A study on North east corner method in Transportation Problem and using of Object Oriented Programming model (C++)

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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 C++ and develop a NEM in C++ Flowchart, Algorithm, program.In this paper submitted in screen short.

Keywords: Transportation problem, LPP, optimal solution, North east corner rule, object oriented programming.

1. 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 find 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 C++ 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. MATHEMATICALFORMULATION 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 ($a_i \geq 0$).

b_j - Amounts to be received at destination j ($b_j \geq 0$).

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

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

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

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

3. NORTH EAST CORNER RULE

Procedure:

North East Corner Method :

- 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.

Example:

Solve the Transportation problem 16x14 by using North East corner Method, M.T.C. Buses in Chennai, Tamilnadu, India run at Guduvanchery to CMDA, find the minimum number of trips.

Demand / Supply	114	M 70C	144 BT	M 170 B	170	170 A	170 K	170 L	170 P	170 T	70	70 G	70T	L18	supply
GUDUVANCHERY	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
URAPAKKAM	0	0	0	0	0	0	2	0	0	0	0	0	0	1	3
VANDALUR	23	0	0	0	0	5	2	2	0	9	0	0	2	1	44
PERUGALANTHUR	23	0	0	0	0	5	2	2	0	9	0	0	2	1	44
TAMBARAM	23	15	2	1	10	5	2	2	1	9	5	1	2	1	79
TAMBARAM SANATPRIUM	23	15	2	1	10	5	2	2	1	9	5	1	1	1	79
CHROMEPET	23	15	2	1	10	5	2	2	1	9	5	1	2	1	79
PALLAVARAM	23	15	2	1	10	5	2	2	1	9	5	1	2	1	79
TIRUSULAM	23	15	2	1	10	5	2	2	1	9	5	1	2	1	79
MEENAMBAKKAM	23	15	2	1	10	5	2	2	1	9	5	1	2	1	79
KATHIPARA	23	15	2	1	10	5	2	2	1	9	5	1	2	1	79
CIPET	23	15	2	1	10	5	2	2	1	9	5	1	2	1	79
JAFERKANPET	0	15	2	1	10	5	2	2	1	9	5	1	2	1	56
ASHOK PILLAR	0	15	2	1	10	5	2	2	1	9	5	1	2	1	56
VADAPALANI	0	15	2	1	10	5	2	2	1	9	5	1	2	1	56
CMDA	23	15	2	1	10	5	2	2	1	9	5	1	2	1	79
DEMAND	253	130	24	12	120	70	32	28	12	126	60	12	28	15	

Proof:-

The given problem balanced Transportation problem. Because Demand = supply. There exists a feasible solution. By using north east corner method in initial basic feasible solution.

Demand Supply	114	M 70C	144 BT	M 170 B	170	170 A	170 K	170 L	170 P	170 T	70	70 G	70T	L18	supply
GUDUVANCHERY	0	0	0	0	0	0	2	0	0	0	0	0	0	0 (2)	2
URAPAKKAM	0	0	0	0	0	0	2	0	0	0	0	0	0	1(3)	3
VANDALUR	23	0	0	0	0	5	2	2	0	9	0	(6) 0	2 (28)	1 (10)	44
PERUGALANTHUR	23	0	0	0	0	5	2	2	0	9	0 (38)	0 (6)	2	1	44
TAMBARAM	23	15	2	1	10	5	2	2	1	(57) 9	(22) 5	1	2	1	79
TAMBARAM SANATPRIUM	23	15	2	1	10	5	2	2	1 (10)	(69) 9	5	1	1	1	79
CHROMEPET	23	15	2	1	10	5 (17)	(32) 2	(28) 2	(2)1	9	5	1	2	1	79
PALLAVARAM	23	15	2	1	(26) 10	5 (53)	2	2	1	9	5	1	2	1	79
TIRUSULAM	23	15	2	1	(79) 10	5	2	2	1	9	5	1	2	1	79
MEENAMBAKKAM	23	15 (28)	(24) 2	(12) 1	(15) 10	5	2	2	1	9	5	1	2	1	79
KATHIPARA	23	(79) 15	2	1	10	5	2	2	1	9	5	1	2	1	79
CIPET	23 (6)	15 (73)	2	1	10	5	2	2	1	9	5	1	2	1	79
JAFERKANPET	0 (79)	15	2	1	10	5	2	2	1	9	5	1	2	1	56
ASHOK PILLAR	0 (56)	15	2	1	10	5	2	2	1	9	5	1	2	1	56
VADAPALANI	0 (56)	15	2	1	10	5	2	2	1	9	5	1	2	1	56
CMDA	23 (79)	15	2	1	10	5	2	2	1	9	5	1	2	1	79
DEMAND	253	130	24	12	120	70	32	28	12	126	60	12	28	15	972

The initial basic feasible solution is given as

Min z = 0x2+1x3+1x10+2x28+6x0+0x6+0x38

+9x57+5x22+10x1+69x9+5x17+

32x2+28x2+2x1+26x10+5x53

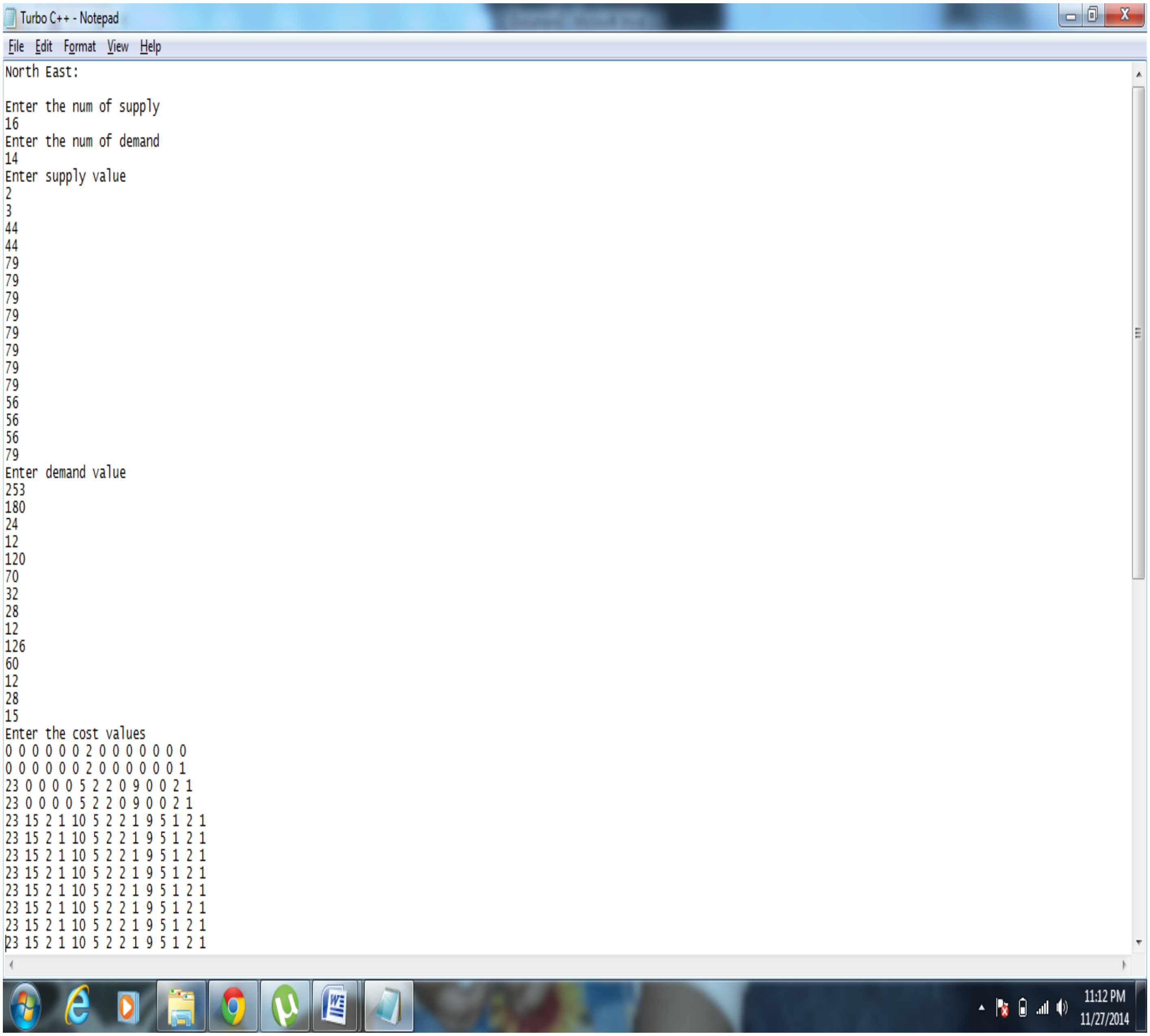
+79x10+2x24+1x12+15x10+15x28

79x15+23x6+15x73+

0x56+56x0+56x0+23x79

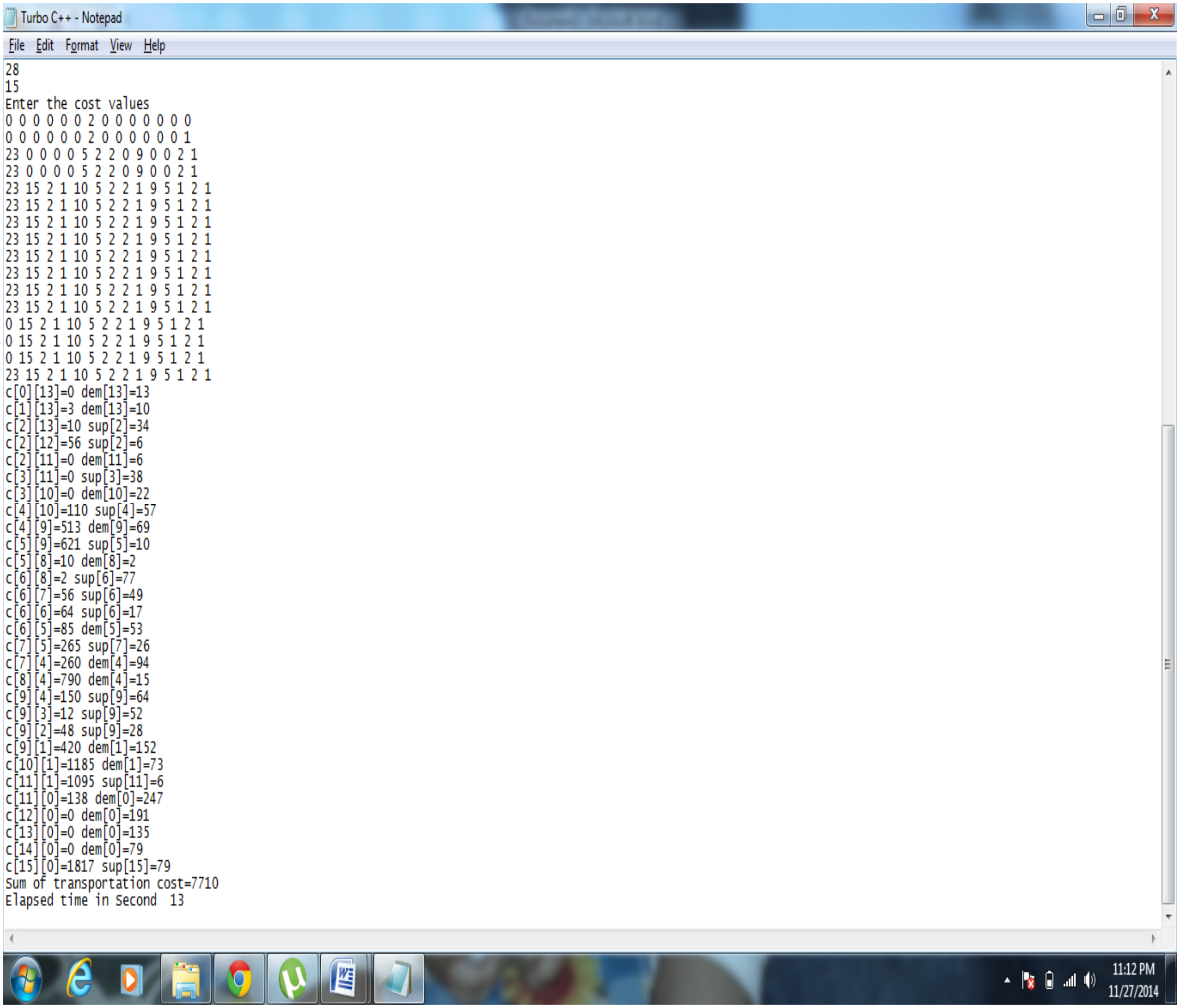
= 7710 trips.

Output :



```
North East:

Enter the num of supply
16
Enter the num of demand
14
Enter supply value
2
3
44
44
79
79
79
79
79
79
79
79
56
56
56
79
Enter demand value
253
180
24
12
120
70
32
28
12
126
60
12
28
15
Enter the cost values
0 0 0 0 0 0 2 0 0 0 0 0 0 0
0 0 0 0 0 0 2 0 0 0 0 0 0 1
23 0 0 0 0 5 2 2 0 9 0 0 2 1
23 0 0 0 0 5 2 2 0 9 0 0 2 1
23 15 2 1 10 5 2 2 1 9 5 1 2 1
23 15 2 1 10 5 2 2 1 9 5 1 2 1
23 15 2 1 10 5 2 2 1 9 5 1 2 1
23 15 2 1 10 5 2 2 1 9 5 1 2 1
23 15 2 1 10 5 2 2 1 9 5 1 2 1
23 15 2 1 10 5 2 2 1 9 5 1 2 1
23 15 2 1 10 5 2 2 1 9 5 1 2 1
23 15 2 1 10 5 2 2 1 9 5 1 2 1
```




```
28
15
Enter the cost values
0 0 0 0 0 0 2 0 0 0 0 0 0 0
0 0 0 0 0 0 2 0 0 0 0 0 0 1
23 0 0 0 0 5 2 2 0 9 0 0 2 1
23 0 0 0 0 5 2 2 0 9 0 0 2 1
23 15 2 1 10 5 2 2 1 9 5 1 2 1
23 15 2 1 10 5 2 2 1 9 5 1 2 1
23 15 2 1 10 5 2 2 1 9 5 1 2 1
23 15 2 1 10 5 2 2 1 9 5 1 2 1
23 15 2 1 10 5 2 2 1 9 5 1 2 1
23 15 2 1 10 5 2 2 1 9 5 1 2 1
23 15 2 1 10 5 2 2 1 9 5 1 2 1
23 15 2 1 10 5 2 2 1 9 5 1 2 1
0 15 2 1 10 5 2 2 1 9 5 1 2 1
0 15 2 1 10 5 2 2 1 9 5 1 2 1
0 15 2 1 10 5 2 2 1 9 5 1 2 1
23 15 2 1 10 5 2 2 1 9 5 1 2 1
c[0][13]=0 dem[13]=13
c[1][13]=3 dem[13]=10
c[2][13]=10 sup[2]=34
c[2][12]=56 sup[2]=6
c[2][11]=0 dem[11]=6
c[3][11]=0 sup[3]=38
c[3][10]=0 dem[10]=22
c[4][10]=110 sup[4]=57
c[4][9]=513 dem[9]=69
c[5][9]=621 sup[5]=10
c[5][8]=10 dem[8]=2
c[6][8]=2 sup[6]=77
c[6][7]=56 sup[6]=49
c[6][6]=64 sup[6]=17
c[6][5]=85 dem[5]=53
c[7][5]=265 sup[7]=26
c[7][4]=260 dem[4]=94
c[8][4]=790 dem[4]=15
c[9][4]=150 sup[9]=64
c[9][3]=12 sup[9]=52
c[9][2]=48 sup[9]=28
c[9][1]=420 dem[1]=152
c[10][1]=1185 dem[1]=73
c[11][1]=1095 sup[11]=6
c[11][0]=138 dem[0]=247
c[12][0]=0 dem[0]=191
c[13][0]=0 dem[0]=135
c[14][0]=0 dem[0]=79
c[15][0]=1817 sup[15]=79
Sum of transportation cost=7710
Elapsed time in Second  13
```

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 c++ has been developed. This shows that the computed results tally with the results obtained c++ programming. **.** Object oriented program code for said programs is given for better understanding.

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