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BUSINESSAPPLICATIONSOF OPERATIONSRESEARCH USING LINGO 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 Business. Here we are up to show that Mathematics and Operations research is used in various fields of pro duction and Business management . LINGO is an Operations research Software designed to solve Optimization models .By applying this we can solve Operations research problems.

KEYWORDS

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

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.

INTRODUCTION TO PERATIONS RESEARCH AND LINGO SOFTWARE OERATIONS RESEARCH

Used to analyse complex Real life and Business problems.It deals with Problem formulation, Solution and finally appropriate decision making. We use Linear and Non-linear programming techniques to find values for the variables for optimizing performance. Optimal solution is used to find out best possible solution .

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LINGO

LINGO is a Operations Research software and Mathematical modelling 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 decision variable.

INTEGER

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

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some or all of the variables as integers.

BUSINESS APPLICATIONS

Operations Research is used for finding best optimal solution and for decision making.In this we are going to solve problems in some of the business management field

LINEAR PROGRAMMING PROBLEM

PROBLEM

1: PLANNING OFPRODUCTION FORPROCESSED FOOD PRODUCTS(Operations Management)

This problem comes under Operations management and we solve this us- ing linear programming.

let us take case of a company that has forcasted the demand(in number of units) for processed food product over next 6 months (April-September)

INPUT DATA

Month	Demand
April	400
May	500
June	900
July	800
August	500
September	600

The company has inventory of 60 units that was produced in march. The Company has strict rules for keeping stock of processed food products in inventory,so that the inventory can be kept only for maximum of 2 months. Thus anything produced in April should be sold latest by June end.

Due to storage capacity restrictions maximum inventory can only be 200 units. The company has estimated keeping inventory costs 15 dollars per unit per month of storage.The company can produce maximum of 600 units with regular labour at a cost of 60 dollars per unit. Labour can bepaid overtime to produce an additional 300 units at a cost of 90 dollars per unit.

The company wishes to end the product line at the end of September and would not like to have any inventory remaining after end of September.How much should the company produce each month to meet the demand at minimum cost.

$$i \leq j \leq i + 2$$

Because product manufactured in month can either be sold in month i or month i+1 or month i+2.

To solve this we take a decision variable x_{ijl}

As the number of units produced in month i for sale in monthj by Labour type l.(Months i and j range from 1-6 pertaining to months April-September.April-September.Labour types l=1 for regular and l=2 for over- time working labour. Further in regard to decision variable , it will be obvious that

The cost of production $c_{ijl}$for the product manufactured in month i,and sold in month i is

OPERATIONS MANAGEMENT

Operating management is concerned with planning,organizing, supervis- ing,production,services and delivery, successful turns of inputs and outputs in most effective manner.

We are going to solve planning of production and manufacturing in food based company or factory to maintain a resources allocation,activities of employees,material and production capacity to meet the demand at min- imum cost.

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60 or 90 dollars per unit depending on regular or overtime labour.The cost of production for the product manufacture in month i, which is sold in month i+1,is 75 or 105 dollars per unit(considering inventory cost for a month)depending on whether it is
produced by regular or overtime labour. The cost of production and inventory for the product manufactured in month i,which is sold in month i+2, is 90 or 120 dollars per unit (considering inventory cost for two months)depending on whether it is produced by regular or overtime labour.Hence, the objective function is

Minimize $\sum_{i=1}^{4} \sum_{j=1}^{i+2} \sum_{l=1}^{2} x_{ijl} c_{ijl}$

Because monthly production is restricted to

maximum of 600 and300units for regular and overtime respectively. The first set of constraints

$\sum_{j=1}^{i+2} x_{ijl} \leq t_l$

For i=1,2,3,4 and l=1,2.
Where t_l is the maximum production of 600 and 300 units for regular and overtime labour respectively.
The inventory can be maximum of 200 units. Thus the end of April,the number of units produced in April for sale in May and June has to be less than 200 units. At the end of May the sum of (1) number of units produced in April for sale in June and (2) number of units produced in May for sale in June and July has to be less than 200 units. This will be second set of constraints.
The demand in each month has to be met by production in that month
and the production in the earlier two months. This will require third set of constraints.

We use coding in LINGO Software to get the output.

OUTPUT

In the solution it is observed that whatever is produced in the months

Month	April	May	June	July	August	September
Demand	400	500	900	800	500	600
April Reg	400	100	-	-	-	-
April Ov	-	-	-	-	-	-
May Reg	-	400	200	-	-	-
May Ov	-	-	-	-	-	-
June Reg	-	-	600	-	-	-
June Ov	-	-	100	-	-	-
July Reg	-	-	-	600	-	-
July Ov	-	-	-	200	-	-
Aug Reg	-	-	-	-	500	-
Aug Ov	-	-	-	-	-	-
Sept Reg	-	-	-	-	-	600
Sept Ov	-	-	-	-	-	-

April, May, August and September is consumed in that month only.Overtime production has to be resorted only in the months of June

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and July.

INTEGER PROGRAMMINGPROBLEM

PROBLEM 2: PRODUCT MIX(Operations Management)

This Problem comes under Operations Management and we solve this us- ing Integer Programming.

Let us consider the Company which is manufacturing four products namely P_1,P_2,P_3,P_4.Each product is required processing in the three different treatment plants T_1,T_2,T_3.

Each unit of Product P_1,P_2,P_3 and P_4 requires processing in all the three treatment plants T_1,T_2 and T_3.The time(in hours) required for processing is given below.

INPUT DATA

-	P1	P2	P3	P4
T1	3	3	2	1
T2	4	8	2	4
T3	5	1	8	9

Each treatment plant (T_1,T_2,T_3) are available for 75 hours per week.The profit we obtain by selling the product are 60,100,40,37 for the product P_1,P_2,P_3,P_4 respectively.The Company has predicted four units as the maximum demands for the product P_2 and there is enough demand for the product P_1,P_3 and P_4.

We have to find how many units of the product P_1,P_2,P_3,P_4 have to be produced to maximize the demand.For solving this problem let us take integer decision variable xi as the number of units of the product(P_i) produced.

We use coding in LINGO Software to get the output

Because the Company has predicted four units

OUTPUT

The solution to this problem is

Our objective is to maximize our profit.So the objective function is

$$\sum_{i=1}^{4} x_i f_i$$

where fi is the profit obtained by selling the product Pi.
In the machine Tj,the time required for processing the product Pi is tij. The following constraint for model hours of availability aj of machine Tj.

$$\sum_{i=1}^{4} x_i t_{ij} \leq a_j$$

for product P2 as the maximum demand,we will have an additional constraint;

x_2<=4.

that production of 12 units of product P1,3 units of product P2,1 unit of product P3 and none of product of P4.

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P1	P2	P3	P4
12	3	1	0

CONCLUSION

In this we use LINGO software to formulate and solve Operations research problems in Business for making better decision and for optimising the performance of organizations and business. The result of this method is seen in improved management and business Operations. We have taken some of the business fields to show that Operations Research plays numerous role in almost all the business fields. Operations research helps the organization and companies to move their business in right direction. Operations research helps in knowing the current status of our business and gives a best solution in all possible ways to improve our business

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