Linear programming term paper example

Term Project - Questions

- What are the some of the key questions one needs to answer in order to figure out how to execute the timeshare exchange?

When a person wants to execute a timeshare, there are a number of points that he/she needs to take into consideration. The user needs to answer the following questions in order to figure out how to execute the timeshare exchange:

- How much is the fee for exchange?

Whenever an exchange is done, there has to be some fees associated with it. Therefore one need to determine how is required in order to execute the exchange. Determining the fee will provide one with the opportunity to tie up any slack ends of the contract so that all the arrears are handled before entering into an exchange contract.

- What is the size of the facility being sought?

This will help in determining whether the purchase satisfies the user's needs and the amount of money to be paid for it.

- What is the rating of the resort in question?

The rating also helps in determining whether a given exchange is worth the price offered based on the rating offered for the resort in question.

- Is the exchange company regionally based or an international company?

This will help the user to determine whether he/she can obtain a similar resort elsewhere in the world and how much to pay for the services offered.

- How will the Timeshare Exchange be advertised?

This helps one in promoting the exchange and informing prospective clients about its existence.

- What are the legal requirements needed for the execution of a timeshare?

Usually there are some legal requirements which are needed in order for a person to be able to execute a timeshare. All the deeds need to be drawn up stating the rules of the contract before it is executed.

- What data are required?

- Data for the prospective customers and owners

- Ratings of the resort

- Market review data – including whether a chosen location viable and business friendly

- Overall price of the exchange and funds availability

- Come up with an example, illustrating that Richard Wall's ranking procedure does not result in the optimal timeshare exchange schedule; that is, that the schedule it produces can be improved. How would you cost out the business implications of your example?

The ranking procedure provided by Richard Wall used numeric preference score which was associated with every demand. The requests were sorted in descending order depending on the preference scores. This ranking procedure matched well with the priority system which was currently in place but does not result in the optimal timeshare exchange. Therefore optimization techniques need to be implemented in order to improve the technique. TRE received uneven requests from the clients and it was also very hard to determine how to schedule some of the activities based on this preference model. TRE was therefore not achieving its revenue potential as a result of using this ranking procedure. Therefore it was not providing the

best services to its clients. This then resulted into uneven requests coming from the clients and this could lead to losses at some point in the business operations. In order to mitigate this problem, the ranking procedure need to be revised and an optimal solution sought which would not only help in improving the profitability of the timeshare exchange but also ensure that all the clients are satisfied. This business implication meant that the clients were not satisfied and this also led to a negative portrayal of the exchange process. Once the clients are not satisfied, the business is bound to make losses. Therefore it would be very costly for the business if they used this ranking procedure without improvements in order to optimize its performance.

- Propose a heuristic algorithm that would take an existing feasible schedule as an input and modify it to improve its quality.

Hint: Given two owners (A and B) and their satisfied requests, is it possible to improve the solution by giving A's request to B and B's to A? What about owners 3, 4, and so on?

The following section shows a pseudocode that can be used to implement above problem

Input : Number of owners of a timeshare exchange n and array of costs c(i, j) i, j= 1,.. n (We begin client #1) Output: Choice of client and the cost.

(* starting values *)

C= 0

cost= 0

request = 0

e= 1 (*e= pointer of the chosen client)

for c= 1 to n-1 do

choose the pointer j with

minimum= c(e, j)= min{c(e, k); preference (k)= 0 and k= 1,.., n}

cost= cost + minimum

e= j

C(r)= j

end r-loop

if A is unsatisfied and B satisfied

Assign user A value B

Else leave value A

End If

If B is unsatisfied and A satisfied

Assign User B value A

Else leave value B

End if

C(n)= 1

cost= cost+c(e, 1)

preferred client = r

display " Name of Client + cost + value assigned"

- Review multiple objective decision-making approaches and suggest the one you believe fits best for the timeshare exchange fair problem. Explain your choice.

There are several multiple objective decision making approaches that can be used to solve different decision making problems. The choice of the method to be used depends on the problem being solved.

Some of the methods include:

- Analytic Hierarchy process – this is a process that permits a deliberation of qualitative and quantitative features of decisions. This method reduces composite assessment to a number of simple comparisons and then help in synthesizing the results.

- Paired comparison analysis – is essential in determining the significance of certain options in relation to others. It uses a set of preferences to determine the problem to be solved and the decision to be selected.

- Grid analysis – is a technique used to support the decision making process. It is commonly used in situations whereby there are several alternatives that need to be considered. It then works out the relative importance of each of the alternatives and then settles on one.

- Decision tree – this is in form of a graph which has a number of possible sequences. It is usually used to map observations about a given item.

- Linear programming – this is one of the most important methods of optimization whereby the objective function and the constraints are all linear. This method utilizes algorithms in order to find a solution for a specific problem. It is commonly used at various managerial levels to minimize the costs of operation and hence maximize the profits of a given establishment.

- Network Flow Model - This is a form of linear programming in which the owners of an establishment submit their requests for the intervals in a centralized pool and the exchange will determine the person who is awarded which interval. This method helps in guiding the management on how to go about the process of decision making and hence choose the best combination to optimize their results. This method is one of the most

important for implementing the issues of timeshare exchange whereby the clients/owners can be awarded different slots with an surety of optimized results.

- Using your answer to Question 5, develop a mathematical programming approach for determining an optimal exchange schedule.

The solution presented in number (5) above uses linear programming in form of the network flow model and the following points have to be taken into consideration:

- Index sets:

The index sets are the sets of the premises and the owners. They will determine the size of this model.

- Decision variables:

Since the main question is to determine how the award should be done, our decision variable for this case will therefore be client who needs to be awarded a given slot at one given time.

- Objective:

- Constraints:

All premises are to be occupied. No premise is to be assigned to two different users at the same time.

Formulation:

Maximize premises utilization

All hotels occupied

No double booking of the premises

Decision Variables

Let

X be the number of resorts

Y be the number of seasons

Z be the number of colors

The total number of options available = 3*4*3

= 36 options available

Therefore the constraints are

$3X + 4Y + 3Z <= 36X>= 3$

$Y>= 4$

$Z>= 3$

Objective Function:

The objective is to maximize the resort utilization

$3X + 4Y + 3Z = 36$

Nonnegativity constraints (all the variables should be nonnegative):

$X, Y, Z> 0$

Complete linear programming model:

$Max3X + 4Y + 3Z$

$3X + 4Y + 3Z <= 36$

Now solving in Excel

1. In the Microsoft Office button, go to excel options to click Add-ins

2. In the Add-Ins box, select Solver Add-In and click Go

3. once the solver button has been added, the problem can now be solved as

follows:

i. maximize 3X + 4Y + 3Z

X>= 3

Y>= 4

Z>= 3

The following table is generated

In excel, the following table is generated

Whereby O5: 06 represents the cells covered

4. Enter the coefficients of the objective function Z

5. Enter the coefficients of the Constraint

6. For the Objective function value, enter the formula for computing Z =

SUMPRODUCT (O5: Q6). This formula uses the coefficient values and also the

solution values for variables X and Y, which are supposed to be solved.

7. Similarly enter the formula for LHS of the Constraints

8. Now Excel Solver will be used, in the Data tab click Solver.

The solver box appears as follows.

9. Set the Target Cell for the Objective Function Z value

10 Check the Equal to Min i. e., Minimum Option.

11. For Changing Cell, select the solution values of the variables X

12. For subject to the constraints, LHS >= RHS

13. Also all the solution values needs to be positive,

14. Now click the Solve button.

The value of Z is therefore found.

Using the optimal solution X= 10 when Y= 0 and Z = 0

This implies that there are 10 options available for selection for the resorts without taking into consideration the season or the color. The resorts are therefore assigned on first come first serve basis.

- Download the data from Tables 1 and 2 in the A case, and use a mathematical programming package of your choice to solve the simplified exchange problem described above, using the approach suggested in Questions 5 and 6.

Let:

X be resorts (X1, X2, X3)

X1= Orlando

X2= San Diego

X3= Horseshoe

Y be seasons (Y1, Y2, Y3, Y4)

Y1= Fall

Y2 = Summer

Y3= Winter

Y4= Spring

Z be colors (Z1, Z2, Z3,)

Z1= red

Z2= blue

Z3,= white

Indices

O – owners

Xj – resorts

Zj – colors

Parameters

Rq – requests

Sb – submitted

Nodes

Yj - Seasons

C – City

Arcs

Allocation of O to R

NODES:

identifier : Xj

index domain : 1

definition : NetOutflow <= Xj (1)text : resort allocation for O ; identifier :

Cindex domain : 1definition : NetInflow >= C(1)

text : resort city c ;

ARC:

identifier : O

index domain : (O | T(R)

text : color Z ;

ARC:

identifier : O

index domain : (O | T(R)

range : nonnegative

decision: Oi allocated to Rithe

The following network diagram shows which resort is assigned to which user per season

h

- Please advise Wall as to how to quantify these opportunity costs. How big are these costs in the data sample from Table 1? Comment on the short- and long-term benefits and losses from the allowing or forbidding downgrade and upgrade requests.

In most of the decision making actions, the opportunity costs are typically less than the paybacks of the substitutes chosen. It is very necessary to quantify opportunity costs so that one can determine how he is bound to lose/ gain from a given initiative. In order to quantify the opportunity costs, Walls need to use the following procedure:

- Determine the available alternatives

- Establish the cost of each alternative

- Identify the opportunity costs

- Find the difference in costs to quantify the opportunity costs

Some of the long-term effects include increased profitability in future and customer convenience while short-term effects include the increased costs of operation which may not be attainable when the project commences.