MS-Excel–Driven Simplex Method for Solving Linear Programming Problems in Real-World Applications

SURESH KUMAR SAHANI[1], GARIMA SHARMA[2], CHANCHAL KUMARI[3]
[1]Faculty of Science, Technology, and Engineering,
Rajarshi Janak University, Janakpurdham,
NEPAL

[2]Department of Mathematics, School of Liberal Arts and Sciences
Mody University of Science and Technology
Lakshmangarh-332311, Sikar, Rajasthan
INDIA

[3]Department of Mathematics, School of Liberal Arts and Sciences
Mody University of Science and Technology
Lakshmangarh-332311, Sikar, Rajasthan
INDIA

Abstract: - Optimal Resource allocation plays significant aspect in many of the daily life activity in both industries and services and hence the intent of this work is to analyze the application of linear programming as a rational basis for decision making process for optimal allocation of resource. This research take us through three case studies of manufacturing, raw-material blending, and loan-portfolio management (Bhawani Manufacturer, Raman Traders, and New Bharat Bank), providing key studies on how the mathematical modelling aids to structured and financially efficient decisions. This article is devoted from a linear programming perspective only and is limited to how linear programming can be leveraged to minimize operational inefficiencies, reduce costs, and maximize profits. It illustrates the direct and unambiguous application of optimization concepts to practical problems by melding the Simplex Method with operational software such as Microsoft Excel Solver.

Key-Words: - LPP, Mathematical Modelling, Simplex Method, Microsoft Excel Solver

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1 Introduction

The role of LP has become even more important due to the increasing complexity of contemporary organizational systems. It removes uncertainty and helps managers make transparent, data-driven decisions. This chapter explains the fundamental ideas of LP, acquaints the reader with its mathematical structure, and demonstrates its significance as a tool for logical decision-making. In this research clearly shown how to maximize a linear function for the aim while taking linear inequality restrictions into account by providing a theoretical framework and a practical-solution technique. Dantzig's work enabled the evolution and widespread application of linear programming techniques in disciplines such as industrial engineering, operations research, economics, and transportation [6]. The goal (aims) of this study to apply (use) linear programming-LP techniques to optimize (improve) the asset allocation of commercial banks-Singapore, balancing the trade-off between return, risk, and liquidity. It is significant because it demonstrates how banks may utilize mathematical models to make well-informed judgments about how to distribute funds while meeting legal and regulatory constraints and optimizing portfolio returns. This study is actually a case study since it examines the consolidated balance sheets of Singapore's: commercial-banks [15]. In 1993, Farkas et al. (1993) done the research on distribution-network of an aluminum factory in order to reduce expenses and increase operational effectiveness. It is notable because it shows how mathematical optimization approaches may be implemented successfully in industrial settings and offers a useful foundation for comparable production scenarios. Through a case study, the essay provides insights into the issues and solutions related to large-scale industrial operations [7]. In 1996, Gutierrez explored the case study is to create and apply a linear programming model (LP-model) to improve the effectiveness of production scheduling and distribution logistics in a manufacturing company. Because it applies the established model to a specific manufacturing company, providing practical applicability and insightful information [9]. Its main objective is to improve production efficiency through cost reduction and the effective utilization of labor, raw materials, and equipment while honoring capacity and demand constraints. The study shows how LP-linear programming models may improve decision-making in the marble industry by guaranteeing maximum production at the lowest-cost and offering a practical approach for resource management in this sector [14]. In 2012, Balogun et al. studied the objective of this study in order to maximize profit by identifying the most profitable items to produce within the limitations of available raw materials and production capacity, the study proposes (intends) to employ linear programming techniques to optimize production decisions at the Nigeria Bottling Company's Ilorin facility. It is significant because it demonstrates how linear programming can be used practically to address real-world production issues, providing a quantitative approach to decision-making that could increase operational efficiency and profitability. The essay offers insights into the difficulties of production optimization in large-scale bottling plants as a case study [4]. In 2015, Maurya et al. Using production and sales data from a chemical factory in Adama, Ethiopia, an LP model was created using MS Excel Solver. The results showed that using quantitative methods rather than subjective evaluation significantly boosted profitability; specifically, it was possible to identify the optimal daily production mix that would yield a profit of Birr 107,353.17. The study demonstrates how LP may be applied practically to enhance decision-making and operational effectiveness in industrial settings [12]. In 2016, Akpan & Iwok studied "Application of linear programming for optimal use of raw materials in a bakery". The study aims to maximize profit in a bakery setting by efficiently allocating raw resources among competing variables—big bread, gigantic loaf, and little loaf by using the Simplex method, a linear programming technique. It is important because it demonstrates how linear programming, a quantitative-approach to decision-making that increases operational-performance and profitability, may optimize resource allocation in the baking industry. This case study demonstrates how linear programming is applied in a real-world bakery [1]. In 2018, research paper he used linear programming approaches to identify the best way to distribute loans across different categories in order to maximize returns and reduce risks. Its importance stems from the mathematical framework it gives banks to improve portfolio management, guaranteeing effective fund distribution while abiding by risk restrictions. This research article, which offers theoretical insights and practicals [8]. In 2019, Jyothi et al. studied "Application of a linear programming model for production planning in an engineering industry—a case study". This study goal (aims) to seek to improve scheduling production within a cellular manufacturing system that produces car electrical parts. The study adopts a lexicographic technique to maximize production output, minimize production costs, and improve capacity utilization. This article's significance lies in its practical-application of optimization-techniques to real-world manufacturing challenges, which offers a validated model that could aid industry in efficient production planning. This book examines a particular car electrical part manufacturing industry in South India, making it a case study [11]. In 2019, Jain et al. combined studied on "Application of linear programming for profit maximization of the bank and the investor". This paper aims to maximize net returns for the Central Bank of India and its investors. Considering limitations such as interest rates and investment limitations, it creates models to establish the best way to distribute money across different loan products and investment programs. Its practical application of linear programming to actual banking and investing settings, which delivers meaningful knowledge regarding financial decision-making, is what makes this work significant [10]. In 2019, Briones & Escola advanced in order to optimize heat exchanger networks (HENs) and minimize energy consumption by efficiently matching hot and cold process streams, the research intends to show how to use Microsoft Excel's Solver add-in to solve linear programming problems. The technique is appropriate for both instructional and real-world industrial applications because it demonstrates the actual application of a broadly accessible and accessible tool for resolving complicated optimization issues in chemical engineering. The paper shows how Excel Solver may be used in academic settings to solve HEN optimization issues [5]. In 2019, order to maximize profitability at Johnsons Nigeria Ltd., this case study uses linear programming (LP) to optimize labor use, production capacity, and resource allocation. The main objective of the study is to determine the most cost-effective production mix under various constraints, such as resource availability and market demand. This study describes how LP can help businesses choose the optimal course of action to maximize revenues through improved decision-making and operational efficiency. The study's findings show that using LP models significantly boosts profitability while reducing unnecessary manufacturing costs [13]. In 2022 research aims (goals) to develop and implement a linear programming-LP model to optimize the distribution of funds among various loan products, taking account constraints such product allocations and bad debt probability, in order to maximize profit at a bank in Ghana's Upper West Region. What makes it noteworthy is its practical application of linear programming to real-world banking issues; it provides a quantitative approach to decision-making that could increase operational efficiency and profitability. This case study paper offers insights into the complexities of loan portfolio optimization in the banking sector [2].

2 Problem Formulation

2.1 Problem: 1

Case Study: Bhawani Manufacturer

Product1, Product2, and Product3 are the three new items that the company's management is considering using this excess capacity to produce. The total machine hours accessible on a weekly basis for each type of equipment that could potentially restrict production are outlined below:

Type of machines	Surplus available capacity (Machine Hours each Week)
Milling machine	250
Lathe	150
Grinder	50

As illustrated in the table below:

Types of machines	Capacity Requirement (Machine Hours each Week)		
	Product 1	Product 2	Product 3
Milling machine (x_1)	8	2	3
Lathe (x_2)	4	3	0
Grinder (x_3)	2	0	1

The profit for each unit is Rs. 20 for Product 1, Rs. 6 for Product 2, and Rs. 8 for Product 3. The company capacity among the three products to achieve the highest possible total revenue.

Formulation of problem1:

Let's define the decision variables:

x_1= Total units of product 1 to be produced

x_2= Total units of Product 2 to be produced

x_3= Total units of Product 3 to be produced

Objective Function:

Maximize (total revenue) $Z = 20x_1 + 6x_2 + 8x_3$

Constraints:

Milling machine constraint: $8x_1 + 2x_2 + 3x_3 \le 250$

Lathe constraint: $4x_1 + 3x_2 + 0x_3 \le 150$

Grinder constraint: $4x_1 + 3x_2 + 0x_3 \le 50$

& **non-negativity constraints** (production quantities cannot be negative): $x_1, x_2, x_3 \ge 0$

2.2 Problem: 2

Case Study: Raman Traders

The goal focuses on reducing the expenses of producing one liter of the final product while adhering to specific quality standards.

The final product must meet the following criteria: A minimum zeta content of 12%, since zeta helps clean the internal moving parts of engines. The details are summarized below:

	Raw Materials		
	A	B	C
Combustion Point (°F)	200	180	280
Gamma Content (%)	4	3	10
Zeta Content (%)	20	10	8

Raw material A costs Rs. 9.00 per liter, whereas raw materials B and C cost Rs. 6.00 and Rs. 7.50 per liter, respectively.

As management trainees, we are expected to recommend an appropriate method for determining the most cost-effective blend of raw materials that satisfies all the product's requirements per liter.

Formulation of Problem 2:

Let's define the decision variables:

x_1= proportion of raw material A

x_2 = proportion of raw material B

x_3 = proportion of raw material C

Objective Function:

The purpose is to lower the overall expenses of raw materials used in the production of one liter of the finished product. The cost of the raw materials is given as Rs. 9.00 per liter for A, Rs. 6.00 per liter for B, and Rs. 7.50 per liter for C. Therefore, the objective function is

Minimize $Z = 9x_1 + 6x_2 + 7.5x_3$

Constraints:

1. Combustion Point Constraint:

The combustion point of the finished product must be at least $222°F$.

$$200x_1 + 180x_2 + 280x_3 \geq 222$$

2. Gamma Content Constraint:

The gamma content of the finished product cannot exceed 6% of the volume.

$$4x_1 + 3x_2 + 10x_3 \leq 6$$

3. Zeta Content Constraint:

The zeta content of the finished product must be at least 12% of the volume.

$$20x_1 + 10x_2 + 8x_3 \geq 12$$

4. Total Mixture Constraint:

The total volume of raw materials used must sum up to 1 liter (since we're producing 1 liter of the finished product).

$$x_1 + x_2 + x_3 = 1$$

5. Non-Negativity Constraint:

The distribution of raw materials must be non-negative. $x_1, x_2, x_3 \geq 0$

2.3 Problem: 3

Case Study: New Bharat Bank

New Bharat Bank is in the process of planning its loan operations for the upcoming year. The bank provides five distinct loan options, each generating a different annual return. The bank aims to maximize the revenue from loans while adhering to the operational limitations mentioned above. Management is looking for strategies to optimize its loan portfolio to achieve the maximal possible returns while staying within these constraints.

This case study analyses the problem of optimization that the New Bharat Bank faces, using linear programming approaches to identify the most effective allocation of loans across various categories while maximizing revenue.

Formulation of Problem 3:

Let's define the decision variables:

x_1= Amount of Education Loan (in crores)

x_2= Amount of Furniture Loan (in crores)

x_3= Amount of Automobile Loan (in crores)

x_4= Amount of Home Construction Loan (in crores)

x_5= Amount of Home Repair Loan (in crores)

Objective Function:

The bank aims to optimize its complete revenue derived from loan interest. The revenue from each loan type is given by the annual return in percentage. The objective function, representing the total revenue, is

Maximize $Z = 0.15x_1 + 0.12x_2 + 0.09x_3 + 0.10x_4 + 0.07x_5$

Constraints:

1. Total loan limit:

The total amount the bank can lend is Rs 75 crore, so

$$x_1 + x_2 + x_3 + x_4 + x_5 \leq 0$$

2. Education loan limit:

Education loans cannot exceed 10% of the whole loans.

$$x_1 \leq 0.10 \times 75 = 7.5$$

3. Combined Education and Furniture Loan Limit:

The sum of education and furniture loans cannot exceed 20% of the whole loans.

$$x_1 + x_2 \leq 0.20 \times 75 = 15$$

4. Home construction loan constraints:

The amount of home construction loans must be at least 40% of the whole home loans (which includes home construction and home repair loans):

$$x_4 \geq 0.40(x_4 + x_5)$$

The amount of the home construction loan must be at least 20% of the whole loan portfolio.

$$x_4 \geq 0.20 \times 75 = 15$$

The amount of home construction loans cannot exceed 25% of the whole loan portfolio.

$$x_4 \leq 0.25 \times 75 = 18.75$$

5. Non-negativity constraint:

Since the amounts of loans cannot be negative,

$$x_4 \leq 0.25 \times 75 = 18.75$$

2.4 Methodology

Simplex Method

An essential technique for discovering the most effective answer to problems with linear programming is the Simplex Method. This mathematical method utilizes tableaus alongside slack, excessive quantities, and preference variables to solve optimization problems. Even complex linear programming scenarios might be managed by it.

The start of slack and excess variables transforms inequities into equalities. A slack variable is implemented when handling a "less than or equal to"

($\leq$) inequality. Whereas when addressing "greater than or equal to" ($\geq$) inequalities, an untrue variable is identified and a surplus variable is dismissed. If the constraint is already an equality, merely the counterfeit variable is put in place.

Artificial variables shouldn't be incorporated into the final response, given that they have no real-world significance.

The initial response was discovered through the creation of an initial simplex table. The equation for determining $\Delta_{\text{j}} = Z_j - C_j$. The similar column has been assigned as the key column, and the variable with the greatest negative value in Δ_{j} is chosen as the incoming variable. The corresponding column has been chosen as the key column, and the variable with the greatest negative value in Δ_{j} has been chosen as the incoming variable. The variable selected as the heading variable is the one that comes with the lowest ratio of the element on the right, b_{j} to the corresponding column elements.

The key element is the junction of the key row and key column, and the corresponding row is the key row. Row operations are employed to modify the remaining elements to zero while changing the key element to unity. The most suitable approach is found whenever all $\varDelta_j$ values are non-negative, and that's the outcome of this functioning.

The steps below are performed with the goal of employing the Simplex Method to get the best solution:

1. First, verify that all values on the right-hand side of the constraints are true (i.e., b_j's) are acceptable. Any items that are negative are increased by -1 in order to render them positive.
2. Then, slack, surplus, and artificial variables are added to the LP problem to convert it into standard form.
3. To represent the initial solution, construct the initial simplex table.
4. Calculate $\varDelta_j = Z_j - C_j$.

- If $\varDelta_j \geq 0$, then we get the optimal solution.
- If $\varDelta_j \leq 0$ then continue to the next iteration until the best possible solution is reached.

Formulation

The standard form of LPP is expressed as

Optimize (Max. or Min.) $Z = C_1x_1 + C_2x_2 + \ \dots \ \dots \ \dots \ + C_nx_n$

Subject to constraints:

$$a_{11}x_1 + a_{12}x_2 + \ \dots \ \dots \ \dots \ + a_{1n}x_n = b_1$$
$$a_{21}x_1 + a_{22}x_2 + \ \dots \ \dots \ \dots \ + a_{2n}x_n = b_2$$
$$\dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots$$
$$\dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots$$
$$\dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots$$
$$a_{m1}x_1 + a_{m2}x_2 + \ \dots \ \dots \ \dots \ + a_{mn}x_n = b_n$$

and $x_1, x_2, \ \dots, \ x_n \ \geq 0$

Microsoft Excel Solver

It is also possible to resolve the linear programming problem using Microsoft Excel, so let us now define the steps to find our optimal solution in LPP.

Step1: Problem formulation

The first step is to formulate the LP issue mathematically. This includes:

- Specifying a function that should be maximized or minimized.
- Determining the decision variables that affect the objective.
- Listing the constraints that the solution must satisfy.

An LP model is structured as

Maximize or Minimize $Z = \text{C}_1\text{x}_1 + \text{C}_2\text{x}_2 + \ \dots \ \dots \ \dots \ + \text{C}_\text{n}\text{x}_\text{n}$

Subject to constraints:

$$\text{a}_{11}\text{x}_1 + \text{a}_{12}\text{x}_2 + \ \dots \ \dots \ \dots \ + \text{a}_{1\text{n}}\text{x}_\text{n} = \text{b}_1$$
$$\text{a}_{21}\text{x}_1 + \text{a}_{22}\text{x}_2 + \ \dots \ \dots \ \dots \ + \text{a}_{2\text{n}}\text{x}_\text{n} = \text{b}_2$$
$$\dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots$$
$$\dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots$$
$$\dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots ...$$
$$\text{a}_{\text{m}1}\text{x}_1 + \text{a}_{\text{m}2}\text{x}_2 + \ \dots \ \dots \ \dots \ + \text{a}_{\text{mn}}\text{x}_\text{n} = \text{b}_\text{n}$$

and $\text{x}_1, \text{x}_2, \ \dots, \ \text{x}_\text{n} \ \geq 0$

Step2: Creating the Problem in Excel

After defining the problem, it is then represented in Excel by

- Entering starting values in designated cells for decision variables.
- Creating a formula that uses the decision variable cells to compute the goal function.
- Excel can calculate the left-hand side (LHS) of each condition depending on the variables by developing formulas for each restriction.

Step3: Enabling the Solver Add-in

To use Solver in Excel, it needs to be enabled:

- Go to File > Options > Add-ins
- In the Add-ins box, click Go.
- Tick the checkbox for Solver Add-in and click OK.

Step4: Configuring Solver

Then, the solver is set up by

- Selecting the cell containing the objective function.
- Indicating whether the goal is to maximize or minimize.
- Indicate which cells include the decision variables.
- Adding each constraint by
  - Identifying the cell that calculates the LHS.
  - Selecting the proper relational operator ($\leq, =, or\ \geq$).
  - Entering the RHS value or cell reference.

Since the Simplex LP approach works well with linear models, it is chosen as the solution technique.

Step5: Running the Solver

The Simplex LP strategy is used as the solution technique because it performs well with linear models.

Step6: Understanding the Results

The optimal values for the objective function and the choice variables are recorded in the last stage.

3 Problem Solution

The simplex method is applied to determine the solution for the linear programming problem.

Problem 1

Objective function:

Maximize (total revenue) $Z = 20x_1 + 6x_2 + 8x_3$

Subject to constraints:

$$8x_1 + 2x_2 + 3x_3 \leq 250$$
$$4x_1 + 3x_2 + 0x_3 \leq 150$$
$$4x_1 + 3x_2 + 0x_3 \leq 50$$

and

non-negative restrictions, i.e. $x_1, x_2, x_3 \geq 0$

The constraints in the problem consist of less than inequality. Adding slack variables to convert the inequalities into equalities and then applying the simplex method to get the optimal solution, i.e.,

$$Max.\ Z = 20x_1 + 6x_2 + 8x_3 + 0s_1 + 0s_2 + 0s_3$$

Subjective constraints

$$8x_1 + 2x_2 + 3x_3 + s_1 + 0s_2 + 0s_3 = 250$$
$$4x_1 + 3x_2 + 0x_3 + 0s_1 + s_2 + 0s_3 = 150$$
$$4x_1 + 3x_2 + 0x_3 + 0s_1 + 0s_2 + s_3 = 50$$

and $x_1, x_2, x_3, s_1, s_2, s_3 \geq 0$

Processing further to obtain the optimal solution:

	C_j	20	6	8	0	0	0		
B.V.	C_B	x_1	x_2	x_3	s_1	s_2	s_3	X_B	X_B/Y_K
s_1	0	8	2	3	1	0	0	250	31.25
s_2	0	4	3	0	0	1	0	150	37.5
s_3	0	2	0	1	0	0	1	50	25
$Z_j - C_j = \Delta_j$		-20	-6	-8	0	0	0		

Table-1

The most negative value of Δ_j is -20, so the incoming vector is x_1 which is highlighted by the yellow color, and the minimum ratio is 5, so the outgoing vector is s_3 which is highlighted by the blue color.

	C_j	20	6	8	0	0	0		
B.V.	C_B	x_1	x_2	x_3	s_1	s_2	s_3	X_B	X_B/Y_K
s_1	0	0	2	-1	1	0	-4	50	25
s_2	0	0	3	-2	0	1	-2	50	16.67
x_1	20	1	0	$1/2$	0	0	$1/2$	25	–
$Z_j - C_j = \Delta_j$		0	-6	2	0	0	10		

Table-2

The most negative value of Δ_j is -6, so the incoming vector is x_2 which is highlighted by the yellow color, and the minimum ratio is 16.67, so the outgoing vector is s_2 which is highlighted by the blue color.

	C_j	20	6	8	0	0	0		
B.V.	C_B	x_1	x_2	x_3	s_1	s_2	s_3	X_B	X_B/Y_K
s_1	0	0	0	$1/3$	1	$-2/3$	$-8/3$	$50/3$	50
x_2	6	0	1	$-2/3$	0	$1/3$	$-2/3$	$50/3$	–
x_1	20	1	0	$1/2$	0	0	$1/2$	25	50
$Z_j - C_j = \Delta_j$		0	0	-2	0	2	6		

Table-3

The most negative value of Δ_j is -2, so the incoming vector is x_3 which is highlighted by the yellow color, and the minimum ratio is 50, so the outgoing vector is s_1 which is highlighted by the blue color.

	C_j	20	6	8	0	0	0		
B.V.	C_B	x_1	x_2	x_3	s_1	s_2	s_3	X_B	X_B/Y_K
x_3	8	0	0	1	3	-2	-8	50	–
x_2	6	0	1	0	2	-1	-6	50	–

x_1	20	1	0	0	$-3/2$	1	$9/2$	0	0
$Z_j - C_j = \Delta_j$		0	0	0	6	-2	-10		

Table-4

The most negative value of Δ_j is -10, so the incoming vector is s_3 which is highlighted by the yellow color, and the minimum ratio is 0, so the outgoing vector is x_1 which is highlighted by the blue color.

	C_j	20	6	8	0	0	0		
B. V.	C_B	x_1	x_2	x_3	s_1	s_2	s_3	X_B	X_B/Y_K
x_3	8	$16/9$	0	1	$19/9$	$-2/9$	0	50	
x_2	6	$4/3$	1	0	$4/3$	$1/3$	0	50	
s_3	0	$2/9$	0	0	$-1/3$	$2/9$	1	0	
$Z_j - C_j = \Delta_j$		$60/9$	0	0	164	60	20		

Table-5

Since in the last table, all $\Delta_j \geq 0$. Therefore, the table gives the optimal solution of the LPP.

We conclude that $x_2 = 50$, $x_3 = 0$, $s_3 = 0$ and the rest of all variables are zero.

Thus, the highest possible total revenue is

Max $Z = 20x_1 + 6x_2 + 8x_3 + 0s_1 + 0s_2 + 0s_3$

$$= 20 * 0 + 6 * 50 + 8 * 50 + 0$$
$$= 700$$

Therefore, the maximum total revenue is Rs. 700 per week.

Problem 2

Objective function:

Minimize $Z = 9x_1 + 6x_2 + 7.5x_3$

Subject to constraints:

$$200x_1 + 180x_2 + 280x_3 \geq 222$$
$$4x_1 + 3x_2 + 10x_3 \leq 6$$
$$20x_1 + 10x_2 + x_3 \geq 12$$
$$x_1 + x_2 + x_3 = 1$$

and non-negative restrictions, i.e., $x_1, x_2, x_3 \geq 0$

Now, Microsoft Excel Solver is utilized for solving the linear programming problem 2 optimally.

	A	B	C	D	E	F	G	H
1		x	y	z	Z			
2	solution	0	50	50	700			
3	obj.	20	6	8				
4					LHS		RHS	
5	constraint1	8	2	3	250	<=	250	
6	constraint2	4	3	0	150	<=	150	
7	constraint3	2	0	1	50	<=	50	
8								
9								

Table-6

After solving, we get the optimal solution of the LPP. We conclude that $x_1 = 0, x_2 = 50$, and $x_3 = 0$.

Minimize $Z = 700$

Therefore, the most cost-effective blend of raw materials is Rs. 700 per liter.

Problem 3

Objective function:

Max $Z = 0.15x_1 + 0.12x_2 + 0.09x_3 + 0.10x_4 + 0.07x_5$

Subject to constraints:

$$x_1 + x_2 + x_3 + x_4 + x_5 \leq 0$$
$$x_1 \leq 0.10 \times 75 = 7.5$$
$$x_1 + x_2 \leq 0.20 \times 75 = 15$$
$$x_4 \geq 0.40(x_4 + x_5)$$
$$x_4 \geq 0.20 \times 75 = 15$$
$$x_4 \leq 0.25 \times 75 = 18.75$$

and non-negative restrictions, i.e.,, $x_1, x_2, x_3, x_4, x_5 \geq 0$

Now, Microsoft Excel Solver is utilized for solving the linear programming problem 3 optimally.

	A	B	C	D	E	F	G	H	I	J	K
1		x_1	x_2	x_3	x_4	x_5	Z				
2	Solution	7.5	7.5	0	60	0	8.025				
3	Obj. Coeff.	0.15	0.12	0.09	0.1	0.07					
4							LHS		RHS		
5	Constraint 1	1	1	1	1	1	75	<=	75		
6	Constraint 2	1	0	0	0	0	7.5	<=	7.5		
7	Constraint 3	1	1	0	0	0	15	<=	15		
8	Constraint 4	0	0	0	0.6	-0.4	36	>=	0		
9	Constraint 5	0	0	0	1	0	60	>=	15		
10											
11											

Table-7

After solving, we get the optimal solution of the LPP. We conclude that $x_1 = 7.5$, $x_2 = 7.5$, $x_3 = 0, x_4 = 0, x_5 = 0$.

Maximize $Z = 8.025$

Therefore, the total revenue of the New Bharat Bank is 8.025 crores.

4 Conclusion

The findings of this study propose a fundamental strategy that should be implemented in order to effectively manage resources like labour, materials, and equipment in the most efficient manner possible, hence minimising waste and cutting costs in order to accomplish important business objectives.

Throughout these case studies, I have made an effort to optimise, which literally means to maximise profits or minimise losses. The methodology that I have used can be used in any situation to assess and optimise (maximise profit and minimise cost).For Raman Traders, the optimal solution is to achieve a blend of raw materials that is the most cost-effective. For New Bharat Bank, the optimal solution is to achieve a objectives simultaneously, including the maximisation of profits, the enhancement of customer satisfaction, and the guarantee of environmental sustainability.

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Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

Please, indicate the role and the contribution of each author:

Garima Sharma: Conceptualization, methodology, supervision, validation, formal analysis, interpretation of results, manuscript review and editing, and overall guidance of the research work.

Chanchal Kumari: Data representation, literature review, mathematical model formulation, implementation of the Simplex Method and MS-Excel Solver, preparation of case studies, visualization, original draft writing, and compilation of references.

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