Business Analytics for Management Decision
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Lecture – 56
Decision Analytics

Hello everybody, this is Rudra Pradhan here welcome to BMD lecture series, today we will start with decision analytics. In the last couple of lectures we have already discussed several business analytics tools under the umbrella of descriptive analytics, predictive analytics and prescriptive analytics.

And we have discussed several you know business problems and then we have connected with you know various analytical tools under the structure of you know descriptive analytics, predictive analytics and prescriptive analytics and then come with a kind of you know a management decision as per the particular business requirement or management requirement.

So, in the similar lines we will discuss today the component called as you know decision analytics. Here will we address some of the a analytics tools or tool you know look for the management decision corresponding to a particular you know business problem. So, to start with the particular you know you know structure.

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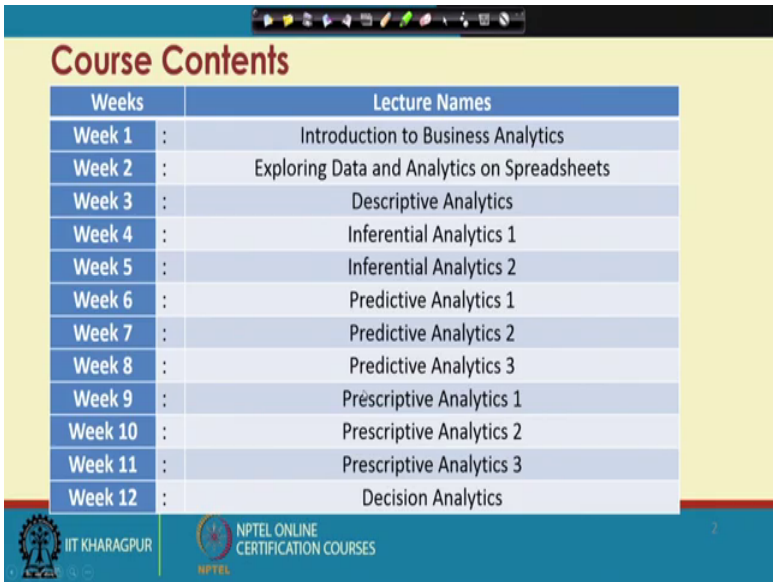

So, this is the last unit of this particular you know course.

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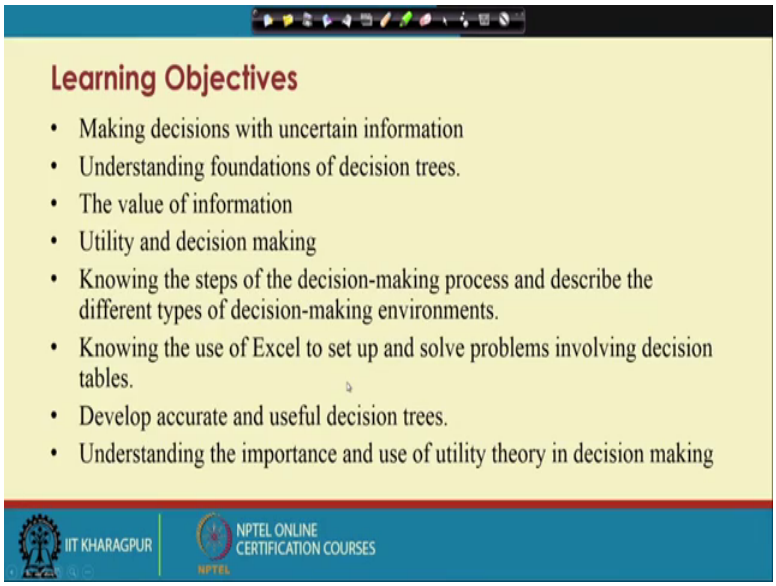

And the typical objectives are making decision with a uncertain you know information understanding the foundation of decision trees, knowing the value of informations, knowing the utility and decision making process. And knowing the steps of the decision making process and describes the different types of you know decision making environments.

And knowing the use of excel spreadsheet to a to set up and to solve problems involving you know decision making process and develop accurate and useful decision trees and finally, to understand the importance and the use of utility theory in the decision making process.

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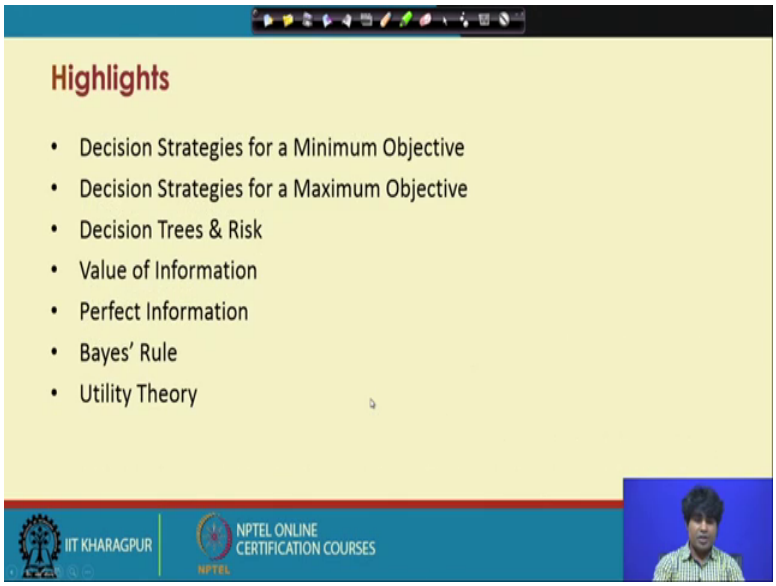

So, the typical highlights are you know to know the decision strategy for a minimum objective, decision strategy for a maximum objective, then decision trees and a risk matrix value of informations and the perfect information best theorem and the utility theory. So, these are the typical highlights which will we address in this particular unit that to you know decision analytics. So, here we have a we have a kind of you know business problem.

So, here we may have a different alternatives, different strategy under the under the you know different strategy and the alternatives we like to pick up a kind of you know situation through which we can address the same business problem.

And then come with a kind of you know decision making through which we can actually apply some kind of you know strategy or some kind of you know forecasting issues through which you can you know bring the kind of you know efficient business environment or the kind of you know kind of you know flexible environment through which we can a you know address the business issues more effectively.

And a there are couple of issues which you can highlight here in the case of you know decision analytics.

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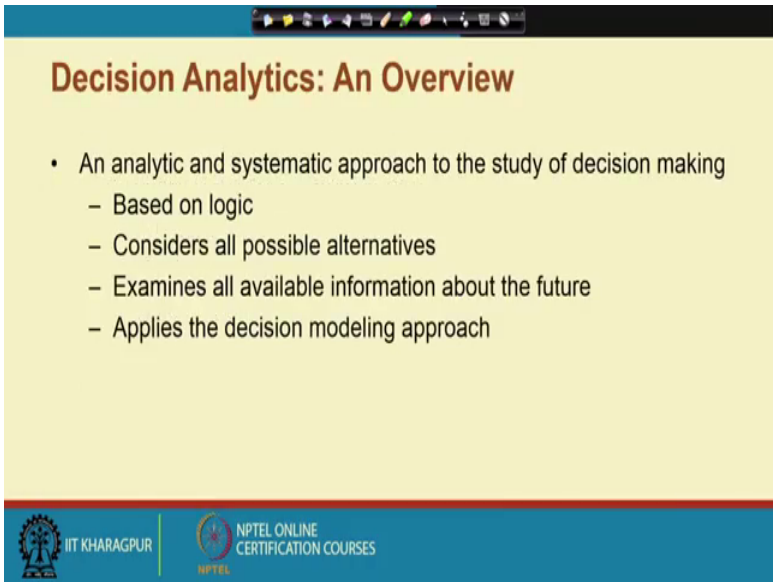

So, first of all what is exactly decision analytics? So, it is an analytic and systematic approach to study and you know the process of decision making and a mostly; it is based on logical kind of you know structure, consider all possible alternatives examine all the available informations and then ok.

So, these are the kind of you know discussion on which you can have here and a so, the typical design making process you know by you know based on particular you know logical issues. And consider all possible alternatives then highlights all available information about the future requirement and a applies the decision modeling approach to address the business problem.

So, these are all the I means these are all the items which we like to you know connect and then you know to address the business problem as per the particular you know a requirement.

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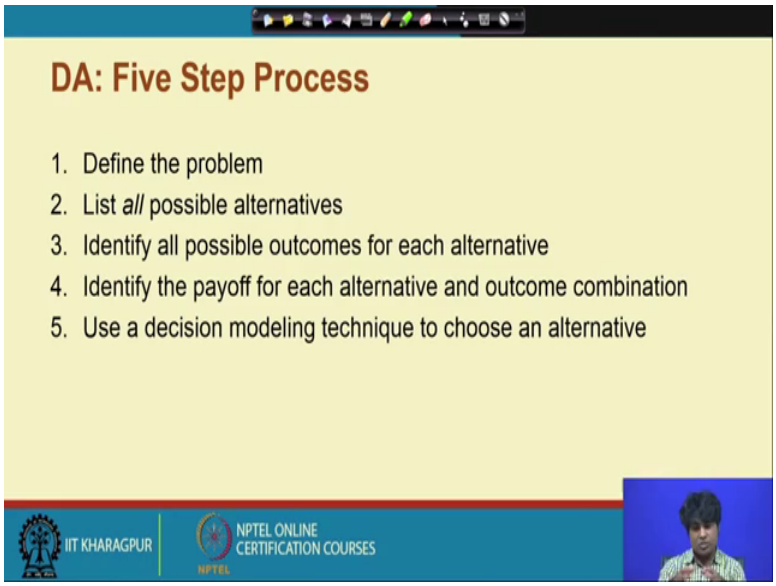

So, what will we do here so, we typically like to know what are the process through which you can you know come with your kind of you know decision making to a kind of you know correspond you know business problem so; that means, we have a business problem. So, we have different strategy, different alternatives then how you know how best we can come with a kind of you know decision making process through which you can address the business problem more effectively.

So, decision analytics basically you know five step process and the first one is to define the problem. So, means a as usual we have discussed you know descriptive analytics, predictive analytics and prescriptive analytics. So, every times the first end requirement is to define the problem accurately once you define the problem, understand the problems then we can you know set the objectives you know connect with the you know data and the kind of you know tools then we can analyze and come with a kind of you know decision through which you can you know address the business problem more effectively.

So, in this case also the same process we have to follow. So, as a result; so, the first step of the particular process is to define the problem, list out possible alternatives and a identify all possible outcomes for each alternatives and a identify the payoff you know for each alternative and a outcome a combine then use decision modeling technique to choose in particular you know alternatives.

So; that means, in the last you know a couple of lectures we have discussed prescriptive analytics. So, here the idea is a you have to find out to several alternatives and then look for the a optimality that you know here we can have you know values of the decision variables through which you can actually a optimize the objective functions corresponding to the requirement of you know minimization or maximization.

So, in the similar angle here we also you know like to address this you know business problem; then come with a kind of you know best solution out of you know possible alternatives ok. So, this is how the a typical requirement.

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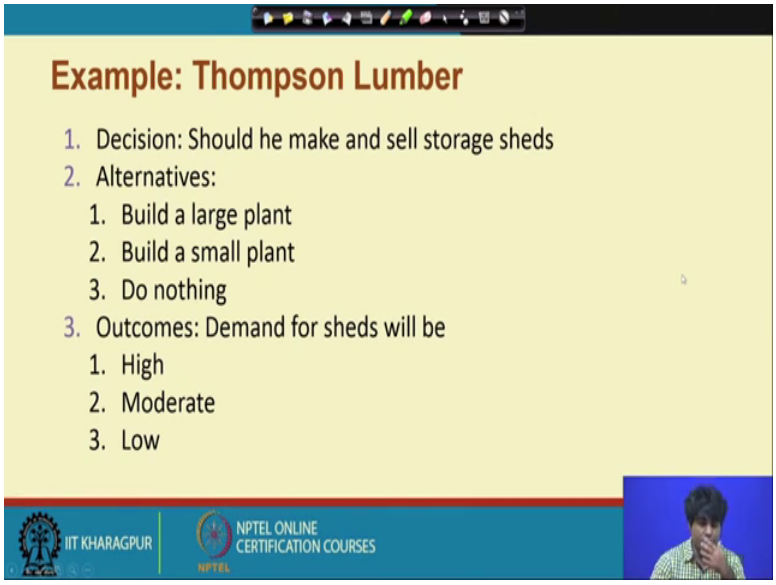

So, now in order to you know just a address how these five steps will work. So, we can start like this and so, the first one is the decision; so, so this is a this is a kind of you know examples where you know you know we should make and sell storage sets. So, this is as per this particular you know examples.

And then in the second steps we like to list out all the alternatives so; that means, in this particular examples we have three alternatives build a large plant, build a small small plant and then do nothing. And corresponding all these three alternatives we have three different outcomes that is the demand for sets that that is with respect to high, moderate and then low so; that means, we have three alternatives corresponding to three alternatives.

So, we have three different outcomes so; that means, these three outcomes high moderate and low will be available for you know large plant and small plant and then nothing. So; that means, all together; so, we have a 3 3 3 options so; that means, altogether we have 9 options and out of which we have to choose a particular you know option through which the particular business problems will be very effective and then come with a kind up you know decision making you know situation through which you can you know highlight the problems more effectively.

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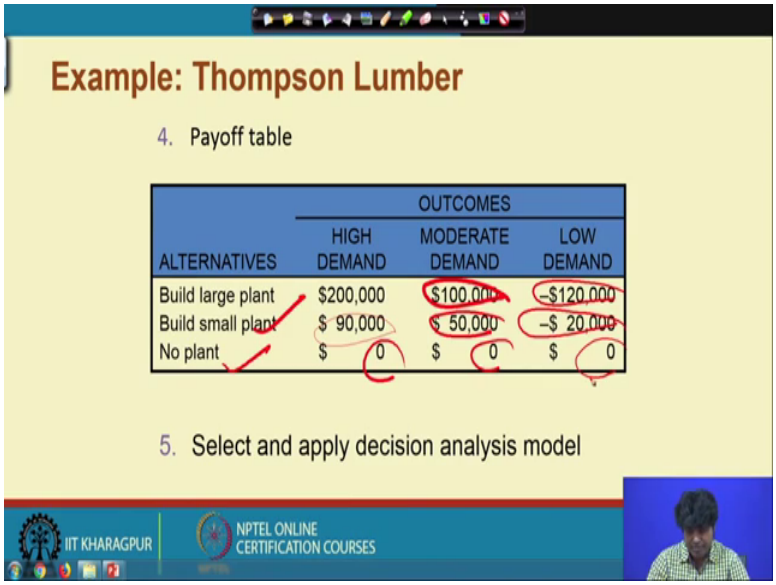

So, now in order to you know address this issues. So, the next step is to prepare a payoff table that is what we sometimes called as you know payoff matrix corresponding to the outcomes and alternatives and we have different alternatives corresponding to different alternatives.

So, the different strategies like you know high demand, moderate demand and low demand. So, we have actually options; so, for instance in this case in this case we have these three alternative 1 and the alternative 2 and alternative 3 and in the case of you know high demand this is actually two you know 200000 and then this is 90000 and this is 0.

And similarly in the case of you know moderate demand. So, for a you know large plant we have a 100000 and this for small plant it is 50000 and for no plant it is a 0. And in the case of you know low demand; the large plant having outcome 120000 minus 120000

and then a small plant it is minus 20000 and then no plant it will be 0. So; that means, see for each head means for each alternatives we have the outcome and these outcomes are available you know at high demand, moderate demand and low demand. And then finally, we like to have a you know select and apply decision analysis model.

So, now corresponding to this payoff matrix and the kind of you know objective which you have actually is (Refer Time: 10:07); so, we can actually see what should be the final you know outcome. So; that means, typically what I have mentioned here corresponding to three alternatives and three different heads like you know high demand, modernity demand and low demand. So, we have here actually 9 different outcomes. So, for a decision making process and that too for this you know objective of this problem.

So, one particular outcome will be the you know final choice to address the problem and then come with a kind of you know management decision. So, that is how you know it can be 200000, it can be 0 or it can be minus 120000. So, like this you know we have a different kind of you know option, but you know. So, we have to you know select a particular options and for that we have a different strategy altogether and that you know the all the strategy to pick up a particular options corresponding to this you know corresponding to these alternatives.

So, exclusively deeper depends upon you know you know you know various tools that is the kind of an analytic structure through which we can actually select a particular options and then we can analyze the problem or you know come with a decision making process.

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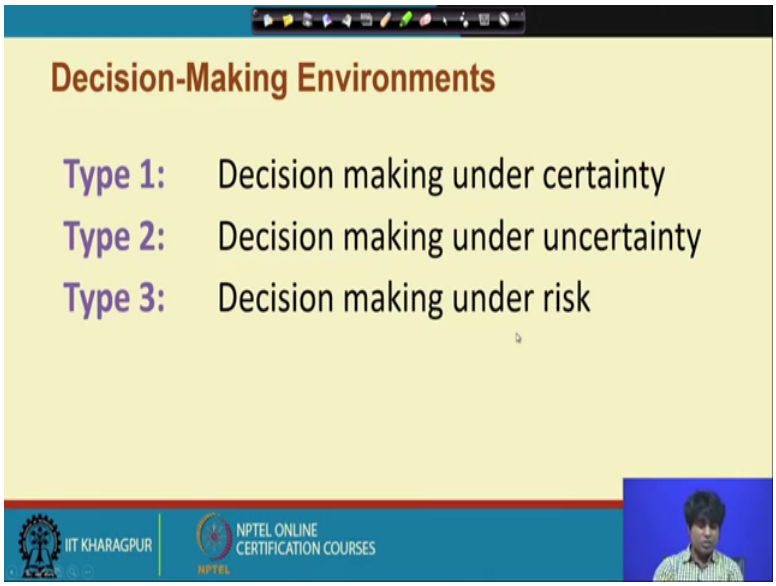

So, this decision making environment means what I have mentioned here and so, we have five different process and all these you know you know process can be highlighted through this payoff tables. Then the payoff tables gives the indication that you know what are the possible alternatives we have corresponding to you know the particular you know business problem.

Then a particular option need to be selected to address the business problem and come with a management decision. So, now so, so far as you know you know the payoff matrix is concerned you know corresponding to this you know problem. So, we can have any one, but what is the typical decision you know process decision making process.

So, we have three different options type 1; so, decision making under certainty and second decision making under uncertainty and third decision making under risk. So; that means, you know we are living in the in a kind of you know dynamic environment and business environment the by the way is very volatile.

And a in fact most of the business environment is a highly competitive and a there are a high chance that you know we have breaks and we have uncertainty and within these you know kind of you know obstacles; we have to find out you know the best decision through which you can address the business problem.

So; that means, typically there are two different situations one situation is completely certains and another situation completely uncertain. And in the case of certain; so, there is you know you know extra kind of you know analytics requires to you know come with a kind of you know decisions or to choose a particular outcome and in the case of you know addiction uncertainty.

So, you need to have a you know proper strategy or you know proper analytical tools through which you can you know come with a kind of you know how to put through which you can address the business problem.

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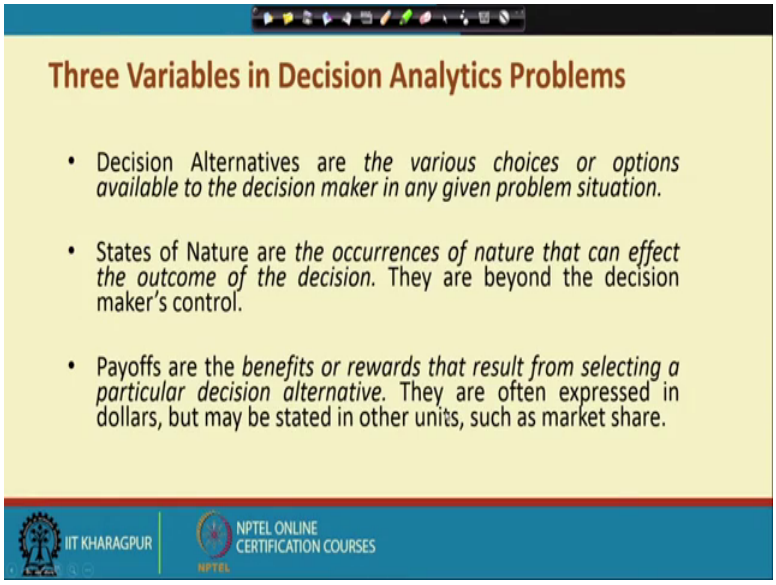

So, by the way; so, what we can do here we like to know what are these three you know options. So, before we go for you know means go for the discussion of these three options. So, I like to you know highlight three you know concepts in the kind of you know decision analytics problem.

So, the decision alternatives are the various you know choices or options that is available to the decision maker in any given problem situation; this is the first one. And second means that is what we have already highlighted the five step process. So, it will give you actually three different you know structural kind of you know understanding and structural kind of you know requirement through which you can you know quickly and you know you know best way to come with a kind of you know decision.

Then the second one is these you know states of nature the chances of you know nature that can affect the outcome of the decision and they are beyond the decision makers control. So, that is how the uncertainty and (Refer Time: 14:24) will be coming into the picture. And then you know payoffs you know are the benefits or you are that result from selecting a particular decision alternatives; they are often expressed in you know sometimes you know a particular you know units, but may be stated in other units such as you know market shares.

So; that means, you know we must have a kind of you know we need to of express on through which you can you know you can effectively address or effectively quantify the particular you know decision making process. So, ultimately; so, three things; so, various alternatives, various you know outcomes corresponding to the alternatives then prefer the you know payoffs through which you can you know you know address the business problem because the payoff will give you the possible outcomes corresponding to the alternate various alternatives and various strategy behind this problem.

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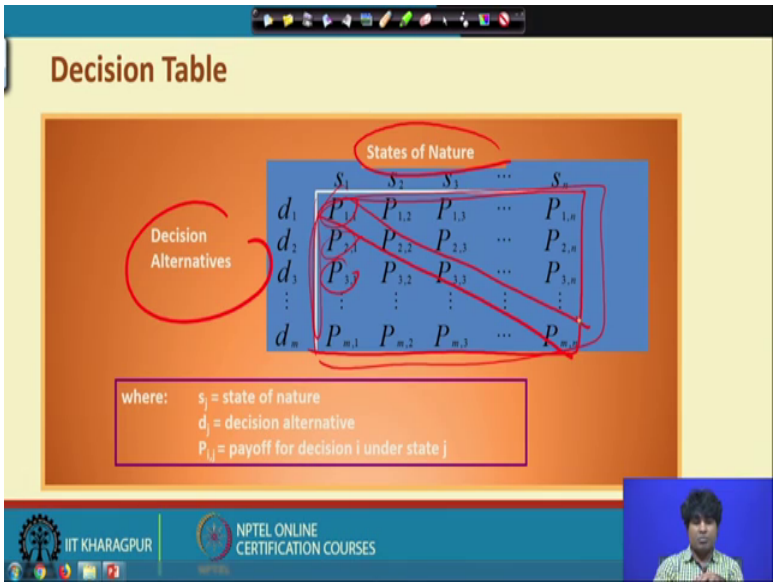

So, now what we have already mentioned you know. So, there are three different situations the certainty situations uncertainty situation and under you know risk involvement. So, the decision making table will be like this; so, we have we have here you decision alternative this side. And then these are all various you know outputs you know the kind of you know predictions. And so, a corresponding to the alternatives we

have a different you know output labels and then; so, these are all actually payoff matrix so; that means, these are all possible you know outcomes corresponding to the various you know alternatives.

For instance in this case; so, d 1, d 2, d 3 d m are the decision alternatives and S 1, S 2, S 3, S n are you know states of you know nature then you know P i j. So, the the entire you know matrix that is called as you know payoff matrix. So, the items under payoff matrix can be represented as P i j. So, it will have actually diagonal elements of diagonal elements on diagonal elements and the a diagonal elements we are i equal to j.

So; that means, the representation will be P 1 1, P 2 2, P 3 3 like this and then others are you know called as you know cross diagonals and where i naught equal to j, but whatever may be the kind of you know case whether it is i equal to j or i naught equal to j. So, every case we have a kind of you know outcome corresponding to the various you know decision alternatives. So, now with this we can actually find out to the case where you can you know address the business problem.

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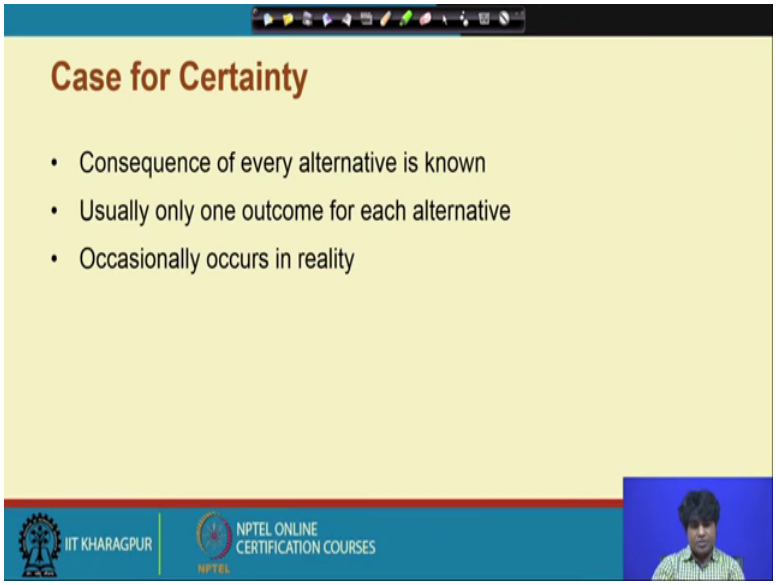

So, the first case is the case of certainty. So, here consequence of every alternative is known. So, this is how the advantage from the (Refer Time: 17:11) means for the decision decision makers. And then usually only one outcome for each alternatives and the fact is that it is actually very you know you know occasional.

So; that means, if you say that you know all the business are you know you know having a very much certain; then there is you know extra kind of strategy or externalities will be required to come or to find out a particular outcome through which you can make the decision more effectively. So, of course, there is a case, but it is very rare in a kind of you know you know real life situation or you know business environment.

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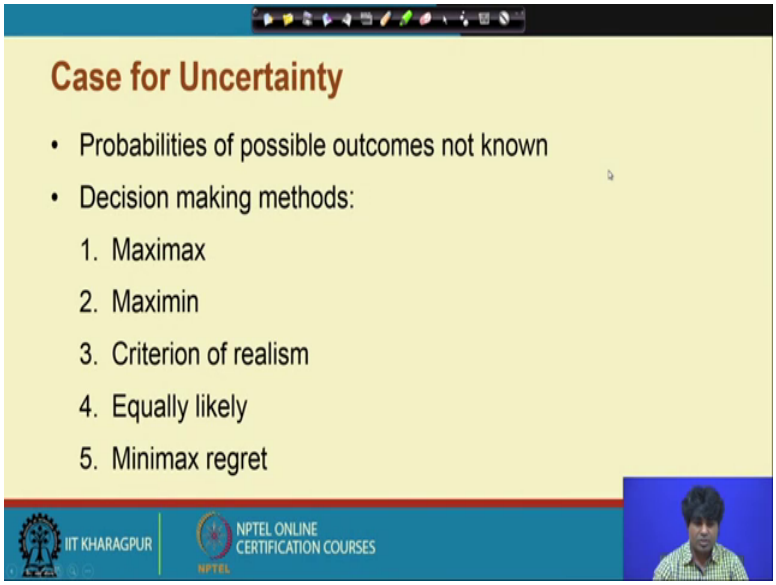

So, then second one is the case of you know uncertainty and where the possible outcomes connected with the probabilities the way we have discussed the kind of you know payoff matrix. So, we are corresponding to various alternatives we have you know kind of you know output and every output is connected with the probabilities.

So; that means, the moment you connected you know probability with the possibly you know or predicted outcome. So; that means, you know there is a you know high chance of you know or you know there is a kind of mismatch between the kind of you know actual and the kind of you know forecasted. So obviously, through probability it can be adjusted and as a result we can come with a kind of you know decision you know through which you can address division you know problem more effectively.

So, in the kind of you know uncertainty environment; business environment with respect to you know outcomes and various you know probability involvement. So, the decision making methods to choose a particular outcome corresponding to a particular you know business problem. So, we have a several you know a methods maximax you know first

one is the maximax, then maxmin then criterion criterion of realism, then equally likely and minimax regret right. So, these are all five different you know possible kind of you know methods or you know analytics through which we can you know predict the business environment where you know and the situation is completely uncertain right.

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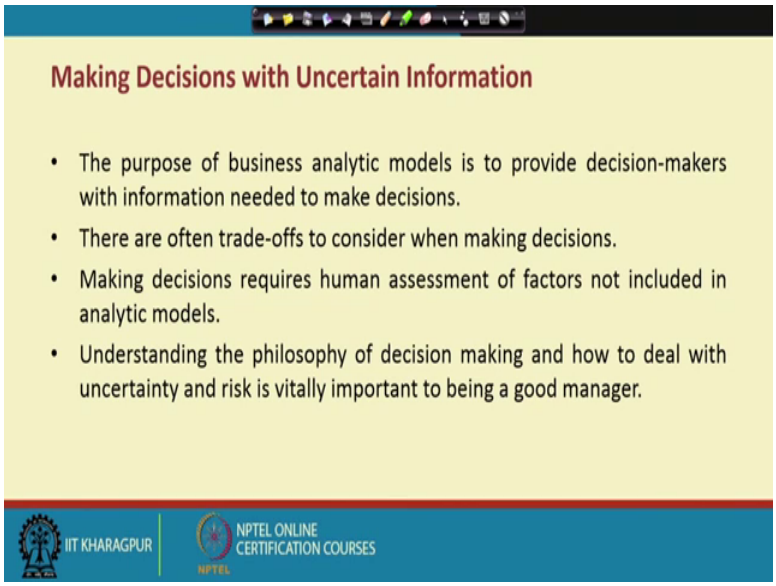

So, let us start with you know one by one; then first one is the making decision with you know uncertain information. And here the objective of business analytic models is to provide the decision makers with information needed to make decisions. And there are often tradeoffs to consider when making decisions since there is uncertainty and various alternatives of course, there is a possibility of you know tradeoffs.

So, within you know various alternatives and you know the kind of you know certainty. So, we like to you know extract the kind of you know tradeoffs and then you know within the particular you know tradeoffs, we have to find out the best which can address you know where you can address the business problem more effectively.

So, then making decision making decisions you know is the requirement where you know human assessment of you know factors not included in the kind of you know analytical models means the idea is that you know through a particular you know structure we have to you know we have to select a particular outcome corresponding to various alternatives and various uncertainty situations. Otherwise you know the particular you know judgment may not be very effective. So, that is how we have a

different kind of you know methods decision making methods or decision making tools and the particular decision will be you know targeted and will be obtained through these management decision tools only.

So, understanding the philosophy of a decision making and how to deal with uncertainty and risk and that is a vital importance to being a you know good manager. That means, having you know various alternatives various uncertainty kind of you know situations which particularly you know outcome we have to pick up you know under a different kind of you know mechanisms. So, that is you know one of the biggest challenge for the decision makers and the to (Refer Time: 21:30) manager who can you know you know take the management decision.

So, we have a different you know methods and there is a high chance you know some kind of you know conflicts and some kind of you know tradeoffs you may find while you know picking up a particular outcome under you know I means with respect to you know various alternatives and possible outcomes.

So; that means, corresponding to various alternatives we have a different alter you know possible outcomes and a all outcomes cannot be useful for the decision making process. A particular outcome which is which is to you know which are which to be the you know best it can be finally, picked up to address the business problem.

So; that means, you know like you know prescription analytics. So, the first first and or a first step of the process is corresponding to various alternatives; you have to find out you know all possible outcomes. And these are all by default you know various alternatives to the decision making process, then you have to pick up a particular outcome through which you can address the business problem.

For instance in the case of you know perspective analytics so, the first end idea is to find out to the corner points corresponding to you know various constants and the conditions. Then to choose a particular corner point you know for optimizing the objective functions; you have to find out the values of the variable and then put into the kind of you know objective function and check where the objective function will be will give you know optimized value that is either at the highest or at the lowest depending upon the specification of the maximization of the objective functions and minimization of the objective function.

So, now ah; so, on you know the process is you know what should be the you know typical management decision with a I know uncertainty kind of you know environment where the information is not actually a clear or you know not certain altogether. So, with you all the informations means available informations; so, we have a connection with you know probability.

So; that means, if you say uncertain then you know there is no way to predict and then come with a kind of you know you know decision making process. So, that is why to make you know uncertain to certain; so, there is need of some kind of you know quantification. And the uncertainty environment to certainty environment depends upon the involvement of you know probability structure.

So, I mean; so, completely you know let us say a completely uncertain to certain depends upon you know the amount of you know probability. For instance if it is exactly the probability value will be 0 to 1s; so, if it is exactly 1 then; that means, the particular you know uncertainty informations can be completely inserted.

And then if it is let us say close to 0; that means, the particular you know environment is very high you know unpredictable and you know not you know very perfect kind of you know scenario through which you can you know address the business problems. So; that means, a you know in the simple language higher the probability corresponding to the particular outcome; higher is the kind of you know effectiveness and higher is the kind of you know management decision. And if the particular you know probability corresponding to the particular outcome is very low; then you know it is a kind of high risk management you know you know kind of you know scenario.

In that case; so, the decision making process will be very sensitive kind of you know you know environment. Otherwise if a probability will be very high then; obviously, the difference between the actual and the predicted will be very less and as a result the decision making process will be very effective.

But ultimately it does not you know you know it is not anybody's hand; so, it depends upon the various alternative the kind of you know business environment and the kind of you know business plan and through these process we have to find out a situation you know that is the best situation through which you can address the business problem as per the particular you know requirement.

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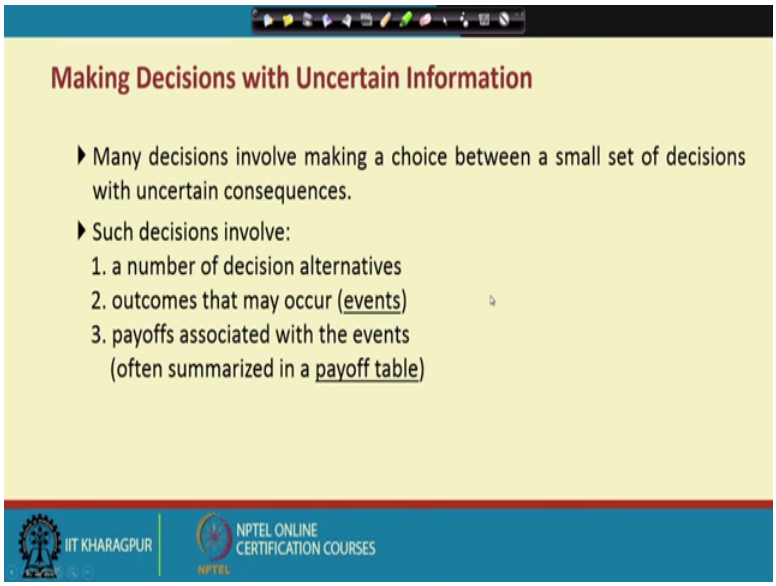

So, under the decision making process that is with respect to uncertain information. So, many many decision involved you know making a choice between a small set of decisions with you know uncertain consequences.

So; that means, when you take a particular you know options. So, there is a kind of reactions; so, it is again between action and reaction that is why what we can say that you know consequences. So, if you pick up a particular you know outcome to address the business problem. So, ultimately what is the consequences? If the probability is very high corresponding to a particular you know output level, then the consequence the (Refer Time: 26:33) consequence can be you know effectively addressed.

But if it is very low probability then it is a highly kind of you know risky to you know generate the particular you know consequences. So, what will we a what will we have here I means you know such decision making process involved a number of decision alternatives and outcomes that may occur that is what it is called as you know events, then the payoffs associated with these you know events you know sometimes you know summarized in the form of a payoff tables or it is called as you know payoff matrix.

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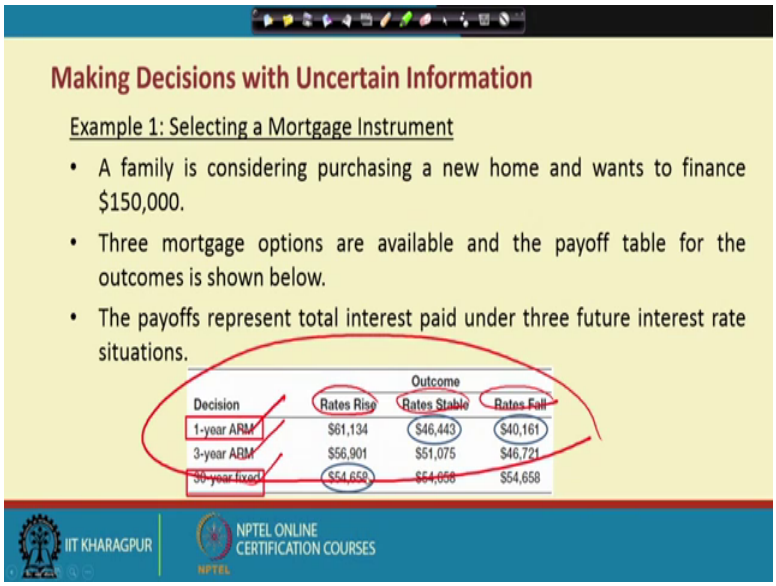

So, now; so, let us let us start with you know simple kind of you know examples making decision with you know uncertain informations. So, the example is you know selecting a mortgage instrument where you know a family is considering purchasing a new flat and wants to finance you know 150000 dollar. So; that means, this is a kind of you know problem background.

So, it is a question of you know financial investment and that to in a kind of (Refer Time: 27:40) business right. So, the (Refer Time: 27:44) typical problem is a to purchase a new flat or new house corresponding to the a you know investment you know financial investment decision and that too it is the matter of you know 150000 dollar to be invested and that to with you know three mortgage options. So, the decision will be 1 year error to 3 your error and 30 year fixed.

So, the outcome will be a with respect to you know the rates increase rates tables and the rates decrease right. So, three mortgage options are available and the payoff table for these outcomes are you know available here and that to that to with respect to these three alternatives. So, 1 year ARM, 3 year ARM and then 20 year you know fixed you know investment. So, so the possible outcomes are with respect to increasing rate, stable rate and the decreasing rate.

So, we have again a 9 options like the you know case which have already highlighted under the barriers you know means 5 steps process and that to the one of the particular

step is the payoff matrix and this particular table is nothing, but a pair of matrix; that means, the all possible outcomes corresponding to various alternatives and the kind of you know business environment right; so, we have been on different options. So, now, any particular option can be the best target, but we know without any analytics you know we are not in a position to pick up a particular you know structure.

So, in this case we like to apply some of a decision making tools like we have already discussed you know maxmin or maxmix. And then the kind of various other alternatives you know techniques through which you can you know take the decision.

And in this case what will we do in the first case the particular you know with respect to this particular requirement. So, let us see here so; that means, technically we have already highlighted here, but that highlight is with respect to you know with respect to a particular you know management decision you know management decision tools only.

So; that means, you know the analytic tools through a particular analytics tools; we like to highlight you know in this case we have to find we have to target this one. And a here we have a 61000 approximately, 56000 approximately and then 54000 approximately; that means, the lowest one is considered here.

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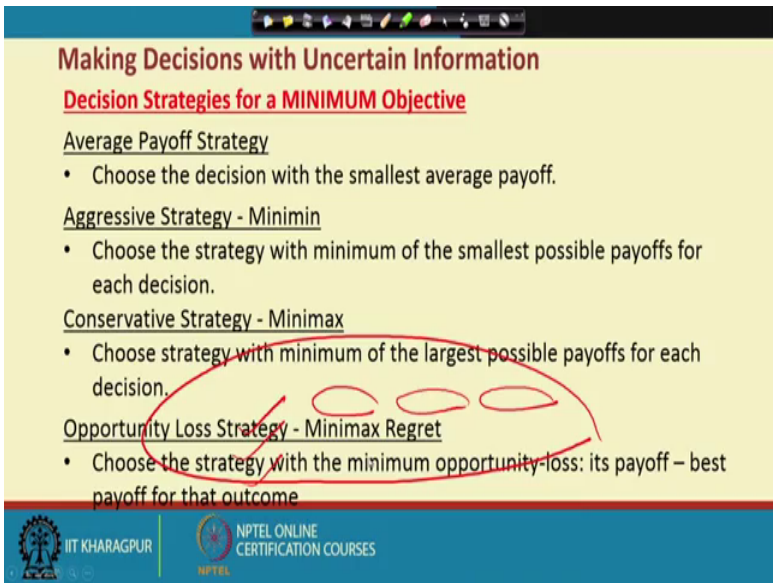

And the same things same things a in the case of you know second outcomes that is where you know rate is a stables. So, we have 51000 approximately we have 54000 approximately and then we have actually in the kind of you know 46.

So; that means, technically out of all these threes. So, we are targeting 46 the that is the lowest one against out of these three alternatives we are picking up the lowest one. So; that means, the minimum one for each case you know has been you know picked up. And then finally, we have a three different options; so, that is you know out of all these 9 options the (Refer Time: 31:08) to you know streamline the process into three then against out of these three we have select the a best.

If it is the kind of you know minimization minimization process then out of this you know you know three minimization and against we have to find out what is the minimum of these three. So; that means, typically 54, 56 and 40; so, this could be the kind of you know final target through which you can you know address the business problem and come with a kind of in a management decision.

That means, this is a kind of you know you know effective strategy through which you we have to choose and then to come with a kind of you know decisions. That means, technically in front of us we have a several kind of you know structural you know things a through which you can come with a kind of you know decision.

So; that means, say what kind of you know strategy we have to apply to you know judge a particular outcome corresponding to a business problem with respect to various objectives and the kind of you know alternatives. So, ah; so, so ultimately there are two different you know kind of you know criteria here. So, first criteria is you know decision strategy for a minimum objective or and the other one is the decision strategy for a maximum objective.

So, we start with first the decision strategy for minimum objective where we have you know couple of issues. So, first issues is the average payoff strategy then the second one is aggressive strategy, third one is the conservative strategy and then fourth one is the opportunity loss strategy. So, the in the first case average payoff strategy; so, we have to take the average of you know all possible outcomes against various alternatives, then you know take the decision.

Then in the case of you know aggressive strategy. So, it is the kind of you know mean kind of you know situations we have we have to find out minimum of you know all possible outcomes; then against minimum of minimum the kind of you know choice of the decision.

Then the third one is the conservative strategy where we can actually use the minimax principles; that means, first we will find out maximum of you know all possible outcomes then we choose the minimum among the maximum. And the last one is the opportunity loss strategy where we use minimax regret.

So, here choose of the strategy with the minimum opportunity loss it is that is the payoff best payoff for that you know outcome. So; that means, these are all you know various possible you know strategy or the criteria through which you can come with a kind of you know decision making to address the business problem and come with a kind of you know management decision through which you can effectively analyze the business scenario.

So, now, how we can apply these techniques in a kind of you know business environment where we have a various alternatives with you know uncertainty connecting to probability with probability, without probability then with you know probability we have a equality of kind of you know situation, inequality kind of you know situation.

And in each case how is the kind of decision making process. So, we can actually see the situation and come with a kind of you know understanding and the kind of you know strategy through which you can pick up a particular outcome to address the business problem.

So, we will discuss all these techniques in the next class and in the meantime we will stop here.

Thank you very much. Have a nice day.