Modified Distribution Method

C \ D		Distributors 70	90	45	50
Factories	100	70 [7]	30 [2]	[4]	[5]
	75	[3]	60 [1]	15 [5]	[2]
	80	[6]	[9]	30 [7]	50 [4]

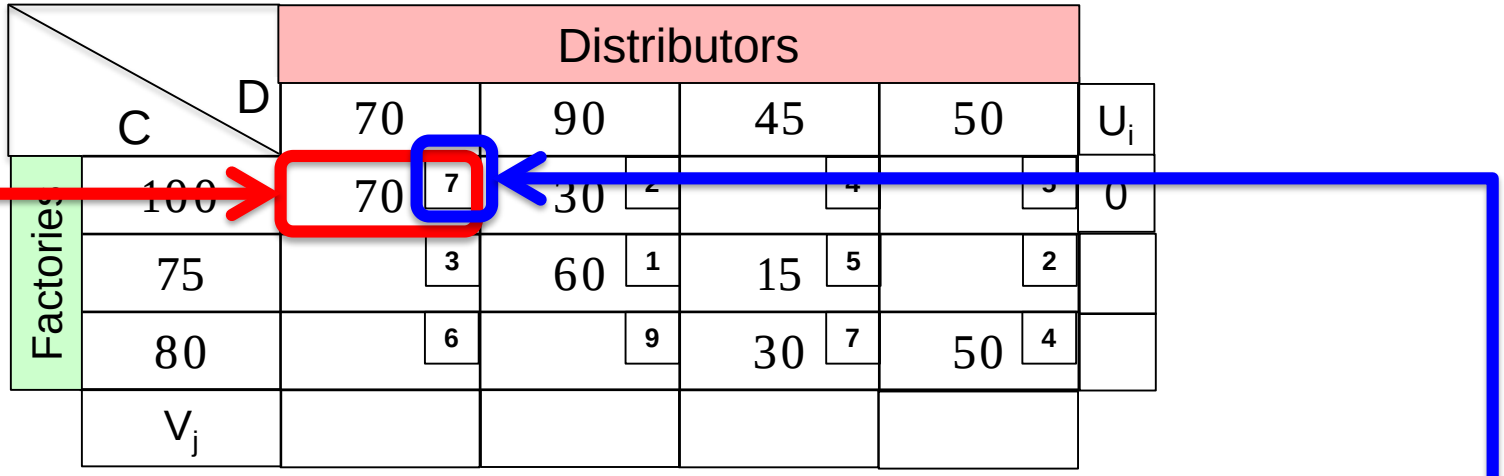
Step 1: Make an initial allocation with the North-West corner rule.

Modified Distribution Method

C \ D		Distributors 70	90	45	50	U_i
Factories	100	70 [7]	30 [2]	[4]	[5]	0
	75	[3]	60 [1]	15 [5]	[2]	
	80	[6]	[9]	30 [7]	50 [4]	
	V_j					

Step 1: Make an initial allocation with the North-West corner rule.
Step 2: Introduce the variables U_i, and V_j. Set U_1 to 0

Modified Distribution Method



Step 1: Make an initial allocation with the North-West corner rule.
Step 2: Introduce the variables U_i, and V_j. Set U_1 to 0
Step 3: If X>0; $C_{ij} = U_i + V_j$

X>0 means that you have assigned capacity to a cell

C_{ij} : The cost for moving capacity from V_j to U_i

Modified Distribution Method

C \ D	Distributors 70	90	45	50	U_i
Factories 100	70 (7)	30 (2)	(4)	(5)	0
75	(3)	60 (1)	15 (5)	(2)	
80	(6)	(9)	30 (7)	50 (4)	
V_j	7				

Step 1: Make an initial allocation with the North-West corner rule.
Step 2: Introduce the variables U_i, and V_j. Set U_1 to 0
Step 3: If X>0; $C_{ij} = U_i + V_j$

Since we set U1 = 0 and C1,1 = 7; then V1 has to be 7

Modified Distribution Method

C \ D		Distributors 70	90	45	50	U_i
Factories	100	70 (7)	30 (2)	(4)	(5)	0
	75	(3)	60 (1)	15 (5)	(2)	
	80	(6)	(9)	30 (7)	50 (4)	
	V_j	7	2			

Step 1: Make an initial allocation with the North-West corner rule.
Step 2: Introduce the variables U_i, and V_j. Set U_1 to 0
Step 3: If X>0; $C_{ij} = U_i + V_j$

Since we set U1 = 0 and C1,2 = 2; then V2 has to be 2

Modified Distribution Method

C \ D	Distributors 70	90	45	50	U_i
Factories 100	70 (7)	30 (2)	(4)	(5)	0
75	(3)	60 (1)	15 (5)	(2)	-1
80	(6)	(9)	30 (7)	50 (4)	
V_j	7	2			

Step 1: Make an initial allocation with the North-West corner rule.
Step 2: Introduce the variables U_i, and V_j. Set U_1 to 0
Step 3: If X>0; $C_{ij} = U_i + V_j$

Since V2 = 2 and C2,2 = 1; then U2 has to be -1

Modified Distribution Method

	C \ D	Distributors 70	90	45	50	U_i
Factories	100	70 [7]	30 [2]	[4]	[5]	0
	75	[3]	60 [1]	15 [5]	[2]	-1
	80	[6]	[9]	30 [7]	50 [4]	
	V_j	7	2	6		

Step 1: Make an initial allocation with the North-West corner rule.
Step 2: Introduce the variables U_i, and V_j. Set U_1 to 0
Step 3: If X>0; $C_{ij} = U_i + V_j$

Since U2 = -1 and C2,3 = 5; then V3 has to be 6

Modified Distribution Method

C \ D		Distributors 70	90	45	50	U_i
Factories	100	70 [7]	30 [2]	[4]	[5]	0
	75	[3]	60 [1]	15 [5]	[2]	-1
	80	[6]	[9]	30 [7]	50 [4]	1
	V_j	7	2	6		

Step 1: Make an initial allocation with the North-West corner rule.
Step 2: Introduce the variables U_i, and V_j. Set U_1 to 0
Step 3: If X>0; $C_{ij} = U_i + V_j$

Since V3 = 6 and C3,3 = 7; then U3 has to be 1

Modified Distribution Method

	C \ D	Distributors 70	90	45	50	U_i
Factories	100	70 [7]	30 [2]	[4]	[5]	0
	75	[3]	60 [1]	15 [5]	[2]	-1
	80	[6]	[9]	30 [7]	50 [4]	1
	V_j	7	2	6	3	

Step 1: Make an initial allocation with the North-West corner rule.
Step 2: Introduce the variables U_i, and V_j. Set U_1 to 0
Step 3: If X>0; $C_{ij} = U_i + V_j$

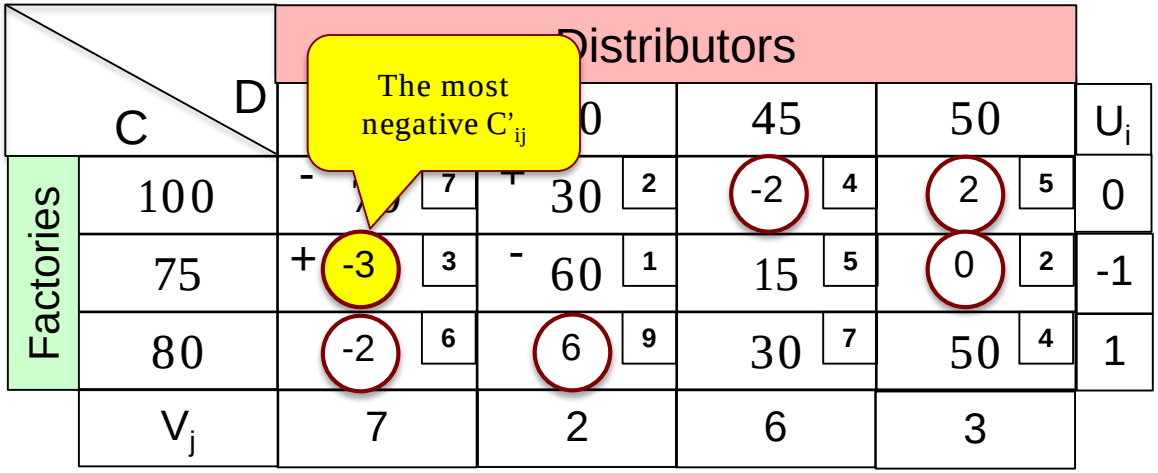
Since U3 = 1 and C3,4 = 4; then V4 has to be 3

Modified Distribution Method

C \ D		Distributors 70	90	45	50	U_i
Factories	100	70 [7]	30 [2]	-2 [4]	2 [5]	0
	75	-3 [3]	60 [1]	15 [5]	0 [2]	-1
	80	-2 [6]	6 [9]	30 [7]	50 [4]	1
	V_j	7	2	6	3	

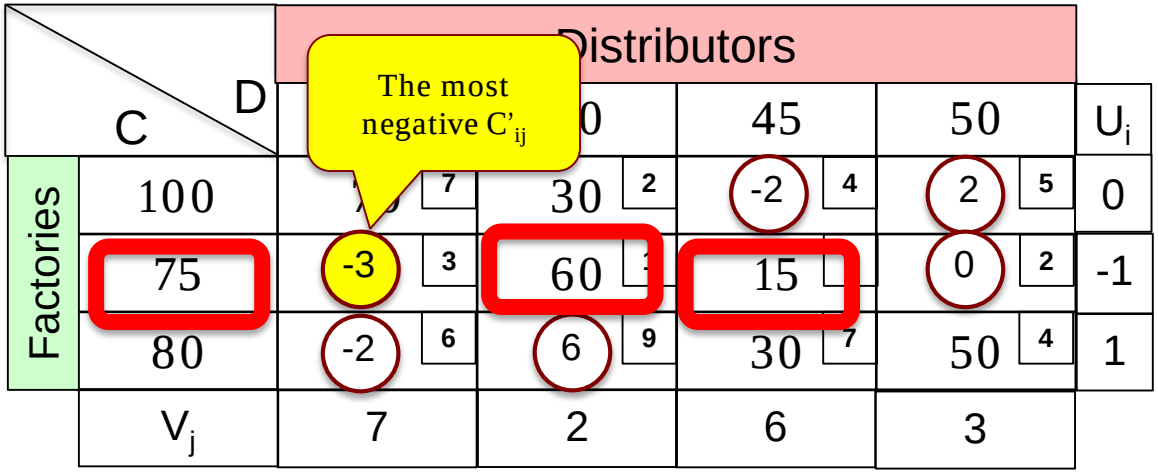
Step 1: Make an initial allocation with the North-West corner rule.
Step 2: Introduce the variables U_i, and V_j. Set U_1 to 0
Step 3: If X>0; $C_{ij} = U_i + V_j$
Step 4: Calculate the shadow cost. If X = 0, then $C'_{ij} = C_{ij} – U_i - V_j$

Modified Distribution Method



Step 5: Transfer the largest quantity possible to the cell that has the most negative C'_{ij} while creating a loop that satisfies the demand and capacity of each column and row. Except for the empty cell with a negative C'_{ij} the cells in the loop should contain quantities.

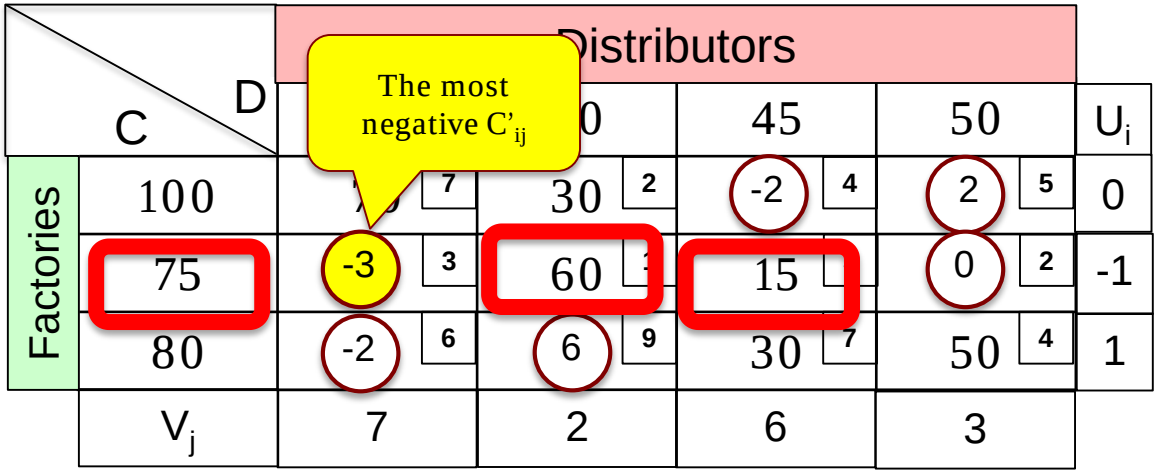
Modified Distribution Method



Step 5: Transfer the largest quantity possible to the cell that has the most negative C'_{ij} while creating a loop that satisfies the demand and capacity of each column and row. Except for the empty cell with a negative C'_{ij} the cells in the loop should contain quantities.

As seen above, the factory's capacity of 75 is distributed to distributor 2 (60) and distributor 3 (15). So we have to re-distribute as much capacity as possible to distributor 3 where we have the negative C'_{ij}.

Modified Distribution Method



Step 5: Transfer the largest quantity possible to the cell that has the most negative C'_{ij} while creating a loop that satisfies the demand and capacity of each column and row. Except for the empty cell with a negative C'_{ij} the cells in the loop should contain quantities.

So, we can re-distribute capacity from either distributor2 (60) or distributor 3 (15). But we then have to balance the matrix by re-assigning capacity between demands in the two other rows.

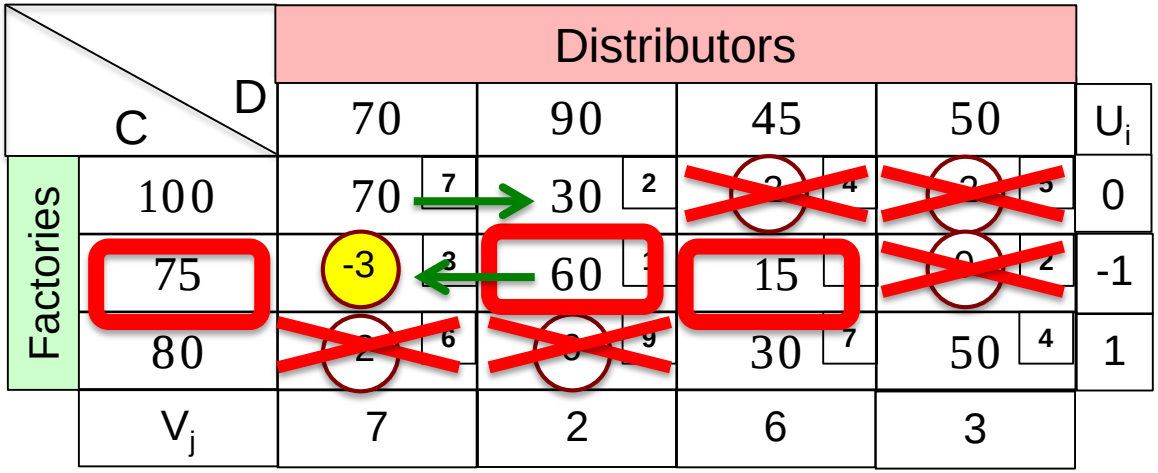
Modified Distribution Method

C \ D	Distributors 70	90	45	50	U_i
Factories 100	70 7	30 2	~~3~~ 4	~~3~~ 5	0
75	-3 3	60	15	~~0~~ 2	-1
80	~~2~~ 6	~~3~~ 9	30 7	50 4	1
V_j	7	2	6	3	

Step 5: Transfer the largest quantity possible to the cell that has the most negative C'_{ij} while creating a loop that satisfies the demand and capacity of each column and row. Except for the empty cell with a negative C'_{ij} the cells in the loop should contain quantities.

We may not move any capacity to cells that have no quantities assigned already!

Modified Distribution Method



Step 5: Transfer the largest quantity possible to the cell that has the most negative C'_{ij} while creating a loop that satisfies the demand and capacity of each column and row. Except for the empty cell with a negative C'_{ij} the cells in the loop should contain quantities.

So, in this example, the only way to get a ballanced matrix is to move material according to the green arrows above! The maximum capacity that can be moved is the lowest of the two quantities at the root of the arrows (60).

Modified Distribution Method

C \ D		Distributors 70	90	45	50	U_i
Factories	100	10 [7]	90 [2]	[4]	[5]	0
	75	60 [3]	[1]	15 [5]	[2]	
	80	[6]	[9]	30 [7]	50 [4]	
	V_j					

Now, a new distribution matrix is achieved. Set U_1 to 0 and calculate the new shadow costs.

Modified Distribution Method

C \ D		Distributors 70	90	45	50	U_i
Factories	100	3 (7)	55 (2)	45 (4)	3 (5)	0
	75	40 (3)	35 (1)	2 (5)	1 (2)	-1
	80	30 (6)	5 (9)	1 (7)	50 (4)	2
	V_j	4	2	4	2	

Step 6: Repeat steps 2-5 until there are no negative C'_{ij}.

Step 7: Calculate the total cost by multiplying each allocation with its specific cost.

$$\text{Cost} = 55_x2 + 45_x4 + 40_x3 + 35_x1 + 30_x6 + 50_x4 = 825€$$

Thank you!

Questions?

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Next lecture on Thursday 2013-11-27

Layout, Line balancing