An Analysis of Improved Version of Vogel's Approach: An Approach to Discover Basic Explanation for Transportation Problem

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Abstract—The transport problem is the unique class in the field of functional Mathematics & Operating Work in linear programming. Existing transport problem algorithms like North West corner rule (NWC), the Last Cost Method (LCM), & Vogel Method for Approximation (VAM). It is available to find the simple feasible solution utilizing a Vogel Method for Approximation (VAM).This paper discusses Vogel's Approximation Method (VAM) limitations & has deployed a superiorApproach after overcoming this transport problem restriction The Vogel Approximation (VAM) approach is the most effective transportation algorithm but it has a certain limit if two or more rows or columns end up with the greatest penalty costs.VAM has no better solution in this situation. In this paper, we have introduced an improved approach to this issue and an algorithm called the improved Vogel approach method (IV-VAM) solution, where the viable solution of this method is far closer to an optimum solution than VAM.

Index Terms—IV-VAM, LPP,VAM,Penalty, Transportation Cost,Transportation Problem (TP),.

I. INTRODUCTION

The problem of transportation (TP) is anunusual kind of problem with linear programming. This issue includes the transportation of the commodity from m to n terms, with a 1.a2 ... am and b1 ..b2 .....bn capacities, respectively. There is also a penalty CIJ for the transport of the unit from Origin I to designations j. This penalty can be either cost, delivery time, delivery protection, etc. The unknown volume of x_{ij} from Origin to Target is the vector x_i. The problem of transportation (TP) is a special kind of problem with linear programming. This issue includes the transportation of the commodity from m to n terms, with a 1.a2 ... am and b1 ..b2 .....bn capacities, respectively. There is also a penalty CIJ for the transport of the unit from Origin to designations.The unknown volume of xij from Origin I to Target j is the vector x_i.

Theory suggests a mathematical methodology to address imprecise concepts and problems there are several potential solutions. Zadeh developed the theory of fusts in 1965. Tanaka et al first proposed the idea of mathematical fluid programming at a general level in the process work of Bellman and Zadeh's fluidized decision[1]. Chanas, Kolodziejczk, and Machaj [3] have given the concept of the fuzzy method to the transportation problem. Transportation issues in the fuzzy environment given some ideas.bySaadand.Abbas [2]. & Abdul Razak&Nagoorgani [4] found a fuzzy explanation for a 2 Stage with trapezoidal. Dinakar&Keerthivasan [3] obtained a fuzzy solution with the Best Candidate Method using periodesteemed triangular fuzzy no.

In this work, the fuzzy transportation problems using interval-valued triangular fuzzy numbers have been discussed the initial basic feasible solution of the same transportation problem is obtained by different methods such as North West Corner rule, North East Corner rule, Least cost approach and Best Candidate Method[5].

Transportation problems are well-known in Operations study for its extensive applicability in genuine life. This is a particular form of n/w optimization problem, where goods are transported from severalOrigin to severalTargets subject to Origin and Targetdemand &supply respectively, to minimize the overall transport costs. In 1941 Hitchcock introduced the fundamental problem of transport[6]. Effective methods have been developed to find a solution, mainly in 1951 by Dantzig[7] and then in 1953 by Charnes, Cooper, and Henderson[8]. The transportation question-solving protocol (TP) consists of three steps:

Step (i): Mathematical Formulation of the TP.

Step (ii): To find a feasible initial solution.

Step (iii): Optimize the initial solution that is possible in step (ii).

The Transportation issue is to define transportation expense, to establish the number of trips of the raw material that hit a certain Origin point for a particular time while meeting the supply & demand limits from Origin to Target in the factory. The transportation issue is It is also important to estimate accurate values of transport costs, delivery times, quantities of raw materials, demands, availability, and the capability of the various mode of transportation b/wOrigins and Targets.

This paper is organized in the following manner,Section II defines the formalization of an optimization problem.Section III defines the Literature review done in the field of operational research and its method's state of the art.Section IV defines the problem domain in existing work and section V defines the proposed methodology,in this various security measure that applied in our proposed approach are defined.section VI defines Experimental analysis and section VII&VIII define conclusion & future scope respectively.

II. FORMULATION OF AN OPTIMIZATION PROBLEM

There are some components used in an optimization problem.

2.1Objective Function

An objective function demonstrates one or more than one quantities which are to be optimized (minimized or maximized). The optimization problems may have more than one objective function. If an optimization problem has multi-objective then it is reformulated and reduced to a single objective function. Here some objective functions are treated as constraints[9].

2.2Variables

The unknowns which are used to describe objective function and constraints are called variables. We find the values of the variables& see that these assure the given objective function &constraints[10].

2.3 Constraints

The constraints are the set of inequalities in the form of given unknowns. Certain values of the variables satisfy the constraints. Once the association among variables, constraints, and objectives is defined, the optimization problem can be formulated[11].

2.4 Mathematical Form of an Optimization Problem

An optimization problem in the standard form is given as:

Let $x_1, x_2, x_3, \ldots \ldots \ldots \ldots, x_n$ be the n variables that is $x=\begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix}$, which minimizes or maximizes $f(x)$;

Subject to the constraints

$$\Phi_i(x) \leq 0, i = 1, 2, 3, \ldots, m$$

$$\Psi_j(x) = 0, j = 1, 2, 3, \ldots, k$$

where the variable x is of n-tuples, $f(x)$ is the objective function, $\Phi_i(x)$ is the inequality constraints and $\Psi_j(x)$ is the equality constraints. This mathematical form of the problem is known as a constraints optimization problem.

2.4.1 Linear Programming Problem

The linear programming can be treated as large innovative progress that has given human-being the aptitude to shape

general goals and to place a pathway of thorough decisions to get the 'best' reach its goals when faced with realistic situations of huge complication. Our tools to perform this are methods to originate real-world problems in exhaustive mathematical models, techniques to solve the algorithms and engines for the operation of the steps of algorithms (computers and software).

A linear form means a mathematical expression of the type

$a_1x_1 + a_2x_2 + a_3x_3 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots.. + a_n$,

where$a_1, a_2, \ldots, a_n$ are constants and $x_1, x_2, \ldots, x_n$ are variables.

LPPs contains the optimization of a linear objective function, subject to the linear equality and inequality constraints. The general formulation of the LPPs is:

Optimize (Max. or Min.)

$Z = C_1x_1 + C_2x_2 + C_3x_3 + \ldots\ldots\ldots\ldots + C_nx_n$ ... (1)

Subject to the constraints

$a_{11}x_1 + a_{12}x_2 + \ldots.. + a_{1j}x_j + \ldots. + a_{1n}x_n \ (\leq = \geq)\ b_1$

$a_{21}x_1 + a_{22}x_2 + \ldots.. + a_{2j}x_j + \ldots.. + a_{2n}x_n \ (\leq = \geq)\ b_2 \ldots$ … … … … … … … … $a_{i1}x_1 + a_{i2}x_2 + \ldots.. + a_{ij}x_j + \ldots.. + a_{in}x_n \ (\leq = \geq)\ b_i$ ... (2)

… … … … … … … … … …

$a_{m1}x_1 + a_{m2}x_2 + \ldots.. + a_{mj}x_j + \ldots.. + a_{mn}x_n \ (\leq = \geq)\ b_m$

and$x_j \geq 0$, $j = 1, 2, 3, \ldots, n$, … (3)

where, C_j is a known cost coefficient of x_j, x_j is an unknown variable, a_{ij} is a known values, b_j is a known values.

III. A BRIEF REVIEW OF THE WORK ALREADY DONE IN THIS FIELD

In this section, important information regarding methodological issues of the study is presented:

P. Mungporn *et al.*[2020] presented Presents a fuel cell (FC)/reformer Origin for highly dynamical applications with a multi-phase interleaved boost converter. Control theory is considered based on the method of Hamiltonian function. We provide easy solutions to complex performance and convergence problems with an association of energy Origin and constant power loads using the port-controlled Hamiltonian method. An FC boost converter (2,5kW 2-phase interleaved converter) to support the proposed control law[12].

R. Liu et al.[2019]proposed The distributional algorithm estimation method (EDA) for the solution of Route Planning problems for AUVs in a complex setting is known as the fixed-height histogram (LFHH). To order to improve its accuracy and convergence, To speed up the discovery of alternative routes, a smooth approach is used. To control complex variables, a design window is often used. LFHH is tested with dynamic factor variations in complex 2-D and 3-D settings, and experimental findings confirm the efficacy of LFHH[13].

P. He, G. Jiang, S. Lam &D. Tang [2019]investigate the Travel-time forecast,which takes into account the time of the commuter on many bus journeys, as well as their waiting time at travel points. A new system is introduced, in which the time and waiting time of a given journey are individually calculated from various data sets (i.e. lines, busses & road networks), and the results are compiled into a final travel time forecast. We assess the impact factors of bus driving times empirically& establish a long-term memory model that can precisely forecast the driving time for each section of the bus routes.We also show that waiting times at points of transition have a major effect on the overall time and that calculating the period of waiting is not negligible since a fixed time of waiting for the distribution can not be taken into account. We implement a novel historical average interval approach to reliably predict waiting time, which can effectively fix correlation and sensitivity problems with waiting time forecasts. Real-world data studies have shown that the proposed method substantially exceeds six baseline approaches for all considered scenarios[14].

M. Sam'anetal. [2018] intended to allocate fuzzy transportation expenses that havethe same ranking value on Fuzzy Transportation Algorithm is randomly chosen to deal with the problem of full-scale transport. This way, however, affects the base cell of which the full unit of estimated fuzzy quantities must be calculated. Then, by adding weight with the SAW technique, the Modified Fuzzy Transports Algorithm showed no such foggy transport costs. A case study is resolved & the results are compared to the solutionsof the current algorithm to explain the algorithm suggested modifications. Since the proposed algorithm is an immediate extension of the classical method, it is simple to understand and practical to the plannedimprovement[15].

A. Vinyl and D. F. Silva[2018] discussed the Conduct of a Monte Carlo simulation test to spread the possibility of route lengths b/w small no. of random location for Traveling-Salesman-problems (TSP). We regard as a convex field where a fixed no. of random locations are generated and the respective euclidean TSP route is located from a known probability distribution. This approach is thoroughly simulated and the resulting experimental distribution for the TSP Tours was analyzed both quantitatively and qualitatively. We show that the duration of the TSP tour is well some assumptions of the geographic shape and probability distribution of locations[16].

Ivaschenko, I. Syusin, and P. Sitnikov,**[2017]** proposed a new concept for TISP which develops intelligent software solutions for transport logistics. The TISP is the intermediary service platform for transport. The key emphasis is on the need to improve the quality of transport services offered. The Smart Transportation Platform is a software system that provides virtual decision points for smart transport companies to compete with and cooperate in an interconnected environment. For the distribution of products and services between fixed numbers of consumers and pickup and delivery service to unplanned customers, the examples of effective TISP implementation in practice are provided[17].

M. A. Manzoor and Y. Morgan[2017] proposed a method based on Linear Support for this problem by a vector machine. In this job, the algorithm Scale-Invariant Transform Function (SIFT) will be used The word bag model is used to represent local features as a permanent length vector representing an image. to extract and reflect local interest. This approach is evaluated on the available vehicle production and model data and is achieved with promising results [18].

IV. PROBLEM DOMAIN

The transportation issue is one of the subclasses of Linear Programmable Problem(LPP) to carry different quantities of a single homogeneous product originally stored in different locations in a manner that reduces overall transport costs. To achieve this aim we need to know how big and where supplies are available and how much is needed.Moreover, the cost of moving a single commodity unit from different Origin to different Targets must be understood.The transportation problem is an important class of linear programming problem aimed at transporting various amounts of a single homogenous product which are transported to different Targets at different Origins in such a way as to reduce transport costs.Transportation problem arises in situations involving physical movements of goods e.g. milk and milk products from plants to cold storages, cold storages to wholesalers, wholesalers to retailers and retailers to customers. The solution of a TP is to determine the quantity to be shifted from each plant to each cold storage to maintain the supply and demand requirements at the lowest transportation cost.

V. PROPOSED METHODOLOGY

We stated at the outset that certain methods exist to overcome transport problems such as North West Corner Law (NWC), Least Cost System (LCM), and VAM, etc. We address Vogel's approach method (VAM) in this section& our proposed approach improved Vogel's Approximation approach.

A. For Vogel's Approximation Approach Existing Algorithm

Vogel Approach (VA) is a recursive method to compute an appropriate feasible alternative of a transportation hitch. This approachis better than the other 2approaches i.e. North West Corner Rule (NWC) &Least cost approach (LCA), Because obtained fundamental feasible answer. The optimal explanation is closer to this method. The current Vogel Approximation Method (VAM) algorithm follows:

Step-1: Identify the boxes with high and high transport costs write in each line the penalty against the corresponding row on the tableside.

Step-2: Identify the minimum and next to minimize transport costs in each column and enter the penalty on the Opposite column side of the table. When the minimum cost is displayed in a row or column two or more times, pick the same costs as the minimum and next to minimize costs and penalty will be 0.

Step-3: a. List the column and row with the highest penalty and arbitrarily sever ties. Assign the variable to the minimum cost in the selected row or column as much as possible. Change supply & demand & delete the column or lines. If a row and a column are met, only one is excluded and a zero supply or demand is applied to the remaining row or column. b. When two or more charges are of the same size, select one (or select the top or far-left row).

Step-4: If the supply or demand of exactly 1 row or 1 column remains uncrossed, Stop. where one row or column with +vedemandor supply is left out, basic variables shall be calculated by the lowest cost approach in the row or column. c. If (rest) 0 supply or demand occurs for all uncrossed rows or columns, the zero basic variables are calculated by the least cost rule. Stop. d. or else, back to Step-1.

B. Finding Limitations Of Vogel's Approximation Method (Vam)

In the VAM method, the penalties are based on the difference between each row and each column of two minimum costs.One of the 2 min. costs arelowest & the other is too elevated The maximum penalty implies that. Choose this row or column in the VAM algorithm, which includes the highest penalty, to ensure that the current Recurrence is less expensive[19]. The VAM algorithm selects either one (or selects the most top row or extreme connection column) [(2.) Step-3(b)] if the maximum cost of penalties appears in a row or column. Nevertheless, the biggest drawback is not necessarily guaranteed the lowest price because the difference between the two pairs can be equal if the one pair is smaller than the other. The difference between 10 and 5 and the difference between 7 and 2 are the same, but the second pair has the smallest number. Of this reason, it can be assumed that the lowest costs in the current VAM algorithm will not be chosen so that total transport costs will not be reduced in the topmost or far-left position. VAM can not be issued in this case.

C. Proposed Algorithm For ImprovedVogel's Approximation Method (IV-Vam)

In the debate above, we have resolved this issue and put forward an enhanced algorithm called â Vogelâ s logical approximate creation (IV-VAM)â as the basis for Vogelâ s approach process. We have also suggested an improved algorithm. We have solved this VAM problem by choosing the row or column the contains the least possible sum and the maximum allocation if two or four or more columnsor rows are maximum penalties. In this algorithm, we have resolved this problem. The following is the algorithm of IV-VAM: Set o_i ***to*** be supply amount of the i^{th}Origin&$t_o$be the sumofdemand of j^{th}Target and c_{ij}be unit transportation.

Step-1: Varify: $if\ o_i < 0\ \&\ t_j < 0$ then end

Step-2 If :$\sum_i O_i > \sum_j t_j\ or if \sum_i o_i < \sum_j t_j$ Then balance the issue of transport by adding demand or supply of dummies.

Step-3 Recognize the smallest &lowest expense per column and row and measure the difference that is the penalty. Pi is the penalty for rows and Pj is the penalty for columns.

$$P_i = |C_{ih} - C_{ik}| \text{and } P_j = |C_{hj} - C_{kj}|$$

Step-4 Select max(p_i, PJ) Choose the lowest row or column cost that has a high penalty & max.possibleamountx_{ij} $i.e$,min(o_i,t_j).IfIn two or more cells in the same column, the lowest cost appears and then the far left or lowest cost cell is selected.

Step-5 Ifa tie occurs in any rows or columns in the biggest penalties, pick the line or column at a lower cost.

Step-6: Change the supply & demand & eliminate the column or lines. If row & column are filled at the same time, then one of them is crossed out &the remainingcolumnor row is supplied or demand-free.

Step-7: If exactly one row or one column remains unregulated with zero supply or demand, stop.

a. If one row or column has +ve volume or request, the basic variables shall be calculated by the lower-cost approach in the row or column.

b. If (rest) zero supply or demand in all uncrossed line(s) or columns, the simple zero variables are calculated using the lowest cost process. Halt.

c. Otherwise, go toStep-3.

D. NUMERICALILLUSTRATION

Consider several special kinds of transport issues where the greatest penalty occurs in two or more rows or columns, solving these by using the Vogel Approximation Method (VAM) and the modified version of the Vogel Approximation Method (IV-VAM) suggested method.

EX.-1:

Consider a transport problem mathematical model in the following

Table-1.1:

Origin	Target					Supply
	T1	T2	T3	T4	T5	
O1	10	8	9	5	13	**100**
O2	7	9	8	10	4	**80**
O3	9	3	7	10	6	**70**
O4	11	4	8	3	9	**90**
Demand	**60**	**40**	**100**	**50**	**90**	

RESULT OF EX.-1 USING Improved Version OF VOGEL APPROXIMATION METHOD :

Expenses are shown in theallocations&right corner, in the bottom left corner are shown

Recurrence-1:

Origin	Target					Supply	Penalty of Row
	T1	T2	T3	T4	T5		
O1	10	8	9	5	13	**100**	3
O2	7	9	8	10	4	**80**	3
O3	9	3 **40**	7	10	6	**30**	**3**
O4	11	4	8	3	9	**90**	1
Demand	**60**		**100**	**50**	**90**		
Penalty of Column	2	1	1	2	2		

The biggest fines in Recurrence-1 can be found in O1, O2, O3 rows three times, but the lowest costs are shown in cells (O3, T2).

Recurrence-2:

Origin	Target					Supply	Penalty of Row
	T1	T2	T3	T4	T5		
O1	10	8	9	5	13	**100**	4
O2	7	9	8	10	4	**80**	3
O3	9	3 **40**	7	10	6	**30**	1
O4	11	4	8	3 **50**	9	**40**	**5**
Demand	**60**		**100**		**90**		
Penalty of Column	2		1	2	2		

Recurrence-3:

Origin	Target					Supply	Penalty of Row
	T1	T2	T3	T4	T5		
O1	10	8	9	5	13	**100**	1
O2	7	9	8	10	4 **80**		**3**
O3	9	3 **40**	7	10	6	**30**	1
O4	11	4	8	3 **50**	9	**40**	1
Demand	**60**		**100**		**10**		
Column Penalty	2		1		2		

Recurrence-4:

Origin	Target					Supply	Penalty of Row
	T1	T2	T3	T4	T5		
O1	10	8	9	5	13	**100**	1
O2	7	9	8	10	4 **80**		
O3	9	3 **40**	7	10	6 **10**	**20**	1
O4	11	4	8	3 **50**	9	**40**	1
Demand	**60**		**100**				
Column Penalty	1		1		**3**		

Recurrence-5:

Origin	Target					Supply	Row Penalty
	T1	T2	T3	T4	T5		
O1	10	8	9	5	13	**100**	1
O2	7	9	8	10	4 **80**		
O3	9	3 **40**	7	10	6 **10**	**20**	2
O4	11	4	8 **40**	3 **50**	9		**3**
Demand	**60**		**60**				
Penalty of Column	1		1				

Recurrence-6:

Origin	Target					Supply	Penalty of Row
	T1	T2	T3	T4	T5		
O1	10	8	9	5	13	**100**	1
O2	7	9	8	10	4 **80**		
O3	9	3 **40**	7 **20**	10	6 **10**		**2**
O4	11	4	8 **40**	3 **50**	9		
Demand	**60**		**40**				
Penalty of column	1		**2**				

Recurrence-7:

Origin	Target					Supply	Penalty of Row
	T1	T2	T3	T4	T5		
O1	10 **60**	8	9 **40**	5	13		
O2	7	9	8	10	4 **80**		
O3	9	3 **40**	7 **20**	10	6 **10**		
O4	11	4	8 **40**	3 **50**	9		
Demand	**0**						
Penalty of Column							

In Recurrence-6, only one row has remains with +vedemand &supply Then the sum is distributed by Least Cost Method by the IV-VAM algorithm. The following is the final workable solution table:

Origin	Target					Supply
	T1	T2	T3	T4	T5	
O1	10 **60**	8	9 **40**	5	13	**100**
O2	7	9	8	10	4 **80**	**80**
O3	9	3 **40**	7 **20**	10	6 **10**	**70**
O4	11	4	8 **40**	3 **50**	9	**90**
Demand	**60**	**40**	**100**	**50**	**90**	

Sum Transportation Cost (By Improved Version-VAM):

$(9\times40)+(10\times60)+(4\times80)+(3\times40)+(7\times20)+$

$(8\times40)+(3\times50)+(6\times10)=2070$

RESULT OF EXAMPLE-1 by VOGEL'S APPROXIMATION METHOD(VAM):

The cost is shown in the right and the lower-left corner, the allocations are shown.

Total Transportation Cost (By VAM):

(5□ 50) □ (10□ 50) □ □ (9□ 10) □ (7 □ 50) □ (6□ 10) □ (4□ 40) (8□ 50)□ □ (4□ 80) □ 2130

Observation: We considered the feasible solution given by VAM for Ex. 1 to 2130 &IV-VAM to 2070 to be less than VAM. It was considered that

Ex.-2:

Assume a Mathematical Model for a Transportation Problemin below:

Table-2.1:

Origin	Target				Supply
	T1	T2	T3	T4	
O1	7	5	9	11	**30**
O2	4	3	8	6	**25**
O3	3	8	10	5	**20**
O4	2	6	7	3	**15**
Demand	**30**	**30**	**20**	**10**	

RESULT OF EXAMPLE-2 USING Improved Version OfVOGEL'S APPROXIMATION METHOD (IV-VAM):

Costs are representing in the right-top corner & allocations are representing in the bottom-left corner.

Table-2.1:

Origin	Target				Supply
	T1	T2	T3	T4	
O1	7 **5**	5 **5**	9 **20**	11	**30**
O2	4	3 **25**	8	6	**25**
O3	3 **20**	8	10	5	**20**
O4	2 **5**	6	7	3 **10**	**15**
Demand	**30**	**30**	**20**	**10**	

Sum Transportation Cost (ByIV-VAM):

(5□ 5)□ □ (7 □ 5) □ (9□ 20) □ □ (3□ 20) □

(2□ 5) □ (3□ 25)+ (3□ 10) □ 415

Result OF EX.-2 by VOGEL'S APPROXIMATION METHOD(VAM):

Source	Target					Supply	Penalty of Row					
	T1	T2	T3	T4	T5	100						
O1	10 **50**	18	9	5 **50**	13		**3**	1	1	1	1	1
O2	7		9	8 1	4 **80**	**80**	3 3**3**					
O3	9 **10**	3	7 **50**	10	6 **10**	**70**	3	3	1	1 2 **2**		
O4	11	4 **40**	8 **50**	3	9	**90**	1 **4** 1 1**3**					
Demand	**60**	**40**	**100**	**50**	**90**							
Penalty Column	2	1	1	2	2							
	2	1	1		2							
	2		1		2							
	1		1		**3**							
	1		1									
	1		2									

Expenses are displayed in the left and allocations in the bottom-left corner.

Table-2.2:

Source	Target				Supply
	T1	T2	T3	T4	
O1	7	5 **30**	9	11	**30**
O2	4 **25**	3 **0**	8	6	**25**
O3	3 **5**	8	10 **5**	5 **10**	**20**
O4	2	6	7 **15**	3	**15**
Demand	**30**	**30**	**20**	**10**	

Observation: By analyzing that VAM gives feasible result for Ex.-2 is 470 &IV-VAMgives 415 which is lesser than VAM

EX.-3:

Assume a Mathematical form of a Transportation issuein below:

Table-3.1:

Origin	Targets							Supply
	T1	T2	T3	T4	T5	T6	T7	
O1	12	7	3	8	10	6	6	**60**
O2	6	9	7	12	8	12	4	**80**
O3	10	12	8	4	9	9	3	**70**
O4	8	5	11	6	7	9	3	**100**
O5	7	6	8	11	9	5	6	**90**
Demand	**20**	**30**	**40**	**70**	**60**	**80**	**100**	

Results Of EX.-4 by Improved Version OF VOGEL'S APPROXIMATION METHOD (IV- VAM):

The expenses are shown in the right corner & in the lower-left corner allocations are shown

Table-3.2:

Origin	Targets							Supply
	T1	T2	T3	T4	T5	T6	T7	
O1	12	7 **20**	3 **40**	8 **0**	10	6	6	**60**
O2	6 **20**	9 **0**	7	12	8 **60**	12	4 **0**	**80**
O3	10	12	8	4 **70**	9	9	3	**70**
O4	8	5	11	6	7	9	3 **100**	**100**
O5	7	6 **10**	8	11	9	5 **80**	6	**90**
Demand	**20**	**30**	**40**	**70**	**60**	**80**	**100**	

Total transportation Cost:

□7□20□□□3□40□□□4□0□□□8□0□□□8□60□□8□60□
□6□20□□□9□0□□

□□4□70□□□3□ 100□□□6□ 10□□□5□ 80□□1900

VI. EXPERIMENTAL ANALYSIS

For the above, we have found that feasible solutions by the enhanced Vogel Approximation Method version (IV-VAM), some of which are the same solution as the Vogel Approximation Method (VAM), are lower, and others very close to the optimal result. The table below shows the analysis of these solutions:

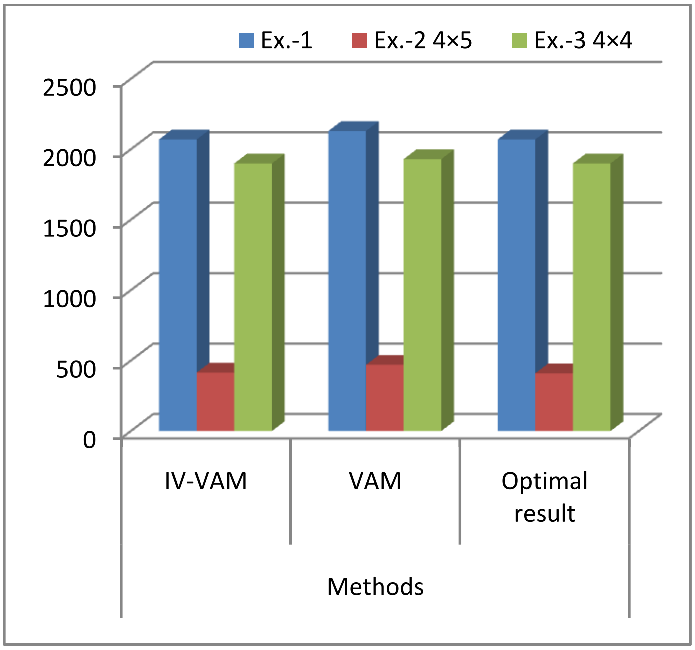

Figure 1.1

Table-6:

Transportation Problem	Problem range	Methods		
		IV-VAM	VAM	Optimal result
Ex.-1	4×5	**2070**	2130	2070
Ex.-2	4×4	**415**	470	410
Ex.-3	5×7	**1900**	1930	1900

VI. CONCLUSION

Vogel method is preferred over the NWCM and VAM because the startingfundamental feasible solution obtained by this approach is either an optimal solution or extremely nearer to the optimal explanation.This method helps to reduce transport costs by interpreting the transport costs from one place to another in a mathematical table. The column reflects the centers of demand, the row the points of supply.In this paper, we come across a restriction of Vogel's Approximation Approach&deployed a superior algorithm by settling this restrictionapproach ―Improved version ofVogel's Approximation Method (IV-VAM) using fixed point for defining Transportation Problem. From the given ex.& other transportation problems, IV-VAM is the least feasible answer than VAM, is extremely similar to an optimal result&at times the same as an optimal solution.

VII. FUTURE SCOPE

A new alternative approach has been developed to solve transport problems that offer either a near-optimal solution or an optimal solution.The new alternate methods are used only for Vogel's Approximation MethodWe could not, however, seek to address other transport- and transshipment-related optimization issues. Thus, the unbalanced problem can be overcome with new alternative methods built in this study.

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