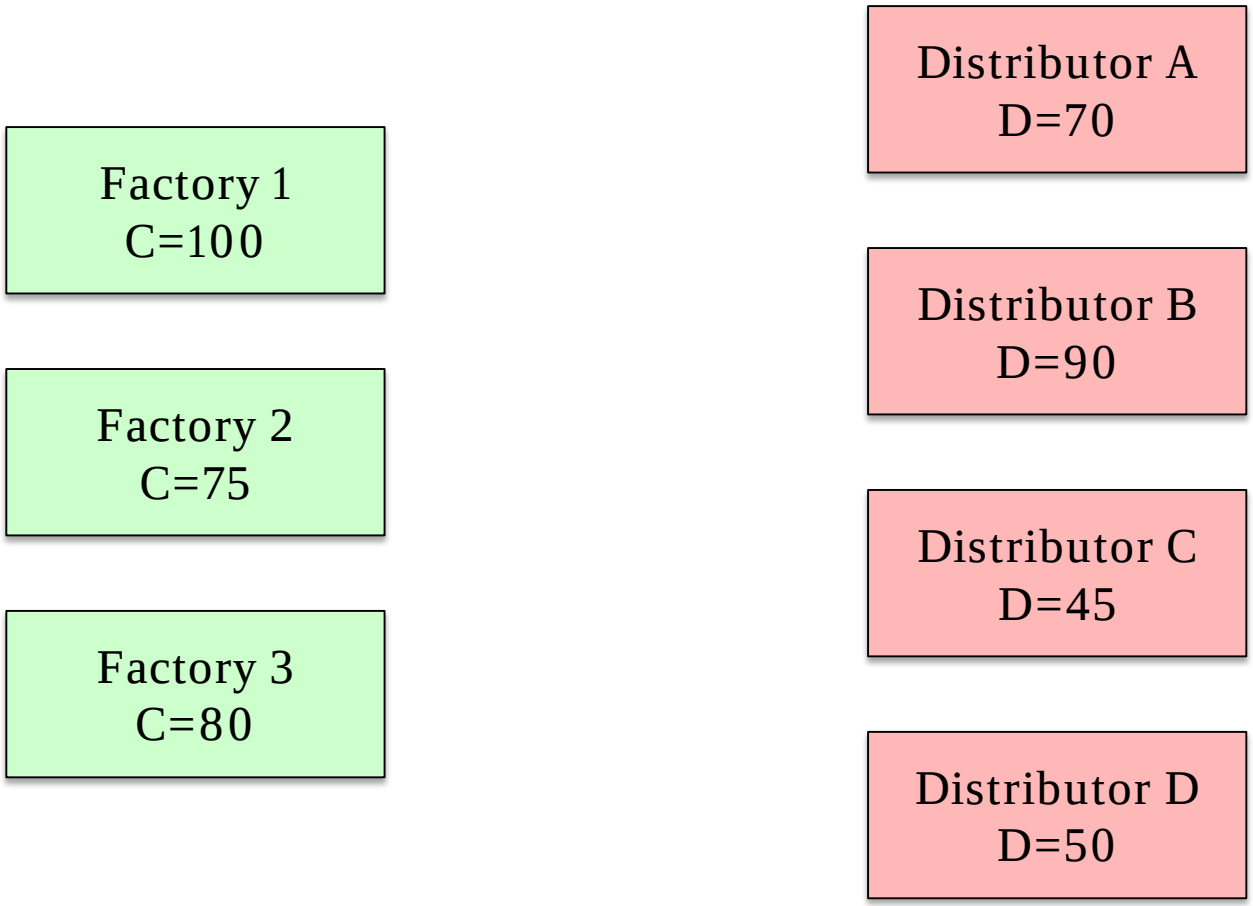
MÄLARDALEN UNIVERSITY
SWEDEN

Transportation method

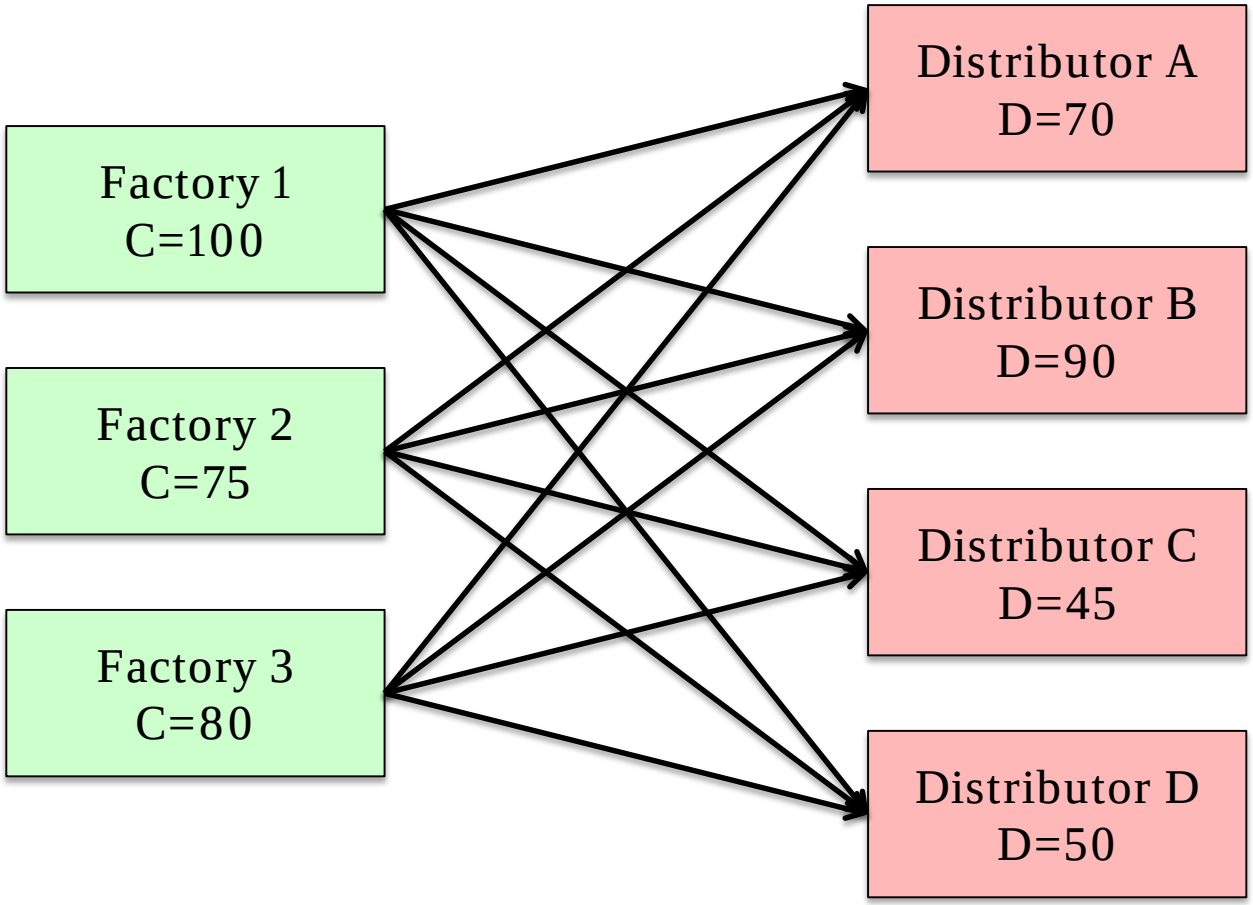
Viktorija Badasjane

PPU426

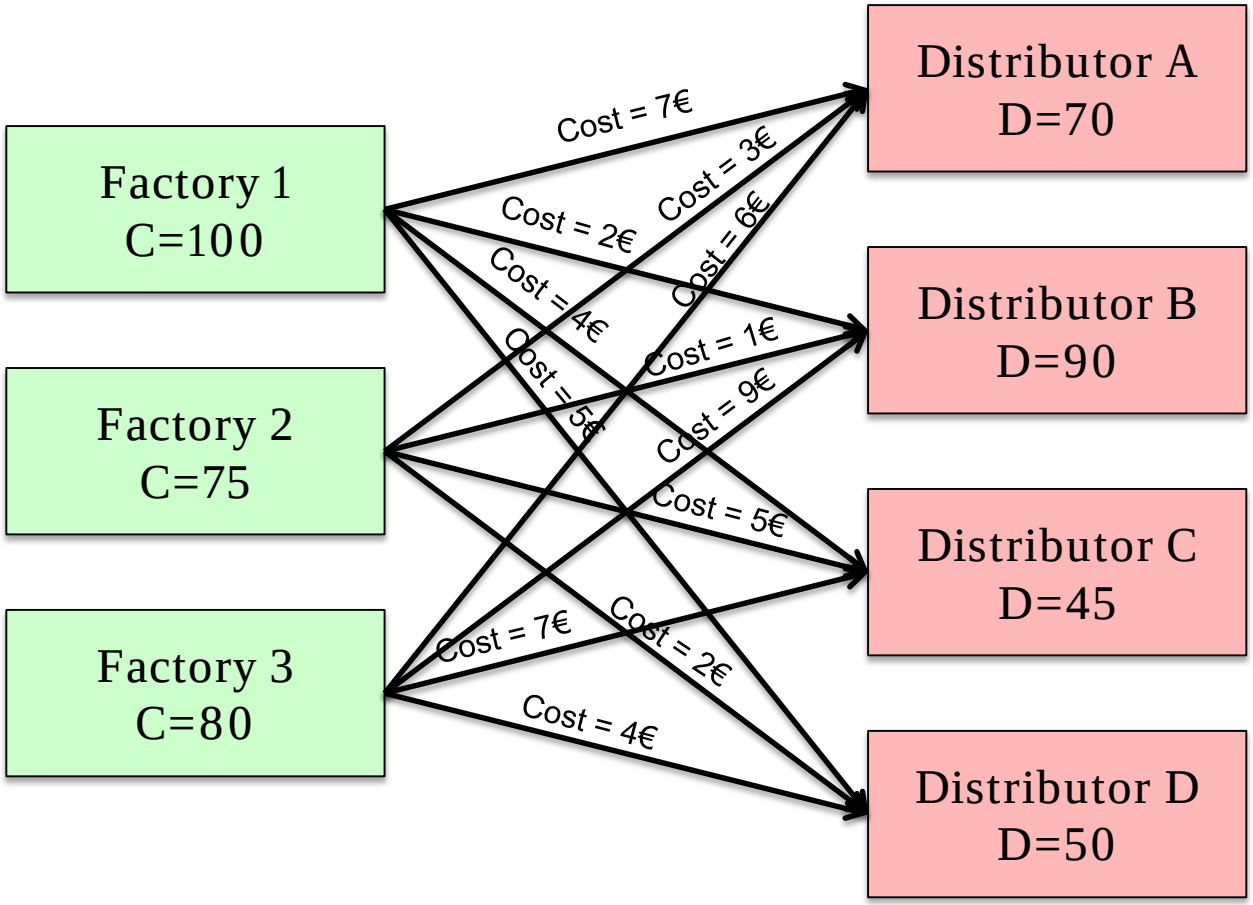
The initial problem



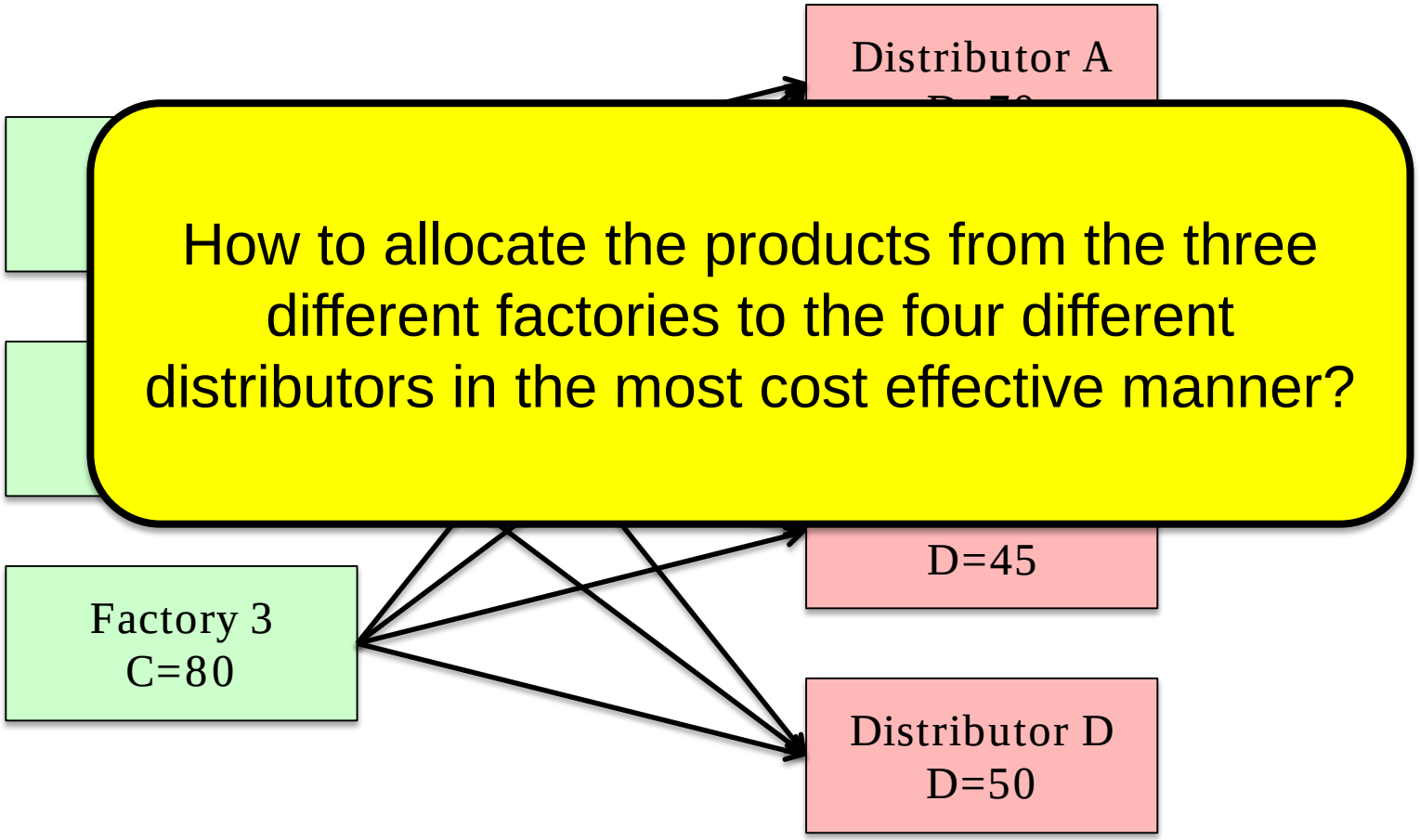
The initial problem



The initial problem



The initial problem



Transportation method

A quantitative approach for cost effective allocation of resources from multiple sources to multiple destinations.

In this course we deal with three different methods:

- Least Cost Method, LCM
- Vogel's Approximation Method, VAM
- Modified Transportation Method, MODI

The initial tableau

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

The Least Cost Method

C \ D	Distributors 70	90	45	50
Factories 100	7	2	4	5
75	3	1	5	2
80	6	8	7	4

Step 1: Identify the cell with the lowest cost.

The Least Cost Method

C \ D		Distributors 70	90	45	50
Factories	100	7	2	4	5
	75	3	75 1	5	2
	80	6	3	7	4

Step 1: Identify the cell with the lowest cost.

Step 2: Allocate as much capacity as possible to the identified cell
Note that you can not allocate more capacity to each row than the total amount for that Factory. Neither can you allocate more capacity to each column than the total demand for that Distributor.

Step 3: Repeat steps 1 and 2 until all capacity is allocated to meet the demand.

The Least Cost Method

C \ D		Distributors 70	90	45	50
Factories	100	40 [7]	15 [2]	45 [4]	[5]
	75	[3]	75 [1]	[5]	[2]
	80	30 [6]	[9]	[7]	50 [4]

Step 4: Calculate the total cost by multiplying each allocation with its specific cost.

$$\text{Cost} = 40_x7 + 15_x2 + 45_x4 + 75_x1 + 30_x6 + 50_x4 = 945€$$

Vogel's Approximation Method

C \ D	Distributors 70	90	45	50	
Factories 100	7	2	4	5	4-2 = **2**
75	3	1	5	2	2-1 = **2**
80	6	9	7	4	6-4 = **2**
	6-3 **3**	2-1 **1**	5-4 **1**	4-2 **2**	

Step 1: For each row and column, find the difference between the two lowest shipping costs.

Vogel's Approximation Method

C \ D	Distributors 70	90	45	50	
Factories 100	7	2	4	5	4-2 = **2**
75	70 **3**	1	5	2	2-1 = **2**
80	6	9	7	4	6-4 = **2**
	6-3 **3**	2-1 **1**	5-4 **1**	4-2 **2**	

Step 1: For each row and column, find the difference between the two lowest shipping costs.

Step 2: In the row or column with the highest difference, allocate as much demand as possible to the cell with the lowest cost.

Vogel's Approximation Method

C \ D	Distributors 70	90	45	50	
Factories 100	7	2	4	5	4-2 = **2**
75	70 3	1	5	2	2-1 = **2**
80	6	9	7	4	6-4 = **2**
	6-3 **3**	2-1 **1**	5-4 **1**	4-2 **2**	

Step 3: If a capacity is fully used, or a demand fully satisfied, that row or column is finished.

Vogel's Approximation Method

C \ D		Distributors 70	90	45	50	
Factories	100	7	2	4	5	4-2 = **2**
	75	70 3	1	5	2	2-1 = **2**
	80	6	9	7	50 4	7-4 = **3**
			2-1 **1**	5-4 **1**	4-2 **2**	

Step 4: Now we repeat steps 1-3 but without the "finished" column, and itterate until all capacity is allocated.

Vogel's Approximation Method

C \ D		Distributors 70	90	45	50
Factories	100	7	85 2	15 4	5
	75	70 3	5 1	5	2
	80	6	9	30 7	50 4

Step 5: Calculate the total cost by multiplying each allocation with its specific cost.

$$\text{Cost} = 85_{x}2 + 15_{x}4 + 70_{x}3 + 5_{x}1 + 30_{x}7 + 50_{x}4 = 855€$$

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

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; $C_{ij} = U_i + V_j$

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

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 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

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?

Viktorija.badasjane@mdh.se