FINDING THE REVENUE AVERAGE BY USING LINEAR PROGRAMMING PROBLEMS (CASE STUDY OF TAQ TAQ BLOCK FACTORY)

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1 author:

Maher A. Nawkhass
Salahaddin University - Erbil
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FINDING THE REVENUE AVERAGE BY USING LINEAR PROGRAMMING PROBLEMS (CASE STUDY OF TAQ TAQ BLOCK FACTORY)

Maher A. Nawkhass
Department of Business Administration, College of Administrative and Financial Science, Cihan University, Hawler, Iraq.
E-mail: maher.a@cihanuniversity.edu.iq.

ABSTRACT. The research aims to find average revenue diagnostics of Taq Taq Block Factory by using Linear Programming Problems (LPP), the research depends on formulating technique to change the problem to mathematical formula then solve to the formula by simplex method and by find the average of two objective functions by new formula. This is achieved to find optimal profit of the company through out two different times, before and after Economic Crisis (Appendix I). Then a comparison of the two different times and its average revenue will show in table (III). The conclusion will be focus on the differential profit and average revenue, before and after crisis.

Keywords: MOLPP; SOLPP; Simplex Method; Optimization.

1 INTRODUCTION

Linear Programming Problems (LPP) is the topic of great importance in Operation Research. They are useful in many fields such as production planning, financial and corporative planning, health care and hospital planning.

Company Managers is often faced with decisions making to the use of limited resources. These resources may include men, materials and money, the problem is based on how to decide on which resources would be allocated to obtain the best result, which may relate to profit or cost or both. The Profit of Maximization in a Product Mix Company was found by Using Linear Programming [4]. And linear programming for optimal production is used to a production line in coca–cola Bottling Company [1].

Formulating technique is used to formulate problem where the problem represented in the case study Taq Taq Block Factory to found the average revenue after and before the Economic Crisis, the simplex technique is one of famous technique in LP which is obtain decision variable to maximums the profit.

The result depend on the value of objective function Irrespective of the number decisions variables with less computational burden, then we take the average of two objective functions by new formula to get the aim which will be shown in theoretical section.

2 GENERAL MATHEMATICAL FORMULATION FOR A LINEAR PROGRAMMING PROBLEM

In general, linear programming problem can be expressed as follows:-

$$Max\ (Min).Z = \sum_{j=1}^{n} C_j X_j \quad (1)$$

Subject to:

$$\sum a_{ij} X_j \ \ (\leq, =, \geq) b_i \text{ where } j = 1,2,\dots,n\ ,\ i = 1,2,\dots,m\ . \quad (2)$$

And $X_j \geq 0,\ j = 1,2,\dots,n.$

For more information see [1988]

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3 CONVERT TWO OBJECTIVE LINEAR FUNCTION TO SINGLE OBJECTIVE FUNCTION BY A AVERAGE TECHNIQUE

Here propose an idea for using Average technique to change the two objectives function subject to equ. (2) to single objectives function that based on the idea that after solve two objective functions subject to equ. (2) before and after Economic Crisis

$$Max.Z = \frac{Max.Z_1 + Max.Z_2}{Av} \quad (3)$$

Subject to equ.(2)
where Av $= 2$

4 THE ALGORITHM OF SIMPLEX TECHNIQUE TO SOLVE LPP. [1988]

To obtaining the optimal solution of the problem use the formula (3), an algorithm is defined which can be written as:

Step1: Give arbitrary value to each objective functions which are to be maximized.

Step2: Solve the all objective functions by use simplex method.

Step3: Convert the maximum objectives to single objective function by using formula (3)

Step4: Optimize the combined objective function which is subject to (2)

5 PRACTICAL ASPECT

In this section, we will present the detail of the problem that is taken from list of information (questionnaire) of case study (Taq Taq Block Factory) and how the problem solved by using LP to find the average revenue and optimal profit of the company before and after the economic crises.

First we want to mention; the questionnaire (Appendix I) taken before and after economic crises so will solve the problem twice before and after crises and find average revenue of company.

5.1 Problem:

A Taq Taq Block factory produces three different size of Blocks A, B and C and Each unit of product A requires 3 hours on Machine I and 2 hours on Machine II and 1 hours on Machine III, while each unit of product B requires 4 hours on Machine I and 1hours on Machine II and 3 hours on Machine III, finally each unit of product C requires 2 hours on Machine I and 2 hours on Machine II and 2 hours on Machine III. The time available for Machine I is 60 hours, while machine II is available for 40 hours. While the time available for Machine III is 80 hours. Formulate the linear programming model of the problem.

Remake Block type A has size 10*40, type B has size 15*40, finally type C has size 20*40.

Formulation: Let x_1 , x_2 , x_3 be the amounts of product of A, B and C respectively.

5.2 The Profit Price Is Give before Economic Crises

The profit earned per unit for products of A, B and C is \$0.5, \$0.66 and \$0.833
The given information is systematically arranged in the form of the following table.

Table 1. Show the formulate the linear programming model of the problem.

Machine	Time on products per hour			Available time for one weeks (Hour)
	A	B	C	
I	3	4	2	60
II	2	1	2	40
III	1	3	2	80
Profit per unit	\$0.5	\$0.66	\$0.833	

Then the LPP is

$$Max.\ Z = 0.5x_1 + 0.66x_2 + 0.833x_3$$

Subject to constrains:

$$3x_1 + 4x_2 + 2x_3 \leq 60$$
$$2x_1 + 1x_2 + 2x_3 \leq 40$$
$$1x_1 + 3x_2 + 2x_3 \leq 80$$
$$x_1, x_2, x_3 \geq 0.$$

After we solve the problem by using simplex method [2], we get the following results:

$Max.\ Z$ =\$18.0345 , at $x_1 = 0$, $x_2 = 6.5$ and $x_2 = 16.5$

5.3 The Profit Price is Give after Economic Crises

The profit earned per unit for products of A, B and C is \$0.25, \$0.33, \$0.415 and \$0.416. The given information is systematically arranged in the form of the following table.

Table 2. Show the formulate the linear programming model of the problem.

Machine	Time on products per hour			Available time (Hour)
	A	B	C	
I	3	4	2	60
II	2	1	2	40
III	1	3	2	80
Profit per unit	\$0.25	\$0.33	\$0.415	

Then the LPP is

$$Max.\ Z = 0.25x_1 + 0.33x_2 + 0.415x_3$$

Subject to constrains:

$$3x_1 + 4x_2 + 2x_3 \leq 60$$
$$2x_1 + 1x_2 + 2x_3 \leq 40$$
$$1x_1 + 3x_2 + 2x_3 \leq 80$$

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$x_1, x_2, x_3 \geq 0.$

After we solve the problem by using simplex method [2], we get the following results:

$Max.Z = \$8.9925$,at $x_1 = 0$, $x_2 = 6.5$ and $x_3 = 16.5$

Now convert two objective linear functions to single objective function by using formula (3)

$$Max.Z_1 = 0.5x_1 + 0.66x_2 + 0.833x_3$$
$$Max.Z_2 = 0.25x_1 + 0.33x_2 + 0.415x_3$$

Subject to

$$3x_1 + 4x_2 + 2x_3 \leq 60$$
$$2x_1 + 1x_2 + 2x_3 \leq 40$$
$$x_1 + 3x_2 + 2x_3 \leq 80$$
$$x_1, x_2, x_3 \geq 0.$$

Now will obtain the value of $Max.Z$ as follows

$$Max.Z = \frac{Max.Z_1 + Max.Z_2}{Av}$$

where $Av = 2$

Subject to

$$3x_1 + 4x_2 + 2x_3 \leq 60$$
$$2x_1 + 1x_2 + 2x_3 \leq 40$$
$$x_1 + 3x_2 + 2x_3 \leq 80$$
$$x_1, x_2, x_3 \geq 0.$$

Then we will get the follows

$$Max.Z = \frac{Max.Z_1 + Max.Z_2}{Av}$$

Where $Av = 2$

Now by using formula 3 we get

$$Max.Z = \frac{0.5x_1 + 0.66x_2 + 0.833x_3 + 0.25x_1 + 0.33x_2 + 0.415x_3}{2}$$

Subject to

$$3x_1 + 4x_2 + 2x_3 \leq 60$$
$$2x_1 + 1x_2 + 2x_3 \leq 40$$
$$x_1 + 3x_2 + 2x_3 \leq 80$$
$$x_1, x_2, x_3 \geq 0.$$

Then

$$Max.Z = \frac{0.5x_1 + 0.66x_2 + 0.833x_3 + 0.25x_1 + 0.33x_2 + 0.415x_3}{2}$$

$$Max.Z = 0.374x_1 + 0.495x_2 + 0.624x_3$$

Subject to

$$3x_1 + 4x_2 + 2x_3 \leq 60$$
$$2x_1 + 1x_2 + 2x_3 \leq 40$$
$$x_1 + 3x_2 + 2x_3 \leq 80$$
$$x_1, x_2, x_3 \geq 0.$$

After we solve the problem by using simplex method [2], we get the following results:

$Max.Z = \$13.51$,at $x_1 = 0$, $x_2 = 6.5$ and $x_3 = 16.5$

6 RESULTS AND DISCUSSION

Depending on table shown 3.3, where simplex method and average technique is applied to solve LPP of the case study problem. The comparisons of these methods are based on the value of the objective function.

Table 3. Comparison between simplex, Average technique:

Methods	Before crises		After crises			
	$Max.z$	(x_1, x_2, x_3)	$Max.z$	(x_1, x_2, x_3)	Average technique	
					$Max.z$	(x_1, x_2, x_3)
Simplex	18.0345	(0,6.5,16.5)	8.9925	(0,6.5,16.5)	13.51	(0,6.5,16.5)

7 CONCLUSION

The main objective of this research is to find the average revenue diagnostics of Taq Taq Block Factory through two different times, before and after Economic Crisis. And find the profit of the company by using LPP technique of the two periods. And we found the result after solve it by using formulation and simplex methods and we get the decision variable and optimal solution which is shown in table III and the average revenue is $13.51 after we solved the problem by using technical method

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Questionnaire

Finding the Average of Revenue by Using Linear Programming Problems

This questionnaire is designed to know what is the price before and after economic crisis of the block product in Taq Taq Company in Kurdistan Region Government

Section One:

Before economic crisis that faced Kurdistan Region Government in 2013

Let x_1 be the amount of block in size 10× 40

Let x_2 be the amount of block in size 15× 40

Let x_3 be the amount of block in size 20× 40

Machine	Time on products per hour			Available time for one weeks (Hour)
	A	B	C	
I	3	4	2	60

II	2	1	2	40
III	1	3	2	80
Profit per unit	\$0.5	\$0.66	\$0.833	

Section Two:

After economic crisis that faced Kurdistan Region Government in 2015

Let x_1 be the amount of block in size 10×40

Let x_2 be the amount of block in size 15×40

Let x_3 be the amount of block in size 20×40

Machine	Time on products per hour			Available time (Hour)
	A	B	C	
I	3	4	2	60
II	2	1	2	40
III	1	3	2	80
Profit per unit	\$0.25	\$0.33	\$0.415	