Transportation Problem

Finding initial feasible solution

Sandhya Yadav
Radheshyam Jangid
Priyanshu Verma
Sankalp Gaur

Indian Institute Of Information Technology Vadodara

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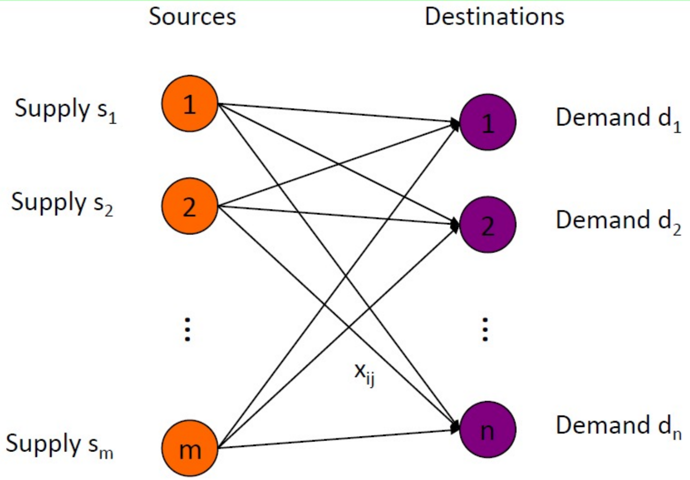
Outline

Introduction

- The transportation problem is a special type of LPP where the objective is to minimize the cost of distributing a product from a number of sources to a number of destinations.
- Because of its special structure the usual simplex method is not suitable for solving transportation problems. These problems require special methods to solve.

Problem Statement



Problem Statement

- **Given:**
  Transportation cost of supply
- **Objective**
  To minimize the cost or the time of transportation or the cost of distributing a product from a number of sources to a number of destinations.

Motivation

- To find out optimum transportation schedule keeping in mind that the cost of transportation should remain minimum.

Methodology

- Methods To Find Basic Physical Soluion:

Method-1

North West Corner Method

Method-2

Least Cost Method

Method-3

Vogels Approximation

North West Corner Method

Step1: Select the north-west cell of the transportation matrix and allocate the maximum possible value to X11.
Step2: If allocation made is equal to supply available at the first source (a1 in first row), move to cell (2,1).
If allocation made is equal to demand of the first destination (b1 in first column), move to cell (1,2).
If a1=b1 , then allocate X11= a1 and move to cell (2,2).
Step3: Continue the process until an allocation is made in the south-east corner cell of the transportation table.
[1]

[1] Operations Research, HAMDY A. Taha, Eight Edition

Least Cost Method

Step1: Select the cell having the lowest unit cost in the table and allocate the minimum of supply or demand values in that cell.
Step2: Then eliminate the row or column in which supply or demand is exhausted.
Step3: Repeat the process with the next lowest unit cost and continue until all available supply and demands are satisfied. [2]

[2] Operations Research, HAMDY A. Taha, Eight Edition

Vogels Approximation

Step1: Calculate penalty for each row and column by taking the difference between the two smallest unit costs.
Step2: Select the row or column with the highest penalty and select the minimum unit cost of that row or column. Allocate the minimum of supply or demand values in that cell.

Vogels Approximation

Step3: Adjust the supply and demand. Eliminate the satisfied row or column. If a row and column are satisfied simultaneously, eliminated either one and assigned zero to other (which would not be considered in future).
Step4: Repeat the process until all the supply sources and demand destinations are satisfied. [3]

[3] Operations Research, HAMDY A. Taha, Eight Edition

North West Corner Method

Northwest corner cell method

Station / Garage	S_1	S_2	S_3	S_4	Number of buses in garage
G_1	20 (2)	11	15	13	**2**
G_2	17 (1)	14 (3)	12 (2)	13	**6**
G_3	15	12	18 (2)	18 (5)	**7**
necessary number of buses at station	**3**	**3**	**4**	**5**	**15**

North West Corner Method

- After applying North West Corner Method we get these costs:

$x_{11} = 5, x_{21} = 10, x_{22} = 5, x_{23} = 15, x_{33} = 5, x_{34} = 10$
Therefore the basic feasible solution is
Z(min cost)=5(20)+10(17)+5(14)+15(12)+5(18)+10(18)=790

Least-cost-method

To / Source	D	E	F	Supply
A	5	8 50	4	50
B	6	6 5	3 35	40
C	3 20	9 40	6	60
Demand	20	95	35	150

Least-cost-method

- After applying Least Cost Method we get these costs:

$x_{12} = 8, x_{22} = 6, x_{23} = 3, x_{31} = 3, x_{32} = 9$
The Basic feasible solution is
Z(min cost)=8(50)+6(5)+3(35)+3(20)+9(40)=955

Vogels Approximation

TO / FROM	D1	D2	D3	D4	CAP.	PANALTY					
S1	~~21~~	~~16~~	~~26~~	13 11	~~11~~ 0	3	—	—	—	—	—
S2	6 17	18 3	~~14~~	23 4	~~13~~ ~~9~~ ~~3~~ 0	3	3	3	4	18	18
S3	~~32~~	27 7	18 12	~~41~~	~~19~~ ~~7~~ 0	9	9	9	9	27	—
REQ.	~~6~~ 0	~~10~~ ~~3~~ 0	~~12~~ 0	~~15~~ ~~4~~ 0	43						
PANALTY	4	2	4	10							
	15	9	4	18							
	15	9	4	—							
	—	9	4	—							
	—	9	—	—							
	—	9	—	—							

Vogels Approximation

- After applying Least Cost Method we get these costs:

$x_{14} = 13, x_{21} = 17, x_{22} = 18, x_{24} = 23, x_{32} = 27, x_{33} = 18$
The Basic feasible solution is
Z(min cost)=13(11)+17(6)+18(3)+23(4)+27(7)+18(12)=796

Conclusion

- The **Transportation Problem** has an interpretation of minimizing the cost for the flow of goods through a supply network
- Among these three cost minimization methods we have found that **Vogel's Approximation method** is the best Method for finding Basic Feasible solution for transportation Problem.