Optimization Techniques and Application

Marketing Management

GROUP 27

18UCS222	**ANIRUDH SINGH**
19UCS042	**VIPUL AGGARWAL**
19UCS045	**RISHIRAJ YADAV**
19UCS103	**KHUSHI SANCHETI**
19UCS129	**RISHABH SAHU**
19UCS147	**MANIT MEHTA**

Submitted to:

Dr. Jayaprakash Kar

Objective 1 :-

In the given project we have to decrease the transportation expenditure to its minimum value for marketing management.

Problem Statement:-

In this problem ,we have to produce products at supply locations and transport them to destinations where they are demanded at minimum cost.The origins are two plants at Jaipur and Kota which supplies or capacities of 400kg and 600kg while the destination are three distributions centre i.e. Mumbai,Pune and Bangalore with demand of 300,400 and 250kg respectively. The cost of transporting 1kg of the product from Jaipur to distribution centers are Rs.7,Rs.8 and Rs.9 respectively and from Kota are Rs.10,Rs.11 and Rs.12 respectively. The cost of product per kg in Jaipur and Kota are Rs.26 and Rs.30 respectively.

Optimize the transportation cost that the marketing manager has to pay to the transportation company.

To→ *From↓*	*Mumbai*	*Pune*	*Banglore*	*Supply*
Jaipur	7	8	9	400 kg
Kota	10	11	12	600 kg
Demand	300 kg	400 kg	250 kg	

FORMULATION :-

For the formulation of the above problem, we need to define some notations that are given below:-

Notation	Definitions
X1	Product transported from Jaipur to Mumbai
y1	Product transported from Jaipur to Pune
z1	Product transported from Jaipur to Bangalore
x2	Product transported from Kota to Mumbai
y2	Product transported from Kota to Pune
z2	Product transported from Kota to Banglore

Objective Function :-

The objective is to minimize **the total transportation cost** that is to be paid to the transportation .

Minimize

$$Z = 7x_1 + 8y_1 + 9z_1 + 10x_2 + 11y_2 + 12z_2$$

Subject to Constraints :

$$x_1 + y_1 + z_1 <= 400k$$
$$x_2 + y_2 + z_2 <= 600k$$
$$x_1 + x_2 = 300k$$
$$y_1 + y_2 = 400k$$
$$z_1 + z_2 = 250k$$
$$x_1, y_1, z_1, x_2, y_2, z_2 >= 0$$

METHOD USED-DUAL SIMPLEX METHOD

Reason:

As the given problem is linear so we can use either simplex or dual simplex method .Dual simplex method is better because the possibility of infeasible solution gets removed by its use.

Matlab and Results:-

Editor - C:\Users\risha\Documents\MATLAB\project_part1_transportation.m

project_part1_transportation.m

```
f=[ 7,10,8,11,9,12]
A=[1 0 1 0 1 0 ;0 1 0 1 0 0]
Aeq=[1 1 0 0 0 0 ;0 0 1 1 0 0; 0 0 0 0 1 1]
b=[400000,600000]'
beq=[300000,400000,250000]'
lb=[0 0 0 0 0 0]
[x,fval,exitflag,output]=linprog(f,A,b,Aeq,beq,lb,[])
```

Command Window

```
Optimal solution found.


x =

           0
      300000
      150000
      250000
      250000
           0


fval =

     9200000
```

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Objective 2 :-

In the following problem we have to create a model which allows the marketing manager to analyze its audience coverage and its advertisement from the accessible media, given the advertising budget as the constraints.

Problem Statement:-

The duty of manager is to suggest allotment of budget between different platforms like TELEVISION , NEWSPAPERS ,HOARDINGS, GOOGLE ADS and Facebook. These allotments are done supposing that our office has done investigation in setting up web analytics service and is calculating conversions through path length reports while performing Multi Channel Funnel Analysis. It has been learnt that a Rs.1 spent on each channel has customer reach as:
Channel(#customers reached)
TV(3),Newspapers(0.4),Hoardings(1.9),Google Ads(1.1),Facebook(2).

Ways of Advertisement	**ROI(in Percent)**
TV	9
Newspapers	11
Hoardings	13
Google Ads	15
Facebook	17

FORMULATION :-

For the formulation of the above problem, we need to define some notations that are given below:-

Notation	Definitions
X1	Budget for TV
X2	Budget for Newspapers
X3	Budget for Hoardings
X4	Budget for Google Ads
X5	Budget for facebook market

Objective Function:-

Maximize customer outreach

$$Z = (0.09x_1 + 0.11x_2 + 0.13x_3 + 0.15x_4 + 0.17x_5)$$

Subject to Constraints:

1)Total budget should not exceed Rs.10 Million

x1 + x2 + x3 + x4 + x5 <= 10000k

2)TV advertising costs at least Rs.1000k

x1 >= 1000k

3)Budget of printing of newspapers is not greater than 50000k

x2 <= 500k changed to x2<50000k

4)Minimum cost of printing of newspaper is at least Rs.400k

x2 >= 400k

5)Budget for Hoardings and google Ads is at least 60% of budget

x3 + x4 >= 0.6(x1 + X2 + x3 + x4 +x5)

0.6x1 + 0.6x2 - 0.4x3 - 0.4x4 + 0.6x5 <= 0

6)Budget for google ads is not to be more than 3.5 times of budget of hoardings

x4 > 3.5x3

7)Budget for google ads more than 400k

-x4 < 400k

8)Budget for google ads not more than 800k

$x4 < 8000k$

9)Facebook advertising costs at least Rs.200k

$x5 > 200k$

10)Budget for Hoardings should be greater than 15000

$x3>15000,$

11)Reaching more than 3 million customers

$3x1 + 0.4x2 + 1.9x3 + 1.1x4 + 2x5 > 3000k$

$x1,x2,x3,x4,x5 >= 0$

Method Used-Dual simplex method

Reason:

As the given problem is linear so we can use either simplex or dual simplex method .Dual simplex method is better because the possibility of infeasible solution gets removed by its use.

As minimization is default in linear programming .So maximization is done by taking -z . So we will find -z.

Matlab and Results:-

Editor - C:\Users\risha\Documents\MATLAB\project_part2_advertising.m

project_part2_advertising.m

```
1 -    f=[-0.09,-0.11,-0.13,-0.15,-1.17];
2 -    A=[1 1 1 1 1 ;0.6 0.6 -0.4 -0.4 0.6;0 0 3.5 -1 0; -3 -0.4 -1.9 -1.1 -2];
3 -    b=[100000000 0 0 0]';
4 -    lb=[1000000 400000 15000 400000 200000];
5 -    ub=[100000000 50000000 100000000 8000000 100000000];
6 -    [x,fval,exitflag]=linprog(f,A,b,[],[],lb,ub)
```

Command Window

```
Optimal solution found.


x =

   1.0e+06 *

    1.0000
    0.4000
    2.2857
    8.0000
    5.4571


fval =

   -8.0160e+06
```

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References:

- Lecture notes and Guidance byDr.Jayaprakash Kar
- Book referred Engineering Optimization, Theory and Practice 4th Edition by Singiresu S. Rao, JOHN WILEY & SONS, INC

Contribution:

Problem Definition:

Manit Mehta , Vipul Agarwal and Rishi Raj

Formulation:

Khushi Sancheti

Coding:

Rishabh Sahu

Formatting:

Anirudh Singh