe in the real world can be explained through some basic conceptual assumptions and their interactions.

So, this is the starting pointthat we are going to use a lot of models.The models do not describe reality in its details.It just tries to capture the essence of the situations and what is the essence in a particular situation will be determined by what we want to capture; what is our main focus in a particular situation.

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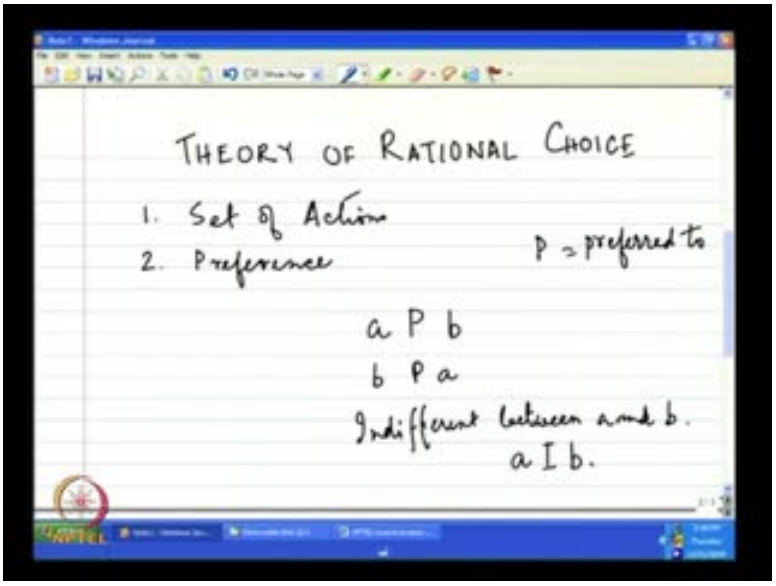

Now, let me go to the next theme here, which is that in this entire courseat the back of our mind, what we shall have is what is known as the theory of rational choice.

This theory of rational choice will always be there, underlying the entire course.Theory of rational choice is the corner stone of the economic theory of our time, the main stream economic theory, but what does it say.

Let me justbriefly try toexplain what this theory of rational choice says.It says that in any situation, every decision maker has a set of actionsavailable to him and this decision maker or what we shall say as economic agent maybe, will take that decision that is best for him according to his preferences.

So, there are two components to this rational choice theory.First is the set of actions of an individual, of an economic agent maybe.It can beother kinds of agents also and second is the preference of that individual.What does one mean by preference?It means that given the actions that he can take what action he prefers to othersand there can be maybe n numbers of actions that he can undertake.

So, it means that he has an idea that if two actions are presented to him, suppose, a and b, whether he likes a to b by P means preferred to.So, whether he prefers a to b or does he prefer b to a or is it the case that indifferent.It can also happen that he is indifferent between a and b; this can be written as a I b - indifferent.

So, the basic point I am trying to make is that every individual at any point of time has many actions to choose from, but he will take that action which is best for him.

Nowand tosay that he will take that action which is best for him, it is necessary that he must be able to say that if he is given two choices - two actions, which is better for him or is it the case that these two actions aresame; it means all the same to him whether he takes the first action or the second action.

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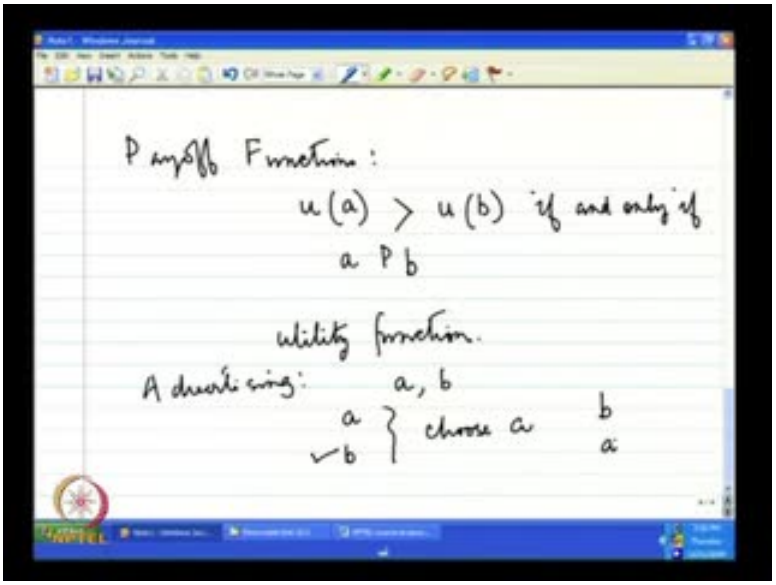

This can also be this entire thing that he has many actions to choose from and he takes the best action according to his preferences can also besummarized through what is known aspayoff function.His preferences can also be summarized through payoff function.Now, what is a payoff function?

Suppose for an individual, u is the payoff function. u is defined over the actions.Suppose, a is an action which is available to him.Then if I apply u on a, then I get a number and suppose there is any other action b.Then similarly, I can take b to be the argument and find out what is the value of u in this case.

Now what is a payoff function?Payoff function tells me that if u is a payoff function then u a is greater than u b, if and only if,a is preferred to b.The implication of, if and only if is that if u a is greater than u b that means a is preferred to b and it goes the opposite way also, if it is found that a is preferred to b, it means that u a is greater than u b.If this is

satisfied, if u satisfies this kind of preferences, then we shall say that u is a payoff function for this individual.Mind you, u is just giving me a number.

So, only if u gives me a number, I can compare between numbers and I can say whether a is preferred to b or the other way or if they are equal.If u a and u b are equal then we shall say that the person is indifferent between a and b.

So, this is the thing about payoff function.In economics, there is a thing called consumer behaviour theory.In consumer behaviour theory, the payoff function is also known as utility function.So, that is particularly for consumer behaviour theory.

Now, theory of rational choice as I just presented to you may seem very obvious because it is saying that any individual, given his actions available to him, given his preferences, takes the best action.

Now,it may not be that obvious, in fact.Take the case of advertising.What do the advertisement firms do?Let me give an example.Suppose an individual has two goods to buy.If he buys good a, he is taking the action a; if he is buying good b, he is taking the action b.

Now, suppose his preferences are such that a is above b, which means that he prefers a to b.If he has sufficient money, that is if he has the capability to take either of the action that means he will chose a, because a is above b.

But now suppose, this company which produces b approaches an advertising firm and this advertising firm now goes to the market and it floods every TV channel, every newspaper with the advertisement of b.

It basically now is trying to convince these kind of consumers that youshould notconsume a, you now should consume b and becauseof the fact that many of the advertisement firm are in fact thriving, suggests that these advertisement firms are able to influence people’s choices.

So, many of the consumers who maybe were consuming a before, they were preferring a to b.Through this advertisement assault on them, if I want to use a strong word, they will now switch and their preference now becomes b over a,which means they are now buying b.

Now, see this kind of situation, if it happens, it is basically violating the theory of rational choice because here the consumer is not sure.Previously he was preferring a to b and he was choosing a.Now, because of something, some external influences,he is now saying that b is preferred to a and I am going to buy b, which means that person'schoices, what they prefer over others are not very clear to themselves at many times and if that is true then the theory of rational choicemay be violated.

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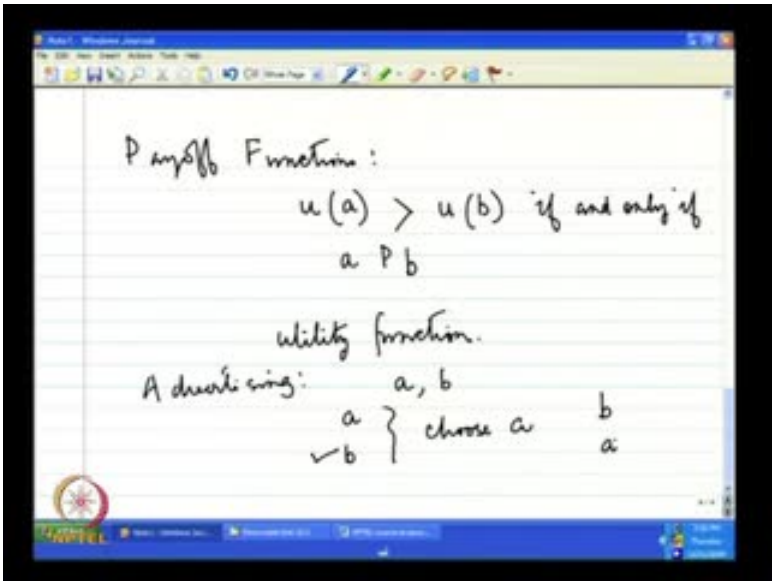

There are other problems with the theory of rational choice as well.For example, though we are notimposing on any restriction on what kind of choices people can make,it may be very outlandish kind of choice for examples take the case of people who are cannibals.

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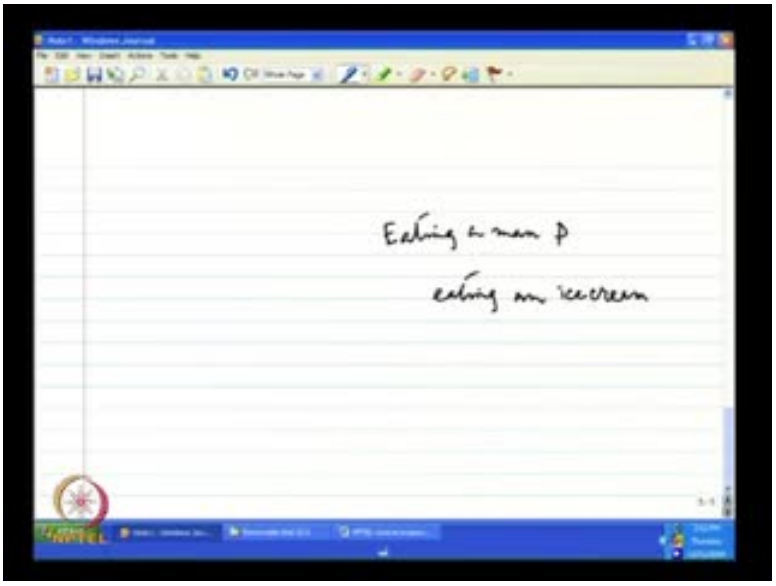

Now, it may appear to a cannibal that eating a man is preferred to having an ice cream.Now, we are not saying that you cannot havethis kind of choices. You can have such kind of preference you are not going to impose any restriction on that.We canvery well have the preferences of cannibals in ourpossible set of choices.That is there; that kind of liberty is there.

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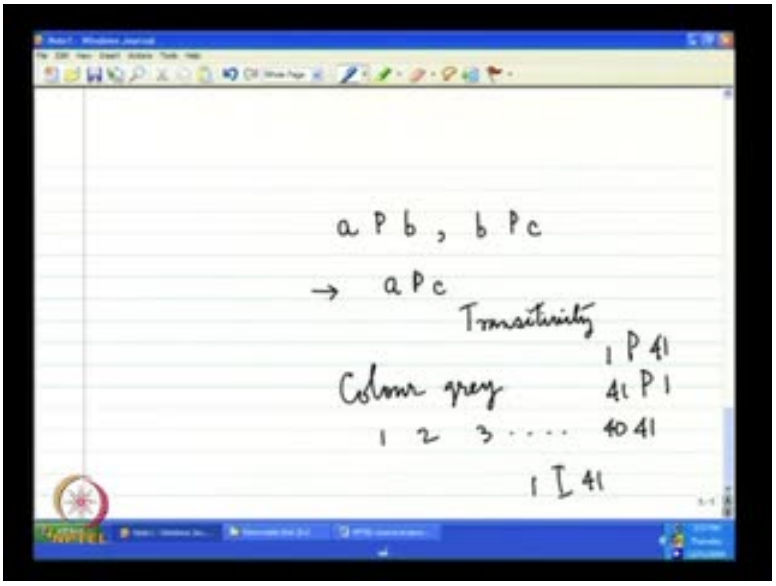

But at the same time, the choice of the consumer or anyagent who is taking any decision has to be consistent. Now, what does it mean?When I say that the choices have to be

consistent,one thing it means is that suppose there are three actions that an individual can take and his preferences are such that he prefers a to b, he prefers b to c.

Now, from this, logically or rationally should follow thathe should prefer a to c.This kind of consistency is known as transitivity of preferences.If you prefer a to b, if you prefer b to c, then it basically means that you prefer a to c. This may seem very logical.For example, if you prefer a house to a car, if you prefer a car to maybe a pen, then obviously you prefer a house to a pen.

But in many situations,it seems that people do not follow transitivity and if transitivity is not followed then again our theory of rational choice is in trouble becausetransitivity is a basicallyoutcome of the theory of rational choice.Now, in which situations people do violate transitivity?Let me give you an example.These are real life examples.These experiments have been done and it is found that people violate transitivity.

For example suppose, one individual is asked to choose from different shades of grey colour and these shades of grey are very minutely close to each other; they are very close shades of grey.

Now suppose, there are 100 shades of grey1,2,3 like that.Since the shades of grey are very similar to each other, maybe very minutely different, if an individual is asked, do you like shade 1 to shade 2?He will most likely say that I am indifferent because they look almost the same to me.Then he is asked,do you like 2 to 3 or vice versa, he will say again they look almost the same to me.So, this way it goes on.

Suppose now 40 and 41, again he will say I am indifferent between 40 and 41 because they look all the same to me, but now when the individual is asked do you like the first one, first shade of grey to the forty first shade of grey, then he can make the difference because he has travelled a lot.

Then depending on his preferences, he might say,I prefer 1 to 41 or maybe, he might say that I prefer 41 to 1 because he can now make the difference that I have travelled a lot and it is very clear to me that the first shade is different from the 41st shade.

So, if I like the dark colour better and one is darker than forty,first shade of grey then the person may choose 1 or if he likes the lighter shade then he will just say that I will like forty first shade than the first shade.

So, these are the examples and there are other examples also, where transitivity is violated, in the sense that if transitivity had been followed what the person should have told us is that he is indifferent between the first shade and the forty first shade because he is indifferent between 1 and 2, he is indifferent 2 and 3, etcetera. He is indifferent between 40 and 41.So, he should have been indifferent between 1 and 41 also, but he is not because now, he can make a distinction between 1 and 41 and hence, he is saying that I like one or maybe I like 41.

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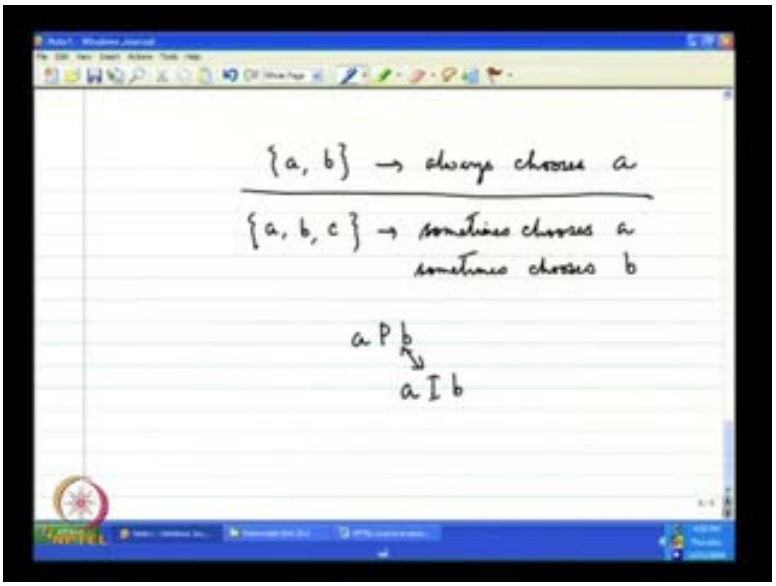

So, there are many cases where the theory of rational choice isnot that fool proof.There are many exceptions.Now, as I have just said that the theory of rational choice has to be consistent.The people's preferences should be consistent and that is one requirement of the theory of rational choice.It means the following thatiffor example, let me give you an example.An individual has two choices a and b; this is the choices that he can make. a is the first action; b is the second action and it is seen that he always chooses a.

If he is given two choices a and b, he always chooses a.Suppose, it is also seen that if the same individual is given three choices;a and b are as before and he is given an additional choice, that is, c.

Now it is seen that he sometimes chooses a and sometimes chooses b.Now, if this is what is observed then you see it again violates the theory of rational choice.Why I am saying that?The reason is that when in the first case, when he has only two choices, he is always choosing a, which means a is preferred to b because he is never choosing b.

In the second case, it is seen that he has now three choices.It is neverthe case, he is choosing c; sometimes he is choosing a, sometimes he is choosing b.What is the conclusion we can draw from that?We can draw the conclusion from the theory of rational choice that both a and b are best suited to him.That is why he is sometimes choosing a, sometimes choosing b.

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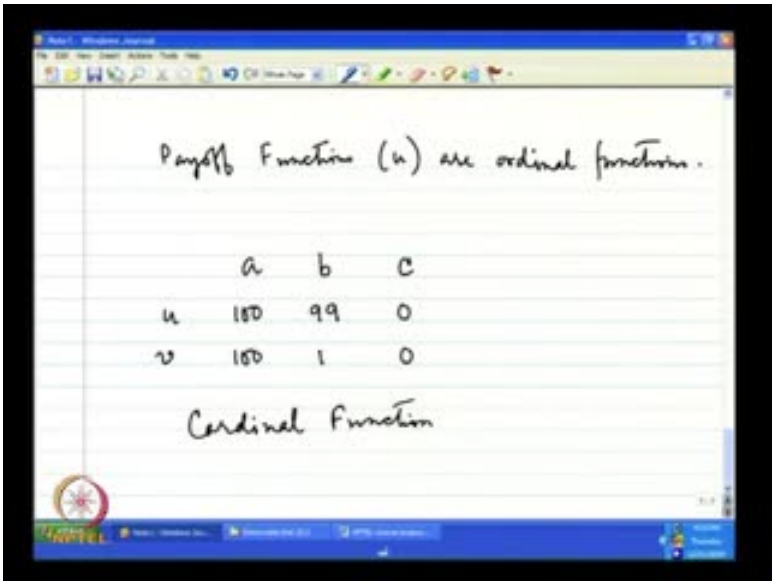

So, it might be that a I b; that is,he is indifferent between a and b and both are best to him.That is why, he is choosing sometimes a, sometimes b, but then it contradicts with the first observation that a is preferred to b.So, this kind of situation if it prevails, it basically violates the theory of rational choice.This is the demand of consistency.Another point I want to make about this payoff function is that, the payoff functions, that is, u are ordinal functions.

Now,what one means by ordinal function is thatif payoff functions are applied over different actions then we get numbers.What matters is not the absolute value of the numbers, what matters is the relative value of the numbers; that is the crux of the ordinal functions.Let me give you an example.Suppose, there are three actions a, b, c and if I

apply u to them, that is, if I take u a, u b, u c, the numbers that I get are 100, 99 and suppose,0.

From this, it is obvious that the best actionfor the individual is for a, the second best is b and the last is c because 100 is more than 99,99 is more than 0.

Suppose, there is another function v and if I apply v to a and b and c, the numbers are the following -100,1 and 0.The point here, is that both u and v, both can be payoff functions because relatively speaking in u, u a is higher than u b, which is higher than u c can be our payoff function.It does not matter what the value of u b is herebecause in thefirst case, the value of u b is drastically different from the value of v b, in the second case.In the first case, it is 99 and the second case, it is 1, but, it does not matter.The ordinal functions will say that it does not matter what value or what absolute value I am giving to these numbers, what matters is relatively 99 is between 100 and 0,1 is also between 100 and 0.So, both u and v will be equally good for me.

So, ordinal functions only emphasize on the relative value, not on the absolute value.If we had talked about cardinal functions, which is the opposite of ordinal then the absolute value would have mattered.For example, if this u and v had been cardinal,I would have said that the preference of bover c is much more in u because the difference is between 99 and 0 whereas, in v,b is liked over c, but that not that much as in u because here in v, the difference is between 1 and 0. That is the case of cardinal.In cardinal approach,if the functions had been cardinal functions then we could have made that kind of conclusion thatit is true that v is liked over c, but in case of u, the preference, the amount of difference of utilityor the benefit that the consumer is getting from b and c is much more, but in case of v it is much less.

So, that could have been the conclusion,if u and v had been cardinal functions, but here when we talk about payoff function, they are not cardinal function; they are ordinal functions, but in thiscoursein a small part, we shall be dealing with cardinal functions.This is justa way of introducing the idea of cardinal functions

So, this more or less, the basic tools that we shall be working with.We have given you the definition of game theory. It basically says that there are different decision makers, who are making decisions and the point is that when I make a decision, it affects not only me, but you also or some other person also.

Since the action of each player is affecting other players, they are going to keep that in mind when they take their own decision.So, there is an element of interaction here in game theory;that is why the actions are interactive.

This is the first point.The second point is that in gametheory, we are going to use a series of models.What are thesemodels?These models are basicallyconceptual tools to understand real life situations.These models are based on some basicprinciples which try to capture the essence of the situation andthirdly, we have said that we are going to apply the theory of rational choice.Theory of rational choice says that any individual at any situation has a set of actions to choose from; he chooses that action which is best for him.

Now, this action may not be unique.There might be two or three actions, which is best for him.In such a situation,maybe he will choose a for some time, maybe he will choose b for some time, where a and b, both are best.

We have also pointed out to some of the problems of the theory of rational choice, which are inheritable.Maybe becauseof some psychological laws,people may not be too much aware of their choices or maybe they are not too much aware of their preferences.So, those things might happen.

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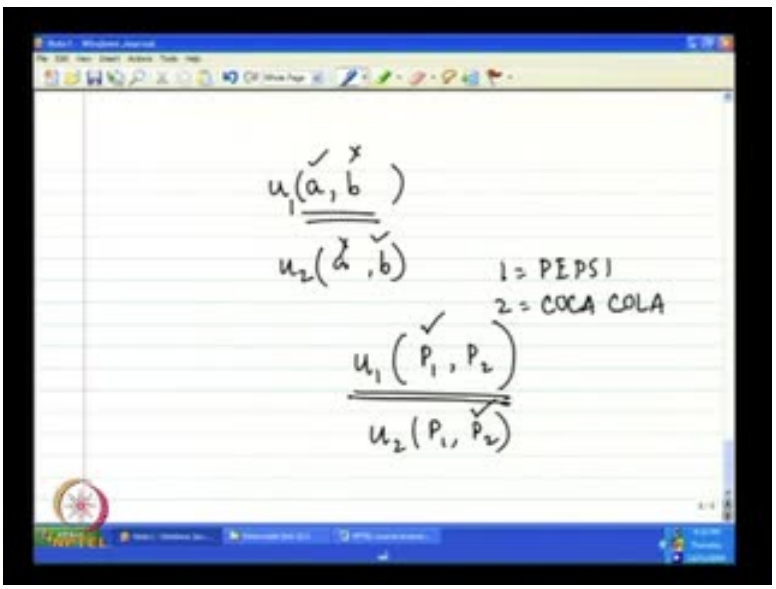

We have also talked aboutthe fact that when people make the decisions, they obviously take the bestchoice available to them, butin this case, mind you, suppose, I am an

individual then what payoff I am getting depends on my action which is suppose a, but since there is an element of interaction, it also depends on the action of the second player which is supposeb.Had this b not been there, the situation would have been easier to understand.He would have taken his own action which is best for him; that is the end of the story.

But in game theory, there is this other element there, is this element of b and if b is there, he does not have the control over this argument which is entering here.He has control over a, but he does not have control over b; suppose, this is individual 1.Similarly, individual 2 has control over b, but he does not have any control over a.So, there the interaction is coming; what you are deciding is affecting me.What player 2 is deciding through b is affecting player 1 and vice versa.That is what makes the game theory more complicated than the situation, where any oneelement had entered the argument set here -if only a were there in u and b where there in u 2.

So this is the idea.If I have to give you some illustrations forthis,for example, again take the case oftwo soft drink companies. If Pepsi Cola decides on P1 and Coca Cola decides on P2 then both these things are affecting u 1.Suppose, this 1 is Pepsi and 2 is Coca Cola then P1 is decided by Pepsi,P2 is decided by Coca Cola, but both of them together decide what is the payoff of Pepsi company and similarly, what is the payoff ofCoca Cola company.Mind you,Pepsi has control over only this and Coca Cola has control over only this and there the element of interaction coming that is,P2 decided by the other person is affecting 1 and P1 is affecting 2.Our aim will be to find out if this is the case, then how we arrive at a situation where there is a kind of stability, what we shall call equilibrium and that will be the purpose of our study of game theory.

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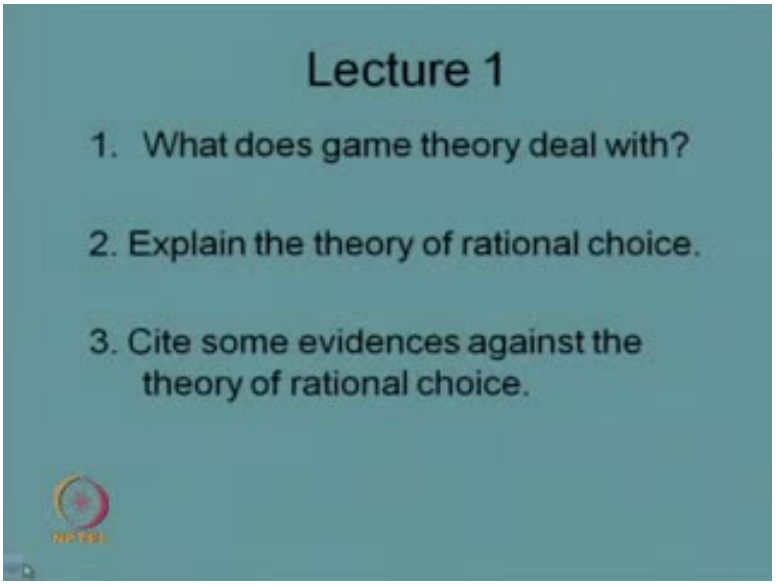

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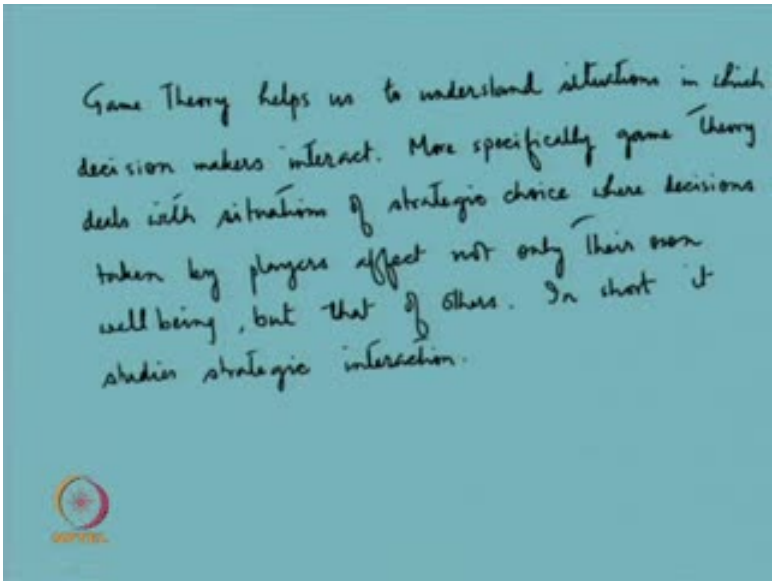

These are the three questions that are there in this exercise.First is, what does game theory deal with. so let us see how we try toanswer thisquestion?Basically, game theory helps us to understand situations in which decision makers interact.So, more specifically, game theory deals with situations of strategic choice where decisions taken by players affect not only their own wellbeing, but that of others.In short, it studies strategic interaction.So, this is the answer to the question, what does game theory deal with.

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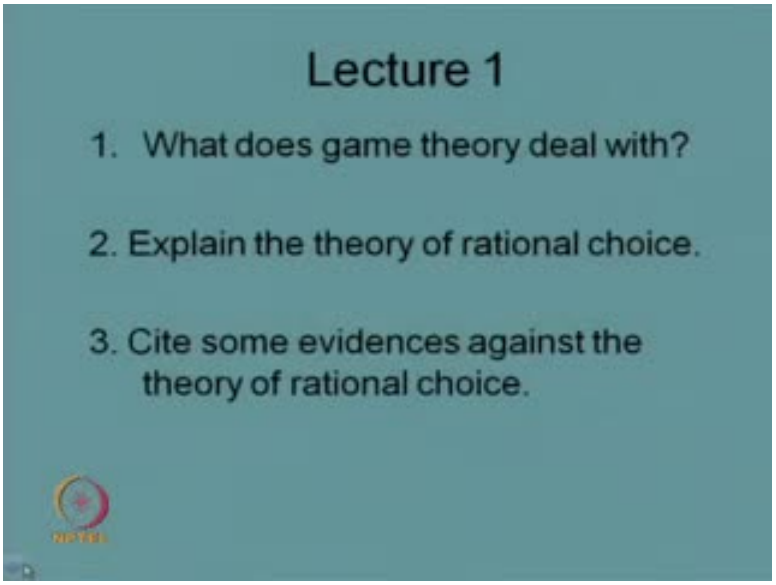

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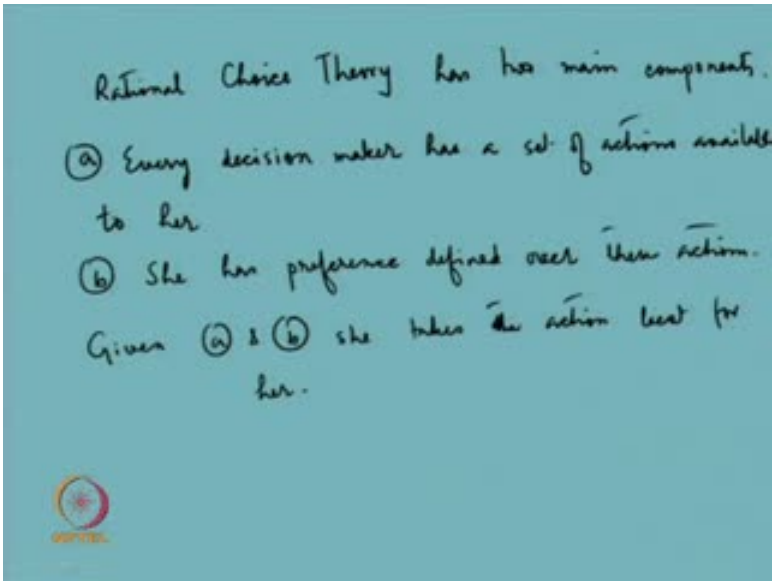

Second question is, explain the theory of rational choice.Rational choice theory has two main components.a, every decision maker has a set of actions available to her.b. She, that is this decision maker, has preferences defined over these actions and given a and b, she takes the action best for her.

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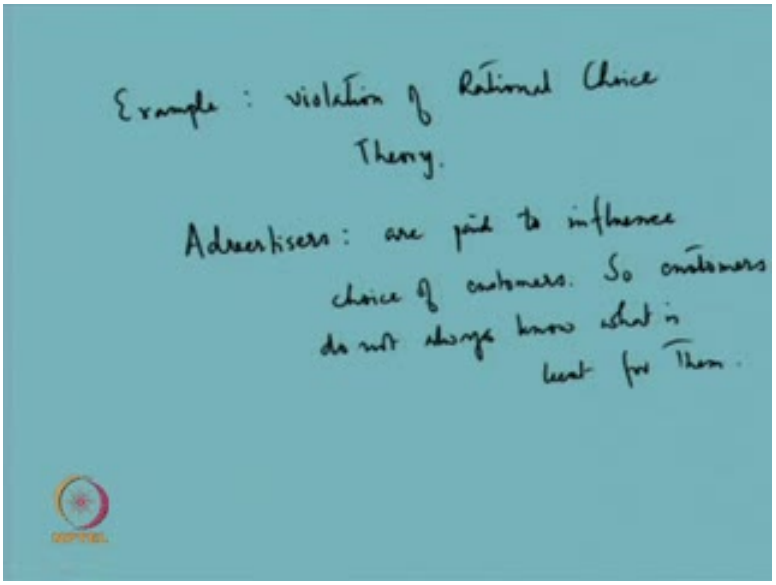

So, just come to the third question; cite some evidences against the theory of rational choice. I will give one example for violation of rational choice.Take the case of advertisers.Advertisers are paid to influence choice of customers.So, customersdo not always know what is best for them, which basically is going against the graying of theory of rational choice.

We shall continue in the next class,with the rest of the topics.Maybe, we shall start with strategic games and Nash equilibrium.Thank you.