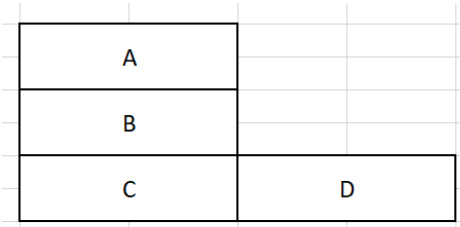
Calculations to find the facility layout with the least cost of moving the materials

Proper facility layout is an important enabler of efficient operations. Optimal facility layout aims to create a safe and simple flow of people, work-in-process and information. In other words, an optimal facility layout means the most effective arrangement of the 3 Ms:

- Men
- Materials (Work-in Process)
- Machines

This is where operational efficiency professionals have a role to play. They can optimize facility layout to eliminate waste such as motion, waiting, inventory (work-in process) material handling, transportation and thus improve throughput to meet customer demand.

In the question that I attempted to solve in Excel, I was given the flow matrix and the original layout of the facility. The facility has 4 departments namely A, B, C and D. The original layout and the flow matrix is as follows:



	1	2	3	4
1		126	126	126
2			106	146
3				101
4				0

For the purpose of this exercise, A is symbolised as 1, B as 2, C as 3 and D as 4. Total Flow matrix talks about the measure of material flow required to move the material from one department to another. Hence, the lesser the number, better it is. The cost of movement of these materials are also given as:

	1	2	3	4
1		5	10	15
2			5	10
3				5
4				0

It is also given that moving to the next department costs $5 per trip, moving to a department that 2 units away costs $10 per trip, and moving to a department that is 3 units away costs $15 per trip. With all this information, I have used Excel to find the layout of the facility with the cheapest movement cost.

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Methodology to calculate the current movement costs:

1. To calculate the total movement costs, the total flow measure needed to move the materials from one department to another and the cost per trip that is required to move that material from one department to another is taken into consideration.
2. For each pair of departments, the total flow and the corresponding cost is multiplied and then aggregated to find the total current movement cost.
3. The formula is:

   Current movement costs = Sum(Total Flow Matrix * Total Corresponding Cost per trip)

Methodology to find a better layout and find the cheapest movement cost:

1. Different combinations of layouts are found which considers the 4 departments; A, B, C, D. 24 combinations including the current layout ABCD. The other possible layouts could be ABDC, ACBD, ACDB, ADBC and so on.
2. The excel sheet calculated the movement costs of each of the layout combinations using the above formula.
3. The layout of the facility with the cheapest would be the best layout.
4. In the excel sheet, it is found that arranging the departments as BDAC instead of ABCD lessens the current movement cost to 835$ only.

The Excel sheet is as follows:

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Below is the total flow matrix for a facility with four departments, and the blue print showing how the facility is currently laid out.

	1	2	3	4
1		126	126	126
2			106	146
3				101
4				0

	1	2	3	4
1		5	10	15
2			5	10
3				5
4				0

	A	B	C	D
A		1	2	3
B			1	2
C				1

A) **Using Excel, and cell references,** calculate the current movement costs if moving to the next department costs $5 per trip, moving to a department that 2 units away costs $10 per trip, and moving to a department that is 3 units away costs $15 per trip. (Note: B is not currently next to D, and D is 3 units away from A). (4 marks)

Answer ----->

6275

B) In the blank blue print below, make a better layout, and calculate the new movement costs. (7 marks)

lay out of facility

1	B
2	D
3	A
4	C

Answer ------>

New Movement Costs

835

combinations

3	A
1	B
4	C
2	D

Calculations:

From	To	From	To	Flow	Cost	Distance
A	B	3	1	126	10	-2
A	C	3	4	101	5	1
A	D	3	2	106	5	-1
B	C	1	4	126	15	3
B	D	1	2	126	5	1
C	D	4	2	146	10	-2