

DETERMINING THE NUMBER OF REQUIRED PERSONS FOR A COMPANY BY LINEAR PROGRAMMING AND LINEAR OPTIMIZATION METHODS

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Abstract:

This article is a field research in order to solve the problems of the persons in charge of a private goods transport company and determine the number of required workforces and human resources in that company. In this research, we attempted to solve the problem of workers, and the number of working days and their required off-days in that company by linear programming and optimization problems methods. After the research, the method and mathematical equations are included in the article.

Keyword: Optimization Methods, Linear Programming, Required Persons

Introduction:

In mathematics, linear programming problems include the linear objective function optimization in which a sequence of limitations in the forms of linear equations and inequalities must be imposed. Very formally, linear programming means using a linear mathematical model for obtaining the best outputs, for instance, the maximum benefit, the minimum work according to the terms and conditions, only 10 hours working in a week, not committing illegal works and so on are used(3). For a more accurate explanation, we must mention that in a polygon (like a polyhedral) on which a function with a true value is defined, the aim is to find a point on this polygon with maximum or minimum value of the objective function(8). These points may not exist, but if they exist, searching among vertices of the polygon and finding at least one of them is guaranteed. Linear programming system is a short and easy way to reach the optimized answer and the basic example of Danzig is finding the best allocation of 70 persons to 70 jobs, and still shows his success. For computation, showing all the permutations for choosing the best allocations is very wide and impossible. He observed that by using the simplex algorithm, finding the best answer takes just a few moments and he also understood that the answer is in the corner of the polygon which is formed by constraints of the problem(6). Using the linear programming in many public and private companies and institutions led to the successful implementation of programs and using it caused to save several million \$ of the companies' financial resources. Since people usually have more than one qualitative characteristic, simultaneous improvement of qualitative characteristics is of special significance. The typical problem in simultaneous multi-answered optimization is that optimization of one characteristic influences other qualitative characteristics(9). In other words, conditions optimized for a characteristic, are not necessarily optimized for other characteristics. For this reason, designing a method which can provide an acceptable answer by considering different aspects is of special significance. We tried to solve the problem of one of the private companies through the linear programming model, which is explained in the rest of the article. A private goods transport company had a problem in recruitment of the required persons and we attempted to solve the problem with the linear programming(7).

The persons in charge of the private goods transport company with the brand "118" advertised that they need some workers to be employed in the company in order to solve the human resource problem in shipment of the goods. Since there are different people with different qualities and the company's persons in charge needed specified number of workers per working day, it is worth mentioning that the

number of required persons in each day of week is predetermined and fixed, and is not changeable due to the type of the work(1).

Table1.The number of required persons in each day of week

Days of Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
The Number of Required Persons	16	11	17	13	15	19	19

The company's persons in charge wanted to work as per the provisions of the Labor Law, in a way that according to this law, each worker must work 5 days and have 2 off-days and take a rest(10). The main problem was that the company's persons in charge did not know that according to the special conditions of the company and the Labor Law of the country, how many workers they employ in order to meet the needs of human resources and also observe the laws related to workers' rights. After the field survey and researches, we reached the conclusion that the main problem of the company is the number of required persons and the type of minimization. So, we attempted to solve the values and data through linear programming and optimization problems(4).

The Answer and Solution of the problem:

The number of required persons per week:

Sunday 16
Monday 11
Tuesday 17
Wednesday 13
Thursday 15
Friday 19
Saturday 19

$$\text{Min } Z = x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7$$

S.t

$$x_1 + x_4 + x_5 + x_6 + x_7 \geq 19$$

$$x_1 + x_2 + x_5 + x_6 + x_7 \geq 16$$

$$x_1 + x_2 + x_3 + x_6 + x_7 \geq 11$$

$$x_1 + x_2 + x_3 + x_4 + x_7 \geq 17$$

$$x_1 + x_2 + x_3 + x_4 + x_7 \geq 13$$

$$x_2 + x_3 + x_4 + x_5 + x_6 \geq 15$$

$$x_3 + x_4 + x_5 + x_6 + x_7 \geq 19$$

Table2- The number of required persons per week

Friday	Thursday	Wednesday	Tuesday	Monday	Sunday	Saturday
		X1	X1	X1	X1	X1
	X2	X2	X2	X2	X2	
X3	X3	X3	X3	X3		
X4	X4	X4	X4			X4

X5	X5	X5			X5	X5
X6	X6			X6	X6	X6
X7			X7	X7	X7	X7

$x_i \geq 0$, $i = 1, 2, 3, 4, 5, 6, 7$

Conclusion:

If we want to explain the table and the way of drawing it, it is as follows:

We supposed Xs as the number of required persons per week.

We will explain the table as follows:

Since it was mentioned in the table that each person will work 5 days and rest 2 days, we have done the modeling in a way that 2 off-days follow each other; so, the intersection of rows and columns of the same number (table's diameter) is the number of workers who start to work that day, and from that place we will write the names of these persons and use them(5).

For example in the first row, we write the number of persons who start to work in the first day of week (2X) i.e. Sunday, and Monday, Tuesday, Wednesday and Thursday are their working days. Friday and Saturday are 2 working days of workers who worked on Sundays, which follow each other(2).

Resources:

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