Decision Support System for Managers
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Module – 04
Models in Decision Support Systems
Lecture - 04
Models in Decision Support Systems

Hi, welcome to the 4th module of our course on Decision Support Systems! Today, we are going to talk about 'Models in Decision Support Systems'. We have already discussed about models, we will slightly go into some more details.

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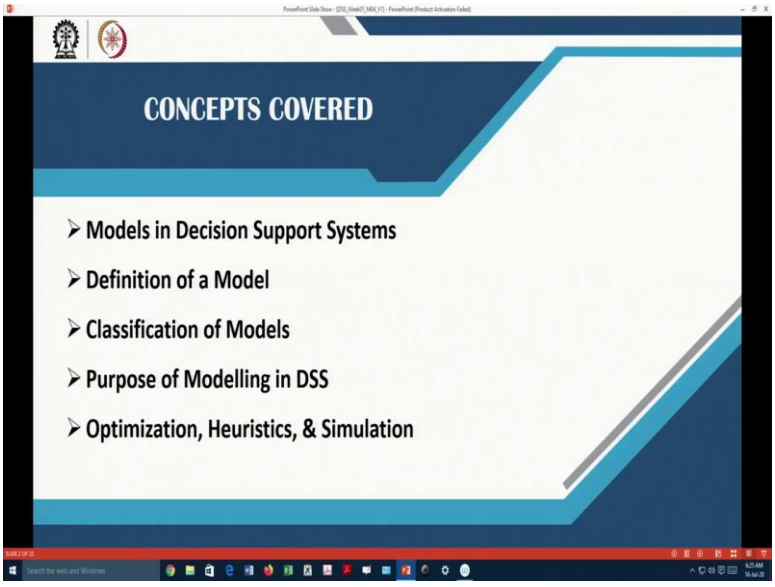

The concepts that will be covered today will be the definition of a model, classification of models, purpose of modeling in decision support system and we will slightly give you an idea about certain terms which are widely used in DSS, those are optimization, heuristics and simulation.

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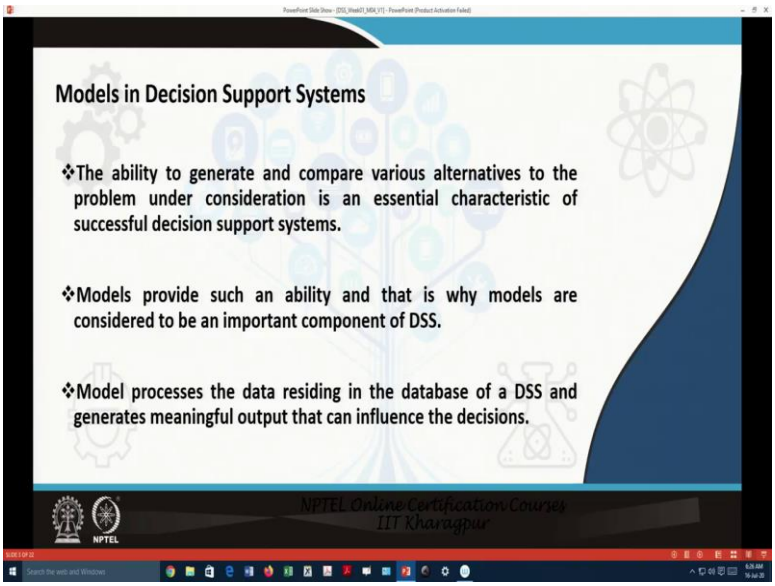

When we talk about models in decision support systems, we must know that the ability to generate and compare various alternatives that have been formulated to solve the problem under consideration is mainly supported by these models. Models they have the ability to generate and compare various alternative solutions procedures. Models provide such an ability and that is why models are considered to be an important component of decision support systems.

Model, they basically processes the data which resides in the database of a DSS and then this models they generate meaningful output which can influence the decisions. Because it is the managers who will interpret this models, results of this models and then decide that which solution is the one that they will accept.

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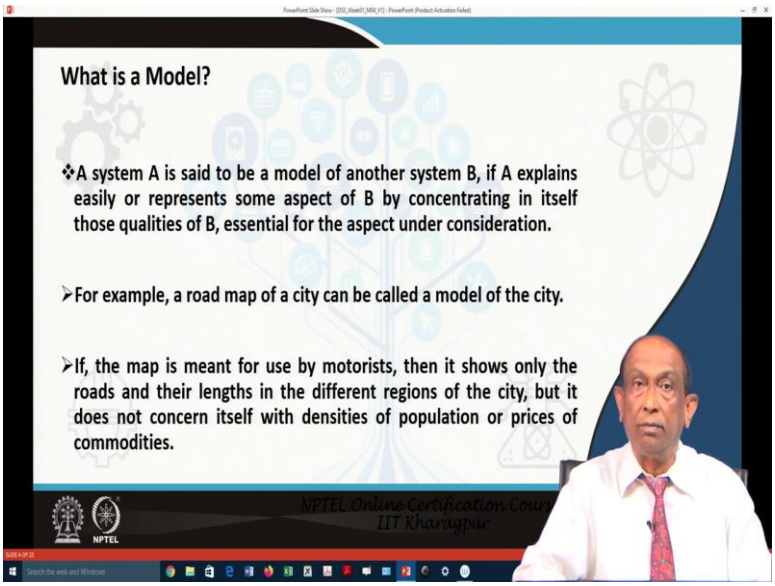

A system A is said to be a model of another system B, if A explains easily or represents some aspect of B by concentrating in itself those qualities of B which are essential for the aspect under consideration. Once again I repeat a system A is said to be a model of another system B. If A explains easily or represents some aspect of B by concentrating in itself those qualities of B which are essential for the aspect under consideration.

For example, a road map of a city can be called a model of the city with respect to the problem that is getting studied. If the map is meant to be used by a motorist then it shows only the roads and their lengths in different regions of the city, but it will not concern itself with the population density or the price of commodities because they are not relevant with respect to the problem in hand. Thus abstraction is a very important feature of any model.

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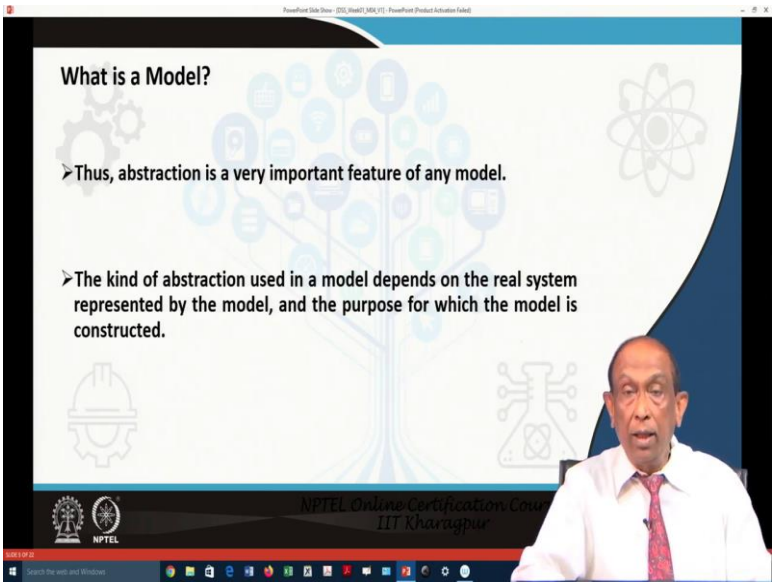

The kind of abstraction which are used in a model will depend on the real system that is getting represented by the model. And most important is the purpose for which the model is built.

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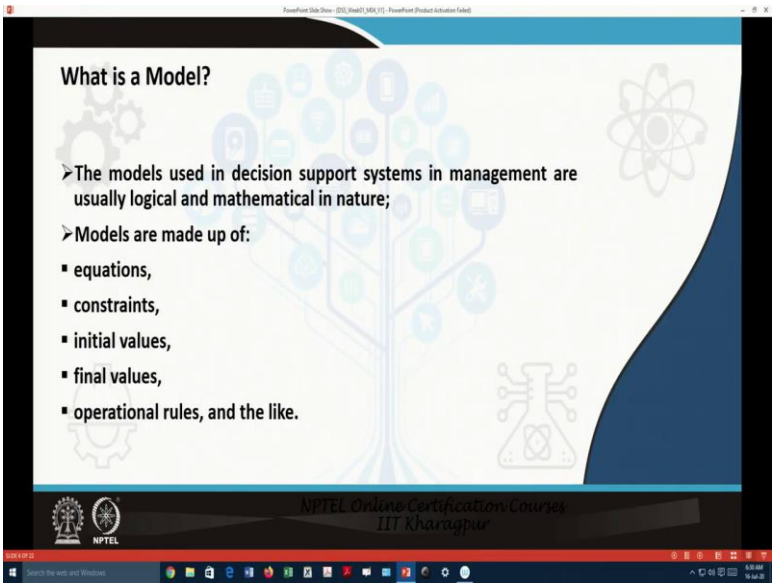

The models that are used in decision support systems particularly in the area of management are usually logical or mathematical in nature. Models in the area of management mainly consist of equations, constraints, initial values, final values that is the boundary conditions, the operational rules and so on. Once again, models are made

up of equations, constraints, initial values, final values and the operational rules. So, boundary conditions are very important.

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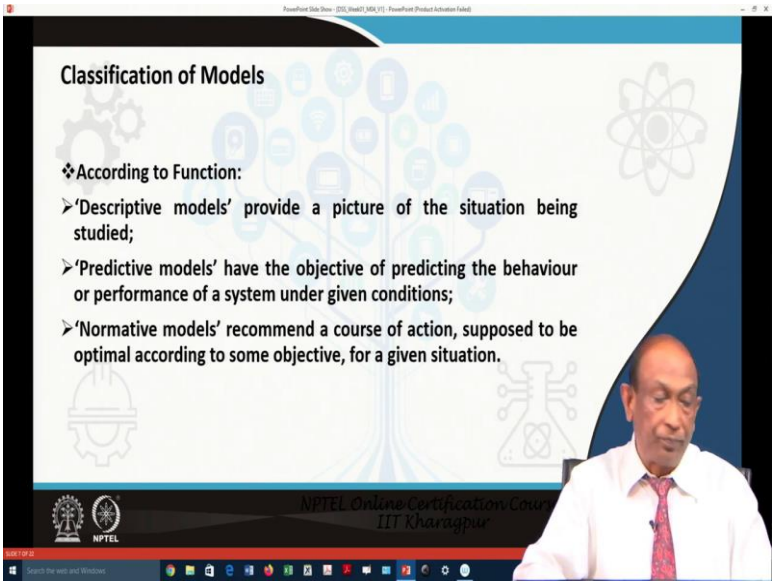

Now, we discuss about the classification of models, the different classes of models that we use in decision support systems. First according to function descriptive models. They provide a picture of the real life situation that we are going to study, the completely describe the different aspects of the real life situation and hence the name descriptive models.

Predicted models they have the property or their primary objective is to predict the behavior or the performance of the system under a given conditions given set of conditions, ok. And normative models, they recommend a course of action and that action is supposed to be optimal given the objective for a given situation; given a situation, given the objective normative models will recommend the optimal course of action.

So, descriptive models, they provide a picture of the situation being studied. Predictive models predict the behavior or performance of the system under consideration. And normative models recommend optimal course of action given the situation with clearly specified objective.

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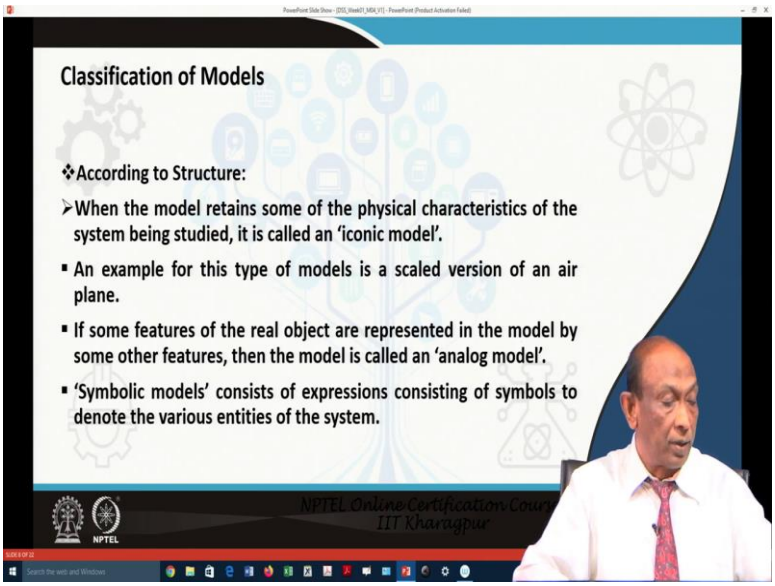

Now, we classify models according to the structure. When a model retained some of the physical characteristics of the system that is that we are going to study it is called an iconic model. So, iconic model retains some of the physical characteristics of the system that we are going to study.

An example for this type of model is a scaled version of an air plane. If some features of the real object are represented in the model by some other features, then that type of model is called an analog model. And symbolic models consists of expressions which involve symbols to denote the various entities of the system. These are very much important in the field of management, industrial dynamics problems. They basically use symbolic models.

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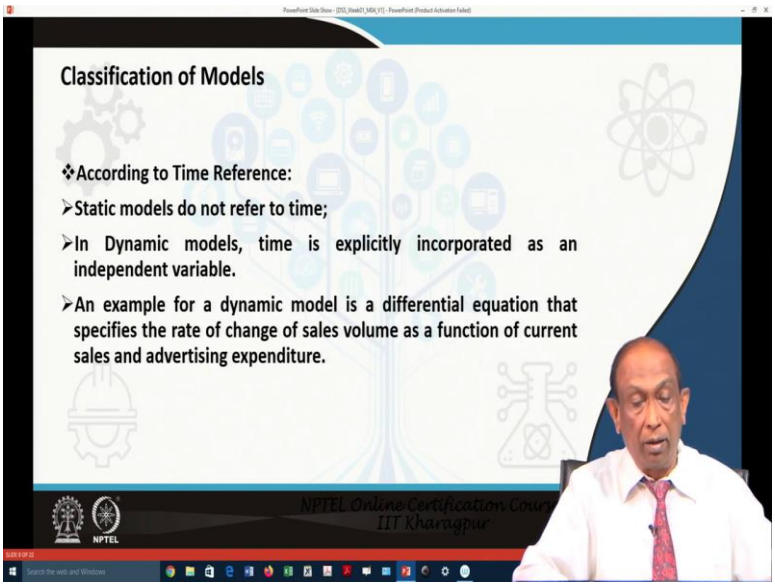

Then, we classify models according to time reference. Static models, they do not change overtime, they do not refer to time. In dynamic models, time is explicitly incorporated as an independent variable. An example of a dynamic model is a differential equation that specifies the rate of change of sales volume as a function of current sales and advertising expenditure.

So, according to time reference we have two kinds of models static models which do not refer to time, dynamic models they refer to time and we have given examples of dynamic models.

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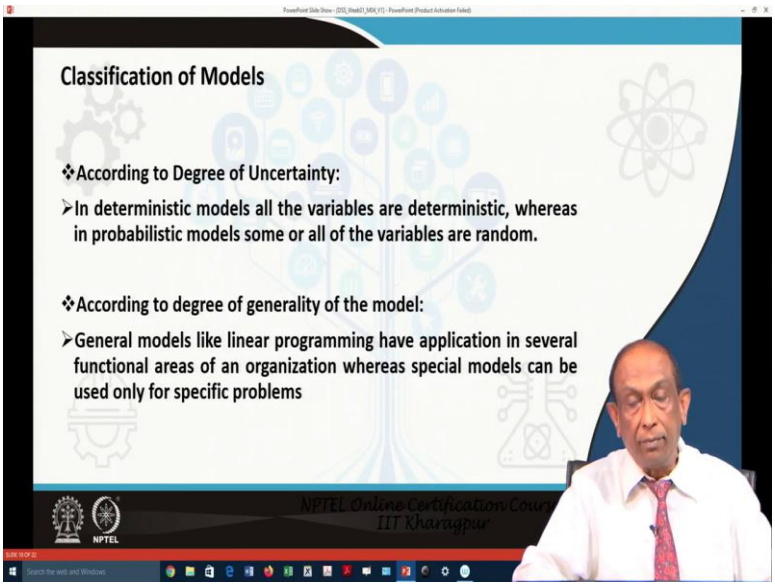

Next classification of models according to the degree of uncertainty. In deterministic models all the variables are known and they are deterministic in nature, whereas in probabilistic models some or all of the variables are random in nature.

Next classification comes when we talk about the degree of generality that is there in the model. General models like say linear programming, they have application in several functional areas of an organization, whereas special models can be used only for solving specific problems.

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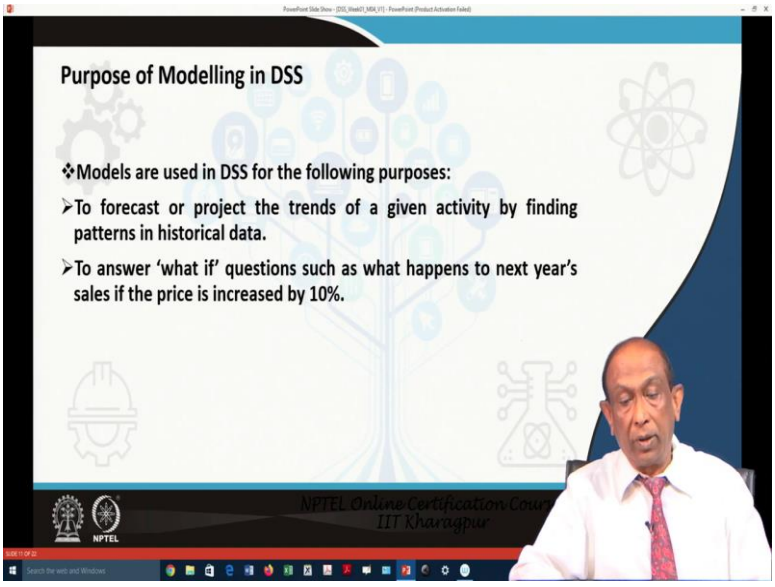

We have already said that models are used in DSS, mainly to solve problems where we need to forecast or project the trends of a given activity by finding patterns in historical data. When we will talk about forecasting DSS, this kind of models will be highly relevant and used.

And also models are used to answer what if questions that is I already said sensitivity analysis type of problems, such as what happens to next year sales if the price is increased by 10 percent. And these kind of models are highly used in every organization through the use of spreadsheets. Spreadsheet models they are very effective in solving sensitivity analysis type of problems.

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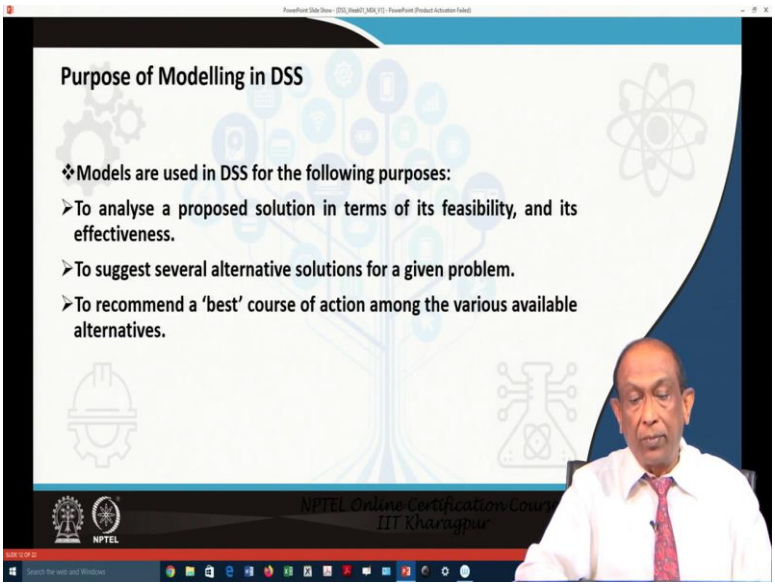

Models are used in DSS to analyze a proposed solution in terms of its feasibility and its effectiveness to suggest several alternative solutions for a given problem and to recommend a best course of action among the various alternatives.

We have already mentioned about all of these points. Again I am repeating because one must be very-very thorough about the usefulness of the model; how to construct the model, the properties of the model; because next to managers, models are the most important components of this effective decision support system.

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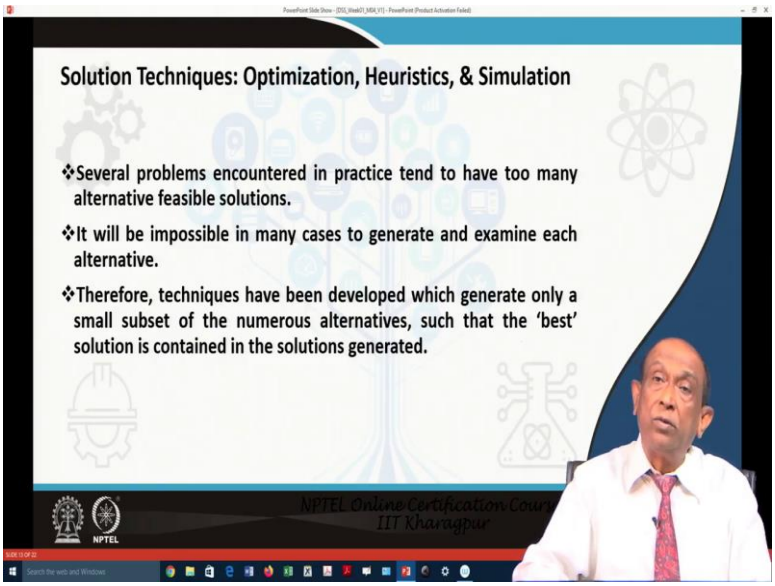

Several problems encountered in practice tend to have too many alternative feasible solutions. And it will be impossible in most cases to generate and examine each alternative. Therefore, techniques have been developed which generate only a small subset of the numerous alternatives such that the best solution is contained in the solutions generated. And these kind of solution techniques are basically from optimization, heuristics and simulation.

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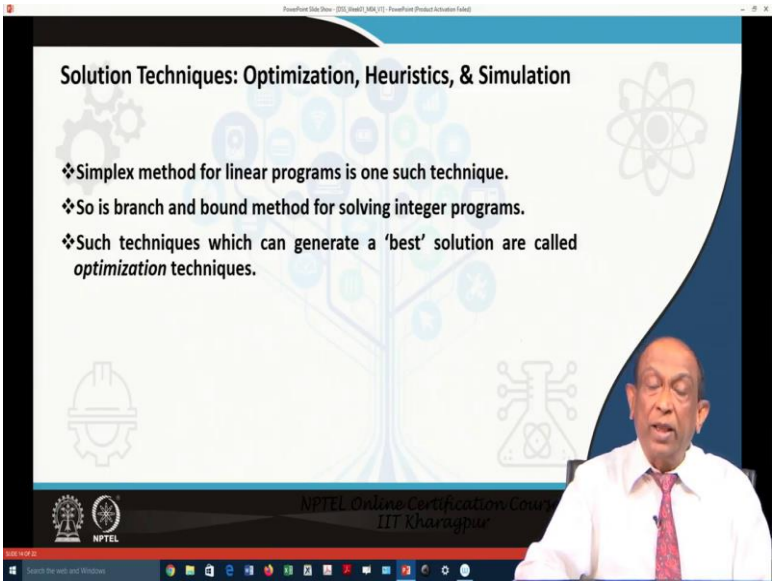

Simplex method for linear solving linear programming type of problem is one such technique which generates optimal solutions. So is branch and bound method for solving integer solution, integer programming problems. And these techniques they generate the best solution on a given constraint and they are basically these techniques are known as optimization techniques. Some problems in real life are very complex.

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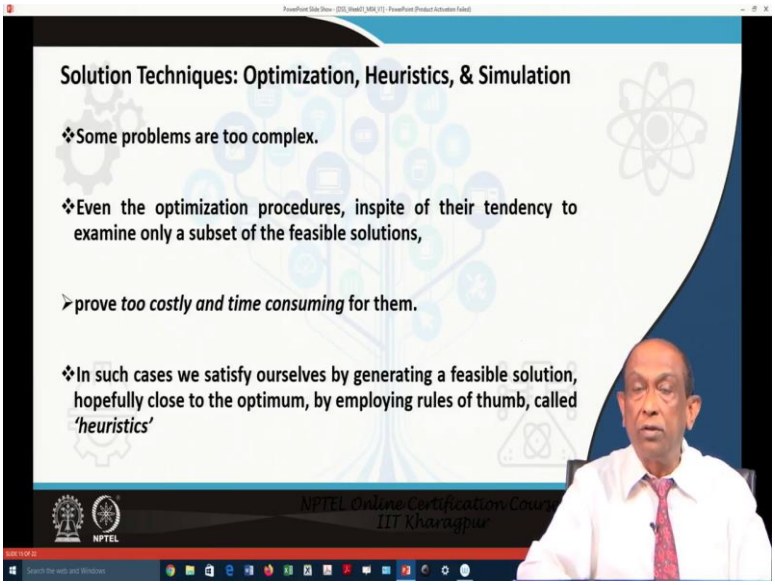

And even the optimization procedures, in spite of their tendency to examine only a subset of the feasible solutions prove too costly and time consuming for solving these kind of complex problems. In such cases, the managers they satisfy themselves by generating a feasible solution which is effective and hopefully very close to the optimum solution by deploying some rules of thumb and these rules of thumb are called heuristics.

So, when the problem in hand is very complex, then we have observed that optimization techniques, will take lot of time and it is also very costly to solve those kind of problems using those optimization techniques, so in industries managers they are more happy to use these kinds of heuristics. That is, they imply certain rules of thumb to generate a feasible solution which is an effective solution and hopefully that solution may be very close to an optimal solution. Even if it is not an optimal solution, the managers they are more satisfied with the effectiveness of that solution and that is what is most important in any decision support systems.

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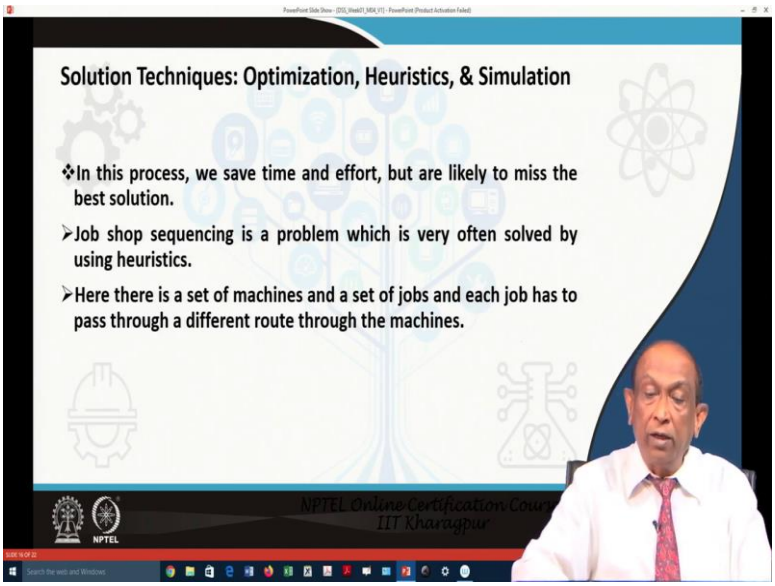

So, by deploying heuristics the managers they save time and effort. They may likely miss the best solution, but the emphasis here is to generate an effective solution. For example, job shop sequencing or even scheduling is a very complex problem. If we try to find an optimal solution we will be left nowhere. So, in production shop such kind of job shop sequencing problems are often solved using heuristics.

In the job shop sequencing problem what is the problem? There is there will be a set of machines and set of jobs and each job has to pass through a different route through the machines, which job should be loaded and which job should follow which route, this is the problem.

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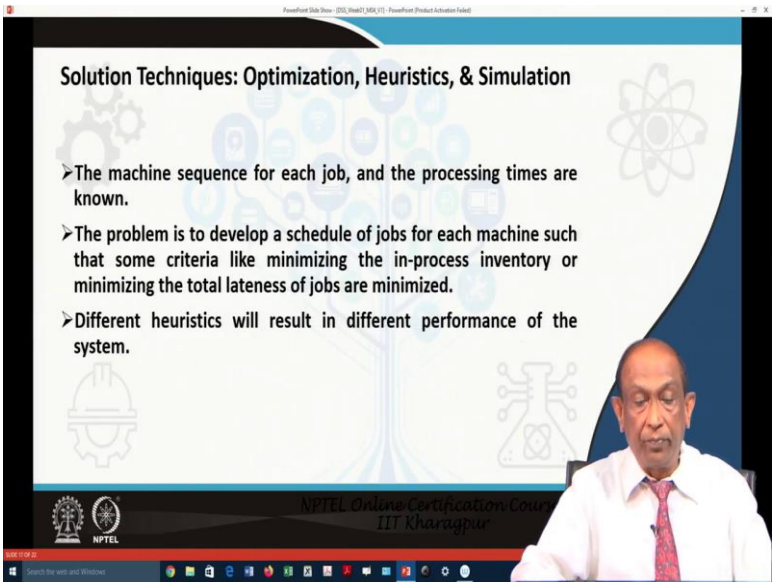

The machine sequence for each job and the processing times for those jobs in the respective machines are already known. The problem is basically to develop a schedule for those jobs for each machine such that some criteria like say minimizing the in process inventory or minimizing the total lateness of jobs is met. Different heuristics will result in different performance of the system. And depending on what the managers want the rules of thumb will be deployed.

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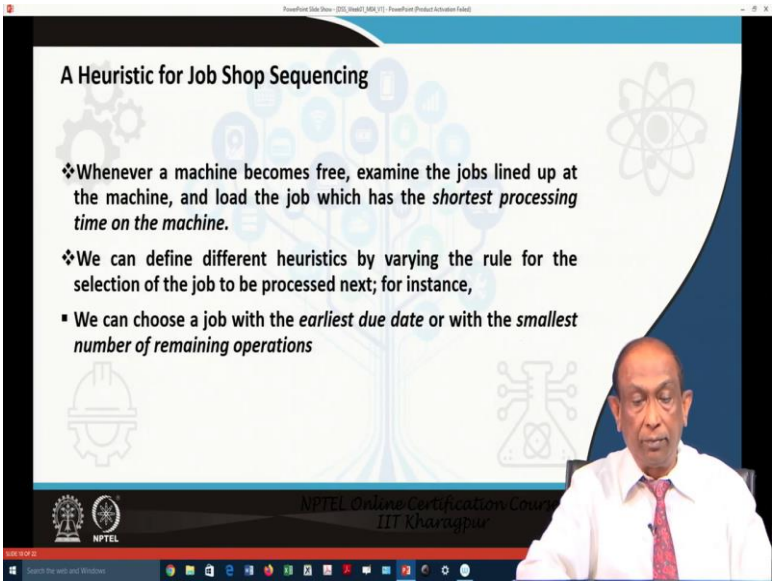

For example, whenever a machine becomes free, examine the jobs that are lined up at that machine and load the job which has the shortest processing time on the machine. This is also known as shortest imminent processing time rule. This is one kind of heuristic.

We can define different heuristics by varying the rule for the selection of the job to be processed next. For example, we can choose a job with the earliest due date or with the smallest number of remaining operations. So, there are different kinds of heuristics and depending on what we want to achieve those kind of heuristics are used in job shop sequencing problem. Heuristics are very-very popular in solving job shop sequencing problems and also in scheduling.

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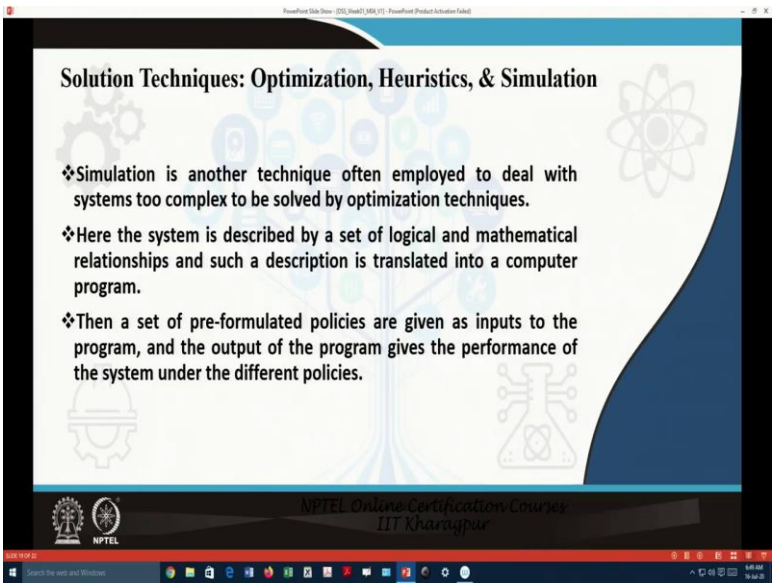

Next, we talk about simulation. Simulation is another technique, often employed to deal with systems that are complex, so complex that if we need to find an optimal solution we will be left nowhere. Here the system is described by a set of logical and mathematical relationship and such a description is translated into a computer program. Then a set of pre-formulated policies are given as inputs to the program, and output of the program gives the performance of the system under the different policies. The policies are embedded as part of the computer program.

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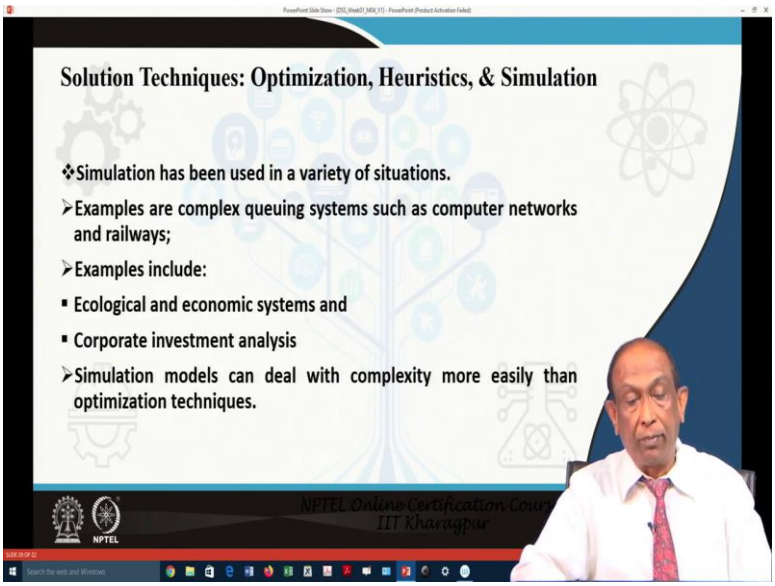

Simulation have been used in a variety of situations. Examples are queuing systems; for example, computer networks, railways. Examples include ecological and economic systems, and corporate investment analysis.

The beauty of simulation techniques is that simulation models can deal with complexity more easily and in a less costly manner compared to use of optimization techniques. And hence, heuristics and simulation they are very popular in designing decision support systems. Of course, optimization techniques have also been used in various DSS. It depends on the situation; depends on the complexity of the problem; depends on the affordability; and things like that.

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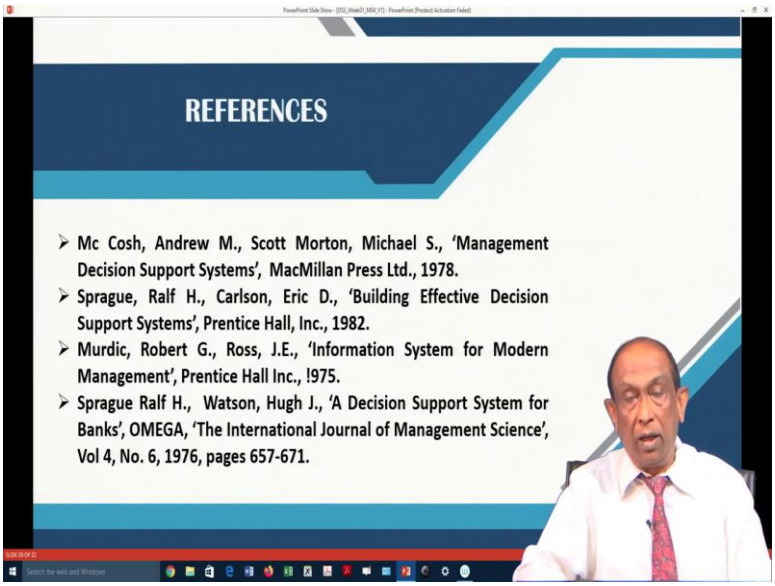

So, this is all that I wanted to discuss in this particular module. The corresponding references have been given.

Thank you! Thank you all!