Production & Operations Management — Recitation 1

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Overview

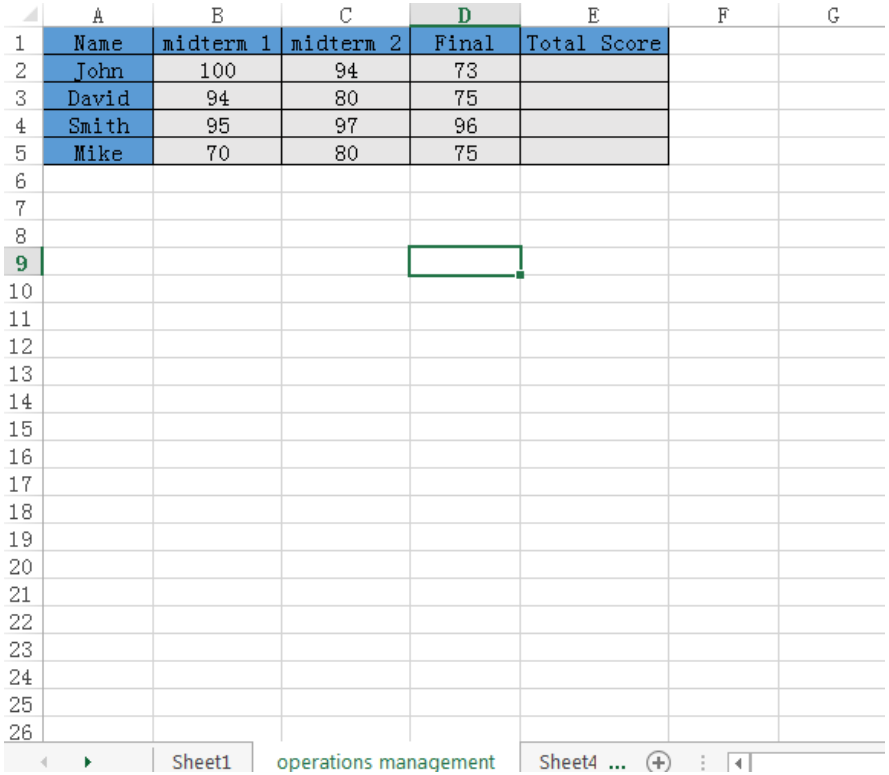
Excel Basics

Things you should know at this point:

- Basic Workbook and Worksheet
- Data Entry in Excel cells
- Defining Range of Cells
- Using Formulas: SUM() and SUMPRODUCT()
- Relative and Absolute Reference

Workbook Creation/Data Entry/Simple Format

- The use of Font, Theme, etc. is the same as Microsoft word



	A	B	C	D	E	F	G
1	Name	midterm 1	midterm 2	Final	Total Score		
2	John	100	94	73			
3	David	94	80	75			
4	Smith	95	97	96			
5	Mike	70	80	75			
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Sheet1 operations management Sheet4 ...

Formula - SUM()

- Click the cell, enter: $=$ sum(**range**)

A	B	C	D	E
Name	midterm 1	midterm 2	Final	Total Score
John	100	94	73	=sum(B2:D2)
David	94	80	75	
Smith	95	97	96	
Mike	70	80	75	

- Locate the mouse at the right down corner, hold left button and drag down

	A	B	C	D	E
1	Name	midterm 1	midterm 2	Final	Total Score
2	John	100	94	73	267
3	David	94	80	75	249
4	Smith	95	97	96	288
5	Mike	70	80	75	225
6					

Formula - SUM()/SUMPRODUCT()

We want to have : $0.2 \times 100 + 0.2 \times 94 + 0.4 \times 73 = 68$**. There are two alternatives:**

- *Pair them naturally.*

	A	B	C	D	E	F
1	Name	midterm 1	midterm 2	Final	Weighted Score	Alternative Formula
2	Weight	0.2	0.2	0.4		
3	John	100	94	73	68	=sum(B3*B2+C3*C2+D3*D2)
4	David	94	80	75		
5	Smith	95	97	96		
6	Mike	70	80	75		
7						
8						

- *Pay attention to the order of sum and product !!!*

	A	B	C	D	E	F
1	Name	midterm 1	midterm 2	Final	Weighted Score	
2	Weight	0.2	0.2	0.4		
3	John	100	94	73	=SUMPRODUCT(B3:D3, B2:D2)	
4	David	94	80	75		
5	Smith	95	97	96		
6	Mike	70	80	75		
7						

SUMPRODUCT(array1, [array2], [array3], [a

Relative Reference & Absolute Reference

As usual, we drag down to replicate the implementation, but ...

	A	B	C	D	E	F	G
1	Name	midterm 1	midterm 2	Final	Weighted Score	Alternative Formula	
2	Weight	0.2	0.2	0.4			
3	John	100	94	73	68	68	
4	David	94	80	75	22395	22395	
5	Smith	95	97	96	23890	23890	
6	Mike	70	80	75	21610	21610	
7							
8							
9							

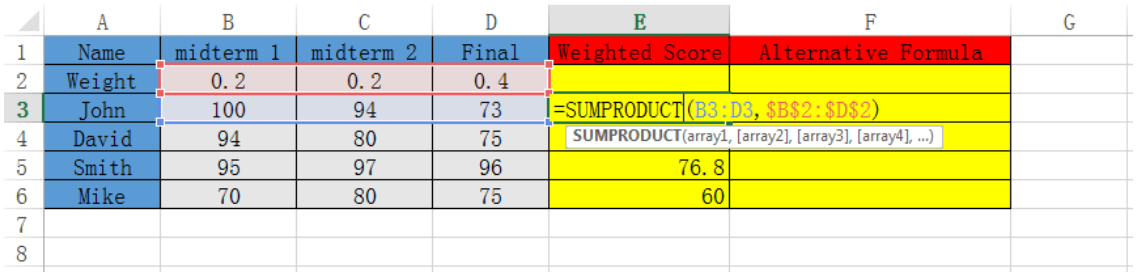
Click the cell we find it is a relative reference

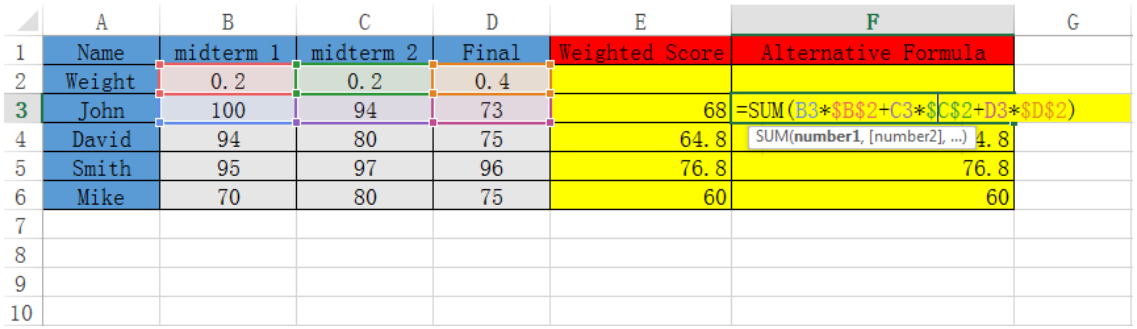
	A	B	C	D	E	F
1	Name	midterm 1	midterm 2	Final	Weighted Score	Alternative Formula
2	Weight	0.2	0.2	0.4		
3	John	100	94	73	68	68
4	David	94	80	75	=SUMPRODUCT(B4:D4,B3:D3)	
5	Smith	95	97	96	23890	23890
6	Mike	70	80	75	21610	21610
7						
8						

Relative Reference & Absolute Reference

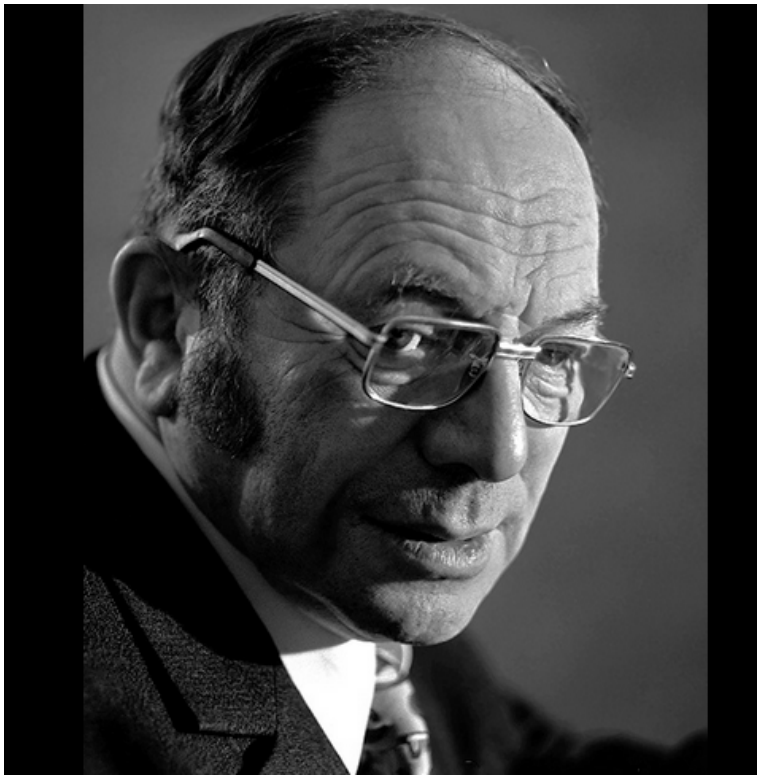
The worlds is saved by relative reference !! The difference is just simple $ sign :

Absolute Reference: $\$B\$4 : \$D\$4$ Relative Reference: $B4 : D4$





Intro. to LP & LP History



Linear Programming is an optimization method to achieve the best outcome under linear constraints. The linear programming method was first developed by **Leonid Kantorovich** in 1939.The World War II calls the need for LP to plan expenditures and returns in order to reduce the costs or increase the losses of the enemy.

LP Model Components

LP models have 4 components

- **Decision Variables:** Amounts of either inputs or outputs
- **Objective Function:** A mathematical statement of profit (or cost, etc.). We are always maximizing the profit, or revenue, or minimize the cost. The objective function is linear, which means it only allows addition, subtraction and multiplication by a scalar;
- **Constraints:** Limitations that restrict the available alternatives. Again, constraints are linear in the same sense as objective function.
- **Non-negativity Constraints:** 'Usually' the amount is not negative

Example: LP problem description

Company A produces three product: product 1, product 2 and product 3. This is on Friday, they need to decide how many to produce for each product. The pricing for them are 5$, 8$, 4$, respectively. To produce product 1, they need 2 hours, to produce product 2, 4 hours are needed, for product 3, it is 8 hours. But the works are only willing to work for 250 hours in total. On the other hand, the material to produce the product is limited by 100 pounds, while product 1, 2, 3 needs 7 pounds, 6 pounds, 5 pounds resp.. On the top of that, since product 1 is not that popular, the manager decides to produce no more than 10 units. Can you help the manager to make the decision on the amount to produce for each product.

Example: LP formulation

Decision Variables:

$$X = \begin{cases} x_1: & \text{Quantity of product 1 to produce next week} \\ x_2: & \text{Quantity of product 2 to produce next week} \\ x_3: & \text{Quantity of product 3 to produce next week} \end{cases}$$

Objective Function:

$$\text{Maximize: } 5x_1 + 8x_2 + 4x_3 \text{ (Profit)}$$

Constraints:

$$\begin{aligned} \text{Subject to: } & 2x_1 + 4x_2 + 8x_3 \leq 250 \text{ (hours)} - -\text{Labor} \\ & 7x_1 + 6x_2 + 5x_3 \leq 100 \text{ (pounds)} - -\text{Material} \\ & x_1 \leq 10 \text{ (10 units)} - -\text{the constraints for product 1} \end{aligned}$$

Non-negative Constraint:

$$x_1, x_2, x_3 \geq 0$$

References

Ahmed, Mahmoud (2014)

Lecture Slides of Operations Management

Thank You !!!