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# A study on North east corner method in Transportation Problem and using of Object Oriented Programming Model

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ABSTRACT

In this paper, the North east corner [NEM] procedure is successfully coded and tested via many randomly generated problem instances. Based on the results we can conclude that the correctness of the newly coded NEM is promising as compared with the previously coded one. We Select very big problem of Transportation problem using Object oriented programming in Java and develop a NEM in Java Flowchart, Algorithm, program. In this paper submitted in screen short.



## Introduction

The term 'OR' was coined in 1940 by M. C. Closky & T.ref then in a small town of Bawdsey in England. It is a science that came into existence in a military content. During world war II, the military management of UK called an Scientists from various disciplines & organized them into teams to assist it in solving strategic & tactical problems relating to air & land defense of the country.

The transportation problem is a special class of LPP that deals with shipping a product from multiple origins to multiple destinations. The objective of the transportation problem is to ind a feasible way of transporting the shipments to meet demand of each destination that minimizes the total transportation cost while satisfying the supply & demand constraints. The two basic steps of the transportation method are

**Step 1**

Determine the initial basic feasible solution

**Step 2**

Obtain the optimal solution using the solution obtained from step 1.

In this paper the corrected coding of NEM in Java is implemented. Then its correctness is verified via many randomly generated instances. The remainder of this paper is organized as follows:

Section II deals with the mathematical formulation of the transportation problem. In section III NEM is summarized. In section IV potential significance of the new object oriented program of VAM is illustrated with a numerical example.

Finally, conclusion by highlighting the limitations and future research scope on the topic is made in section V.

## 2. Mathematical formulation of the Transportation Problem

**A.** In developing the LP model of the transportation problem the following notations are used

$a_i$ - Amounts to be shipped from shipping origin i (ai≥ 0 ).

$b_j$ - Amounts to be received at destination j (bj≥ 0).

$c_{ij}$ - Shipping cost per unit from origin i to destination j (cij≥ 0).

$x_{ij}$ - Amounts to be shipped from origin i to destination j to minimize the total cost ( $x_{ij} \geq 0$ ) .

We assumed that the total amount shipped is equal to the total amount received, that is,

$\sum_{i=1}^{m} a_i \geq \sum_{j=1}^{n} b_j$

**B.** Transportation problem

Min $\sum_{i=1}^{m} \sum_{j=1}^{n} c_{ij} x_{ij}$

Subject to $\sum_{j=1}^{n} x_{ij} \leq a_i$ , i = 1 , 2, … , m

$\sum_{i=1}^{m} x_{ij} \leq b_j$ , j = 1 , 2 , … , n , where $x_{ij} \geq 0 \; \forall$ i , j .

**Feasible solution**

A set of non negative values $x_{ij}$ , i = 1 , 2 , …, n and j = 1 , 2 , …, m that satisfies the constraints is called a feasible solution to the transportation problem .

**Optimal solution**

A feasible solution is said to be optimal if it minimizes the total transportation cost.

**Non degenerate basic feasible solution**

A basic feasible solution to a (m × n) transportation problem that contains exactly m + n – 1 allocations in independent positions.

**Degenerate basic feasible solution**

A basic feasible solution that contains less that m + n – 1 non negative allocations.

**Balanced and Unbalanced Transportation problem**

A Transportation problem is said to be balanced if the total supply from all sources equals the total demand in the destinations otherwise called unbalanced Transportation problem.

Thus, for a balanced problem, $\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j$ and for unbalanced problem, $\sum_{i=1}^{m} a_i \neq \sum_{j=1}^{n} b_j$

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**3. North East Corner Rule Procedure**

- i) The method starts at the North – East corner cell (route) of the tableau (Variable X1n).
- Allocate as much as possible to the selected cell and adjust the associated amounts of supply and demand by subtracting the allocated amount.
- ii) Cross out the row or column with zero supply or demand to indicate that no further assignments can be made in the row or column. If both a row and a column net to zero simultaneously cross out one only and leave a zero supply (demand in the uncrossed out row or column).
- If exactly one row or column is left uncrossed out or below if exactly one row or column is left uncrossed out, stop.Otherwise, move to the cell to the right if a column has just been crossed out or below if a row has been crossed out. Go to step (i).
- Start with X1n and end must be Xm1.

**Problem**

The Metropolitan Transport Corporation, Chennai, Tamil Nadu, India operates buses between Guduvancheri and CMBT from morning 6.00 a.m. to evening 10.00pm. The Number of buses available and required between operating points are given in the tableau below. Determine the minimum number of buses to be operated between the points Guduvancheri and CMBT for the given time period and routes.

| | **6-7** | **7-8** | **8-9** | **9-10** | **10-11** | **11-12** | **12-1** | **1-2** | **2-3** | **3-4** | **4-5** | **5-6** | **6-7** | **7-8** | **8-9** | **9-10** | **Avail** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **GUDUVANCHERY** | 2 | 3 | 7 | 8 | 6 | 5 | 3 | 2 | 2 | 3 | 4 | 5 | 9 | 8 | 7 | 6 | 80 |
| **URAPAKKAM** | 3 | 4 | 8 | 10 | 7 | 6 | 4 | 3 | 3 | 4 | 5 | 6 | 10 | 9 | 8 | 7 | 97 |
| **VANDALOOR** | 6 | 7 | 11 | 13 | 10 | 9 | 7 | 6 | 6 | 7 | 2 | 9 | 13 | 12 | 11 | 10 | 145 |
| **PERUGULATHOOR** | 8 | 9 | 13 | 15 | 12 | 11 | 9 | 8 | 8 | 9 | 10 | 11 | 15 | 14 | 13 | 12 | 177 |
| **TAMBARAM** | 12 | 13 | 17 | 19 | 16 | 15 | 13 | 12 | 12 | 13 | 14 | 15 | 19 | 18 | 17 | 16 | 241 |
| **TAMBARAM SANT** | 12 | 13 | 17 | 19 | 16 | 15 | 13 | 12 | 12 | 13 | 14 | 15 | 19 | 18 | 17 | 16 | 241 |
| **CHROMEPET** | 13 | 14 | 18 | 20 | 16 | 15 | 13 | 12 | 12 | 13 | 15 | 17 | 21 | 19 | 17 | 16 | 251 |
| **PALLAVARAM** | 13 | 14 | 19 | 22 | 16 | 15 | 13 | 12 | 12 | 13 | 16 | 18 | 19 | 20 | 17 | 16 | 255 |
| **TIRUSULAM** | 13 | 14 | 19 | 22 | 16 | 15 | 13 | 12 | 12 | 13 | 16 | 19 | 20 | 21 | 17 | 16 | 258 |
| **MEENAMBAKKAM** | 13 | 14 | 19 | 22 | 16 | 15 | 13 | 12 | 12 | 13 | 16 | 19 | 20 | 21 | 17 | 16 | 258 |
| **GUINDY** | 13 | 14 | 19 | 22 | 16 | 15 | 13 | 12 | 12 | 13 | 16 | 19 | 20 | 21 | 17 | 16 | 258 |
| **CIPET** | 13 | 14 | 19 | 22 | 16 | 15 | 13 | 12 | 12 | 13 | 16 | 19 | 20 | 21 | 17 | 16 | 258 |
| **JAFERKHANPET** | 13 | 14 | 19 | 22 | 16 | 15 | 13 | 12 | 12 | 13 | 16 | 19 | 20 | 21 | 17 | 16 | 258 |
| **ASHOKPILLAR** | 13 | 14 | 19 | 22 | 16 | 15 | 13 | 12 | 12 | 13 | 16 | 19 | 20 | 21 | 17 | 16 | 258 |
| **VADAPALANI** | 13 | 14 | 19 | 22 | 16 | 15 | 13 | 12 | 12 | 13 | 16 | 19 | 20 | 21 | 17 | 16 | 258 |
| **CMBT** | 13 | 14 | 19 | 22 | 16 | 15 | 13 | 12 | 12 | 13 | 16 | 19 | 20 | 21 | 17 | 16 | 258 |
| **Requirement** | 173 | 189 | 262 | 302 | 227 | 211 | 179 | 163 | 163 | 179 | 214 | 248 | 285 | 286 | 243 | 227 | 3551 |

**Proof**

This is a time based approach for a realistic transportation approach. The objective of the problem is to schedule the available buses of MTC Chennai for the route from Guduvancheri to CMBT. The distance between the bus points Guduvancheri and CMBT is taken as 40km. There are nearly 16 bus points from starting to the CMBT.

| | **6-7** | **7-8** | **8-9** | **9-10** | **10-11** | **11-12** | **12-1** | **1-2** | **2-3** | **3-4** | **4-5** | **5-6** | **6-7** | **7-8** | **8-9** | **9-10** | **Avail** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **GUDUVANCHERY** | | | | | | | | | | | | | | | | 80 | 80 |
| **URAPAKKAM** | | | | | | | | | | | | | | | | 97 | 97 |
| **VANDALOOR** | | | | | | | | | | | | | | | 95 | 50 | 145 |
| **PERUGULATHOOR** | | | | | | | | | | | | | | 29 | 148 | | 177 |
| **TAMBARAM** | | | | | | | | | | | | | | 241 | | | 241 |
| **TAMBARAM SANT** | | | | | | | | | | | | | 325 | 16 | | | 241 |
| **CHROMEPET** | | | | | | | | | | | | 191 | 60 | | | | 251 |
| **PALLAVARAM** | | | | | | | | | | | 198 | 57 | | | | | 255 |
| **TIRUSULAM** | | | | | | | | | 63 | 179 | 15 | | | | | | 258 |
| **MEENAMBAKKAM** | | | | | | | | 158 | 100 | | | | | | | | 258 |
| **GUINDY** | | | | | | 74 | 179 | 5 | | | | | | | | | 258 |
| **CIPET** | | | | | 121 | 137 | | | | | | | | | | | 258 |
| **JAFERKHANPET** | | | | 152 | 105 | | | | | | | | | | | | 258 |
| **ASHOKPILLAR** | | | 108 | 150 | | | | | | | | | | | | | 258 |
| **VADAPALANI** | | 104 | 154 | | | | | | | | | | | | | | 258 |
| **CMBT** | 173 | 85 | | | | | | | | | | | | | | | 258 |
| **Requirement** | 173 | 189 | 262 | 302 | 227 | 211 | 179 | 163 | 163 | 179 | 214 | 248 | 285 | 286 | 243 | 227 | 3551 |

To the surprise the occupied cells by the North East Method lies in the diagonal portion of the table starting from right to Left. Based on the occupancy of the cells the total number of buses is calculated for each point for a time period of 6AM to 10PM. The total trips required to cover the points is 53042.

**Screen short**

The above problem evaluated by screen short in below.

The result is same, but computation time very very less.

The result and computation time is mentioned in the screen short.

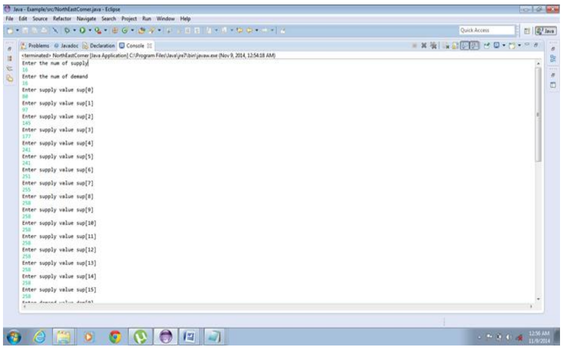

**Figure 1. The Screen Shot of the supply value being entered in JAVA for North East Corner Method for time evaluation - Time Based Problem.**

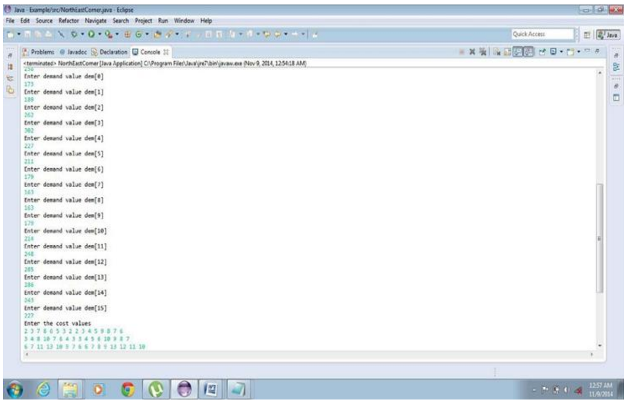

**Figure 2. The Screen Shot of the Demand value being entered in JAVA for North East Corner Method for time evaluation- Time Based Problem.**

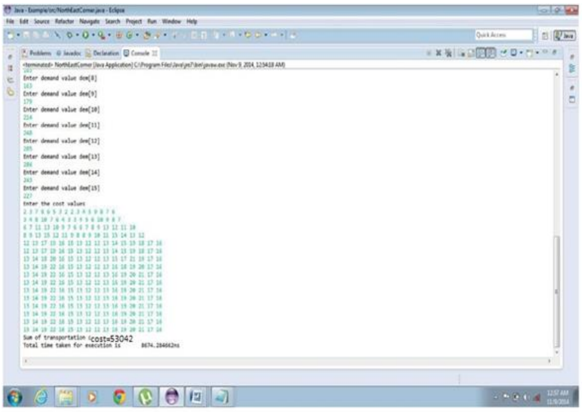

**Figure 3. The Screen Shot of the computational time and cost in Java for North East Corner Method – Time Based Problem.**

**5. Conclusion**

The optimal solution obtained in this present investigation shows much more closeness with initial basic feasible solution obtained by North east corner rule. The comparison of optimal solution have been made with other methods of finding initial solutions and observe that North east corner method give the better initial feasible solutions which are closer to optimal solution. The object oriented programming using Java have been developed. This shows that the computed results tally with the results obtained Java programming. Object oriented program code for said programs is given for better understanding.

**References**

1. Reeb, J.E. and S.A., Leavengood, "Transportation problem: a special case for linear programming problems", EM8779. Corvallis: Oregon State University Extension Service, pp. 1-35, 2002.

2. Charnes, A. and W.W. Cooper, "The stepping stone method of explaining linear programming calculations in transportation problems", Management Science, 1(1): pp. 49-69, 1954.

3. Dantzig, G.B., "Linear Programming and extensions", Princeton, NJ: Princeton University press, 1963.

4. Taha Hamdy A., "Operation Research: An introduction", Prentice-Hall of India, 8th edition. 2006.

5. Reinfeld, N.V and Vogel, W.R., "Mathematical Programming", Englewood Cliffs, New Jersey: prentice-Hall, pp. 59-70, 1958.

6. Nabendu Sen et al., "A study of transportation problem for an essential item of southern part of north eastern region of India as an OR model and use of object oriented programming", International Journal of Computer Science and Network Security, 10(4), pp. 78-86, 2010.

7. Saleem, Z.R. and Imad, Z.R., "Hybrid two-stage algorithm for solving transportation problem", Modern Applied Science, 6(4), pp. 12-22, 2012.

8. R. Palaniyappa and V. Vinoba , " A new type of transportation problem using object oriented model " , International Journal of Mathematical Archive-4(11), 2013, 71-77

9. R. Palaniyappa and V. Vinoba "A Study of Unbalanced Transportation problem and use of object oriented programming" International Research Journal of pure Algebra -4(4),2014, 1-5, ISSN 2248-9037.

10. Dr. V. Vinoba and R. Palaniyappa, "A Study of Unbalanced Transportation problem and use of object oriented programming model (Java)" International research Journal of pure Algebra - 4(6), 2014, 1-4, ISSN 2248 - 9037.

11. Dr. V. Vinoba and R. Palaniyappa, A study on North East corner Method in transportation problem using object oriented programming (C++)" International Journal of mathematics trends and technology – Volume 16, December 2014, ISSN 2231 – 5373.

12. Winston L.W. (2010): Transportation, Alignment and transshipment problem to accompany operation research "Applied and Algorithm ", 4th edition.