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SOLVING RUSSELL'S APPROXIMATION METHOD USING BEST CANDIDATE METHOD

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ABSTRACT

Problem statement: This study is about describing solution technique called Best Candidates Method (BCM) for solving optimization processes. The most important and successful applications in the optimization refers to transportation problem (TP), the special class of the linear programming (LP) in the operation research (OR). **Approach:** In this paper, we consider the best candidate method (BCM) applying the Russell's Approximation method (RAM). Where the supply, demand and minimum cost is uncertain. The minimum cost in the Russell's Approximation method has been discussed**.**

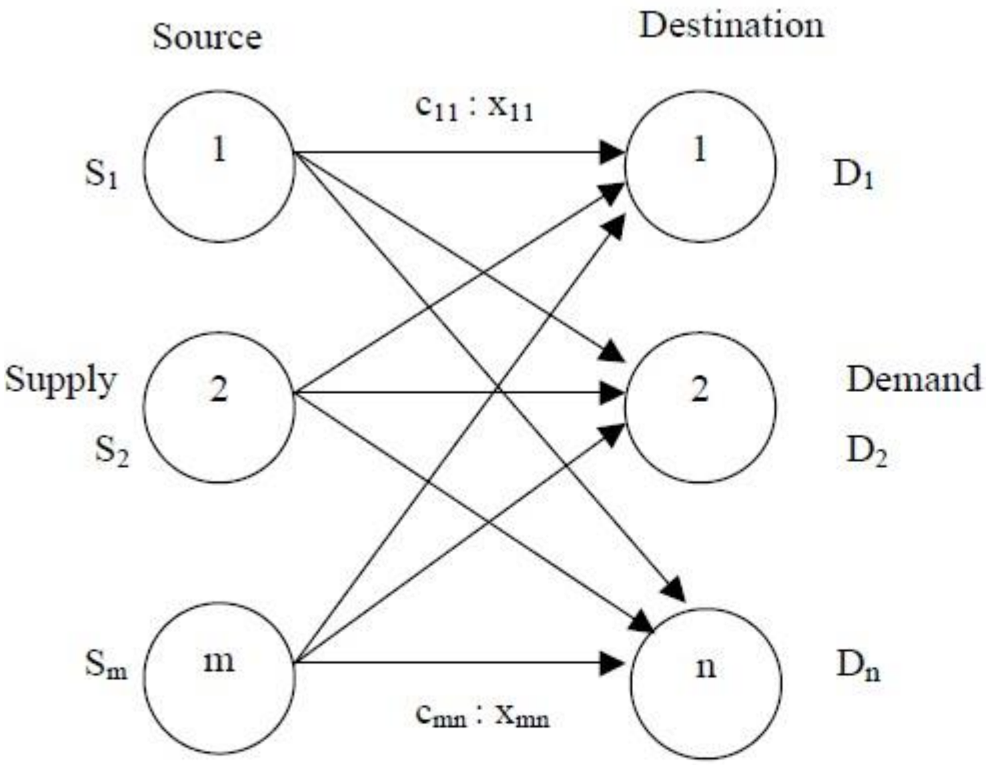
KEYWORDS: Demand, Supply, optimal solution, objective function, Russell's Approximation Method, Best Candidate Method.

INTRODUCTION:

For survival of our life we want to move the goods from one place to another place. Due to the high population, it is very challenging for the company, how to send the number of costumers or how to minimize the transportation cost. Where introduced the transportation problem.

The Transportation theory or transport theory is a name given to the study of optimal transportation and allocation of resources. The problem was formalized by the French Mathematician Gaspard Monge in 1871.

The main objective of the transportation problem is minimizing the total shipping cost of supply the destinations with the required demand from the available supplies at the source.



The problem is to determine an optimal transportation scheme that is to minimize the total of the shipments cost between the nodes in the network model, subject to supply and demand constraints.

The concept of this paper is Best Candidates Method (BCM) in we utilize our idea by using Russell’s Approximation Method for solving this paper.

2. PRELIMINARIES

2.1 Definition: Transportation

The transportation problem or transport is the movement of people and goods from one location to another. The transportation is the movement of products from one node in the distribution channel to another.

2.2 Definition: Objective function

The linear function Z= $C_1x_1 + C_2x_2 + \cdots + C_nx_n$which is to be minimized (or) maximized is called the objective function of the general LPP.

2.3 Definition: Feasible Solution

If any solution to a general form which also satisfies the constraints non negative restrictions if the problem, is called a feasible solution of the general LPP.

2.4 Definition: Basic feasible solution

A feasible solution to a m- origin and n- destination problem is said to be basic feasiblesolution if the number of positive allocations are (m+n-1).

If the number of allocations in a basic feasible solutions are less than (m+n-1) it is calledDegenerate basic feasible solution. Otherwise non-degenerate.

2.4 Definition: Optimum solution

A feasible solution (not necessary basic) is said to be optimal. if it minimize the totaltransportation cost

2.5 The Best Candidates Method (BCM):

The Best Candidates Method (BCM) has the following process:

Step 1:

Prepare the BCM matrix, If the matrix unbalanced, then the matrix are balanced without using the added row or column candidates in solution procedure.

Step 2:

Select the best candidates that is for minimization problems to the minimum cost and for maximize profit to the maximum cost, electing the best two candidates in each row, if the candidates repeated more than two times, then the candidates should be elected again. Check the columns that not have candidates and elect one candidate for them. If the candidates repeated more than one time.

Step 3:

Find the combinations. To determine only one candidates for each row or column by starting from the row that have least candidates and delete that row and column. If there is situation that have no candidates for some rows or columns elect the best available candidates. Repeat step 3 by determining the next candidate in the row that started form. Compute and compare the summation of candidates for each combination to determine the best combination that give the optimal solution.

3. PROPOSED METHOD.

Russell’s Approximation Method

Step1: Check whether the problem is balanced or unbalanced, i.e.) demand=supply. If not add dummy row or column to make it balanced problem.

Step2: For each source row still under consideration, determine its A_i (largest cost in row i)

Step 3: For each destination column still under consideration, determine itsB_j

Step 4: For each variable, calculate $\Delta_{ij} = C_{ij} - (A_i + B_j)$

Step 5: Select the variable having the most negative Δ value, break lies arbitrarily.

Step 6: Allocate as much as possible eliminate necessary calls from consideration, return to step 2.

4. NUMERICAL EXAMPLE

Problem:

Finding the optimal cost for the problem of assigning five jobs to five persons.

Plant	D_1	D_2	D_3	D_4	Supply
S_1	10	30	25	15	14
S_2	20	15	20	10	10
S_3	10	30	20	20	15
S_4	30	40	35	45	12
Demand	10	15	12	15	

Solution:

Step 1:

In this problem, the matrix is unbalanced, where the total of supply is not equal to the total of demand in the matrix.

Plant	D_1	D_2	D_3	D_4	Supply
S_1	10	30	25	15	14
S_2	20	15	20	10	10
S_3	10	30	20	20	15
S_4	30	40	35	45	12
Demand	10	15	12	15	

Step 2:

Here we add a dummy row to make supply is equal to demand, so the transportation costs in this row will be assigned to zero.

Plant	D_1	D_2	D_3	D_4	Supply
S_1	10	30	25	15	14
S_2	20	15	20	10	10
S_3	10	30	20	20	15
S_4	30	40	35	45	12
Demand	10	15	12	15	**52/52**

Step 3:

By using RAM, we determine the best combination that will produce the largest cost, where is one candidate for each row and column. The result from applying RAM

Plant	D_1	D_2	D_3	D_4	Supply	A_i
S_1	10	30	25	15	14	30
S_2	20	15	20	10	10	20
S_3	10	30	20	20	15	30

S_4	30	40	35	45	12	45
S_5	0	0	0	0	1	0
Demand	10	15	12	15		
B_j	30	40	35	45		

Compute the reduced cost to each where

$\Delta_{11} = C_{11} - (A_1 + B_1) =$10-(30+30) =-50 $\Delta_{12} = C_{21} - (A_1 + B_2) =$30-(30+40) =-40

$\Delta_{13} = C_{13} - (A_1 + B_3) =$25-(30+35) =-40 $\Delta_{14} = C_{14} - (A_1 + B_4) =$15-(30+45) =-60

$\Delta_{21} = C_{21} - (A_2 + B_1) =$20-(20+30) =-30 $\Delta_{22} = C_{22} - (A_2 + B_2) =$15-(20+40) =-45

$\Delta_{23} = C_{23} - (A_2 + B_3) =$20-(20+35) =-35 $\Delta_{24} = C_{24} - (A_2 + B_4) =$10-(20+45) =-55

$\Delta_{31} = C_{31} - (A_{3+} B_1)$10-(30+30) =-50 $\Delta_{32} = C_{32} - (A_3 + B_2) =$30-(30+40) =-40

$\Delta_{33} = C_{33} - (A_3 + B_3) =$20-(30+35) =-45 $\Delta_{34} = C_{34} - (A_3 + B_4) =$20-(30+45) =-55

$\Delta_{41} = C_{41} - (A_4 + B_1) =$30-(45+30) =-45 $\Delta_{42} = C_{42} - (A_4 + B_2) =$40-(45+40) =-45

$\Delta_{43} = C_{43} - (A_4 + B_3) =$35-(45+35) =-40 $\Delta_{44} = C_{44} - (A_4 + B_4) =$45-(45+45) =-45

$\Delta_{51} = C_{51} - (A_5 + B_1) =$0-(0+30) =-30 $\Delta_{52} = C_{52} - (A_5 + B_2) =$0-(0+30) =-40

$\Delta_{53} = C_{53} - (A_5 + B_3) =$0-(0+35) =-35 $\Delta_{54} = C_{54} - (A_5 + B_4) =$0-(0+45) =-45

Select the variable having the most negative Δ value and select the minimum supply or demand and made the allotment in the cell having the least unit cost.

Plant	D_1	D_2	D_3	D_4	**Supply**	A_i
S_1	10 [-50]	30[-40]	25[-40]	15[-60]	14	30
				{**14**}		
S_2	20 [-30]	15[-45]	20[-35]	10[-55]	10	20
S_3	10 [-50]	30[-40]	20[-45]	20[-55]	15	30
S_4	30 [-45]	40[-45]	35[-40]	45[-45]	12	45
S_5	0 [-30]	0[-40]	0[-35]	0[-45]	1	0
Demand	10	15	12	15 (15-14=**1**)		
B_j	30	40	35	45		

The most negative value is $\Delta_{14} = (-60)$

Min (14,15) =1

Plant	D_1	D_2	D_3	D_4	**Supply**	A_i
S_2	20	15	20	10	10	20
S_3	10	30	20	20	15	30
S_4	30	40	35	45	12	45
S_5	0	0	0	0	1	0
Demand	10	15	12	15		
B_j	30	40	35	45		

Plant	D_1	D_2	D_3	D_4	**Supply**	A_i
S_2	20 [-30]	15[-45]	20[-35]	10[-55]	10	20

				{**1**}	(10-1=9)	
S_3	10 [-50]	30[-40]	20[-45]	20[-55]	15	30
S_4	30 [-45]	40[-45]	35[-40]	45[-45]	12	45
S_5	0 [-30]	0[-40]	0[-35]	0[-45]	1	0
Demand	10	15	12	1		
B_j	30	40	35	45		

The most negative value is $\Delta_{24} = (-55)$

Min (1,10) =1

Plant	D_1	D_2	D_3	**Supply**	A_i
S_2	20	15	20	9	20
S_3	10	30	20	15	30
S_4	30	40	35	12	45
S_5	0	0	0	1	0
Demand	10	15	12		
B_j	30	40	35		

$\Delta_{21} = C_{21} - (A_2 + B_1) =$ 20-(20+30) =-30 $\Delta_{22} = C_{22} - (A_2 + B_2) =$ 15-(20+ 40) = -45

$\Delta_{23} = C_{23} - (A_2 + B_3) =$ 20-(20+35) =-35 $\Delta_{31} = C_{31} - (A_{3+} B_1)$ =10-(30+ 30) =-50

$\Delta_{32} = C_{32} - (A_3 + B_2) =$ 30-(30+40) =-40 $\Delta_{33} = C_{33} - (A_3 + B_3) =$ 20-(30+ 35) =-45

$\Delta_{41} = C_{41} - (A_4 + B_1) =$ 30-(40+30) =-40 $\Delta_{42} = C_{42} - (A_4 + B_2) =$ 40-(40+40) = -40

$\Delta_{43} = C_{43} - (A_4 + B_3) =$ 35-(45+35) =-40 $\Delta_{51} = C_{51} - (A_5 + B_1) =$ 0-(0+30) =-30

$\Delta_{52} = C_{52} - (A_5 + B_2) =$ 0-(0+30) = -40 $\Delta_{53} = C_{53} - (A_5 + B_3) =$ 0-(0+35) = -35

Plant	D_1	D_2	D_3	**Supply**	A_i
S_2	20 [-30]	15[-45]	20[-35]	9	20
S_3	10 [-50] {**10**}	30[-40]	20[-45]	15 (15-10=**5**)	30
S_4	30 [-45]	40[-45]	35[-40]	12	45
S_5	0 [-30]	0[-40]	0[-35]	1	0
Demand	10	15	12		
B_j	30	40	35		

The most negative value is $\Delta_{31} = (-50)$

Min (10,15) =1

Plant	D_2	D_3	Supply	A_i
S_2	15	20	10	20
S_3	30	20	15	30
S_4	40	35	12	45
S_5	0	0	1	0
Demand	15	12		
B_j	40	35		

$\Delta_{22} = C_{22} - (A_2 + B_2) =$ 15-(20+ 40) = -45 $\Delta_{23} = C_{23} - (A_2 + B_3) =$ 20-(20+35) =-35

$\Delta_{32} = C_{32} - (A_3 + B_2) =$ 30-(30+40) =-40 $\Delta_{33} = C_{33} - (A_3 + B_3) =$ 20-(30+ 35) =-45

$\Delta_{42} = C_{42} - (A_4 + B_2) =$ 40-(40+40)=-40 $\Delta_{43} = C_{43} - (A_4 + B_3) =$ 35-(45+35)=-40

$\Delta_{52} = C_{52} - (A_5 + B_2) =$ 0-(0+30) = -40 $\Delta_{53} = C_{53} - (A_5 + B_3) =$ 0-(0+35) = -35

Plant	D_2	D_3	Supply	A_i
S_2	15[-45] {**9**}	20[-35]	9	20
S_3	30[-40]	20[-45]	5	30
S_4	40[-45]	35[-40]	12	40
S_5	0[-40]	0[-35]	1	0
Demand	15 {15-9=**6**}	12		
B_j	40	35		

The most negative value is $\Delta_{22} = (-45)$

Min (19,15) =9

Plant	D_2	D_3	Supply	A_i
S_3	30	20	5	30
S_4	40	35	12	40
S_5	0	0	1	0
Demand	6	12		
B_j	40	35		

Plant	D_2	D_3	Supply	A_i
S_3	30[-40]	20[-45] {**5**}	5	30

S_4	40 [-40]	35[-40]	12	40
S_5	0 [-40]	0 [-35]	1	0
Demand	6	12 (12-5=**7**)		
B_j	40	35		

The most negative value is $\Delta_{33} = (-45)$

Min (5,12) =5

Plant	D_2	D_3	**Supply**	A_i
S_4	40	35	12	40
S_5	0	0	1	0
Demand	6	7		
B_j	40	35		

Plant	D_2	D_3	**Supply**	A_i
S_4	40 [-40] {**6**}	35 [-40]	12 (12-6=**6**)	40
S_5	0 [-40]	0 [-35]	1	0
Demand	6	7		
B_j	40	35		

The most negative value is $\Delta_{41} = (-40)$

Min(6,12)=6

Plant	D_3	**Supply**	A_i
S_4	35	6	35
S_5	0	1	0
Demand	7		
B_j	35		

Plant	**D3**	**Supply**	A_i
S_4	35 [-40] {**6**}	6	35
S_5	0 [-35]	1	0
Demand	7(7-6=**1**)		
B_j	35		

The most negative value is $\Delta_{43} = (-35)$

Min(6,7)=6

Plant	**D3**	**Supply**
S5	0[-35]	**1**
Demand	**1**	

The final allocation table:

plant	D_1	D_2	D_3	D_4
S_1	10	30	25	15(**14**)
S_2	20	15 (**9**)	20	10(**1**)
S_3	10(**10**)	30	20(**5**)	20
S_4	30	40(**6**)	35(**6**)	45
S_5	0	0	0(**1**)	0

The minimum Transportation cost is obtained as:

Min = 15*14+15*9+10*1+10*10+20*5+40*6+35*6+0*1=1005

Here, the number of allocated cells=8,

Which is equal to m+n-1=5+4-1=8.

Therefore, this solution is non- degenerate.

CONCLUSION:

The transportation problem of special type of optimization problems in operation research. The main objective is to find the minimum transportation cost. In this paper, we have proposed a BCM for solved Russell's approximation method has the minimum transportation cost is very easier to apply in real life problems.

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