Operation Research: Mini Project

Transportation Problem:

If there are more than one centres, called origins from where goods need to be shipped to more than one places called “destinations” and the cost of shipping from each of the origins to each of the destinations being different and known, the problem is to ships the goods from various origins to different destinations in a such manner that the cost of shipping or transportation is minimum.

The transportation problem is to transport various amounts of single homogenous commodity, that are initially stored at various origins to different destinations in such a way that the total transportation cost is minimum.

There are 3 method’s in transportation problem:

1. Northwest Corner Method
2. Least Cost Cell Method
3. Vogel’s Approximation Method

Solving the below problem using transportation method.

Qno. The demand pattern for a product at for consumer centers, A, B, C and D are 5000 units, 7000 units, 4000 units and 2000 units respectively. The supply for these centers is from three factories X, Y and Z. The capacities for the factories are 3000 units, 6000 units and 9000 units respectively. The unit transportation cost in rupees from a factory to consumer center is given below in the matrix. Develop an optimal transportation schedule and find the
optimal cost.

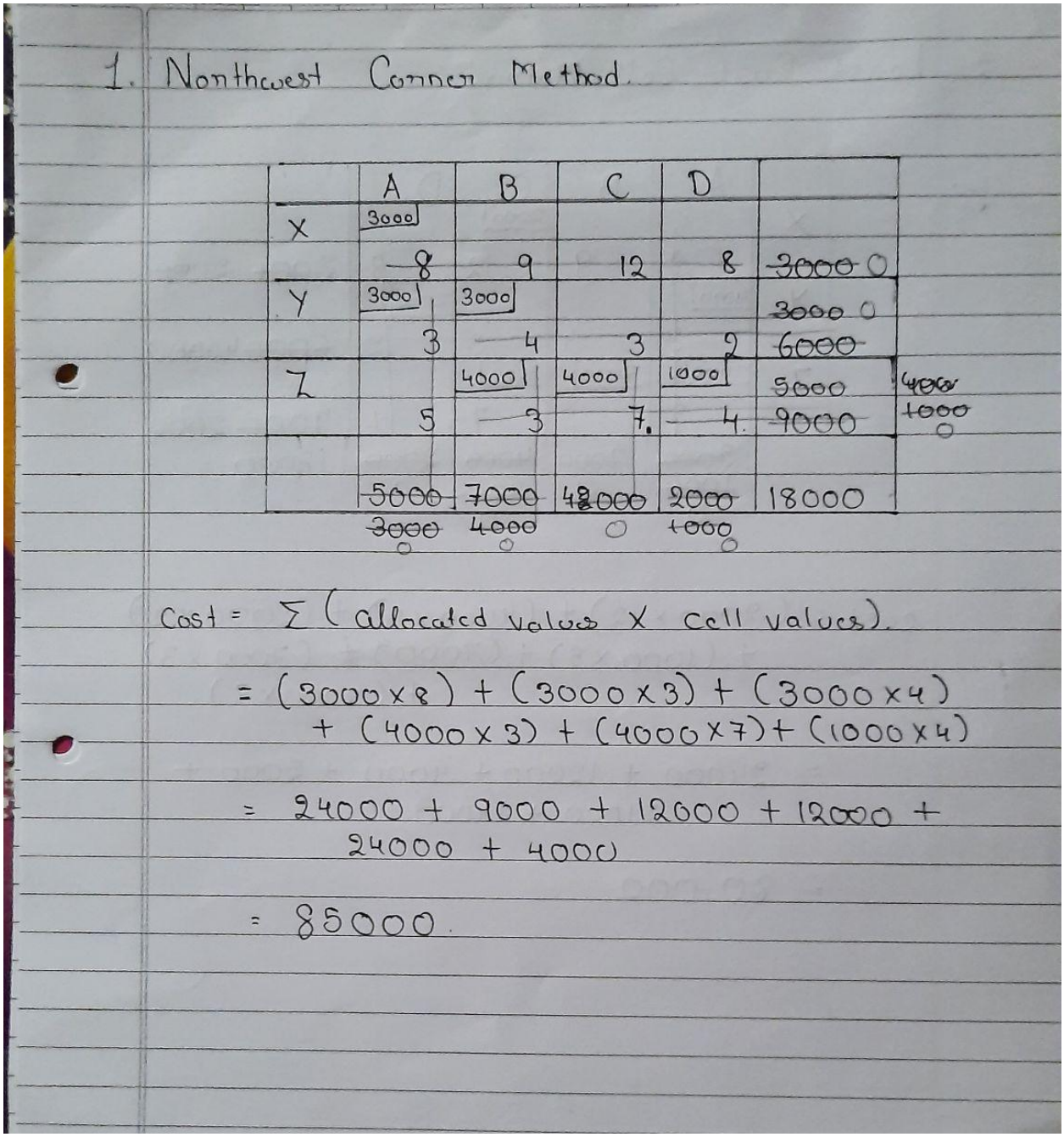
From.		to		
	A	B	C	D
X	8	9	12	8
Y	3	4	3	2
Z	5	3	7	4

Solution:

Transportation schedule

From.		to			
	A	B	C	D	
X	8	9	12	8	3000
Y	3	4	3	2	6000
Z	5	3	7	4	9000
	5000	7000	4000	2000	18000

1. Solving using Northwest Corner Method



1. Northwest Corner Method.

	A	B	C	D	
X	3000				
	8	9	12	8	~~3000~~ 0
Y	3000	3000			~~3000~~ 0
	3	4	3	2	~~6000~~
Z		4000	4000	1000	5000
	5	3	7.	4.	~~9000~~
	~~5000~~	~~7000~~	~~48000~~	~~2000~~	18000
	~~3000~~ 0	4000 0	0	1000 0	

~~4000~~ 1000 0

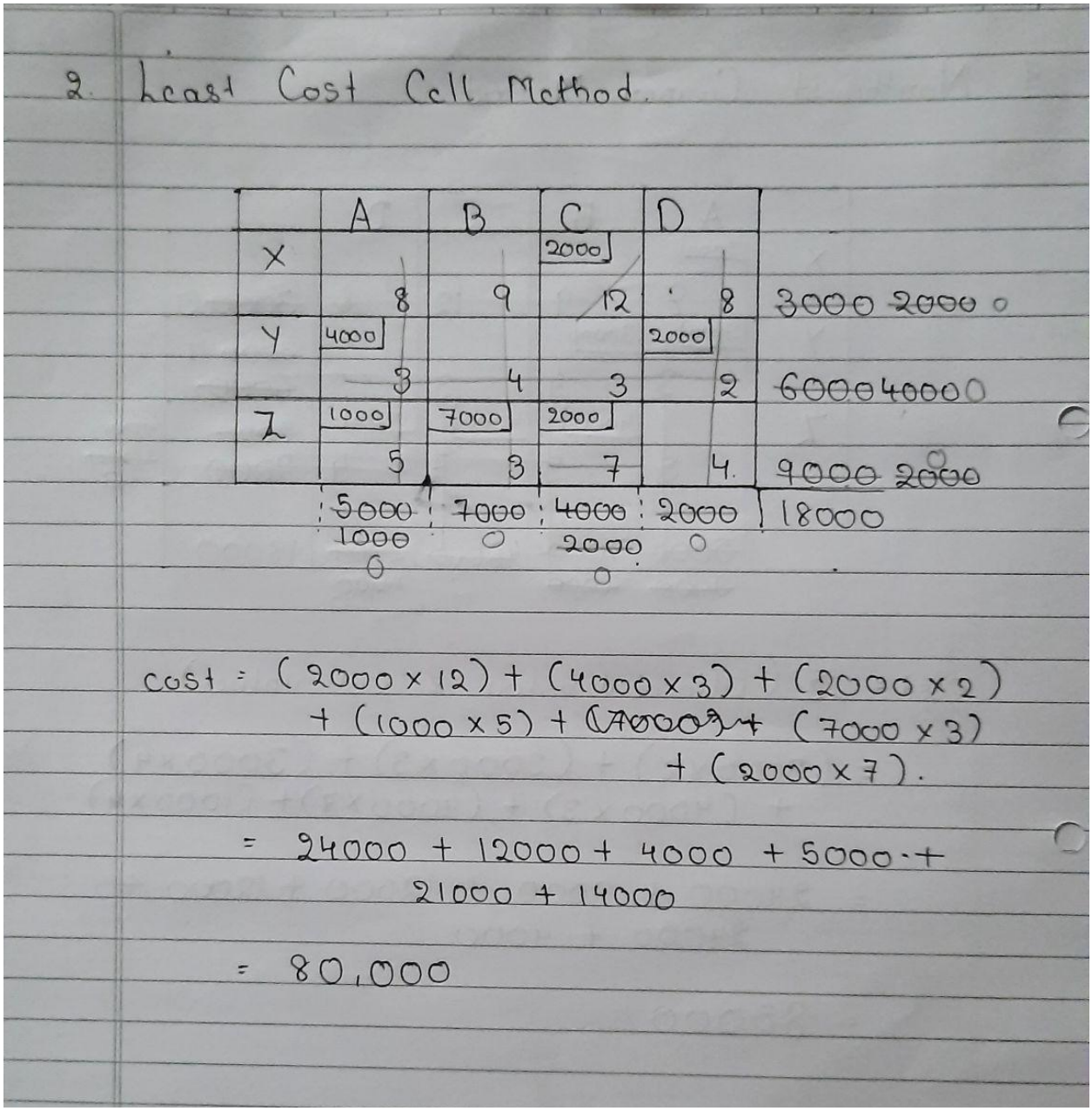
Cost = Σ (allocated values × cell values).

= (3000 × 8) + (3000 × 3) + (3000 × 4) + (4000 × 3) + (4000 × 7) + (1000 × 4)

= 24000 + 9000 + 12000 + 12000 + 24000 + 4000

= 85000.

2. Solving usind Least Cost Cell Method



2. Least Cost Cell Method.

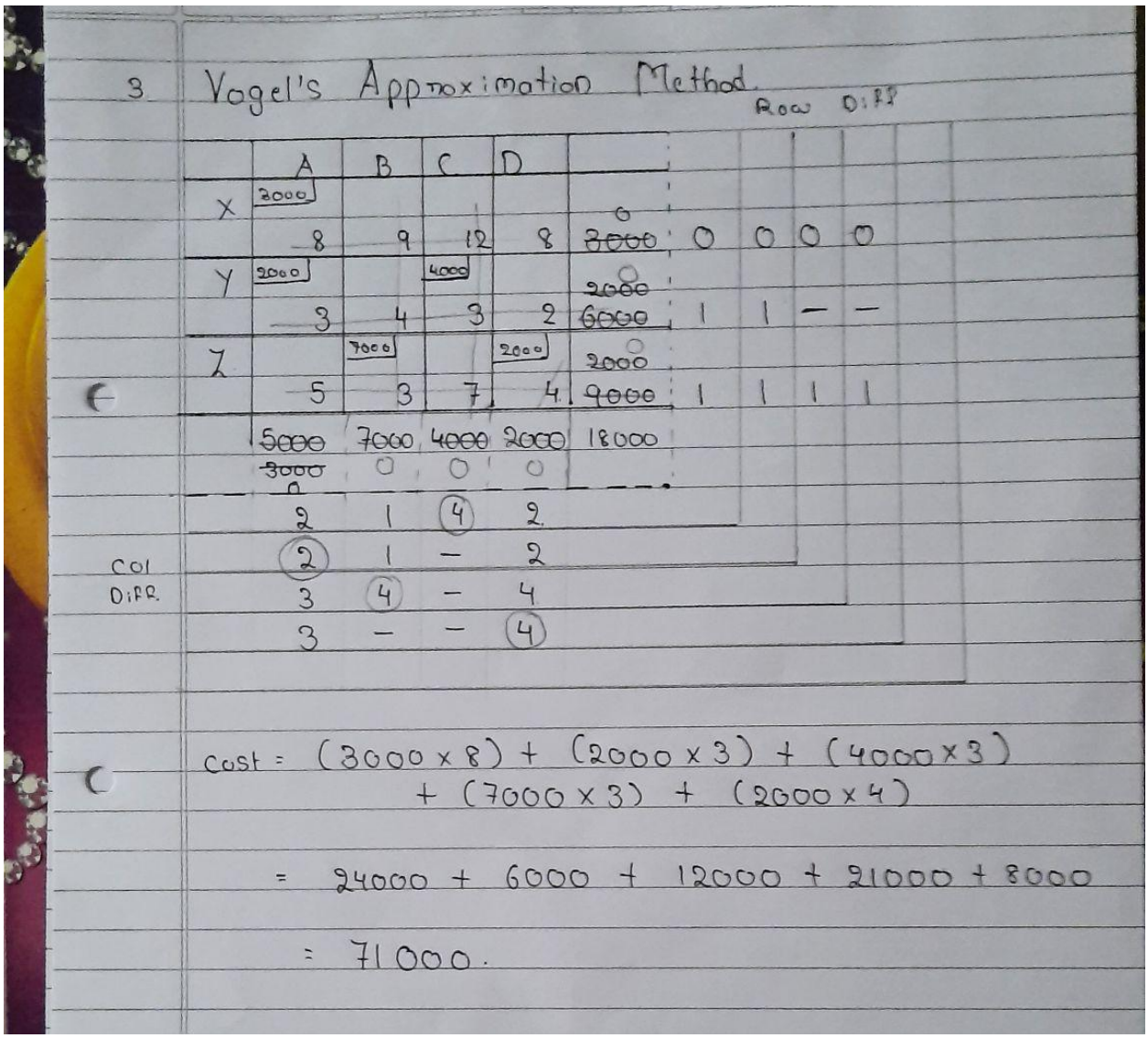
	A	B	C	D	
X			2000		
	8	9	12	8	3000 2000
Y	4000			2000	
	3	4	3	2	6000 4000
Z	1000	7000	2000		
	5	3	7	4	9000 2000
	5000 1000	7000	4000 2000	2000	18000

cost = (2000 × 12) + (4000 × 3) + (2000 × 2) + (1000 × 5) + (7000 × 3) + (2000 × 7).

= 24000 + 12000 + 4000 + 5000 + 21000 + 14000

= 80,000

3. Solvind using Vogel's Approximation Method



- Cost using Northwest corner method: 85000
- Cost using Least cost cell method: 80000
- Cost using Vogel's approximation method: 71000

Therefore, the optimal cost is 71000.

Implementation of above problem in R language.

```
library(lpSolve)

costs <- matrix(c(8,9,12,8,
                  3,4,3,2,
                  5,3,7,4), nrow = 3, byrow = TRUE)

colnames(costs) <- c("A","B","C","D")
rownames(costs) <- c("X","Y","Z")

row.signs <- rep("<=",3)
row.rhs <- c(3000, 6000, 9000)

col.signs <- rep(">=",4)
col.rhs <- c(5000, 7000, 4000, 2000)

TotalCost <- lp.transport(costs,"min",row.signs,row.rhs,col.signs,col.rhs)

lp.transport(costs,"min",row.signs,row.rhs,col.signs,col.rhs)$solution
print(TotalCost)
```

Output:

```
> lp.transport(costs,"min",row.signs,row.rhs,col.signs,col.rhs)$solution
     [,1] [,2] [,3] [,4]
[1,] 3000    0    0    0
[2,]    0    0 4000 2000
[3,] 2000 7000    0    0
> print(TotalCost)
Success: the objective function is 71000
>
```