Stepping stone method

Example Problem: Given IBFS

- Condition for applying any optimality test:

→Number of occupied cells is exactly equal to m+n-1, where ‘m’ is the number of rows, while ‘n’ is equal to the number of columns

→ Unoccupied cells are AF, BD, BF, CD

From \ TO	D	E	F	Supply
A	6 (20)	4 (30)	1	50
B	3	8 (40)	7	40
C	4	4 (25)	2 (35)	60
Demand	20	95	35	150

Optimality: m+n-1 = 3+3-1 = 5

Total Cost: 20*6 +30*4 + 40*8 +25*4 +35*2 = 730

Evaluating the unoccupied cells or empty cells

- Closed path is created for empty cell which starts from the unoccupied cell and returns to the same unoccupied cell;
- For “Closed loop”, cells are selected in a sequence such that one cell is unoccupied, and all other cells are occupied;
- A pair of consecutive used cells lies either in the same row or the same column;
- The first and last cells in the closed loop lies either in the same row or column;
- Only horizontal and vertical movement is allowed;
- Once the loop is created, assign “+” or “–“ sign alternatively on each corner cell of the loop, beginning with the “+” sign for the unoccupied cell;

Net evaluation for unoccupied cells

- Calculate net change in TC i.e., d_{ij} for each unoccupied cell

Empty Cells: AF, BD, BF, CD

From \ To	D	E	F	Supply
A	-6 (20)	+4 (30)	1	50
B	+3	-8 (40)	7	40
C	4	4 (25)	2 (35)	60
Demand	20	95	35	150

Cell	Closed Loop	Net Cost Change
BD	BD-AD+AE-BE	3-6+4-8 = -7
AF	AF-CF+CE-AE	1-2+4-4 = -1
BF	BF-CF+CE-BE	7-2+4-8 = 1
CD	CD-AD+AE-CE	4-6+4-4 = -2

+2

Optimality test : Stop if all $d_{ij} \geq 0$

- If any d_{ij} is negative then TC can be reduce by taking that cell into the basis;
- Cell BD has negative d_{ij};
- Hence, TC can be reduced by taking this cell into the basis by forming a loop with + and – signs alternatively;

- Consider the cells with a negative sign. Compare the allocated value (i.e. 20 and 40 in this case) and select the minimum (i.e. select 20 in this case)
- Now subtract 20 from the cells with a minus sign and add 20 to the cells with a plus sign
- Draw a new iteration
- Cell AD goes away from the basis and cell BD becomes the new basic cell

Revise the allocations and calculate revised TC;

The most favored cell is BD, since it has the highest opportunity cost i.e. 7

From \ To	D	E	F	Supply
A	-6	+4 (50)	1	50
B	+3 (20)	-8 (20)	7	40
C	4	4 (25)	2 (35)	60
Demand	20	95	35	150

Total Cost: 20*3 +50*4 + 20*8 + 25*4 +35*2 = 590

Initial solution and initial TC

From \ TO	D	E	F	Supply
A	6 (20)	4 (30)	1	50
B	3	8 (40)	7	40
C	4	4 (25)	2 (35)	60
Demand	20	95	35	150

Optimality: m+n-1 = 3+3-1 = 5

Total Cost: 20*6 +30*4 + 40*8 +25*4 +35*2 = 730

Revised solution and revised TC

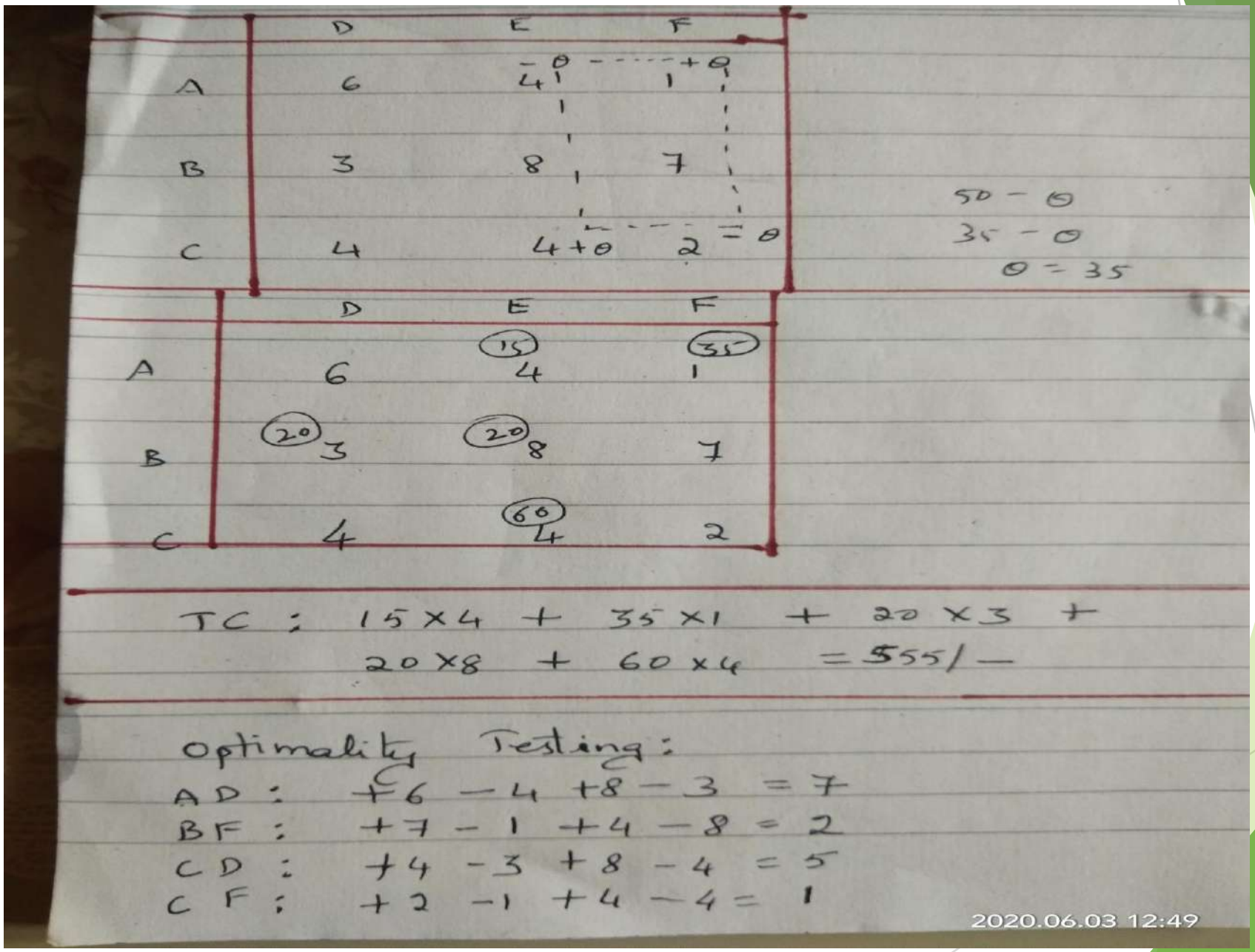
The most favored cell is BD, since it has the highest opportunity cost i.e. 7

From \ To	D	E	F	Supply
A	-6	+4 (50)	1	50
B	+3 (20)	-8 (20)	7	40
C	4	4 (25)	2 (35)	60
Demand	20	95	35	150

Total Cost: 20*3 +50*4 + 20*8 + 25*4 +35*2 = 590

Evaluate the unoccupied cells and test for optimality

- AD : + 6 - 4 + 8 – 3 = 7
- AF : + 1 – 2 + 4 – 4 = -1
- BF : + 7 – 2 + 4 – 8 = 1
- CD : + 4 – 3 + 8 – 4 = 5
- Taking cell AF into the basis revise the allocations; calculate revised TC;


D E F
A 6 4 1
B 3 8 7
C 4 4+θ 2 = θ
−θ +θ
50 − θ
35 − θ
θ = 35
D E F
A 6 4 1
B 3 8 7
C 4 4 2
15
35
20
20
60
TC : 15 X 4 + 35 X 1 + 20 X 3 +
20 X 8 + 60 X 4 = 555/−
Optimality Testing :
AD : +6 −4 +8 −3 = 7
BF : +7 −1 +4 −8 = 2
CD : +4 −3 +8 −4 = 5
CF : +2 −1 +4 −4 = 1
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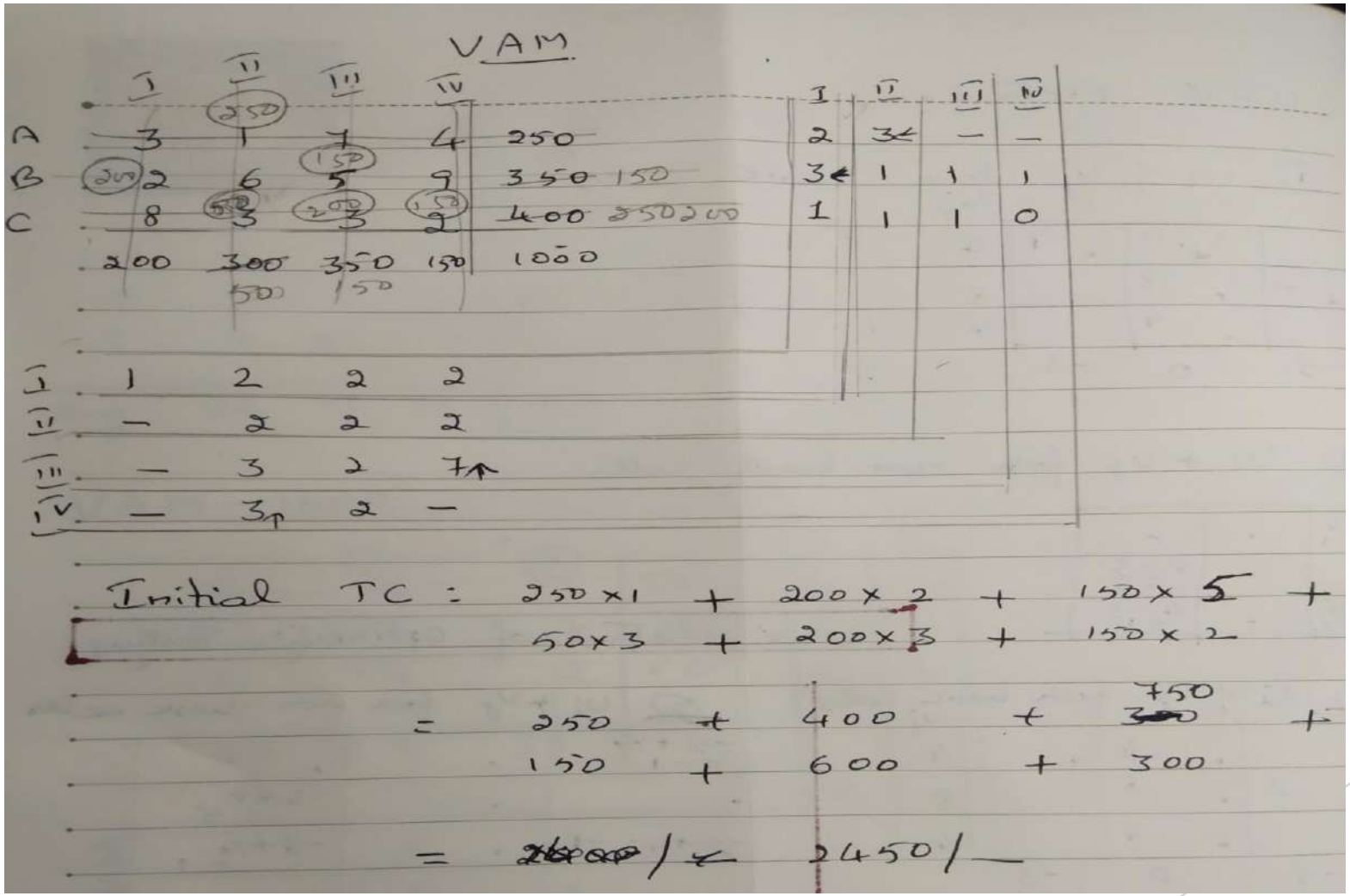
Revised solution

- Revised TC is 555 which is less than the previous TC of 590;
- Optimality rule : all ($d_{ij} \geq 0$); hence, this is the optimal solution;

Problem 2:


VAM
Initial TC : 250 x 1 + 200 x 2 + 150 x 5 +
50 x 3 + 200 x 3 + 150 x 2
= 250 + 400 + 750 +
150 + 600 + 300
= 2450/-

Optimality test