EM384: Analytical Methods for Engineering Management

Lesson 3: Modeling with Spreadsheets II

17 January 2023

Table of contents

Review

General Guidelines for Building Spreadsheet Models

- Enter the data first.
- Organize and clearly identify the data.
- Enter each piece of data into one cell only.
- Separate the data from the formulas.
- Keep it Simple.
- Use Relative and Absolute References.

Debugging a Spreadsheet Model

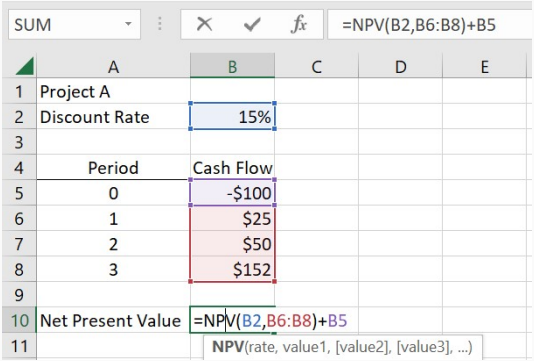
- Try different values for the changing cells (try 0s, try 1s, try very large numbers)
- Look at the critical areas/locations of the model (i.e. the output cells).
- Check your formulas.
- Check your cell references (“Trace Dependents”).
- Walk through your model step by step from the beginning.
- Formulas $\rightarrow$ Evaluate Formula.
- CTRL $\sim$ (Show all formulas used)

Lesson Objectives

Lesson 3 Objectives

- Understand and apply Net Present Value (NPV) to a problem.
- Execute advanced Excel commands (COUNT,IF, nested IF, SUMPRODUCT, NPV).
- Apply conditional formatting to a spreadsheet.

Net Present Value



- Net Present Value is the difference between the present value of cash inflows and the present value of cash outflows over a period of time.
- NPV is the result of calculations that find the current value of a future stream of payments, using the proper discount rate.

$$NPV = \sum_{i=0}^{n} \frac{X_i}{(1+r)^i}$$

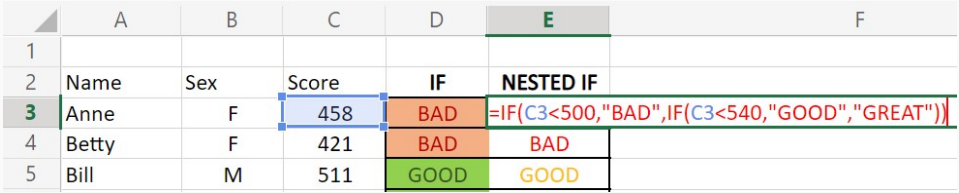
Where X_i is the cash flow at period i, r is the discount rate, and n is the number of time periods. The discount rate depends on your business case, but could be the rate of inflation, what you could expect to make on an investment, etc.

IF Function

	A	B	C	D	E	F
1						
2	Name	Sex	Score	IF	NESTED IF	
3	Anne	F	458	=IF(C3>=500,"GOOD","BAD")		
4	Betty	F	421	BAD	BAD	
5	Bill	M	511	GOOD	GOOD	
6	Bob	M	512	GOOD	GOOD	

- IF functions allow you to condition an output based on an input or logical expression.
- Usage: =IF(condition, value if true, value if false)

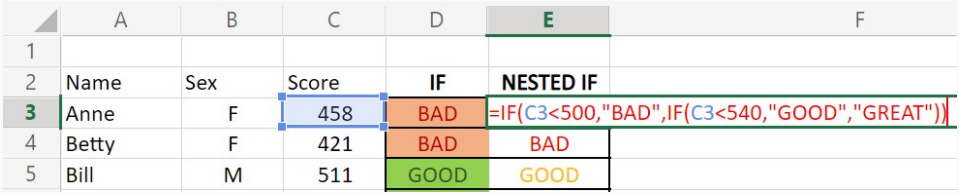
Nested Functions



	A	B	C	D	E	F
1						
2	Name	Sex	Score	IF	NESTED IF	
3	Anne	F	458	BAD	=IF(C3<500,"BAD",IF(C3<540,"GOOD","GREAT"))	
4	Betty	F	421	BAD	BAD	
5	Bill	M	511	GOOD	GOOD	

- Nested functions allow you to implement more complex logic in a single cell.
- You can place another function in the place of an output.
- This allows you to have more than two possible outputs.

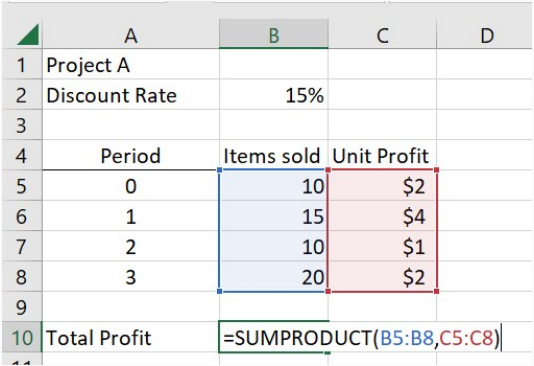
Nested Functions



	A	B	C	D	E	F
1						
2	Name	Sex	Score	IF	NESTED IF	
3	Anne	F	458	BAD	=IF(C3<500,"BAD",IF(C3<540,"GOOD","GREAT"))	
4	Betty	F	421	BAD	BAD	
5	Bill	M	511	GOOD	GOOD	

- Nested functions allow you to implement more complex logic in a single cell.
- You can place another function in the place of an output.
- This allows you to have more than two possible outputs.

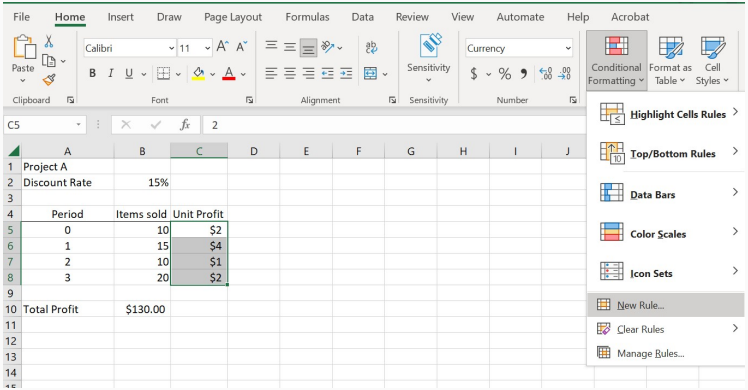
SUMPRODUCT Function



	A	B	C	D
1	Project A			
2	Discount Rate	15%		
3				
4	Period	Items sold	Unit Profit	
5	0	10	$2	
6	1	15	$4	
7	2	10	$1	
8	3	20	$2	
9				
10	Total Profit	=SUMPRODUCT(B5:B8,C5:C8)		

- The SUMPRODUCT function allows you do a *dot product* with two ranges of cells.
- If you recall math class, the dot product of two vectors $< a_1, a_2 >$ and $< b_1, b_2 >$ is $a_1b_1 + a_2b_2$ and is a scalar.

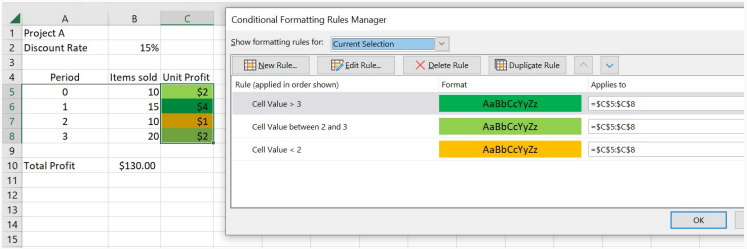
Conditional Formatting



	A	B	C
1	Project A		
2	Discount Rate	15%	
3			
4	Period	Items sold	Unit Profit
5	0	10	$2
6	1	15	$4
7	2	10	$1
8	3	20	$2
9			
10	Total Profit	$130.00	

- Conditional Formatting Allows you to change the fill and font of a cell based on its content.
- This is useful to quickly differentiate between cell values when you have many outputs.

Conditional Formatting



- You can implement several rules at once, as in this example.

Practical Exercise

Conclusion

Next Class

Homework:

- Read PDF entitled *"Analysis Using Spreadsheets"* Chapter 4.1-4.3
- Work on Homework Set 1

Next Lesson:

- Sensitivity Analysis. Understand "Base Case", "What-If", and "Breakeven" Analysis and apply using spreadsheet models.
- Apply 1-way and 2-way data tables to a problem.