EXCEL WORKSHOP I: INTRODUCTION TO EXCEL

With Applications from Ratemaking

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IF(logical_test, [value_if_true], [value_if_false])

	A	B	C
1		**Formula**	**Output**
2	100	=IF(A2>73,"Pass", "Fail")	Pass
3	80	=IF(A3>73,"Pass", "Fail")	Pass
4	60	=IF(A4>73,"Pass", "Fail")	Fail
5	40	=IF(A5>73,"Pass", "Fail")	Fail
6	20	=IF(A6>73,"Pass", "Fail")	Fail

- If **[value_if_true]** or **[value_if_false]** are not given, they default to TRUE and FALSE
- If **logical_test** is true, output is **[value_if_true]**
- If **logical_test** is false, output is **[value_if_false]**
- IF statements can be nested

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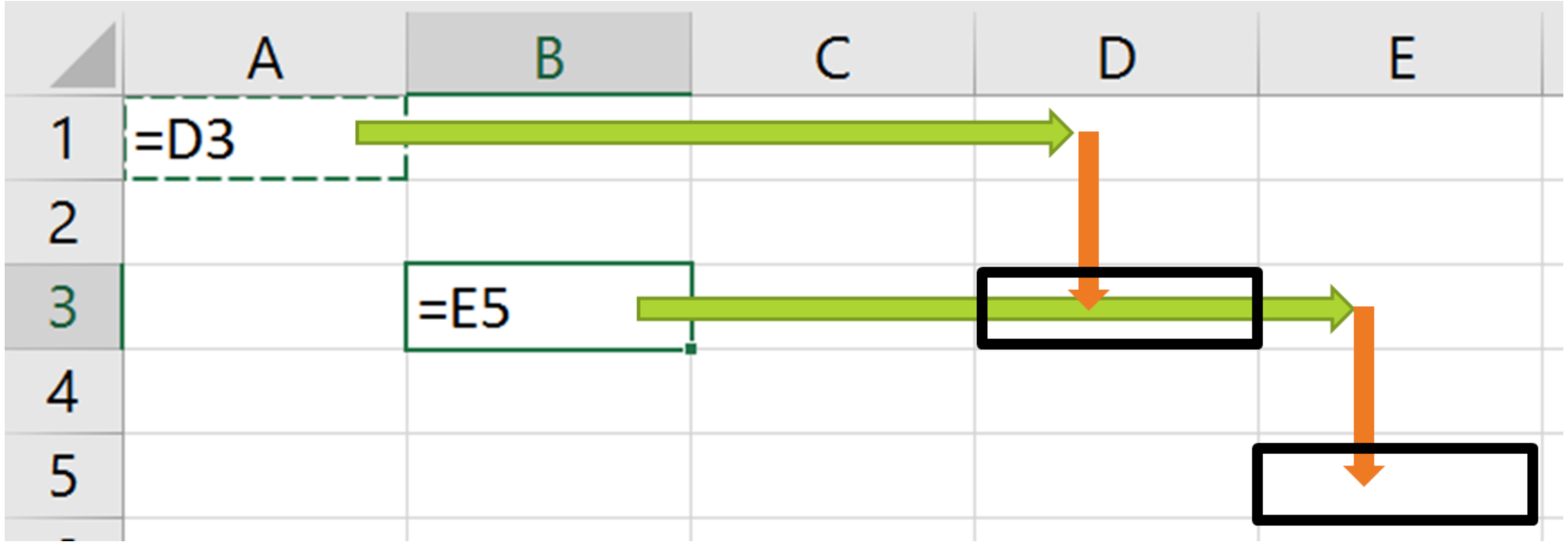
Relative Cell References:

Suppose we copy the formula in cell A1 and paste it in cell B3.



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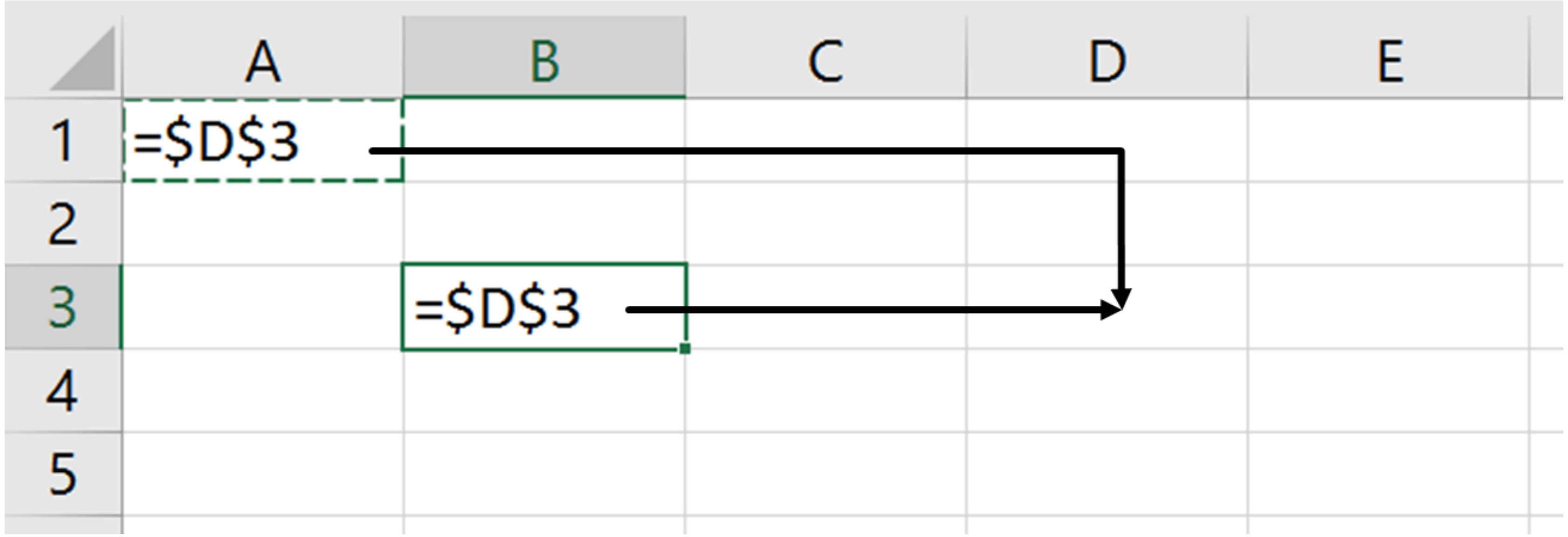
Absolute Cell References:

Suppose we copy the formula in cell A1 and paste it in cell B3.



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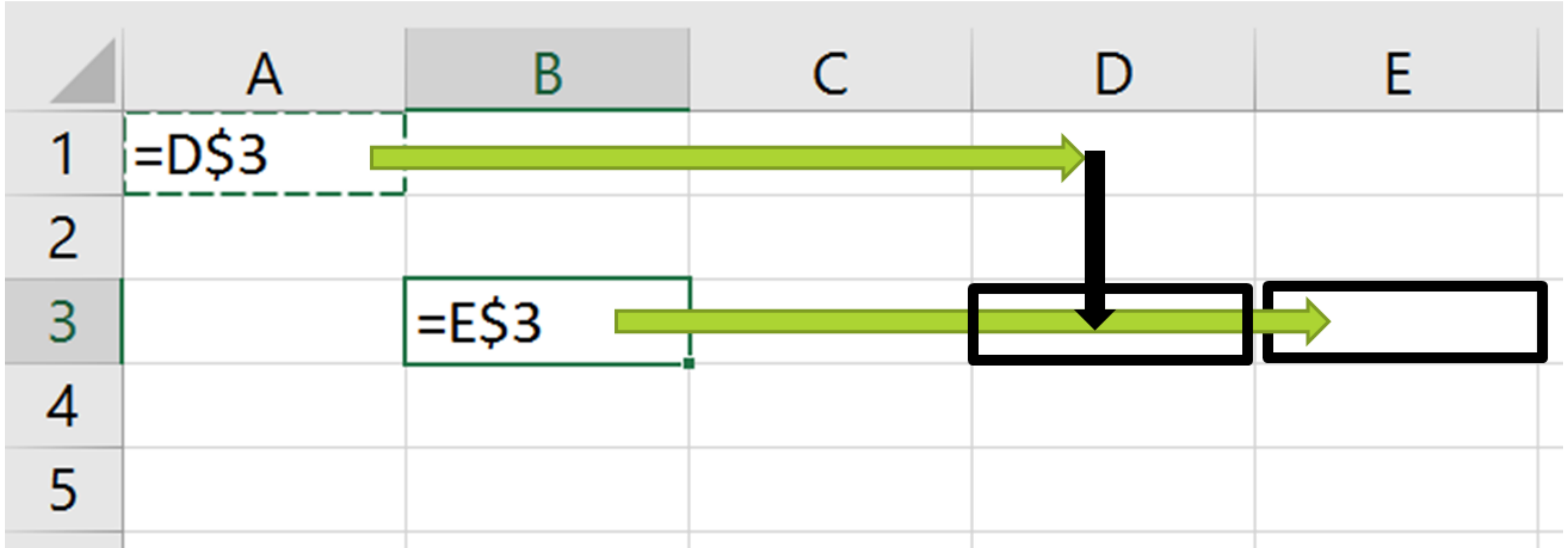
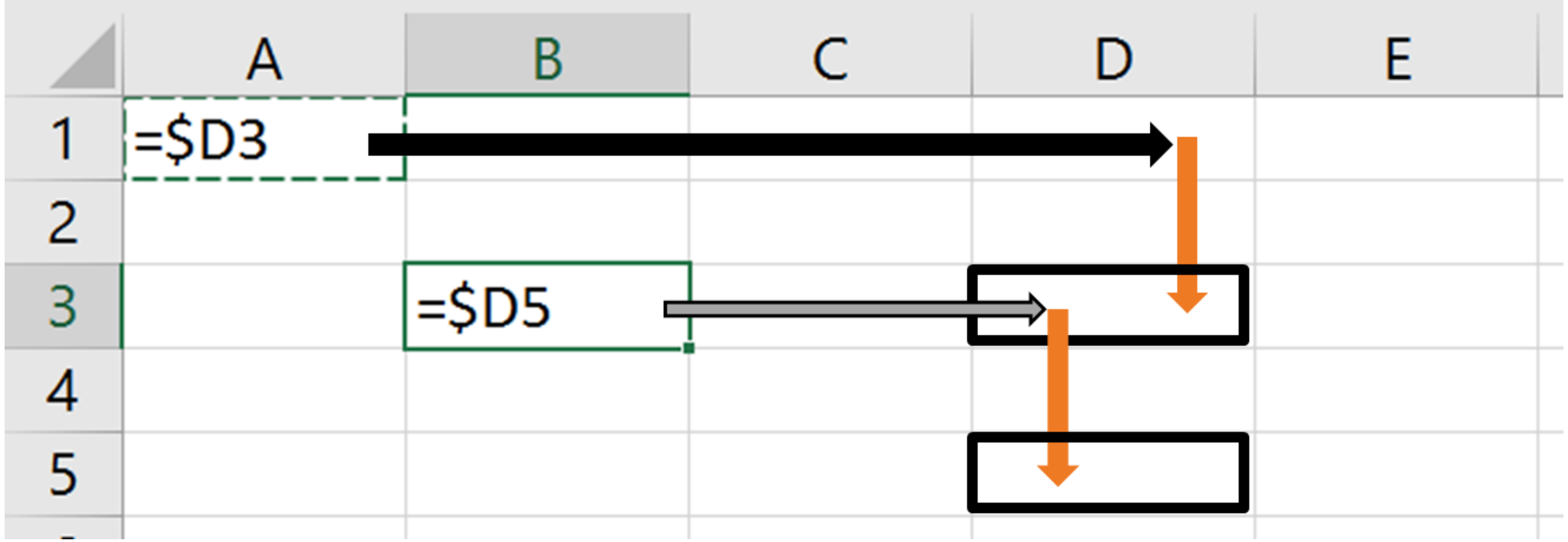
Mixed Cell References:
Suppose we copy the formula in cell A1 and paste it in cell B3.



Here, the black arrow does not indicate a relative shift, but an **absolute** shift to row 3.

Mixed Cell References:
Suppose we copy the formula in cell A1 and paste it in cell B3.



Here, the black/gray arrows do not indicate relative shifts, but **absolute** shifts to column D.

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SUM(number1, [number2], …)
PRODUCT(number1, [number2], …)

	A	B	C	D
1	1		**Formula**	**Output**
2	2		=SUM(A1,A2,A3,A4,A5)	15
3	3		=SUM(A1:A5)	15
4	4		=PRODUCT(A1:A3, A5)	30
5	5			

- Each of the **number**s can be either a reference to a single cell or to a range

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VLOOKUP(lookup_value, table_array, col_index_num, [range_lookup])

- Looks for **lookup_value** in the first column of **table_array**
- Returns the value in the column number indicated by **col_index_num**
- **[range_lookup]**: Default is TRUE (approximate match). FALSE means you want an exact match.
  - For approximate match, data must be sorted in ascending order.

VLOOKUP(lookup_value, table_array, col_index_num, [range_lookup])

	A	B	C	D	E
1	*Name*	*Student ID*		**Formula**	**Output**
2	Joe Bruin	272577814		=VLOOKUP("Joe Bruin",$A$2:$B$4,2,FALSE)	272577814
3	John Doe	644907243		=VLOOKUP("Jane Doe",$A$2:$B$4,2,FALSE)	534763964
4	Jane Doe	534763964		=VLOOKUP("Johnny",$A$2:$B$4,2,FALSE)	#N/A

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VLOOKUP(lookup_value, table_array, col_index_num, [range_lookup])

	A	B	C	D	E	F
1	*Percent*	*Grade*			**Formula**	**Output**
2	0	F		52	=VLOOKUP(D2,$A$2:$B$6,2,TRUE)	F
3	60	D		85	=VLOOKUP(D3,$A$2:$B$6,2,TRUE)	B
4	70	C		92	=VLOOKUP(D4,$A$2:$B$6,2,TRUE)	A
5	80	B		63	=VLOOKUP(D5,$A$2:$B$6,2,TRUE)	D
6	90	A		75	=VLOOKUP(D6,$A$2:$B$6,2,TRUE)	C

COUNTIF(range, criteria)
SUMIF(range, criteria, [sum_range])

- COUNTIF counts all cells in **range** that satisfy **criteria**.
  - The **criteria** can be given as a value, in which case the values in **range** must be equal to that value.
  - It can also be given as a boolean expression in quotes.
- SUMIF is similar, but it sums the values in **range** instead of counting them.
  - Or, it sums across a different **[sum_range]**, using the values in corresponding **range**-**criteria** pairs.

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COUNTIF(range, criteria)
SUMIF(range, criteria, [sum_range])

	A	B	C	D
1	1		**Formula**	**Output**
2	2		=COUNTIF($A$1:$A$7,3)	0
3	4		=COUNTIF($A$1:$A$7,2)	1
4	8		=COUNTIF($A$1:$A$7,">4")	4
5	16		=COUNTIF($A$1:$A$7,"<>4")	6
6	32			
7	64			

COUNTIF(range, criteria)
SUMIF(range, criteria, [sum_range])

	A	B	C	D	E
1	A	1		**Formula**	**Output**
2	B	2		=SUMIF($B$1:$B$7,"<10")	15
3	C	4		=SUMIF($A$1:$A$7,"A",$B$1:$B$7)	73
4	A	8		=SUMIF($A$1:$A$7,"<>B",$B$1:$B$7)	109
5	B	16			
6	C	32			
7	A	64			

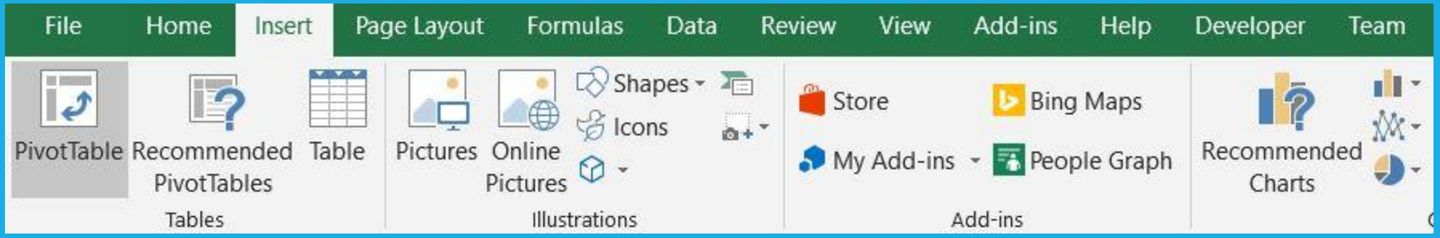
# COUNTIFS(criteria_range1, criteria1,…)
SUMIFS(sum_range, criteria_range1, criteria1,…)

- These do the same thing as COUNTIF and SUMIF, but you can specify multiple criteria.
- Note that for SUMIFS, **sum_range** comes first.

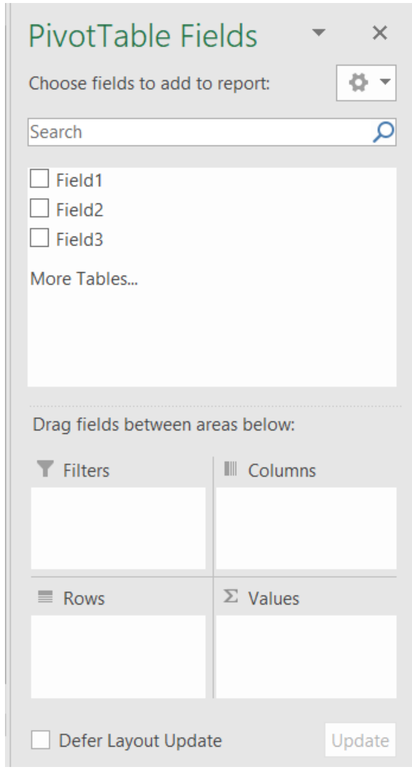
COUNTIFS(criteria_range1, criteria1,…)
SUMIFS(sum_range, criteria_range1, criteria1,…)

	A	B	C	D	E	F
1	Gender	Age	Number of Claims		**Formula**	**Output**
2	M	24	0		=SUMIFS(C2:C14,A2:A14,"F",B2:B14,">30")	1
3	M	37	1			
4	M	38	0			
5	M	31	2			
6	M	28	2			
7	F	36	0			
8	F	25	1			
9	M	60	0			
10	F	27	1			
11	F	61	0			
12	F	35	1			
13	M	32	1			
14	M	54	2			

PivotTables



- PivotTables can be used to quickly summarize data
- Click and drag different fields to “columns”, “rows”, or “values”, depending on what you want
- You can also filter data



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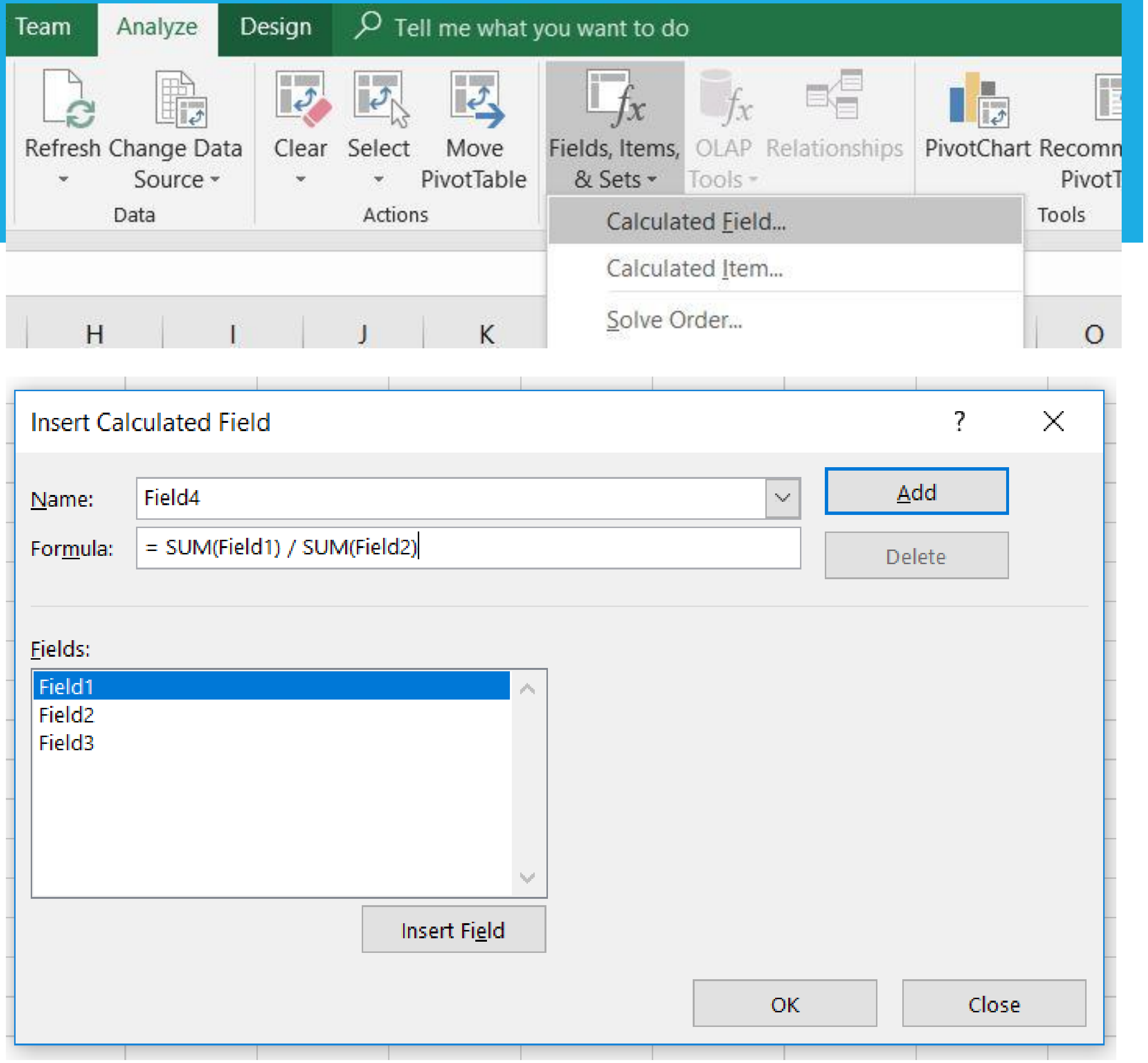
Calculated Fields

- Calculated fields are useful for aggregate-level calculations
- For example, we could look at the value of Field4 for each Field3



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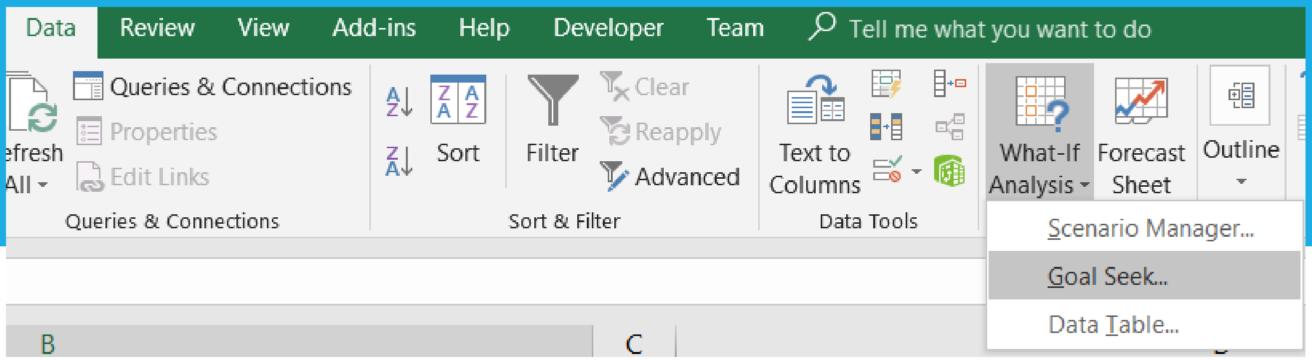
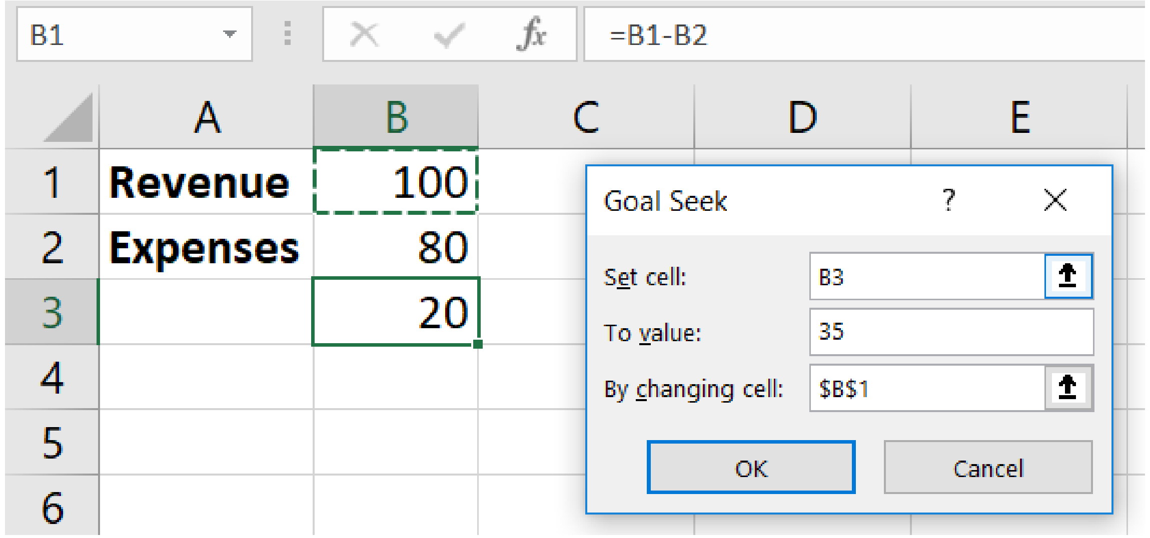
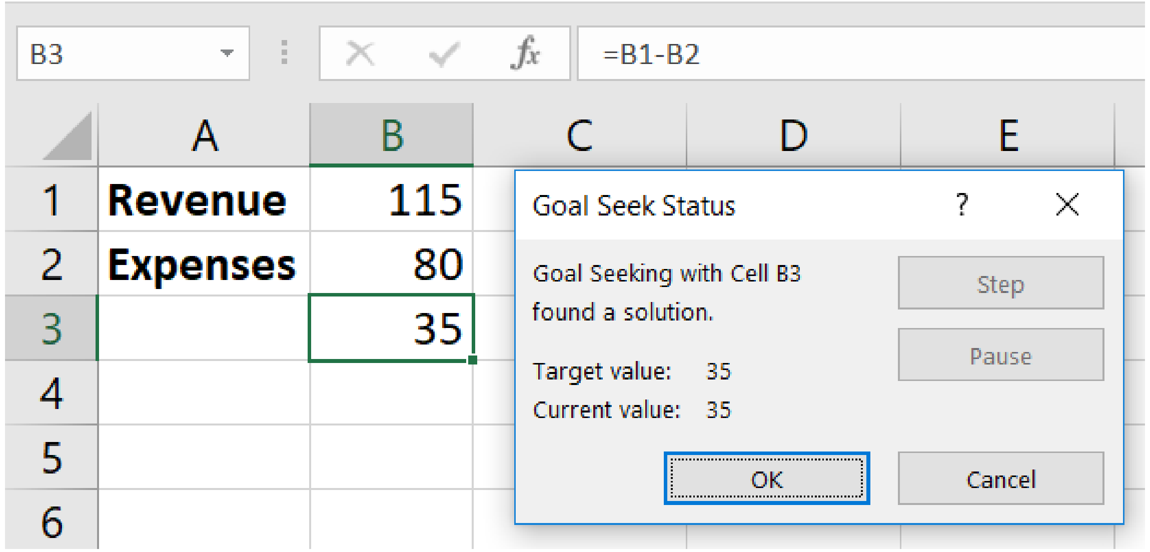
GoalSeek







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APPENDIX

Background on the problem and mathematical justification

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Background

- You are a pricing actuary for Bruin Auto Liability Insurance, LLC, a Los Angeles based company insuring personal automobile casualty losses in Southern California.
- Due to limited data collected, BAL Insurance only uses two variables in their pricing algorithm: driving frequency and county. Assume these two variables are independent.
- You have been tasked with analyzing the premiums charged and claims filed to determine if the rates are adequate.

Background

- It is January 1st, 2019. Through your discussions, you discover that sufficiently many claims for a given calendar year will be reported in 3 years.
- Therefore, you have enough reliable data to analyze 2014 and 2015. However, volume of claims and policy in 2014 are fairly low.
- Thus, you are to conduct an analysis of premiums and claims for policy year 2015.
- For your convenience, the relevant policy data and claims data have been extracted from the full data tables.

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Background

- Management's target loss ratio is 85%.
- Conduct an analysis of 2015 data and, based on your results, recommend an alternative rating algorithm to use in the future, if claims in 2016-2018 are similar to those in 2015.
- Backtest your new rating algorithm on data from 2014.
- Determine whether the rates you have set are feasible on the data from policy year 2014, and state the overall loss ratio on that sheet.

Adjusting the loss ratios

- For simplicity, let's only look at the relativities for **county**, though the process for driving frequency is the same.
- Specifically, let's look at Los Angeles. We decompose the premium collected from all LA policyholders into the base rate and the factor:

$$\mathrm{LR}_{\mathrm{LA}} = \frac{\sum \mathrm{Claims}_{\mathrm{LA}}}{\sum \mathrm{Premium}_{\mathrm{LA}}} = \frac{\sum \mathrm{Claims}_{\mathrm{LA}}}{\mathrm{BaseRate} \cdot \sum \mathrm{Factor}_{\mathrm{LA}}}$$

- Note that we cannot simply replace $\mathrm{Factor}_{\mathrm{LA}}$ with 1.20, since Factor refers to the product of county and driving frequency relativities.

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Adjusting the loss ratios

- Let $\mathrm{LR_T}$ be the target loss ratio. Then, multiplying our previous equation by $\frac{\mathrm{LR_T}}{\mathrm{LR_{LA}}}$,

$$\mathrm{LR_{LA}} \cdot \frac{\mathrm{LR_T}}{\mathrm{LR_{LA}}} = \frac{\sum \mathrm{Claims_{LA}}}{\mathrm{BaseRate} \cdot \sum \mathrm{Factor_{LA}}} \cdot \frac{\mathrm{LR_T}}{\mathrm{LR_{LA}}}$$

- Or, reordering:

$$\mathrm{LR_T} = \frac{\sum \mathrm{Claims_{LA}}}{\mathrm{BaseRate} \cdot \frac{\mathrm{LR_{LA}}}{\mathrm{LR_T}} \cdot \sum \mathrm{Factor_{LA}}}$$

Adjusting the loss ratios

- The key difference between this equation is the additional component of $\frac{\mathrm{LR_{LA}}}{\mathrm{LR_T}}$.

$$\mathrm{LR_{LA}} = \frac{\sum \mathrm{Claims_{LA}}}{\mathrm{BaseRate} \cdot \sum \mathrm{Factor_{LA}}}$$

$$\mathrm{LR_T} = \frac{\sum \mathrm{Claims_{LA}}}{\mathrm{BaseRate} \cdot \frac{\mathrm{LR_{LA}}}{\mathrm{LR_T}} \cdot \sum \mathrm{Factor_{LA}}} = \frac{\sum \mathrm{Claims_{LA}}}{\mathrm{BaseRate} \cdot \sum \left(\frac{\mathrm{LR_{LA}}}{\mathrm{LR_T}} \cdot \mathrm{Factor_{LA}} \right)}$$

- To adjust the loss ratio in LA to be equivalent to the weighted-average loss ratio, we must multiply the current factor by $\frac{\mathrm{LR_{LA}}}{\mathrm{LR_T}}$.

Adjusting the loss ratios

$$LR_{LA} = \frac{\sum Claims_{LA}}{BaseRate \cdot \sum Factor_{LA}}$$

$$LR_T = \frac{\sum Claims_{LA}}{BaseRate \cdot \sum \left(\frac{LR_{LA}}{LR_T} \cdot Factor_{LA} \right)}$$

- We can choose any target loss ratio we want, but we will use the weighted-average loss ratio in this example.
- Regardless of our choice, our final premiums will be the same after base rate modifications.