OPERATIONS RESEARCH IN AIRLINE MANAGEMENT USINGLINGO SOFTWARE

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ABSTRACT

In this paper ,Operations research along with LINGO software is employed to achieve an appropriate decision making with goal of optimizing performance and management styles of Airlines .Here,we are up to show that Mathematics and Operations research is used in various stages of airline Management .LINGO is an Operations research Software designed to solve Optimization models ,by applying this we cansolve Operations research problems.

KEYWORDS

Operations research , LINGO software ,programming types , Business applications of operations research.

INTRODUCTION

Operations research is used for solving complex problem of business throughout mathematical analysis.Result of these methods seen in improved business operations and management styles.The method we use is LINGO software for solving optimization models using Linear and Integer programming which helps in getting faster easier and more efficient outputs

OPERATIONS RESEARCH

Used to analyse complex Real life and Business problems.It deals with Problem formulation, Solution and finally appropriate decision making. Operations Research is used in various business fields to maximize the profit or to minimize the total cost for better decision making.

LINGO SOFTWARTE

LINGO is a operations research software and Mathematical modeling language designed to efficiently build and solve linear and integer optimization models .It solve optimization programming problems faster, easier and more efficient.

PROGRAMMING TYPES

We are using two programming types for solving theproblem.

LINEAR

It deals with Objective function representing either the profit to be maximized or a cost to be minimized and we use set of constraints that circumscribe decision variable. Linear Programming will have constraints and Objective function all are linear functions of decisionvariable.

INTEGER

Some of the variables are required to take an discrete values.In Integer Programming we use some or all of the variables asintegers.

BUSINESS APPLICATIONS

Operations Research is used for finding best optimal solution and for decision making.In this we are going to solve problems in Airline management .

MARKETING MANAGEMENT

Marketing management manages planning,directing of business ,organizing,coordination and controlling of a business.

Objective of marketing management is to generate profit, to create public image and to fulfil customer satisfaction.Revenue management is used for increasing loads on low demand flights and increasing yields on high demand flights,inventory control and to control revenue outcome of aflight.

We are going to solve Revenue management in airline by allocation of number of aircraft seats on aircraft to maximize therevenue.

SUPPLY CHAIN MANAGEMENT

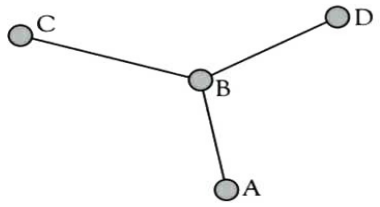
Supply chain management covers both manufacturing and services which involves management of materials,demand forecasting,planning,distribution and more. We are going to do supplier selection which include quality,quantity,price, delivery speed,flexibility etc… we are going to analyse on multiple criteria to finalize the bestsupplier.

LINEAR PROGRAMMING PROBLEM

PROBLEM 1 : REVENUE MANAGEMENT FOR AIRLINES(Marketing Management)

This problem comes under marketing management and we solve thisusing linear programming.

Let us take case of an airline that has two 200 seated aircraft(1 and 2) the aircraft are operated between 4 cities we name it as (A,B,C,D).Aircraft 1 leaves A flies to C via B in morning returns to A in the evening through the same route .Aircraft 2 leaves D and flies to C via B in morning and returns to D in evening through same route ,now we consider only morning flights .The meetings junction for both the aircraft flying from A to C and D to C is B. The airline uses two fare classes targeting on business class(class 1)and leisure class (class 2).



The airline hasdeveloped forecast of demand for two fare classes for different destinations pairs served by two aircraft in the morning.

INPUT DATA

Demand for two fare classes with destination pairs .

origin destination	class 1 fare	class 1 demand	class 2 fare	class 2 demand
A-C	400	60	190	100
A-B	280	52	150	130
B-C	300	80	170	130
D-C	600	20	250	80
D-B	400	55	200	110

The airline has to decide allocation of number of aircraft seats to each of the fare classes on each aircraft to maximize therevenue.

To solvethisproblemwedefineintegerdecisionvariable x_{ijkl}

which indicate number of seats reserved for fare class k(1 and 2 for class I and class II) on aircraft numberoperating between origin i and destinationj.

Thus we have 12 integer decision variables

x_{AC11}, x_{AC21}, x_{AB11}, x_{AB21}, x_{BC11}, x_{BC21}, x_{BC12}, x_{BC22}, x_{DB12}, x_{DB22}, x_{DC12}, x_{DC22}.

Because our objective is to maximize the revenue the objective function is

$$Maximize \sum x_{ijk} f_{ijk}$$

where $f_{ijk}$is the fare class of k between origin i and destination j because seat allocated have to be less than or equal to the aircraft capacity,constraint have to modeled according to that.For the AB leg number of seat allocation has to be less than aircraft capacity,which is modeledas

$$x_{AB11} + x_{AB21} \leq 200$$

This constitute first set of constraints . Further the seats allocated for each classes on each flight has to be less than or equal to demand. for example number of seats allocated on AB forclassIhas to be less than 52 ,whichismodeledbytheconstraint,

$$x_{AB11} \leq 52$$

These constitutes second set of constraints.The seatallocationson two aircraft for the different flight legsof total Revenue is 162060 obtained by solving the LINGO program. The capacity constraints are revised after regular intervals to find reservations done for each flight leg and fare class in the preceding time interval. The programs are re-run to obtain revised seat allocations.

We use coding in LINGO software to get our output.

OUTPUT

Flight leg	aircraft 1	
	class I fare	class II fare
A-C	60	30
A-B	52	58
B-C	0	110
D-C	-	-
D-B	-	-

Flight leg	aircraft2	
	class I fare	class II fare
A-C	-	-
A-B	-	-
B-C	80	20
D-C	20	80
D-B	55	45

INTERER PROGRAMMING PROBLEM

PROBLEM 2 : FLIGHT CATERING SYSTEM(Supply Chain Management)

This problem comes under Supply chain management and we solve this using Integer programming .
This model covers only supply of fresh items(meals),alcoholic items and soft drinks will not come under this model .
The Airline Company wishes to place a order for 900 meals per day for which 4 suppliers are available (s1,s2,s3,s4).Each supplier varies from each other in accepting the orders in lot sizes.
The lot size l_j is 50,30,100,60 for suppliers S1,S2,S3,S4 respectively.

Each supplier j can supply only a maximum quantity $m_j$given by 500,500,600,400 for suppliers S1,S2,S3,S4 respectively .

Selection of suppliers based on multiple criteria is difficult , the company should check the scores of financial consideration,food safety,on time delivery,uplift,onboard stowage safety etc… for each of the supplier and have to decide who is the best supplier .In this problem we are going to select supplier on the basis of four important criteria.Thus the weights of the objectives are

-	Price	Quality	Delivery	Processing capability
Weight	0.0758	0.4759	0.3224	0.1260

It will be noticed that sum of the weights of the objectives is1.

The scores of the suppliers are:

-	price	quality	delivery	process capability
S1	0.37	0.37	0.14	0.40
S2	0.16	0.37	0.13	0.35
S3	0.33	0.20	0.49	0.02
S4	0.14	0.06	0.25	0.24

S_j denotesthescoreofthesupplier s'_j denotes the finalscoreofthesuppliers the final score for each supplier j is calculated using weights and scores of each supplier.

For example Final score of first supplier is calculated by

(0.0758*0.37)+(0.4759*0.37)+(0.3224*0.14)+(0.1260*0.40)=0.299665

In this way final score for all the suppliers are calculated

supplier	S1	S2	S3	S4
Final score	0.299665	0.274223	0.28069	0.150006

we are defining linear integer program , let x_j be a integer decision variables denoting the number of lots ordered from supplier chain. The company wishes to meet all the objectives (final score)

$$Maximize \sum_{j=1}^{4} s'_j x_j l_j$$

The company has to obtain 900 meals from all the suppliers with whom the orders are placed . it is modeled by constraint

$$\sum_{j=1}^{4} x_j l_j \leq 900$$

The above mentioned is the constraint 1.

Each supplier j can supply only a maximum quantity m_j

This is modeled by the following constraints and it is second constraint.

$$X_j l_j \leq m_j \text{ for all j (constraint2)}$$

lotsize is represented as l_j
m corresponding to maximum quantity m_j
s corresponding to finalscore s'_j
x_j denoting the number of lots ordered for each supplier j

x corresponding to integer decision variables.

We use coding in LINGO software to get our output.

OUTPUT

The solution gives an optimal order of 10 lots with supplier S1 and 4 lots with supplier S3.No orders are placed with the suppliers S2 and S4.

CONCLUSION

In this we use LINGO software to formulate and solve Operationsresearch problems in Airlines for making better decision and for optimizing the performance of Airline organizations . The result of this method is seen in improved management style and business Operations. We have taken some of the problems on airline management to show that Operations Research plays numerous role in almost all the business fields. Operations research helps the organizations to move their business in right direction. Operations research helps in knowing the current status of our business andgivesabestsolutioninallpossiblewaystoimprove the business.

REFERENCES

Anderson,D.R.,Sweeney , D.J.,Williams , T.A.,Camm,J.D., Mar- tin , K.(2012). An introduction to management science : Quantitative approaches to decision making (XIIIthed.).Mason,OH:South- western Cengage Learning.

Schrage,L.(1997).Optimization modelling with LINGO (Vth ed.).Chicago,IL: LINDO Systems.

Sharma,S., Dubey, D.(2010).Multiple sourcing decisions using integrated AHP and knapsack model:A case on carton sourcing.International Journal of Advanced Manufacturing Technology 51, 1171-1178.

Winston,W.L.(2003).Operations research : Applications and algorithms(IVth ed.). Independence ,KY:Cengage Learning.