Project Management for Managers
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Lecture - 26
Decision Tree Analysis- I

Hello friends, I welcome you are all in this session of Project Management for Managers, subject and the topic which we have been discussing is risk analysis for standalone projects.

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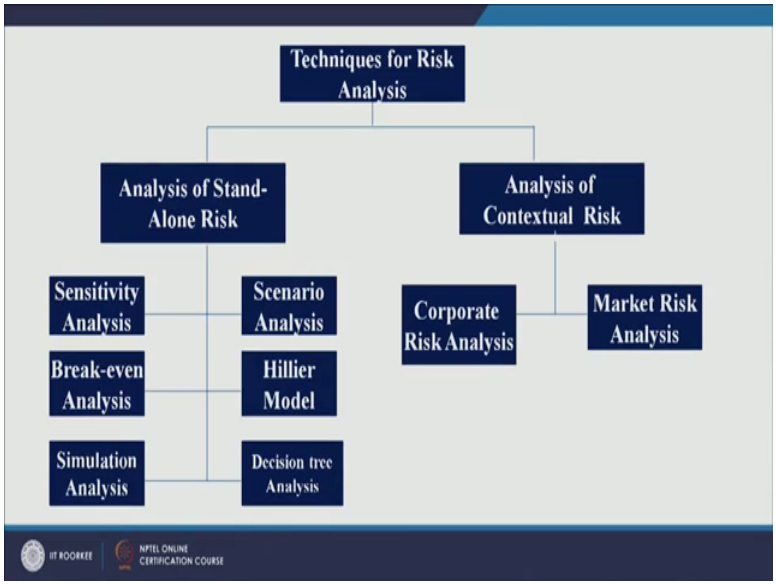

Let me tell you what we have done so far, we have done sensitivity analysis, we have done scenario analysis, break even analysis, we have also seen couple of examples on hillier models of finding risk for a particular project. We have also seen simulation analysis right when do we apply simulation analysis. In fact, we apply simulation analysis in a situation which is highly uncertain right and when formulation of mathematical equations is very difficult. In fact, formulation of mathematical modeling is difficult then in that scenario we apply simulation.

Let us look at decision tree analysis, which is also one of the techniques of analysing risk in a project. So, what is decision tree analysis?

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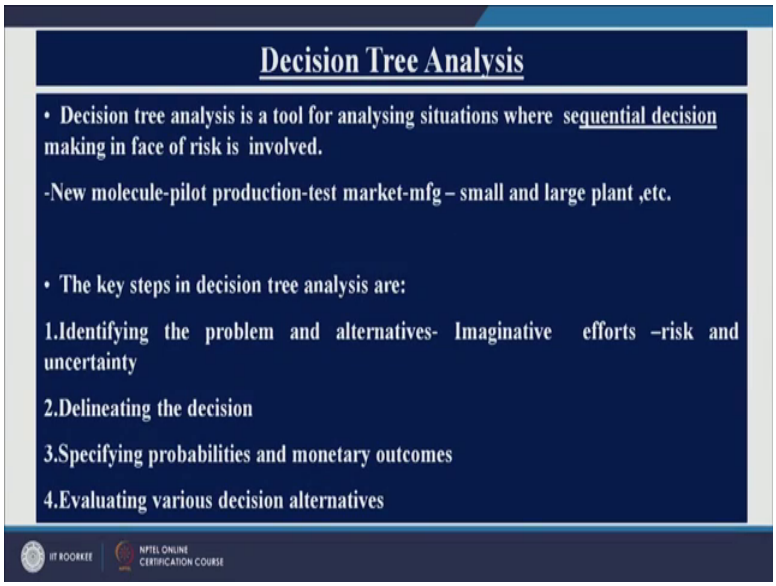

It is a tool for analysing situation where sequential decisions decision making is required; as I said in one of the sessions that to complete a project you need to make several decisions, and many times you need to make decisions when you do not have much information with you or initially you will have very very you know fluid information and you have to take a decision right. So, in project many times you need to take decisions in different in a sequence right.

For example let us say if I start a project today, and the life of the project is 10 years, suppose if something goes wrong tomorrow right then what would be the decision. If something goes after two years then what should be the decision right and to solve a problem using decision tree analysis we should know what is the probability of future events so that we can know how that event will affect our project. So, let us take an example let us say there is a pharmaceutical company, which has come up with a molecule right and the pharmaceutical company has gone for let say pilot production of that molecule and a test marketing has also been done.

Now, after these two things after pilot production and test marketing, the next decision which the pharmaceutical company has to decrease to start manufacturing right; now when the when you start manufacturing what kind of plant you need that is a decision to be made. So, do you want a small plant or a large plant right? So, let us say if you are coming up with a small plant and if the demand of the product is very high then you will

have to expand the plant capacity right. Suppose if you go for large plant in the beginning itself right and if demand comes out to be low, then you would be at a lost right. So, these are couple of sequential decisions right.

So, you need to take sequential decisions according to the probability of happening a particular event right, and then you should check what is the expected monetary value of one particular node in a decision tree right. So, there are couple of steps involved in decision tree analysis the first thing is you should identify what is the problem right unless and until you identify problem you do not know how to solve it right. So, identify the problem, once problem is identified then you should look for different alternatives, what are different ways of solving that particular problem and this is the process where in we should go for brainstorming session right; because brainstorming session will help you in identifying problem as well as in identifying several alternatives right.

So, if you are a let us say not going for brainstorming session then how to find out alternatives, in that case you will have to rely on let us say past data right. So, past data will help you what kind of you know actions you are you had taken earlier, for a problem which has just occurred in your project. If this kind of problem occurred earlier also then you will take similar alternatives right or similar decision. So, in this stage it is good to come up with different imaginative offers to come up with different alternatives. So, people who are sitting in let say brainstorming session they should be imaginative, to come up with several alternatives to solve that particular problem and when you come up with several eternities you should also keep in mind what would be the risk if you take up one particular alternative.

So, you should be very careful while generating alternatives in brainstorming session. So, you have to take care of risk and uncertainty. Now this is the first step right second step is delineating the decision with third one is specifying probabilities and monetary outcomes evaluating various decision alternatives right. Now we will see in detail second third and fourth steps right.

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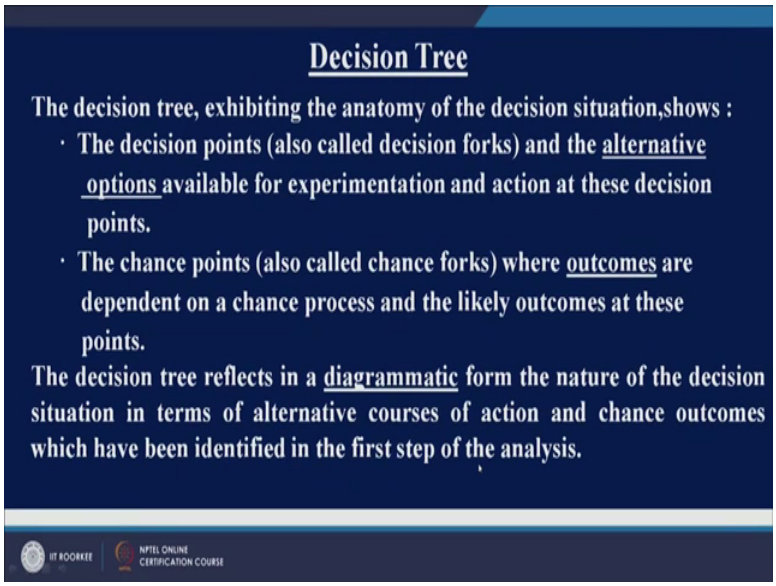

So, in a day in a decision tree you have got different branches and different nodes. So, that the decision tree exhibiting the anatomy of decision situation shows decision points and chance points; decision points also called decision forks.

So, at this point you are coming up with different alternatives right. Once you are done with decision points then you come up with come at this point chance points right they are also called outcomes. So, first decision point is what are different alternatives, second decision point is what are different outcomes of those alternatives. Now the decision tree reflects in a diagrammatic form the nature of decision situation in terms of alternative courses of action and chance outcomes which have been identified in first step of the analysis.

So, this is how you should prepare a tree right there would be a couple of nodes, then couple of branches and from each branch again you will have some more branches and so on. So, this is how decision tree you can prepare. Now decision tree should be simple as for as possible; if you make a complex decision tree then it would be very difficult to you know easily infer it.

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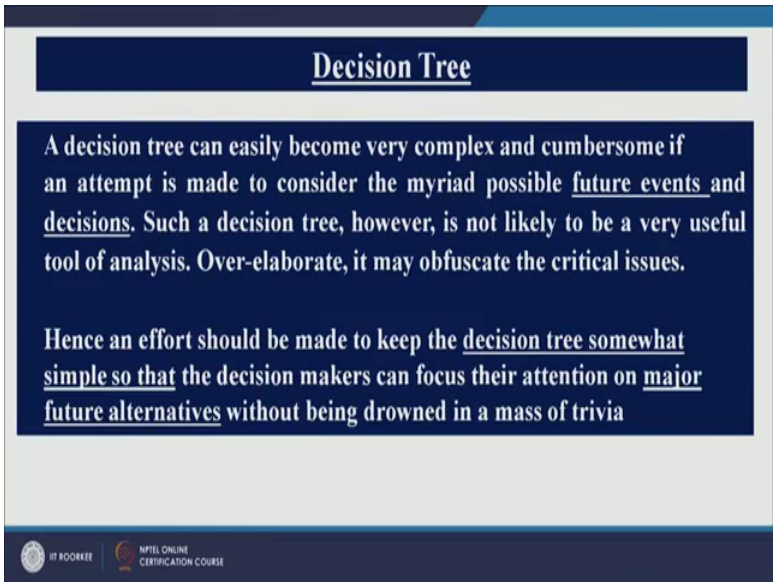

So, it is always suggested that you should go for a simpler decision tree because you can always prepare a complex decision tree by coming up with several alternatives, and assigning different probabilities to those alternative.

But whenever you come up with alternatives try to see that those alternatives are feasible. Feasible means it should be feasible in terms of let us say technical aspects, marketing aspects and other aspects as well right. So, try to come up with lots of alternatives in the beginning and then try to summarize you know summarize those alternatives. Let us say if you have come up with let us say 10 alternative for a problem. So, tried to reduce those 10 alternatives in to let us say 3 or 4 right because you will you would like to assign probabilities also to those 10 alternative. So, it is good to assign probabilities to only 3 alternatives instead of 10 alternatives.

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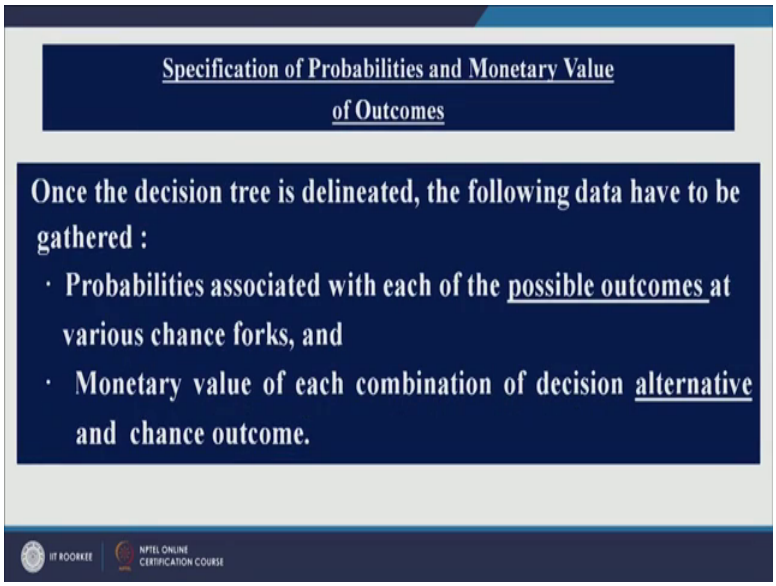

So, it is suggested that decision tree should be simple right. Once you are done with second step this is the third step in decision tree analysis, specification of probabilities and monetary value of outcomes. So, as I said once you are done with delineation of decision tree, you need to collect following data. So, the probability is associated with each of the possible outcomes and monetary value of each combination of decision alternative and chance outcome. So, you need to assign different probabilities right and also monetary values, to those alternatives which are having properties attached to them.

Now, how to assign probability, now this is quite a difficult task; so, probabilities can be assigned in two ways either in subjective way or in objective way. When I say subjective way means you got some past data and you know how things have happened in past so, that. So, you can easily probability to a future event. For example, let us say if this laptop has failed 10 times in last 10 months. So, I know what is the probability of failing this laptop, I can assign that in next month also the probability of failing this laptop is let us say 0.3 right.

So, since I have past data I can do some analysis on past data and I can assign a probability to future event; this is known as objective type of assigning probabilities to a particular alternative right. But in real life situation you do not have many times past data of something right. So, you need to assign probability in a subjective manner; when I say subjective manner means a on the basis of experience you will have to assign

probabilities. So, let us take an example let us say you are coming up with a new electric moped and what is the probability of success of that particular electric moped.

Now, since I do not have any past data about failure or success of electric moped.

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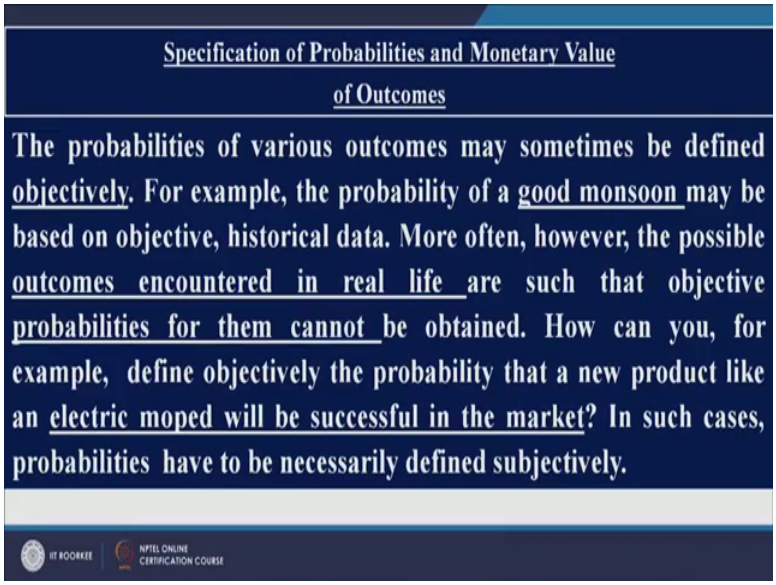

So, what I will do? I will assign some probability right based on my experience. So, let us say a probability is 0.5 right or let say 0.3. So, it would be different you know different experts will give you different probabilities. So, this is the way in which you can assign probabilities.

Another example is let us say if you want to forecast what would be the monsoon next year right. So, since you have got past data you can easily calculate what would be the probability of having good monsoon in next year. So, this again a subjective not subjective, but it is an objective type of probability.

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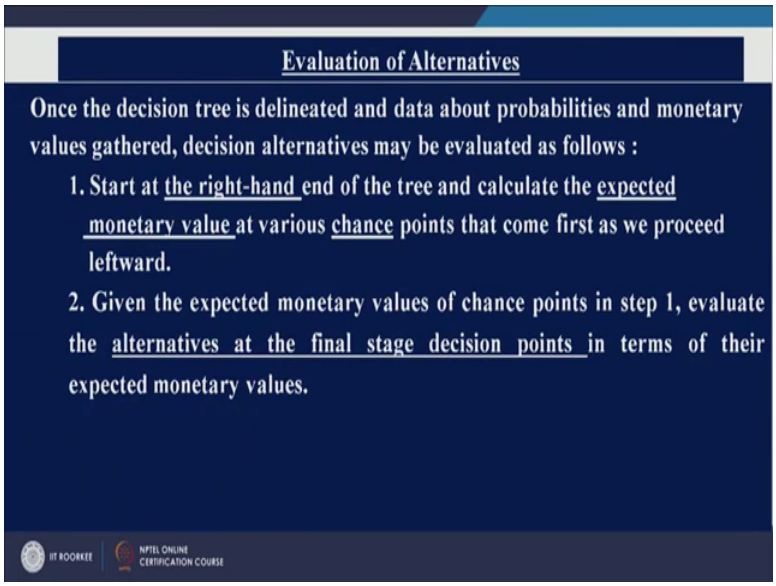

The fourth step in decision tree analysis is evaluation of alternatives. Now since your you have done first 3 steps right the first one was identification of problem and generation of alternatives, then delineation of tree, the third one was assignment of probabilities and monetary values right and the fourth one is evaluation of alternatives. Now this is the most important step and in evaluation of alternatives what we do we have a decision tree. So, we start at the right hand side of the tree and calculate expected monetary value at every chance point right.

So, we move in decision tree analysis from right to left, then given the expected monetary value of the chance point in first step what we have calculated; evaluate alternatives at final stage decision points in terms of their expected monetary values right.

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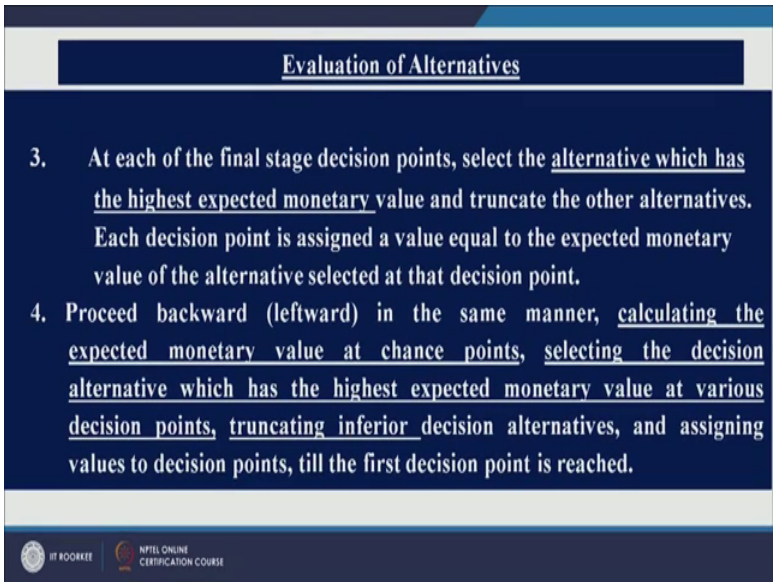

Similarly, you keep on moving from you know different from right side to left side and keep on evaluating different alternatives and different nodes and finally, towards left you will have only one decision to be made whether let us say to start a particular project or not right or to which alternative you should select at the end of the day.

So, you should continue this process; what process calculate the expected monetary value a chance points, select the decision alternative which has the highest expected monetary value at various decision points truncating inferior decision alternatives. So, when you move from right to left side you need to keep on ignoring those alternatives which are not getting much expected monetary value. So, what we will do? We will take up an example and will solve the question using decision tree analysis. So, let us take this example the scientist at a company have come up with an electric moped.

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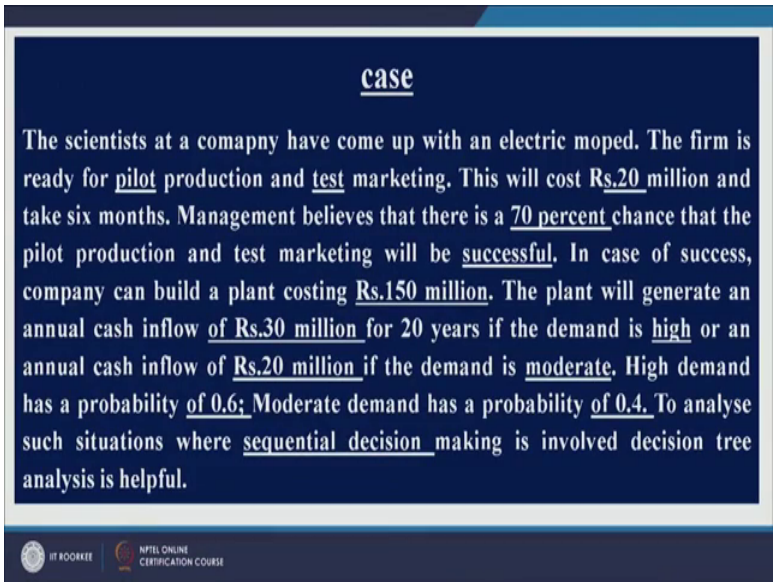

Now, the firm is ready for pilot production and test marketing this process will cost complete 20 million rupees and it will take 6 months time right. So, the cost is 20 million time 6 months for pilot production and test marketing. Now management believes that there is 70 percent chance that the pilot production in test marketing will be successful; it means there is only 30 percent chance that pilot production in risk and test marketing will be a failure right. Suppose if these two things these two things let say these two things are a successful right product pilot production and test marketing if this is successful then what the company will have to start manufacturing this particular product right.

In that case the plant with cost 150 million, when the probability is 0 there is no need of starting any plant right. So, in case pilot production and test marketing are successful then only you will go for manufacturing of this particular product and you will come up with a plant which would cost you 150 million rupees right the plant will generate an annual cash flow of 30 million for 20 years if the demand is high right. Otherwise it would generate 20 million for 20 years if demand is mortar. High demand has probability of 0.6 and moderate demand has probability of 0.4.

So, just see here once again the demand is the probability that the demand is high would be 0.6 and in that case the be getting 30 million for next 20 years right, otherwise for low probability the company would be getting 20 millions for next 20 years right. To analyse

such situations where sequential decision making is in is involved decision tree analysis is helpful right. So, this is a case of this is a case where you can apply decision tree analysis.

So, let me prepare decision tree for this particular example and then we will solve this particular case right.

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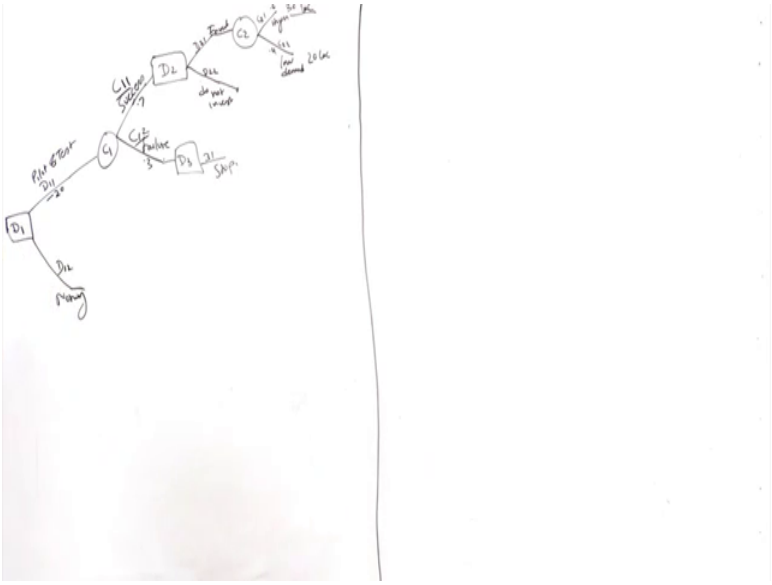

So, this is your decision point and this point you have got two options right either you should go for test marketing and pilot production or do not do in do not do anything right. So, let us look at this option. So, this is you are carrying out pilot production and test marketing right if not you are doing nothing right do not do anything right first alternative second alternative. So, let us call it D 11 and D 12 right when you go for this there would be a cost of rupees 20 million right.

Now, we know that if this is successful then we will go for we will see whether was the probability of success. So, here we will go if it is let us say success, and this is failure right. So, probability of success is its given in question 0.7 and let us write over 0.3 is probability of failure right. Now when probability of success is 0.7, again you can have this is your C 11 this is C 11 and this is C 12 right and so, this is C11 and C 11 and C 12. Now let us take a decision over here whether you should invest or you do not want to invest right.

So, let us call it D 21 right invest, invest otherwise D 22 do not invest right. If you invest then there are two options whether the demand is high or demand is low right. So, C 2 high demand low demand right. So, this is C 21 high demand and this is C 22 low demand right. If demand is high you will have annual cash flow of 30 lakh, 30 lakh and if it is low then it would be 20 lakh right and the probability of high demand is its given is 0.6 and this is 0.4 right.

So, if this is a failure then you are not doing anything you are just stopping right do not invest if you if you are not investing anything right. So, you will stop here right. So, this is our decision tree. So, let us look at this is D 3. So, D 31 is stop right now this is our decision tree. Now we want to take a decision should we go for this particular project or not, this decision is to be made. Let me tell you before going for solving this particular question, what we have done in last session right in last 25 minutes. So, what we have done here is we have started with defining what is decision tree, as I said decision tree is a process where in you will have different nodes and different branches right.

So, for a decision tree analysis there are 4 steps which you need to take; the first step is very important you need to find out what is the problem and what are different alternatives. Once you are done with problem and alternatives the next step is delineation of decision tree right you need to prepare a decision tree. So, in which you will have different you know decision points and different choice points right, after this the most important step is the assignment of probabilities and monetary values, and this assignment of probability can be objective or subjective. It is suggested that you should try to assign probabilities in objective manner, but if you do not have past data then you do not have anything, but to go for subjective probabilities.

The next step is evaluation of alternatives. So, as I said I teach point you need to find out expected monetary value, after this you just drop out those decisions which are inferior in nature and then finally, you should take a decision whether you should continue with a project or you should stop that particular project, and let me stop over here as for as this session is concerned, in next session we will solve this particular question.

Thank you very much.