

Application of Linear Programming techniques in Personnel Management

Lalit Mohan

Department of Mathematics, Central University of Haryana, Mohindergarh

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ABSTRACT

No individual or organization can succeed without making appropriate decision. Thus the process of decision making in today's social and business environment has become a tedious task. Its proposed to apply LPP techniques within area of personnel management to optimize the cost of some training programme adopted by an establishment which feature really a very good number of employees that include teaching and non- teaching staff. The institute desires to send its employees for a training programme essential for all-round development at minimum cost.

1. Introduction

Linear programming is an important part of mathematical modelling technique useful for allocation of limited resources like labour, materials, machines, time, cost etc. to several compelling activities. It is known that OR came into existence as a discipline during the 2nd world War to manage scarce resources. Although a specific model and technique of OR are often traced back as early as in World War I when Edison (1914-1915) made an attempt to attenuate shipping losses from enemy submarines. About an equivalent time A.K.Erlang, a Danish engineer administrated experiments to review the fluctuations in demand for telephone facilities using automatic dialing equipment. The term OR was coined as a results of research on military operations during World War II. Then a gaggle of specialists in Mathematics, Economics, Statistics, Engineering and other physical sciences were formed as special units within the armed forces to deal with strategic and tactical problems of various military problems. Following the success of this group OR became more useful. After World War II ended, efforts were made to use OR approach to civilian problems associated with business, industry, research and Development etc. Many operation researchers continued their research after World War; consequently many important advancements were made in OR techniques. In 1947, G.B. Dantzig developed the concept of LPP and its solution.

2. Mathematical Formulation

The problem of linear programming may be stated as that of the optimization of linear objective function of the following type:

$$Z = d_1y_1 + d_2y_2 \dots \dots \dots + d_my_m.$$

Subject to constraints are

$$\begin{matrix} b_{11}y_1 + b_{12}y_2 \dots \dots \dots + b_{1m}y_m (\leq, =, \geq) a_1. \\ b_{21}y_1 + b_{22}y_2 \dots \dots \dots + b_{2m}y_m (\leq, =, \geq) a_2. \\ \cdot \quad \cdot \quad \cdot \\ \cdot \quad \cdot \quad \cdot \\ b_{n1}y_1 + b_{n2}y_2 \dots \dots \dots + b_{nm}y_m (\leq, =, \geq) a_n. \end{matrix}$$

where $y_1, y_2, \dots, y_m \geq 0$.

These are called the non-negative constraints.

The following variables are defined as:

A). *Decision variables*: These are junior and senior staff from the institution. It is represented by Y_1 and Y_2 respectively. These variables are used in the two models formulated under the academic and non academic staff of the institution.

$$Y_1 = \text{Junior Staff}, Y_2 = \text{Senior Staff}$$

B). *Objective Function*: In any business set up the main aim is to minimize cost and in this case; it is a minimization problem because the cost of training of staff to the establishment has to be minimized. Therefore, the objective function is given by:

$$\text{Minimize: } Z = D_1Y_1 + D_2Y_2$$

where D_1 and D_2 are average costs associated to training of junior and senior staff for academic and non- academic staff in the institution; for this study, the cost units are unity in both cases.

C). *Constraints*: The constraint for this study is the time available for training as the programme is in- service training.

Department	No of Junior Staff	No of Senior Staff
Non Academic Unit		
Rectory	5	20
Bursary	8	5
Library	6	3
Registry	5	15
Services	3	30
Academic Unit School of Mgt. Studies .		
Business Adm. Dept.	-	5
Accountancy Dept.	1	6
Marketing Dept.	1	10
Banking and Finance Dept.	2	3
School of Applied Science		
Food Tech. Dept.	4	10
Science Lab Tech.	3	9
Dept. Hotel and Catering Dept.	2	8
Secretarial Dept.	1	3
Computer Science Dept.	3	-
Mathematics and Statis. Dept.	-	2
School Offices	1	5
School of Engineering		
Mechanical Eng. Dept.	5	3

Electrical Eng. Dept.	2	3
Computer Eng. Dept.	1	3
Civil Eng. Dept.	1	12
School of Environmental Studies		
Building Tech. Dept.	2	1
Estate Mgt. Dept.	1	3
Quantity Surveying Dept.	1	10
Architectural Tech. Dept.	3	10

The proposed study will demonstrate usefulness of OR in social and economic problems.

3. Data Presentation

The data used for this study has been assumed.
List of staff in various units of departments of the institution

- 1.) Non-Academic Research Model
 $Min. Z = y_1 + y_2$
 S.t.
 $5 y_1 + 20 y_2 \geq 120$
 $8 y_1 + 5 y_2 \geq 120$
 $6 y_1 + 3 y_2 \geq 120$
 $5 y_1 + 15 y_2 \geq 120$
 $3 y_1 + 30 y_2 \geq 120$
 $y_1, y_2 \geq 0$

Rectory Dept.

Bursary Dept.

Library Dept.

Registry Dept.

Service Dept.
- 2.) Academic
 $Min. Z = y_1 + y_2$
 S.t.
 $5 y_1 \geq 5$
 $y_1 + 6 y_2 \geq 5$
 $y_1 + 10 y_2 \geq 5$
 $2 y_1 + 3 y_2 \geq 5$
 $y_1, y_2 \geq 0$

Business Adm. Dept.

Accountancy Dept.

Marketing Dept.

Banking and Finance Dept.
- 3.) School of Applied Science
 $Min. Z = y_1 + y_2$
 S.t.
 $4 y_1 + 10 y_2 \geq 5$
 $3 y_1 + 9 y_2 \geq 5$
 $2 y_1 + 8 y_2 \geq 5$
 $y_1 + 3 y_2 \geq 5$
 $3 y_1 \geq 5$
 $2 y_2 \geq 5$
 $y_1 + 5 y_2 \geq 5$
 $y_1, y_2 \geq 0$
- 4.) School of Engineering
 $Min. Z = y_1 + y_2$
 S.t.

$$5 y_1 + 3 y_2 \geq 5$$

$$2 y_1 + 3 y_2 \geq 5$$

$$y_1 + 3 y_2 \geq 5$$

$$y_1 + 12 y_2 \geq 5$$

$$y_1, y_2 \geq 0$$

5.) School of Environmental Studies

$$Min. Z = y_1 + y_2$$

S.t.

$$2 y_1 + y_2 \geq 5$$

$$y_1 + 3 y_2 \geq 5$$

$$y_1 + 10 y_2 \geq 5$$

$$3 y_1 + 10 y_2 \geq 5$$

$$y_1, y_2 \geq 0$$

4. Results

Non Academic Optimum Solution $Z = 21.05$, $y_1 = 18.94$, $y_2 = 2.10$ Integer optimum $z = 21$, $y_1 = 19$, $y_2 = 2$ From the solution to the problem for non-academic staff using integer optimum solution, The minimized objective function is given as $z = 21$, y_1 (Junior staff) is 19 and y_2 (Senior staff) is 2 which means that 19 junior staff and 2 senior staff from the non-academic staff should be sent for training programme which can cost 19 multiply by the cost of coaching Junior staff plus 2 multiply by the cost of coaching senior staff. Academics School of Management Solution : Optimum $z = 2$, $y_1 = 1$, $y_2 = 1$ From the solution of the model for academic staff (School of Management) we discover that one Junior staff and one senior staff should be sent for training programme which can cost 1 multiply by the cost of training Junior staff plus 1 multiply by the cost of training senior staff. School of Applied Science Solution optimum $Z = 4.16$, $y_1 = 1.66$, $y_2 = 2.5$ Integer optimum $Z = 4$, $y_1 = 2$, $y_2 = 3$ From the solution of the model we discover that 2 junior staff and 3 senior staff should be sent for the training programme which will cost 2 multiply by the cost of training junior staff and 3 multiply by the cost of training senior staff.

5. Conclusion

The objective of this study is to use the LPP techniques within the effective use of resources for staff training within the institution. The study uses the Junior and Senior staff as decision variables. The results show that the no. of Junior and Senior staff from each unit (non-academic and academic) that ought to be sent for training programme are often reduced.

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