Decision Support System for Managers
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Lecture – 37
Decision Support Systems for Marketing:
Decision Support Systems for Media Selection Model

Hello and welcome to "Decision Support Systems for Managers"! Today, we are starting the module on 'decision support systems for marketing' and we are beginning this, with a DSS for media selection model.

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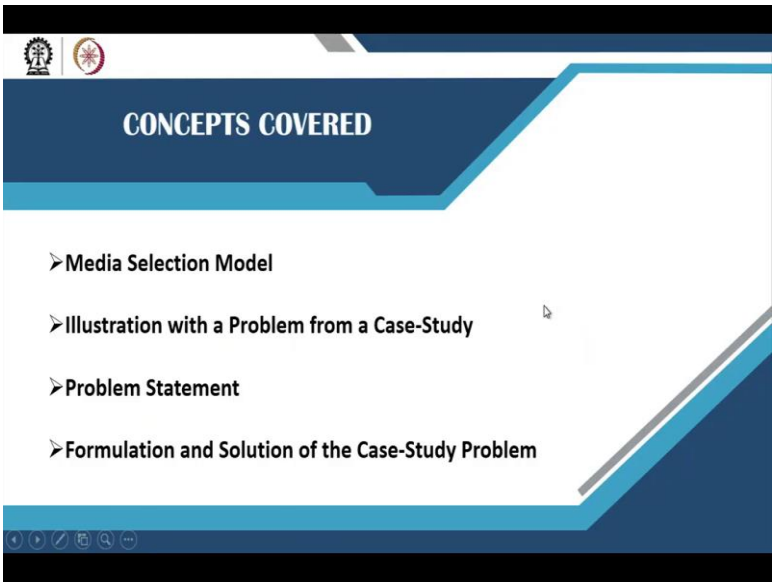

So, first of all, we will talk about the concepts we will cover in this lecture. We will talk about the media selection model. So, media selection is that we want to reach out through media to the target audience. To reach out to the target audience, we have a lot of media which are available to us and every media comes with a cost and comes with some kind of a reward, the reward is in terms of the number of people to whom it can reach.

So, we need to do an optimization problem in terms of the number of media which we will choose with the goal of the rewards which you want to get that is the a particular cut off in terms of a target audience which can be reached. So, we are illustrating this with a case study, then we will talk in terms of the problem statement and then, we will

formulate the problem in terms of an equation and we will solve that and we will present this as a case study problem.

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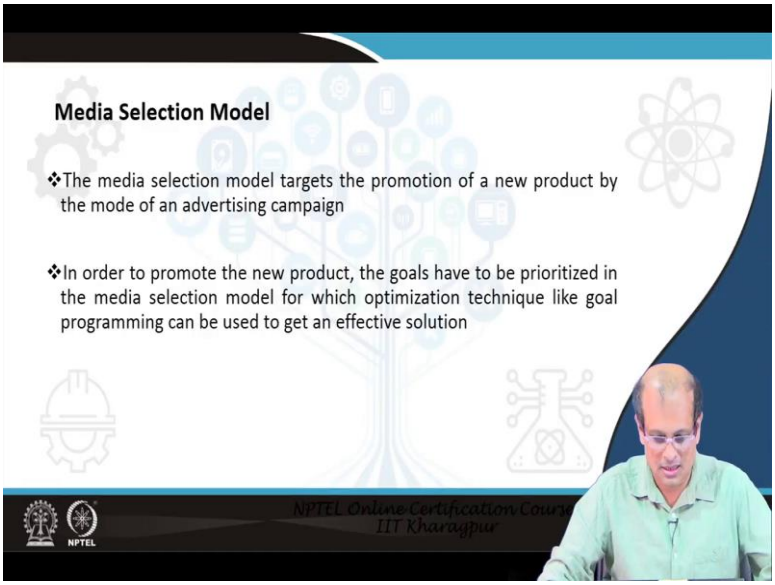

So, in this lecture, we are talking in terms of the media selection problem is a targeting the promotion of a new product through an advertisement campaign. So, in this case, we have chosen a new product, but the media selection problem is not necessarily true for a new product only, this can very well suit an old product or a mix of new product and old product.

And we are talking in terms of an advertisement campaign. We actually are not talking in terms of the other promotions; we are only limiting ourselves to the advertisement. So, we are promoting the new product. So, we are prioritizing the goals for the media selection model and we are using some optimization techniques like goal programming which will be used to prioritize the media selection model and that would be used to get to an effective solution.

So, I will summarize this part. We are looking at a new product, we are looking at a media selection for a new product and we are looking at mode as an advertisement. Then, we are saying that we have multiple goals, the goals have to be prioritized in the context of our media selection model and the goal programming optimization method would be used and through that we will try to come to an effective solution and we are moving to a case.

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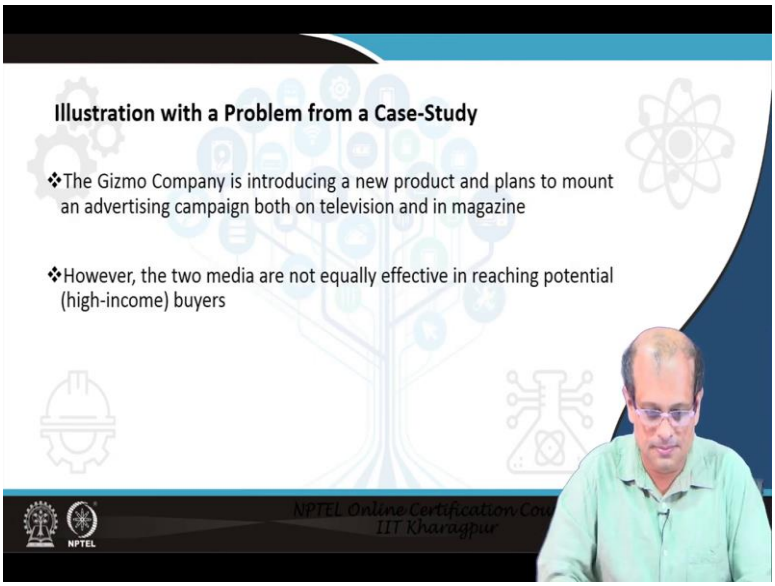

So, there is a textbook example I am taking from. The textbook example talks about a Gizmo Company which is introducing a new product and its plans to start an advertisement campaign. And, it has one television and second a magazine through which it believes it can reach out to its target audience. So, however, which is very true in a general sense also that the two media which are available to me are not equally effective in reaching the potential buyers.

So, in this case, the potential buyers who are there are the high-income buyers. So, I will just summarize this once. So, we have an advertisement campaign, and we have two choices, we have a possibility of reaching out through television and we have a possibility of reaching out through a magazine. And, we know that these are differentially effective, they are not equally effective and my target market in this case is high income buyers and you want to reach out to them.

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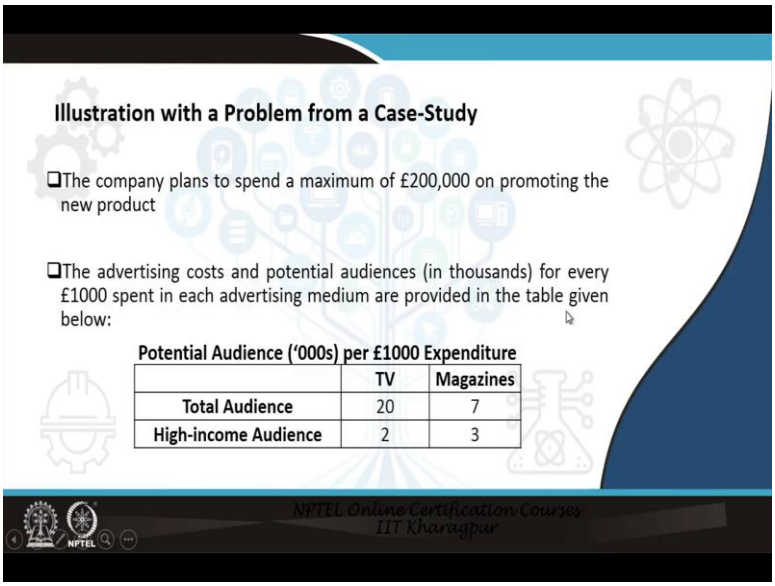

So, we will just talk about the figures for the case. So, the company believes that it cannot spend more than 200,000 pounds for the promotion of the new product. So, this is a budget constraint we are having. Now, we have other data which is available to us. We have the advertisement costs and the potential audiences given to us and these are in thousands. For every pound 100 1000 spent on each ad medium and they are given in the table below.

So, we have 2 cross 2 table as you can see. So, we have potential audience in 1000s per dollar 1000 expenditure. So, you can look at this. So, total audience in TV is 20 and magazines is 7 and high-income audience in TV is 2 and magazines is 3. So, we have a breakup of the total audience in terms of the two mechanisms through which we will do the advertisement; one through television and one through magazine; and also we have a breakup of the same for the high-income audience.

Now that, this is given to us. We will be using this data and moving on with the formulation.

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Now, we will start the problem statement. So, the company has a prioritized its three goals and they are reach an audience of at least 3 million. Now, this is something which has to be done. Then, spent around the word is around so, this is an approximation of around 40 percent of the advertisement budget on magazines. The third problem statement in terms of the goal is reach a high-income audience of approximately 500,000.

So, if you look at the problem statement, the first problem statement which is reach an audience of at least 3 million is fixed, it does not change. Second problem statement which says spend around 40 percent of the advertisement budget is something which will be used in the goal programming once we are prioritizing the goals.

Similarly, the third one is also an approximation. We are saying we will reach high income audience of approximately 500,000. So, these two are the ones which we can deviate from, but the first one is fixed. So, with this knowledge, we move on.

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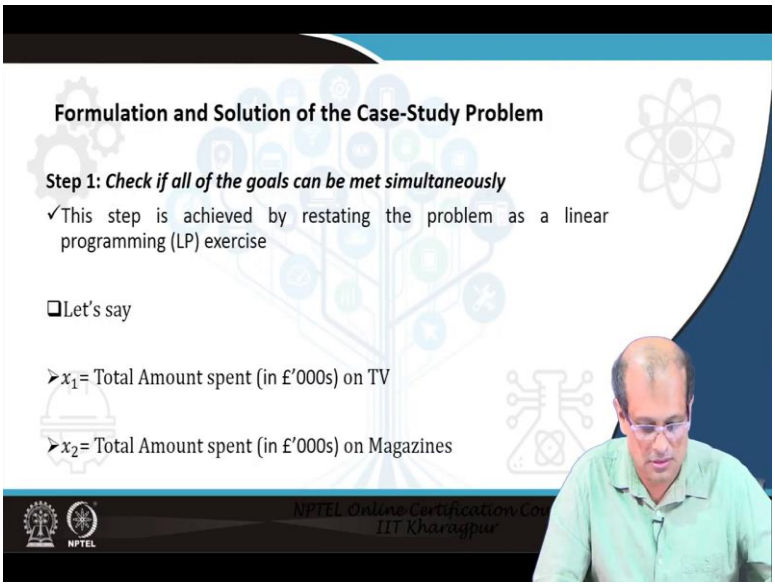

So, now we move to the formulation and the solution of the case study problem. So, we start with the first thing. So, the step 1 is that we check if all the goals can be met simultaneously. If they can be met simultaneously, that is the best thing. So, how do we do this? We are achieving by restating this problem as a linear programming problem.

So, we will define the variables. So, let x 1 be the total amount spent in a pound 1000s on television. Say then x 2 is the total amount spent in 1000s on magazines. So, these are the two variable definition we have spent. So, the amount spent on TV is x 1 and the amount spent on magazines is x 2, the two variable definitions. So, these are the two variable definitions and so, we have x 1 and x 2 as the two variables which we have defined now.

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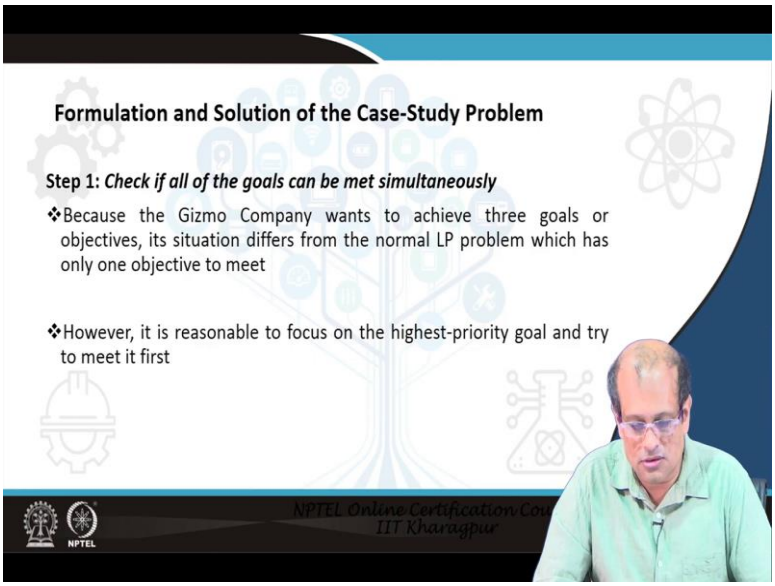

Now, we now continue with the fact that we are checking for whether all the goals can be met together simultaneously. Now, the Gizmo Company wants to achieve three goals and the situation then differs from a normal LP which have only one objective to meet. Now, then we focus on the highest priority goal and try to meet it first. So, we prioritize the goals.

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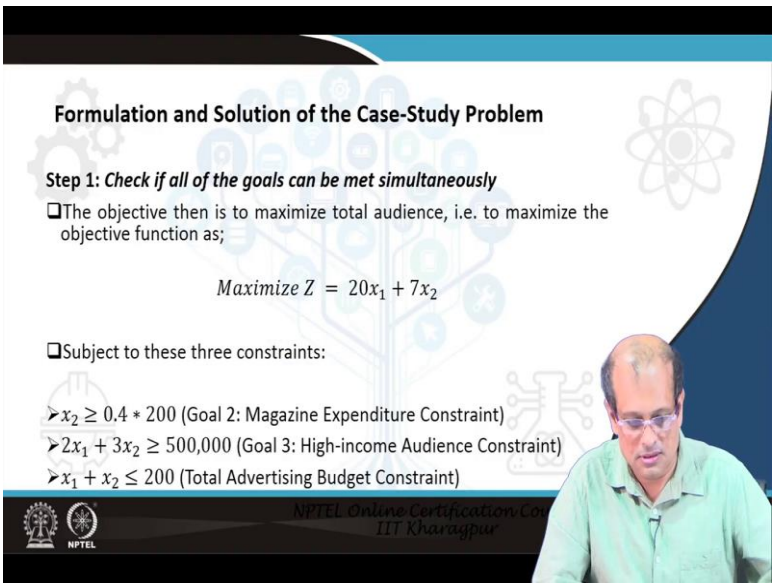

So, we state the objective now. So, the objective is to maximize the total audience that is to maximize this objective function maximize Z 20x 1 plus 7x 2 right. This is translating

from the data which was given to us in a 2 cross 2 matrix and we are defining the three constraints which we had stated in a language form.

The first is x 2 is greater than 0.4 into 200 that is, this is the goal 2 which is the magazine expenditure constraint. Then, 2x 1 plus 3x 2 is greater than or equal to 500,000. This is the goal 3 which is high-income audience constraint and x 1 plus x 2 is less than 200. This is the total advertisement budget which we have with us.

So, now, we have defined the goals as constraints, and we are maximizing the objective function that is the total audience. So, we have formulated the problem, we have stated it mathematically continuing.

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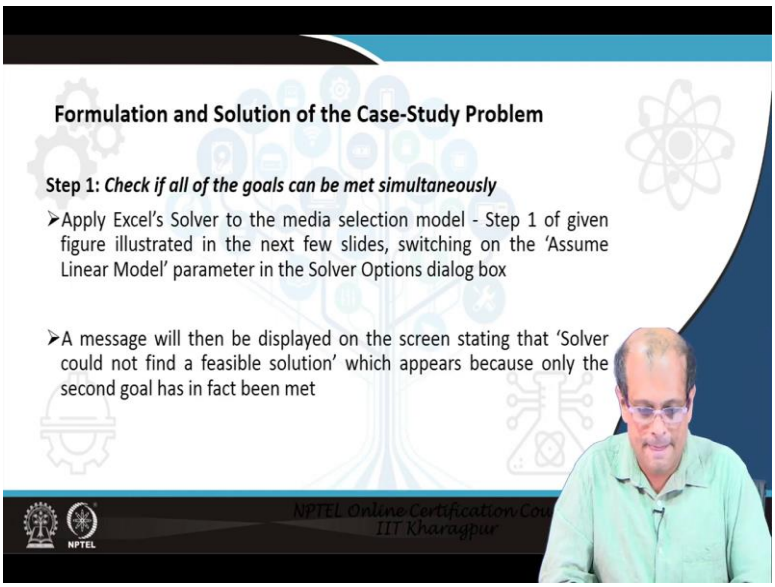

So, we are applying the excel solver and the in the step 1 and we are giving this excel solver output in the next slides and we are assuming that there is a linear model parameter. So, it is a linear model we are taking, and we are using that in the solver options dialog box.

So, this will display a message on the screen which will say that the solver could not find a feasible solution; because only one of the goals that is in this case only the second goal has been met.

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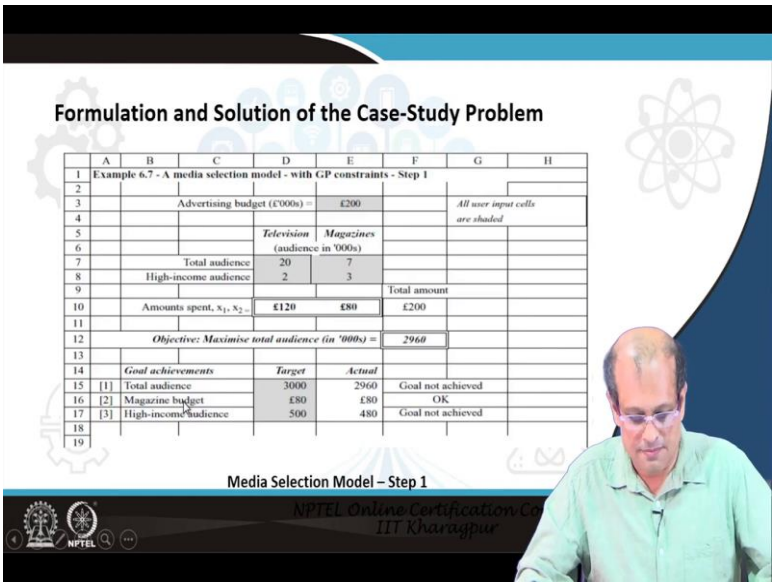

So, this is the kind of an excel solver screenshot which would be available. So, this is taken from a reference textbook which is quoted at the end. So, this is a step 1 of the goal programming problem we are whether when where we are checking whether all the 3 objectives can be met. So, the inputs which are given by the users are shaded.

So, we are giving 200 as the ad budget. Then, this 2 cross 2 matrix of total audience break in terms of TV, magazines and high-income audience in terms of TV, magazines was given to us. Then, we have already been given the total audience, the magazine budget and the high-income audience.

So, we find that the second goal of magazine budget is achieved, while the first goal of total audience and high-income audience these goals are not achieved ok. So, we move on.

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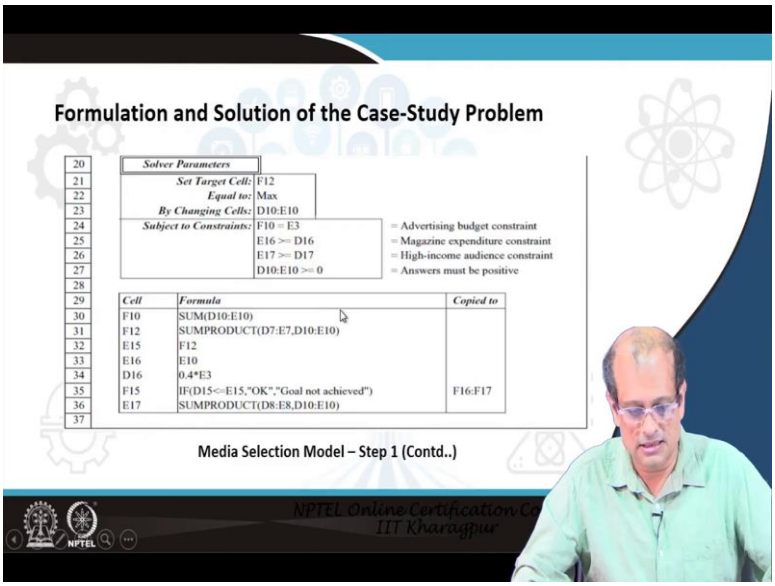

So, this is the way the excel solver input and the basic coding is done. So, the solver parameters, the set target is done F12 and that is set equal to is set to max and by changing cells to D10 to E10 and we can see this out; right.

So, you can very well see. This is how things are happening changing cells on D10 to E10 equal to max and target cells F12 right F12. And then, the constraints are set F10 is E3 that is the advertisement budget constraint, then E16 to D16 that is the magazine expenditure constraint and E7 to D17 that is high-income audience constraint. And all these have to be greater than 0 so, this is the constraints as defined in the excel solver.

So, the solver parameters are basically where we are displaying the maximization and the change of the cells, then the constraint definitions are given. So, these are the cells, and this is the formula which is written in the excel cells and they are finally, copied F15 copied to F16 and F17; right.

So, we can see that F16, F17 they are copied to. So, we get the output as in the goal not achieved for 1 and 3 while the goal achieved for the second problem fine. So, this is the inner workings of the excel; fine. You can solve this with a solver in excel. So, we continue.

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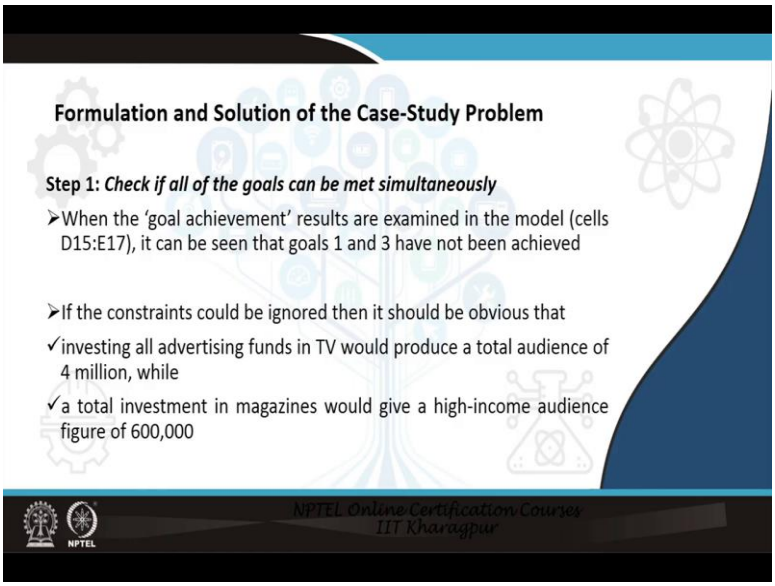

So, when the goal achievement results are examined so, that is the cells D15 to E17, we can see that the goals 1 and 3 have not been achieved, this was discussed. Now, if the constraints could be ignored, then you know if we really ignore the constraints, let us see what do we draw from this.

We can draw out that investing all advertisement funds in TV would produce a total audience of 4 million, while a total investment in magazines would give a high-income audience figure of 600,000. So, this is if I were to ignore the constraints fine. So, I am making that assumption fine. So, these are the results we have drawn, if I were to ignore the constraints.

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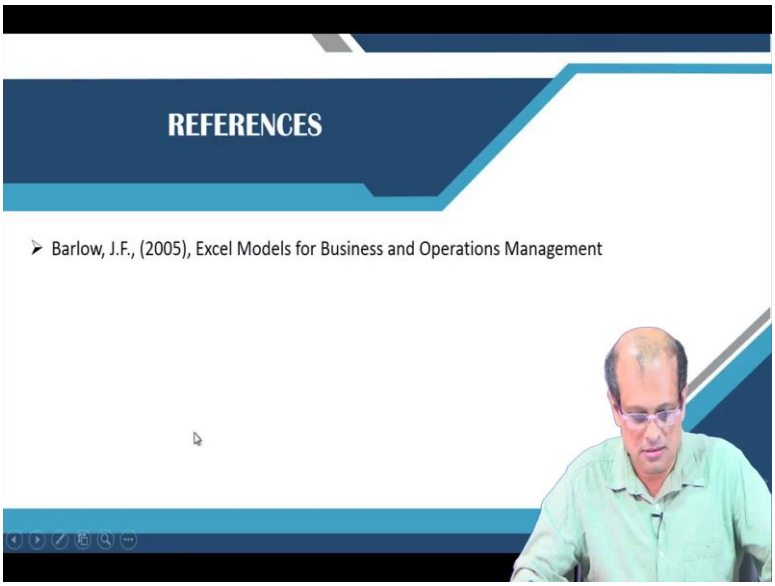

So, this model has come from the reference textbook Excel Models for Business and Operations Management fine. So, I will go back and talk in terms of the statement of the problem and then, the formulation once more. So, we had 3 goals. We had to reach an audience of at least 3 million that was the first goal we had.

Then, we had to spend around 40000; so, this was something which we can ignore as an approximation later on. We can, we will handle this in the next part of the lecture where we will say this around 40 percent can mean slightly more or slightly less than 40 percent of the ad budget on magazines. And, we also had to reach a high-income audience of approximately 500,000.

So, again this is approximately. So, here also we can look at a positive deviation or a negative deviation. This is something which we will do in the next part of the lecture. So, see how the problem statement gets translated to the mathematical problem. So, first of all we define the variables in terms of total spent on TV, magazines 1 and 2, x 1 and x 2.

Then, we focus on the highest priority goal and try to meet it first. So, the highest priority goal and we are trying to meet it first would be the total audience which we are trying to maximize and this is what we try to do and so, 20x 1 into 7x 2 and that is the max the objective function.

So, the constraint is the magazine expenditure constraint this what we defined earlier in terms of a statement, similarly, the high-income audience constraint and total ad budget constraint fine. So, we are been able to state the problem and we have been able to convert the problem to a formulation fine right. So, we have been able to solve this.

So, we have done the part 1 of this study and we have inferred that only one of the goals are met and the other two goals are not met; that means, all the three goals together in this optimization problem cannot be met. So, what is the way forward and what are the lessons we draw?

The lessons we draw is that if the constraints could be ignored, then the total audience is achieved that is 4 million. And, the total investment in magazines would give a high income audience figure of this, but, we are having some constraints which you did not honour; only in that case, we can get to these values ok. So, the way forward is we now go to the steps 2 in the next lecture of the goal programming problem.

In the step 2 of the goal programming problem, we will handle these constraints as in we will handle this spend around 40 percent of the ad budget on magazines, this constraint we will treat this as a deviation. And, reach a high income audience of approximately 500,000; we will learn how to deal with this goal also in terms of a mathematical formulation. So, that part will be the step 2 of the goal programming problem.

So, let me summarize before I close. We were able to handle multiple goals. The goals we said have to be prioritized. Some of the goals have; some of the goals had to be reached for example, reach an audience of at least 3 million. This is a goal which had to be reached; we cannot be less than 3 million that is something we cannot dishonour. However, the other two constraints were approximate constraints and they will be taken forward in step 2 when we set up a goal programming problem.

We also saw that ordering all the three constraints in an optimization problem does not happen. And, we were able to only achieve the magazine budget goal achievement, but could not achieve the target audience and the high income audience goal achievement. So, this is where we got into a problem and this is what we will solve using the step 2 of the goal programming approach fine; ok.

So, I have taken this material from Barlow, 2005, Excel Models for Business and Operations Management; this case has been taken from here as an illustration.

Thank you very much!