Business Analytics for Management Decision
Prof. Rudra P Pradhan
Vinod Gupta School of Management
Indian Institute of Technology, Kharagpur

Lecture – 57
Decision Analytics (Contd.)

Hello everybody it is Rudra Pradhan here, welcome to BMB lecture series. Today we will continue with the Decision Analytics and that to coverage on management decision under uncertainty business environment. So; that means, we have discussed you know various mechanisms a through which you can come with a kind of you know decision making process and to address the particular you know business problem.

In the last lecture, typically we have highlighted various steps and various criteria through which we can choose a particular outcome with respect to various alternatives and various you know possible outcomes. And a then we have to pick up a particular outcome through which you can come with a kind of you know management decision to address the business problem. So, in the last lecture we have highlighted the tools like a you know these are the following you know tools or you know strategy and that to under the a minimum objectives.

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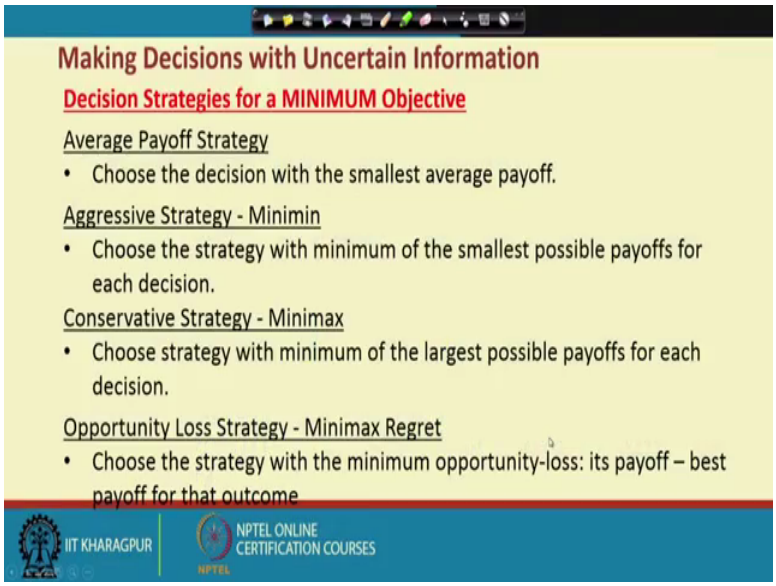

So, the same structure we can apply under the maximum objective and here in the case of you know minimum objective the decision strategy can be of you know four types the

first one is the average payoff strategy, the second one is the aggressive strategy and otherwise called as you know minimin strategy, and then third one is the conservative strategy. This is otherwise called as a minimax strategy then the fourth one is called as a opportunity loss strategy and a it is otherwise called as minimax regret.

So, in the case of you know first one that is the average payoff strategy. So, we the decision making structure will be the smallest average payoff because the objective is the minimum objective and then in that then in the second step means in the second case. So, the choice of the strategy with the minimum of the smallest possible payoffs then again the a third case minimum of the maximum payoffs for the decision and then finally, in the last case minimum of the a opportunity loss case that is the payoff and a the best payoff for that you know outcome so; that means, these are the following criteria and the kind of you know tricks, through which you can pick up a particular outcome to address this particular you know business problem.

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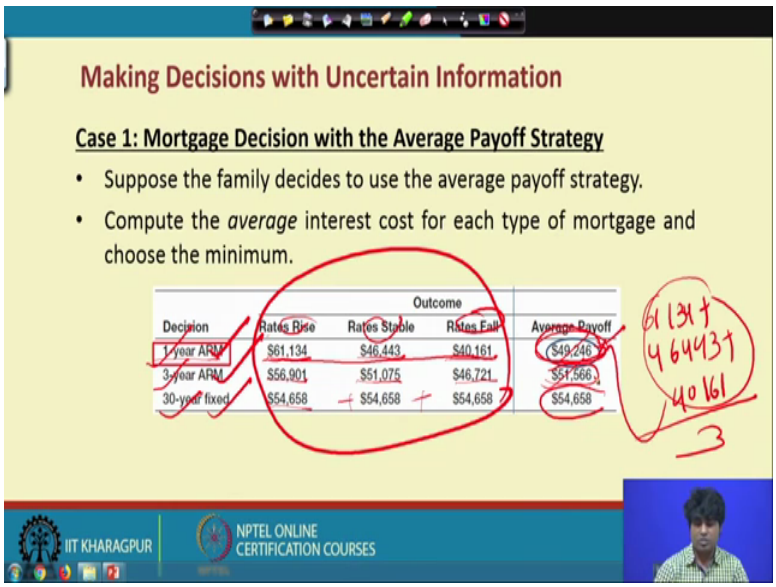

So, now, to highlight all these things we come with the same you know examples here the problem is to it problem is a kind of you know financial decision corresponding to the purchase of a particular you know house. So, it is the investment of you know 150000 us dollar and to purchase a particular you know house.

So, now in the first case you know is the decision with the average payoff strategy. So, now, we have actually here 3 into 3 you know matrix that is the kind of you know

alternatives with you know outcomes. And the kind of you know alternatives here you know 1 year ARM, then 3 year ARM and 30 year ARM. So, so the 1 year ARM 3 year ARM and 30 year fixed a kind of you know investment. So, the possible outcomes are with respect to increasing rate double rate and you know decreasing rate, which we have already highlighted in the last lecture.

And now the same payoff matrix are there and a now the question is you what should be the criteria through which you can pick up a particular option to address this real state business. So, now, the a with the average payoff strategy, so we like to take the average of you know all possible outcomes for instance.

So, corresponding to 1 year ARM; so we have a three different outcomes corresponding to rate increase rate stables and rate decrease so; that means,. So, these are all 61134, 46443 and 40161. So, now, average of these 3 will be 49246, and then that is that is nothing, but actually 61134 plus 46 a 443, plus 4161 then divided by 3. So, because there are 3 outcomes, so this is how this is how will we get the particular you know outcome that is 49246.

Now, corresponding to 3 year ARM we have again 3 different outcomes with respect to rates increase rates tables and rates decrease, that is 56901, 51075 and 46721. So, by default the average of these 3 will be 51566, now come to the third option 30 year fixed. So, we have again 3 different output corresponding to rate increase great stables and red degrees. So, this in code 54658 plus 54.54658, plus 54658 then against by default the average will be 54658.

So, now the choice of this criteria here or the choice of strategies here minimin. So, as a result we have to go for you know minimum of all these you know average a payoff so; that means, the a the possible 9 outcomes now so; that means, these are all initially 9 different outcome corresponding to 3 different strategy and 3 different outcome options. So, now, these 9 outcomes will be converse to 3 different outcomes that is the average payoff so; that means, now the choice will be with respect to 49246, 51566, then 54658. So, now, since it is a choice is the minimum criteria.

So, out of these 3, so 49246 can be the right choice out of 51566 54658. So, this is how the first criteria can help you to choose a particular outcome and to address the a real stage business. So, this is the first case and then corresponding to this first case we can

move the decision making process in the case of you know case 2. So, here we follow the aggressive strategy and this structure is here minimin kind of you know situation.

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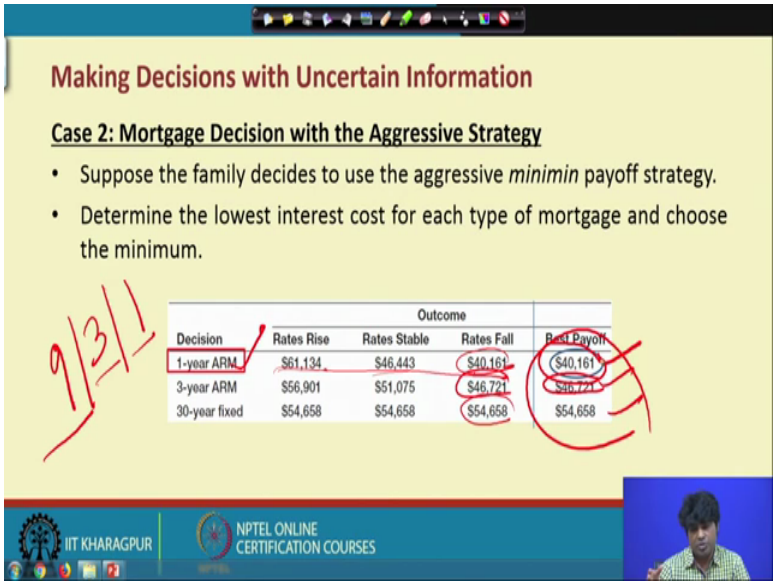

So; that means, again we have a same problem we have the payoff matrix will be the 3 into 3 that is 9 different outcomes same 9 different outcomes, but the choice of particular outcome you know we follow here with you know minimin criteria; that means, you know out of you know 9 different outcomes again it will it will coverts to 3 different outcomes and again out of 3 different outcome. So, come to a particular you know case of you know one outcome.

So; that means, the all the cases the typical structure will be 9 is to 3 is to 1 so; that means, the total possible outcomes are 9 that will converts to 3 and again finally, we will pick up a particular you know outcome out of you know these 3 and that 2 out of you know these 9. So, that that is the choice through which you can come with the a kind of you know management decision.

So, now, in this case a minimin criteria, so corresponding to the first case we have a three different options. So, now, out of these three options we choose the minimum one so; that means, a in this case 400161 is the minimum corresponding to 61134, and 46443 and then again in the second case 3 year 3 year ARM. So, we have actually three different options again. So, the minimum one is again a 46721 out of 56901, and 51075.

So, so accordingly the minimum will be 46721 and then third one 30 year fixed where you know the minimum one is the average of all these three so; that means, in all the cases same kind of you know outcome. So, by default the average will be the final choice. So, now,; that means, now the 9 outcomes will converts to you know 3 outcomes the 1, 2, 3 and out of these 3 we have to find out the minimum one and that that would that will be the best for this particular you know selection process.

So, so as a result you know 40161 is the typical output true through which here aggressive strategy will give you the kind of you know judgment and to address this you know real stage business. So, this is the case of you know second you know where we have applied actually minimin strategy to a payoff you know matrix to find out a situation to address the business problem.

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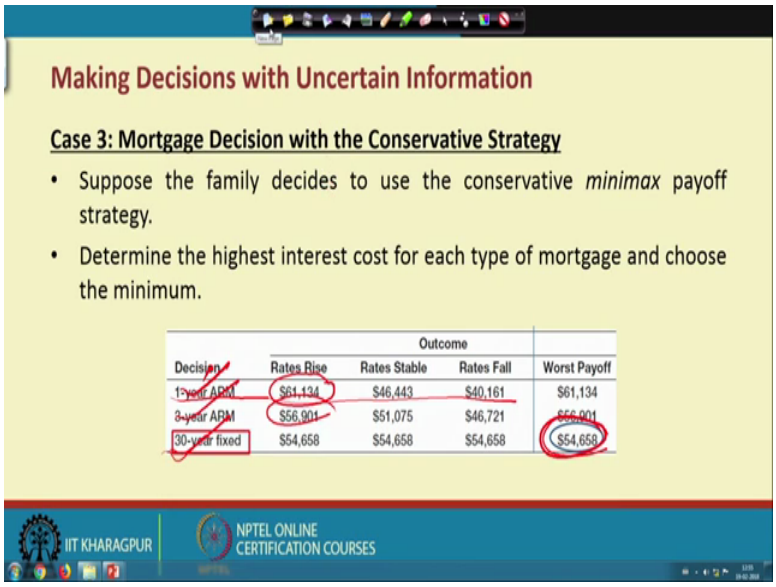

So, now the third one is the corresponding to the first and second. So, the third one option is the minimax and here the same payoff matrix again here so; that means, technically we have again three different alternatives and the alternatives are 1 year ARM, 3 year ARM, and 30 year fixed and again we have a 3 different outcome options increasing rate stable rate and decreasing rate. So, now, in the first case 1 year ARM. So, we have actually three different options out of which maximum one is the 61134 for against 46443 and 40161.

And again 3 for 3 year ARM, so the maximum one is the 56901 corresponding to 51075 and 46721 721 and then the in the case of you know third that is 30 year fixed. So, the maximum one is the finally, the average of these 3 because all are same.

So, by default 54658 now the criteria in this case in the case in the in the situation of you know case 3 is the minimum of you know maximum so; that means, now out of 9 we choose the three maximum you know situations corresponding to these three alternatives and then we have to apply a minimum of this you know three. So, as a result by default 53 54658 is the right choice to address this you know a real stage business. So, this is the this is the situation of you know case 3 now corresponding to case 1 case 2 case 3 we move to case four, so here in the case 4.

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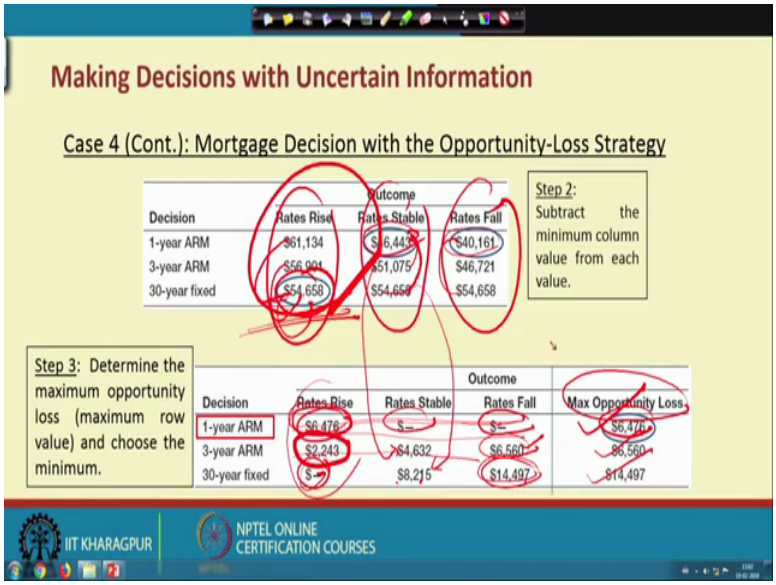

So, now the; a strategy is called as you know opportunity loss strategy. So, here you know it is a kind of you know step by step process and. In fact, little bit a complex compared to the case 1 case 2 and case 3. So, in this case, so we have the original payoff matrix here we have three different strategy and 3 different outcomes levels with respect to increasing stables and decreasing and what will you do here in the first step of this particular you know mechanism process means decision making process.

So, to subtract the minimum you know once you know for you know each column so; that means, the first step is to find out the minimum one in each column so; that means,

this is your first column this is second column and this is third column. So, out of these three we have to find out the minimum one umm as a result.

So, in the first column the minimum one is the 54658 out of you know 61734 then 56901 and again per second column the minimum one is the you know 46443 corresponding to 51075 and 54658 and again in the case of you know third column. So, the minimum one is the 40161 corresponding to 46721 and 54658 so; that means, technically the first steps of the process to find out the minimum of minimum payoff you know with respect to each columns that is the these are all three columns and every columns you to find out the minimum one. And in the second step you have to subtract the minimum one you know with respect to all the you know outcomes of that particular column.

For instance here the 54658 is the minimum one. So, the second in the second step, so the payoff matrix will change and that to or 611134 minus 54658. So, as a result you will get 64 that is actually, so a 61000 minus this then 56000 minus this and then 54605 paid minus again 54658. So, as a result 61134 minus 54658 will give you 64 476 again 56901 minus 54658 it will give you 20243 and then finally, a 54658 minus 54658 it will give you 0.

So, again in the second column the minimum one is the 46043 so as a result. So, these needs to be subtracted with you know each element of this column. So, this minus this minus this and then this minus this. So, as a result this will be 0 and then the 51075 will be come down to 40632 then this will be come down to 802 15, and again in the third column. So, the minimum a payoff his 40161 and that need to be subtracted you know it you know each column each elements of this column so; that means, in this particular place will we have a 0 because 40161 minus 40161.

So, it will be having 0 here, so then this will be 60560, and then and this minus this it will give you 14490. So, this is the second step of this particular you know case that is a you know the case of you know opportunity loss strategy and then. So, these are all actually the kind of you know loss and a. So, the maximum opportunity loss out of these you know three options.

So; that means, technically. So, after you know you know the transformation of you know original matrix to the a second one in the second one we have again 9 outcomes here some value will have a 0 value and other have a positive value. So, so what will we

do so in each row we have to find out; that means, technically with respect to first year error we have a now three different option and we like to find out which one is the maximum. So, so this is 0 this is 0 by default the maximum one is the 6 6476. So, as a result this play 6476 and a for 3 year ARM we have a three different option again and the maximum one is the 6560 as a result 6560 here.

And then the third case we have 30 year fixed; that means, that is the 30 year fixed case. So, we have a 0 here then 8215 and 14497 as a result the maximum one is the 14497 and hence 144 97 is the final choice. So, now, in the next step that is the step for we have to find out the best out of these three so; that means, it is again same.

So, initially we have a 9 different outcomes. So, with a particular trick a you know we convert this 9 different you know items to you know again 9 different outcome outcomes with you know different kind of you know structural change then again. So, from this 9 outcomes we have you know obtain three different outcome and now the choice is actually one with respect to these.

Three since we are following the a minimum objective so; that means, the final choice will be the minimum of minimum of this maximum opportunity loss so; that means, we have here 6470 476 6560 and 14497 as a result, so the final choice. So, the final choice will be the kind of 6476 which we have already highlighted here.

So, that that will be the right choice so; that means, in the case of you know case four. So, a you know we have little bit you know complexity, but ultimately we find a situation where you know the decision can be obtained means the outcome can be a you know selected to you know give the kind of you know management decision as per the particular you know business requirement so; that means, a.

So, these are the four different cases under the uncertain informations where you know we have a business problems corresponding to a particular business problem we have a different alternatives and then these alternatives will means we have a various outcomes corresponding to these alternatives and then we have to find out a particular outcome through which you can address the business problem more effectively as per the particular you know management requirement.

So; that means, we have lots of you know flexibility here by applying different kind of you know structure and different kind of you know analytics tools through which you can a come with a kind of you know decision or to address the business problems; that means, we have discussed various you know analytics under the predictive analytics various tools under the prescriptive analytics again under the decision analytics we have a different kind of you know tools and a.

In fact, we have already discussed couple of you know tools here like you know every strategy maximin minimax strategy minimin strategy then opportunity loss strategy through which you can actually come with a kind of you know a decisions or come with a kind of you know understanding to address the business problem more effectively.

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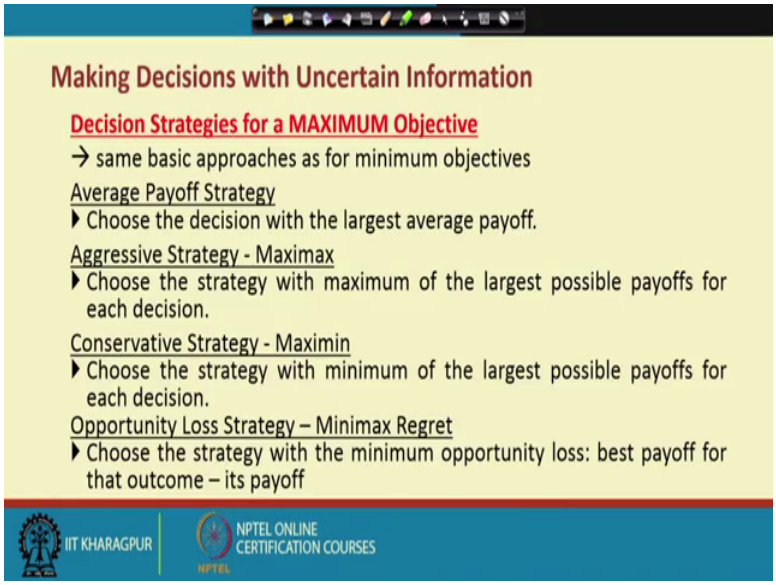

So; that means, if you summarize, so the kind of you know structure will be again like this and. So, average payoff strategy, aggressive strategy, conservative strategy and opportunity loss strategy so; that means, we have highlighted what are the decision criteria under each case and we have connected with a particular problem solve a problem as for the particular you know requirement.

And the discussion which you have and the solution which you have a have a with a particular problem, that is with respect to you know minimum objective. Now the same structure we can follow with you know maximum objectives so; that means, you know

again the same four strategy can be apply just you know in a kind of you know opposite structure so; that means, in the case of you know average payoff.

So, we can first find out average you know in each case; that means, against each alternatives we have a different outcomes. So, we have to find out you know average of all the outcomes corresponding to a particular alternative then again corresponding to second alternative we can find out the average of all outcomes then corresponding to third alternative again you find out the average of all outcomes.

So, now in the earlier case we like to find out the minimum of all these 3 averages. Now here's the criteria is the maximum of these three averages this is the case of you know average payoff strategy with maximum objective. And in the second case aggressive strategy the, the structure is a maximax; that means, earlier it was a minimax and now it is maximax; that means, against what will we do you know against you know each alternative, we have to find out to maximum you know outcome level corresponding to all possible outcomes.

Then against for second alternatives we have to find out maximum of outcome corresponding of available alternatives, agains case 3 a you know corresponding to third alternatives you have to find out the maximum of possible outcomes. Then the corresponding to that particular problems we have a 9 particular outcomes as a result it will convert into three possible outcomes, and then we apply a maximum principles.

So, as a result the maximum of all these three maximums can be the final choice, this is the case of you know aggressive strategy then in the case of in a conservative strategy we use maximins so; that means, the first case corresponding to particular alternative we have to find out the minimum one out of all the possible outcomes then second alternatives you have to find out the minimum one corresponding to all the possible alternatives, again for the third one we have to find out the minimum one corresponding to the all alternatives.

Then finally, the choice of the criteria is the maximum of all these three you know minimum outcomes and a as a result you will find a single kind of you know choice through which you can address the business problem. So, this is the structure of you know conservative strategy and finally, we can have a opportunity loss strategy here the typical structure is a minimax you know regret.

So, here what will we it do find out the a kind of you know maximum one, then you know subtract with you know each elements then ultimately have to find out the minimum of all these you know maximum structure through which you can actually to address the particular you know business decision so; that means. So, out of you know means there are three different columns corresponding to these you know problem.

So, every columns you to find out the minimum one then find out you know the difference corresponding to the minimum one then you know choice is a concerned you have to find out maximum you know of all these you know means find out the maximum then we will go for the kind of no choice. So, these are the various you know kind of you know strategy through which you can you know find out the where to address the business problem with a kind of you know effective management decision.

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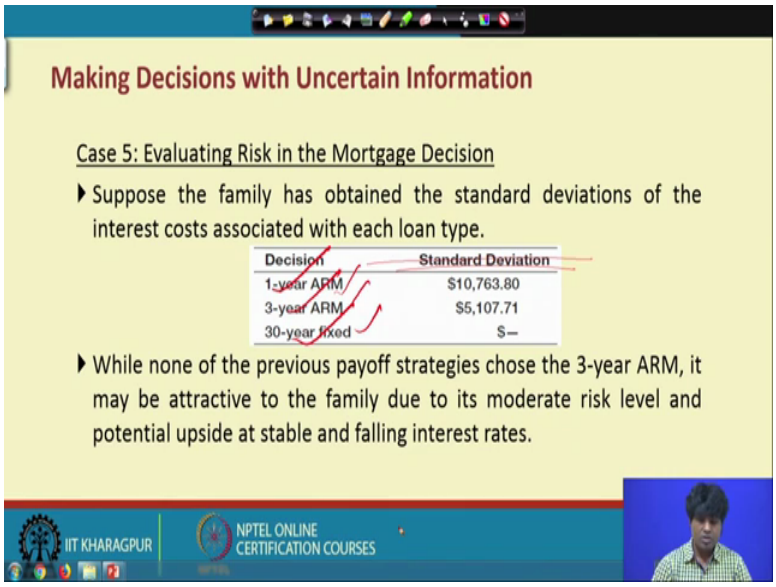

So; that means, you know in the in the in spite of you know all these you know four different cases. So, we have also different situation like you know case five if that is evaluating risk in the a mortgage decision, that is the financial decisions where we can help the standard deviation and take the kind of you know you know judgment for instance against you know we have a three different option here.

For instance 1 year ARM 3 year ARM and 30 year fixed and corresponding to this we have three different levels of you know outputs with the increasing with stable rate with decreasing rates; that means, we have a three outcomes then you have to find out the

standard deviation of these three outcomes for your against you know each alternatives. And then we have to find out which one is the best depending upon the lowest standard lowest standard deviations; that means, technically this is a since it is a risk one of the indicator through which you take care of the respecter is the standard deviation.

So, now in the first step you have to find out the standard deviation against each alternatives and then find out the a minimum one. So, as a result you can come with a kind of you know decision through which you can address this real estate business more effectively, and a that to this is the case for you know risk with your kind of you know mortgage decision to you know for the a you know case of you know purchasing your house.

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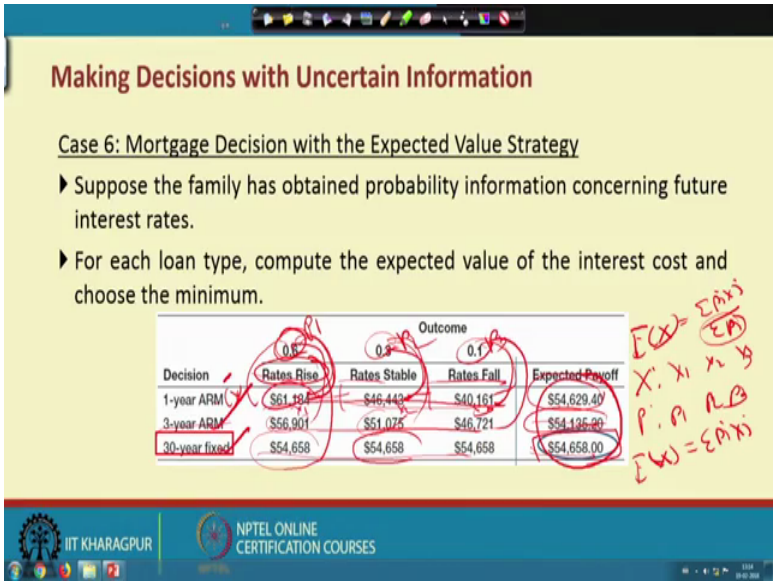

Now, the is the next case is the expected value strategy so; that means, corresponding to all these you know for criteria and the kind of you know a risk criteria, we have another strategy that is called as you know expected value strategy and here's we need to connect with you know probability. So, in the earlier case we have not connected any probability we have to just apply simple criteria and then take come with a kind of you know decisions.

So, here we have to apply the probability and then come with a kind of you know decision so; that means, a technically here, we have actually again three different alternatives and a again three different output levels and each output levels we have a

specific you know probably specification so; that means, the outcome this alternatives corresponding to rate increase corresponding to rate a stables and you know rate decrease.

So, the probability high; obviously, it is a chance of you know high increasing rates; obviously, there is a possibility on high probability stable rate it will be moderate probability and a fall rate that will be less probability. In any case we first specify the probability structure and then again we come with a kind of you know expected payoff.

So; that means, earlier we have actually used the particular concept called as you know every strategy, where we have taken you know this plus this plus this then we take the average of this once again these three we find out the average here, again with these three we can find out average here. Then find out the minimum of these three or maximum of these three depending upon the minimum objective or maximum objective, but in this case a we just you know apply the similar structure, but the typical structure is a slightly different with respect to the probability and involvement.

For instance instead of you know going for you know simple averaging. So, we have we will go here with you know weighted average so; that means, corresponding to probability. So, what will you do here, so we have here actually 0.6, so 0.6 into these and then 0.3 into these and 0.1 into these, then you can find out the probability since it is a kind of you know probability distribution and the typical structure will be so; that means, here expected value of you know if let us say this is the X variables and these are all a possible outcomes X 1, X 2 and X 3 and corresponding X 1 this is P 1 this is P 2 and this is P 3 of course, here the values are there, but typically the typical structure will be.

So, X is the outcome and corresponding probability. So, X 1, X 2, X 3 and P 1, P 2, P 3, so as a result e X equal to summation P i X i divided by summation P i and. In fact, summation P i is always equal to one because total probability is always equal to 1.

So, as a result, so the expected value of X is nothing, but summation P i X i. So, as a result, so the averaging will be simply a 0.6, 0.6 into 61134, then 0.3 46443 and 0.1 into 40161. So, then it will come it will come to 54629.40. Similarly, in the case of you know 3 ARM this into 0.6 this into 0.3 and again 46721 to 0.1 and the this will come down to 54135 approximately and in the case of you know third strategy 30 year fixed. So, 54658 into 0.6 54658 20.3 54658 to 0.1.

So, again it will come down to 54658 and so, ah, in fact, there is no change again and again, so if you if will we apply the minimum strategies. So, you have to choose the minimum of all these three or if you apply maximum objective then you have to find out maximum all these three so; that means, this is another strategy through which you can come with a kind of you know you know management decision to address this real estate business.

So, altogether we have highlighted six different cases to take this you know financial decision to purchase a particular you know house and that to with the investment of 100 50000 US dollar. So, that is how the kind of you know process through which you can you know come with a kind up in a management decision to address business problem.

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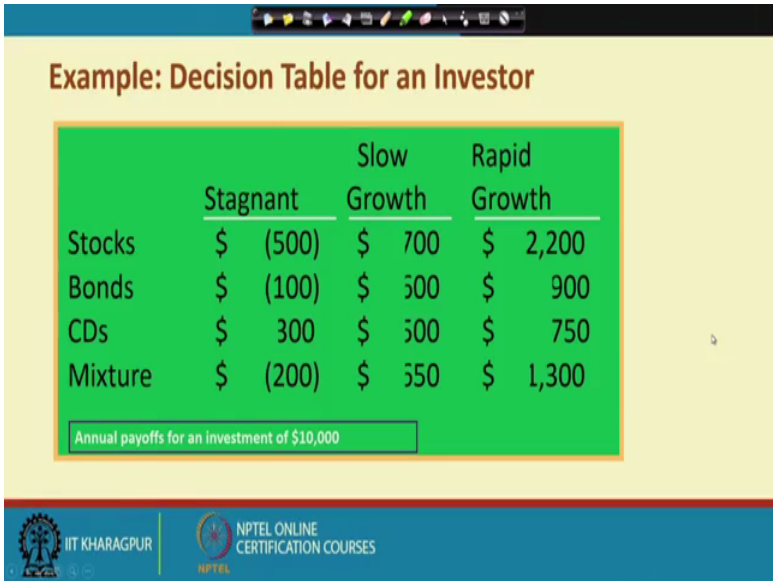

So; that means, typically a whatever tools we have discussed till now is the kind of you know decision making process where we have a various alternatives and the corresponding level of you know outcomes under you know different situations like the case which we have highlighted. We have a three different alternatives corresponding to different levels of outcome with you know rate increase rates stables and rate decrease. So, the levels may be also you know very it is not strictly to three different outcomes only.

So, it may have you know four different levels or five different levels for instance high increasingly rate, medium increasing then stables you know low very low so; that means,

there are different levels you can have depending upon the exact problems or the particular problem and then again the alternatives can be also more than three. So, we have actually specified three different, it you know investment plan, but ultimately there are couple of alternatives or couple of you know strategy through which you know the matrix can be a you know. And then we can have a kind of you know decision making come with a kind of you know decision making process through which you can address the business problem more effectively.

So; that means, understanding the problem is we you know firsthand kind of you know requirement once you understand the problem depending upon the kind of you know problem structure the kind of know business dynamics the kind of you know uncertainty environment then you design the payoff matrix.

So, one spare matrix are you know ready with respect to various alternatives and various outcomes levels then we may in a position to pick up a particular you know tools and with respect to a particular objective like you know maximum objective or minimum objective, we can come with a kind of you know decision through which you can address the business problem more effectively.

So; that means, technically, so this is a completely decision making process where we have a various alternatives and various outcomes levels to address the business problem as per the particular you know management requirement or the kind of you know business requirement. With this we will stop here.

Thank you very much. Have a nice day.