Northeastern University
College *of* Computer and Information Science

CS1100: Computer Science and Its Applications

Excel Basics

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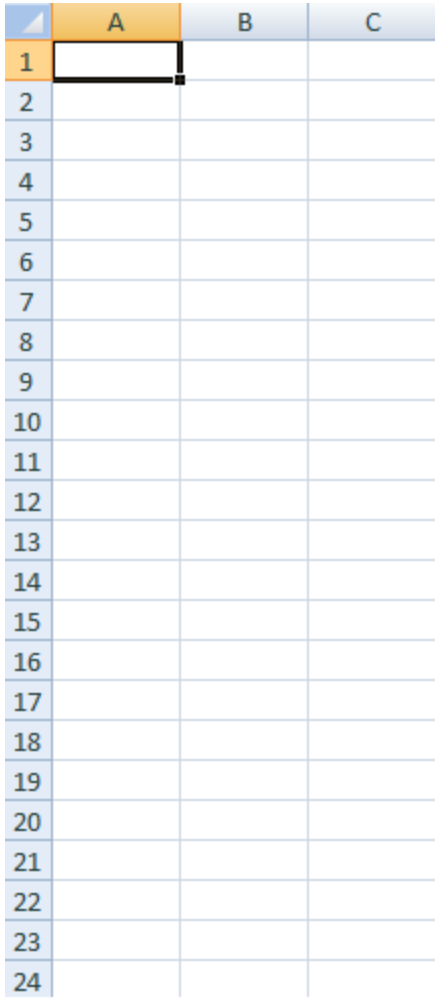
Modified from originals created by Martin Schedlbauer, Peter Douglass and Peter Golbus

Spreadsheets

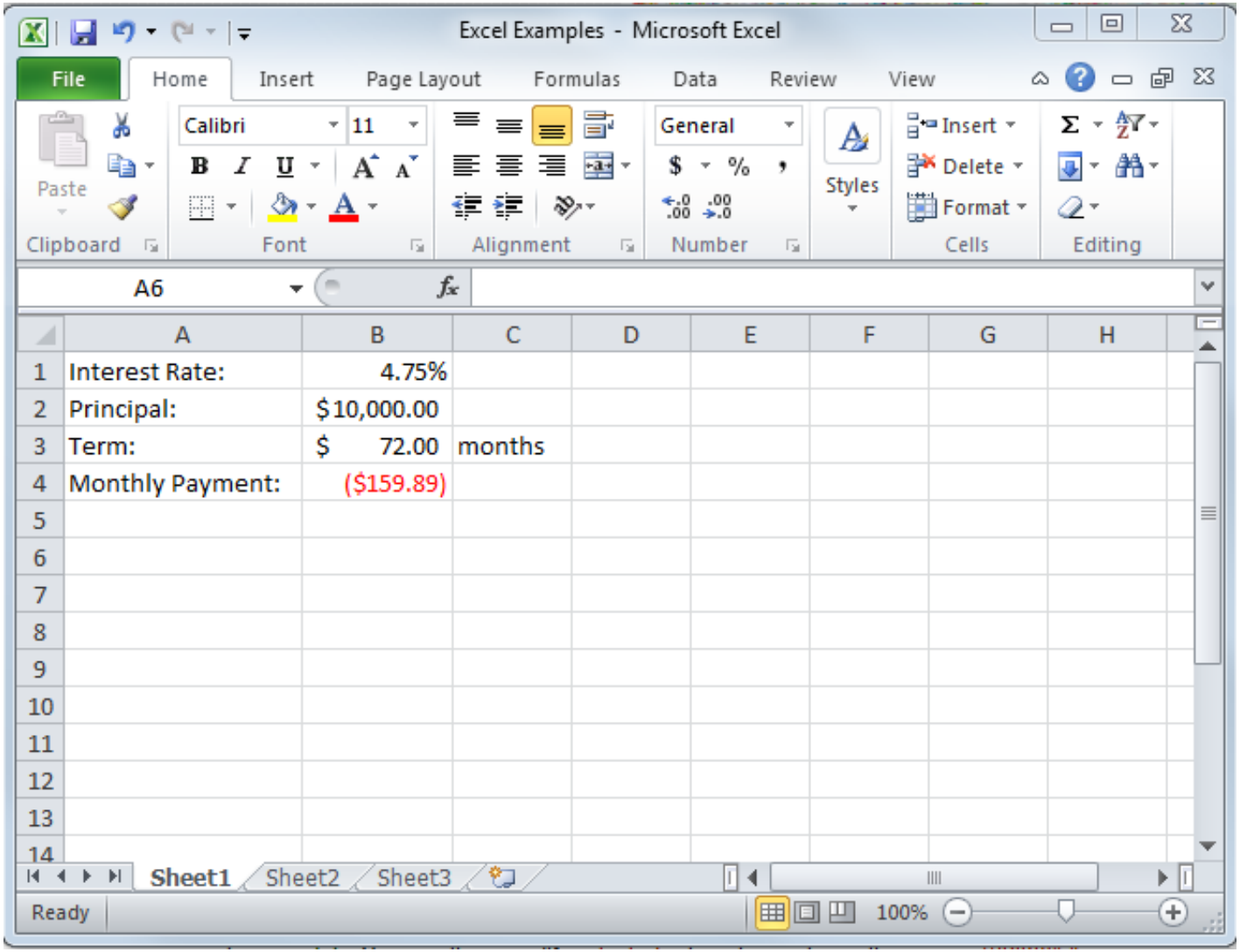
- Spreadsheets are among the most useful technical business applications.
- Principally used for calculations and manipulation of tabular data.
- Common spreadsheet applications:
  - Microsoft Excel
  - Google Spreadsheet
  - Zoho Sheet

Spreadsheet Layout

- Tabular layout arranged in rows and columns.
  - Columns are labeled with letters
  - Rows are labeled with numbers
- Cells are at the intersection of rows and columns
  - Example cell reference: A3, C9
- Cells can contain:
  - Numbers, dates, text, or other data
  - Formulas using functions and cell references



Microsoft Excel 2010



Cell Ranges

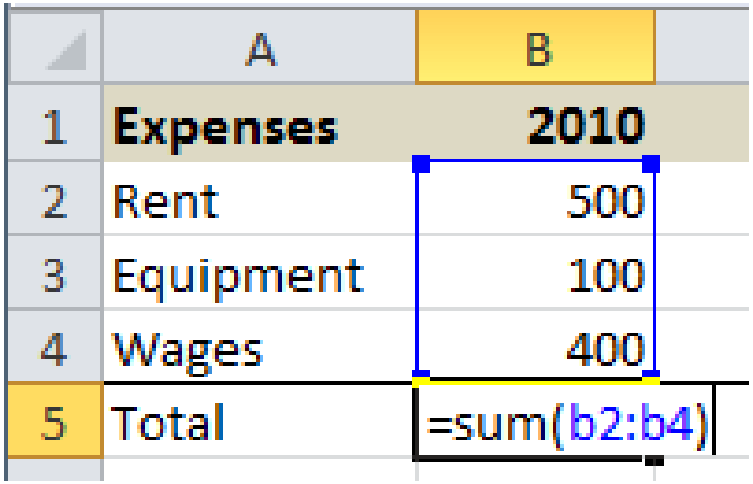
- Many functions require cell ranges:
  - Column Range: A1:A10
  - Row Range: A5:K5
  - Matrix: A1:C5

Functions

- Excel provide thousands of functions to build spreadsheet models:
  - Financial, *e.g.*, pmt, irr, fv, db
  - Aggregation, *e.g.*, sum, count, average
  - Text, *e.g.*, left, mid, trim
  - Date & Time, *e.g.*, today, time, second
  - Lookup, *e.g.*, choose, vlookup, match
  - Logical, *e.g.*, if, not, or
  - Statistical, *e.g.*, median, correl
  - Engineering, *e.g.*, bessel, imlog
  - Trigonometric, *e.g.*, sin, tan, acos

Entering Formulas and Functions

- To enter formulas and functions:
  - start entry with =
- Example:



	A	B
1	**Expenses**	**2010**
2	Rent	500
3	Equipment	100
4	Wages	400
5	Total	=sum(b2:b4)

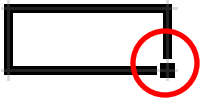
Cell References in Functions

- Most functions require parameters.
- To keep your model flexible and correct even when the data changes, only use cell references in functions.

	A	B
1	Interest Rate:	0.0475
2	Principal:	10000
3	Term:	72
4	Monthly Payment:	=PMT(B1/12,B3,B2)

Copying Cells

- To copy cells:
  - CTRL+C to copy and CTRL+V to paste

  or
  - Use cell dragging 
- Cell references are automatically adjusted when copied.
- Cell references can be locked $.
  - $A1:$A5 is not adjusted when column copied
  - A$1:C$1 is not adjusted when row copied
  - A1 is never adjusted when copied

Anchors and Cell Dragging

- Formulas can be copied to adjacent cells by dragging.
- Dragging changes cell references.
- Usually this is what you want, but sometimes it breaks your formulas.
- Anchors ($) stop cell references from changing.
- But when do you use them?

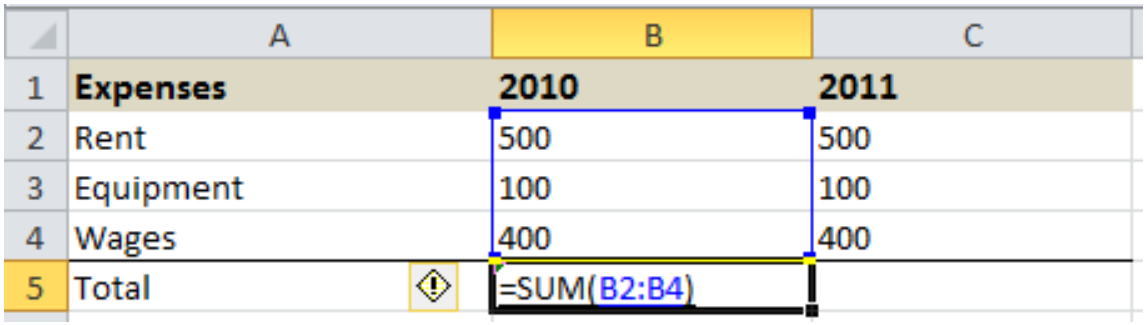
When to Anchor

- Manually rewrite your formula in the cell to the right and the cell below the original cell.
- Compare the *letters* in the original formula to the letters in the formula to the *right*.
- If a letter didn't change, put a $ before it in the original cell.

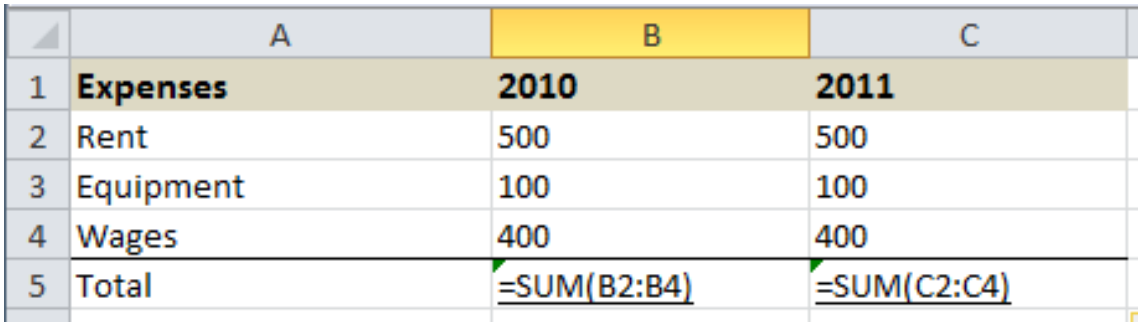
When to Anchor

- Manually rewrite your formula in the cell to the right and the cell below the original cell.
- Compare the *numbers* in the original formula to the letters in the formula to *below*.
- If a number didn't change, put a $ before it in the original cell.

Demo: Copying Formulas



	A	B	C
1	**Expenses**	**2010**	**2011**
2	Rent	500	500
3	Equipment	100	100
4	Wages	400	400
5	Total	=SUM(B2:B4)	



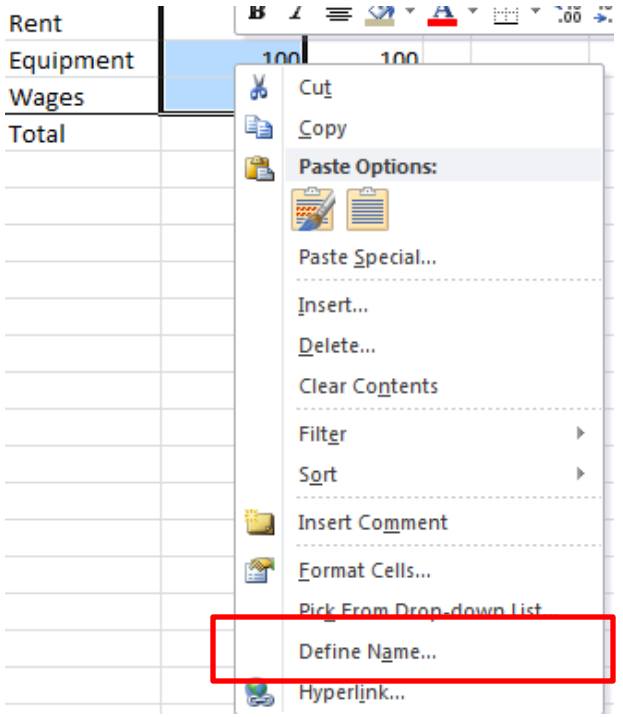
	A	B	C
1	**Expenses**	**2010**	**2011**
2	Rent	500	500
3	Equipment	100	100
4	Wages	400	400
5	Total	=SUM(B2:B4)	=SUM(C2:C4)

- Notice what happens to the cell references when copying from row to row or column to column.
- Observe the effect of cell locking with $.

Click to watch video demonstration

Named Ranges

- To make your formulas easier to read, use named cell ranges.
- To create a named range:
  - Highlight cells to include in named range
  - Click right mouse button on any cell in the selected range for context menu
  - Choose “Define Name…” and provide name
- **Note: named ranges are never adjusted when row or column copied, i.e. both cells and columns are automatically anchored in named ranges.**



Click here to watch demonstration…

Named Ranges in Functions

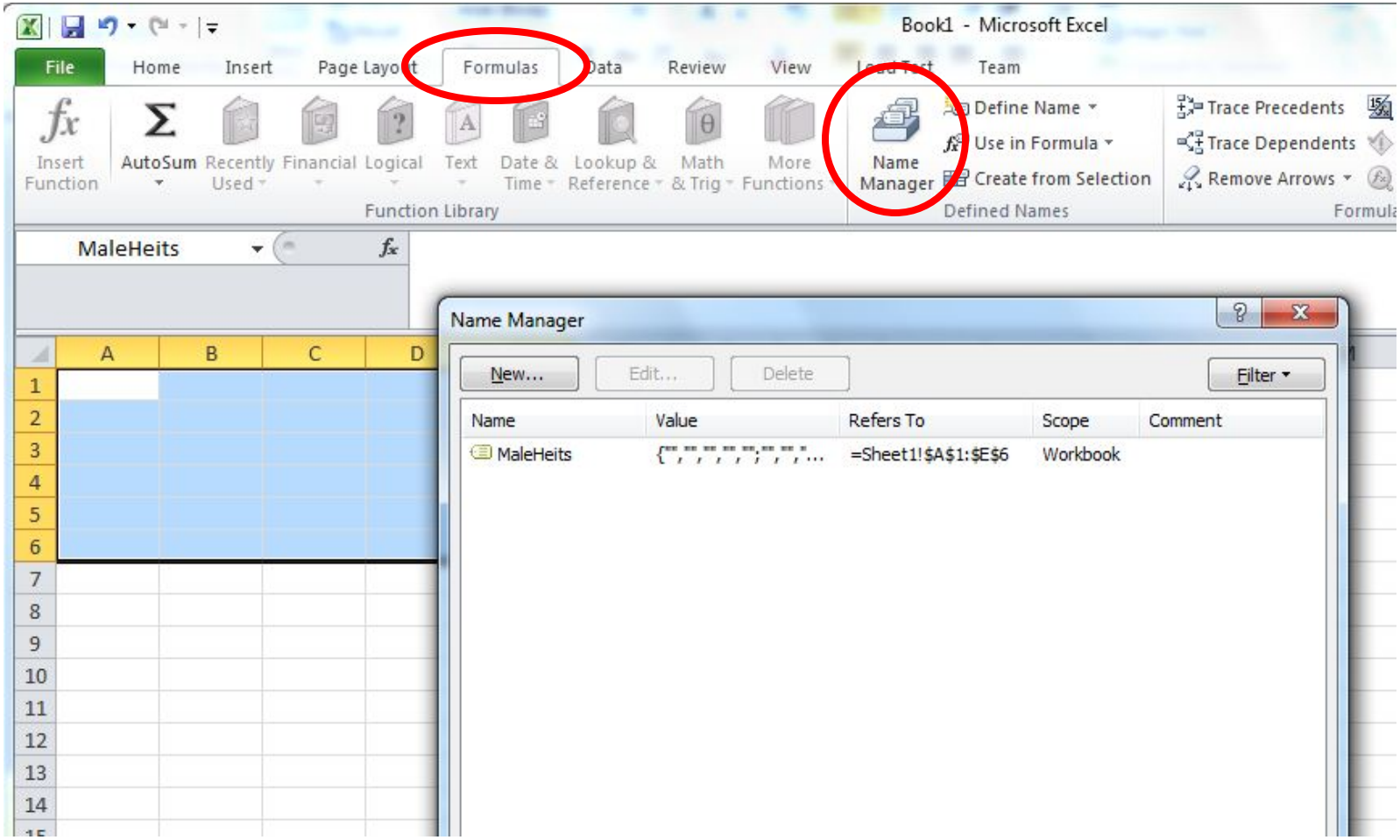
- Named ranges can make function parameters easier to understand:

	A	B
1	Interest Rate:	0.0475
2	Principal:	10000
3	Term:	72
4	Monthly Payment:	=PMT(InterestRate/12,TermInMonths,Principal)

Managing Named Ranges

- To manage (delete, edit, rename, etc) named ranges
  - In the Formulas ribbon
  - Click on Name Manager

Managing Named Ranges



Showing Formulas

- To show the formulas in your spreadsheet, press CTRL+~.

	A	B
1	**Expenses**	
2	Rent	500
3	Equipment	100
4	Wages	400
5	Total	1000

	A	B
1	**Expenses**	
2	Rent	500
3	Equipment	100
4	Wages	400
5	Total	=SUM(B2:B4)

Formatting

- Formatting changes the way values are displayed, but does not change the actual value being used in functions.
- Common formatting options:
  - Currency values
  - Time and date values
  - Numeric formats and decimal points
  - Percent

Demo: Formatting

	A	B	C
1	Interest Rate:	0.0475	
2	Principal:	10000	
3	Term:	72	months
4	Monthly Payment:	-159.8922446	

Unformatted values

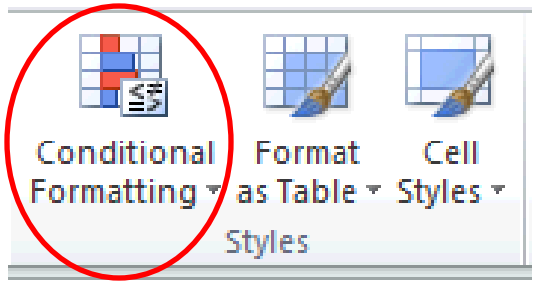
	A	B	C
1	Interest Rate:	4.75%	*Percent*
2	Principal:	$ 10,000.00	*Currency*
3	Term:	72	months
4	Monthly Payment:	$ (159.89)	*Accounting*

Formatted values

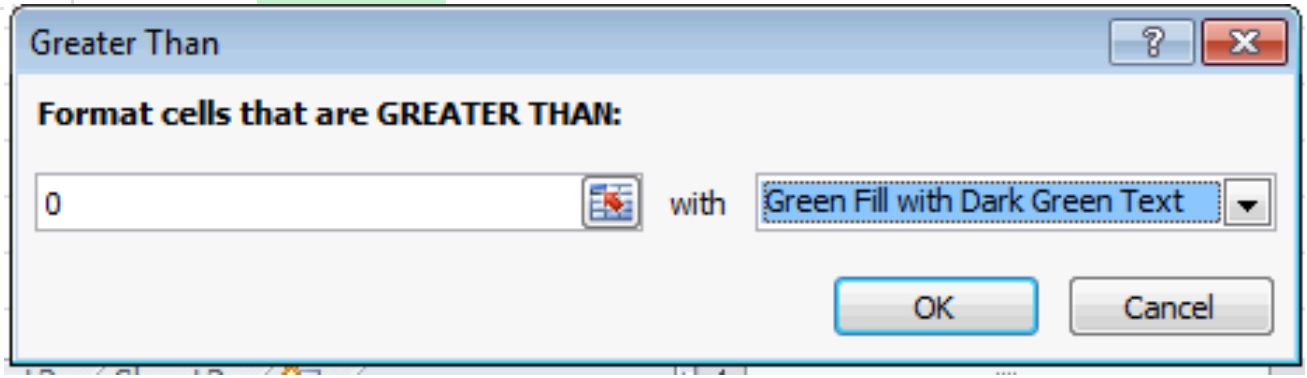
Click here to watch demonstration…

Conditional Formatting

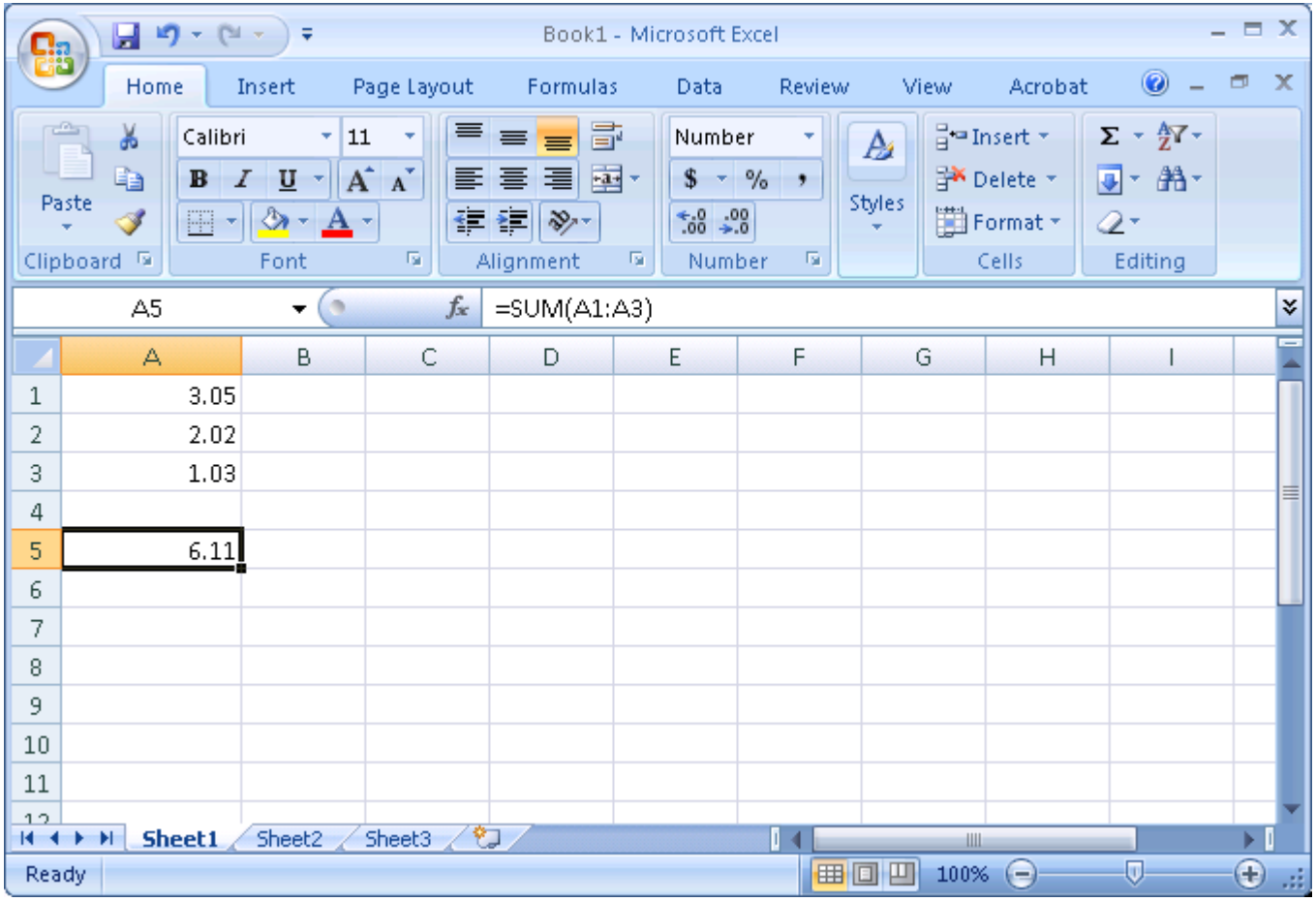
- Conditional formatting is allows the application of specified formatting only when certain conditions are met.
- On the Home tab, in the Styles group, click the arrow next to Conditional Formatting



Stock	Opening	Closing	Change
DNDN	5.88	6.02	0.14
FB	27.77	28.76	0.99
MSFT	27.25	26.74	-0.51
BAC	11.96	12.11	0.15



Formatting Example



Look Carefully at the Formatting Example

- It *appears* to say that the sum of

  3.05

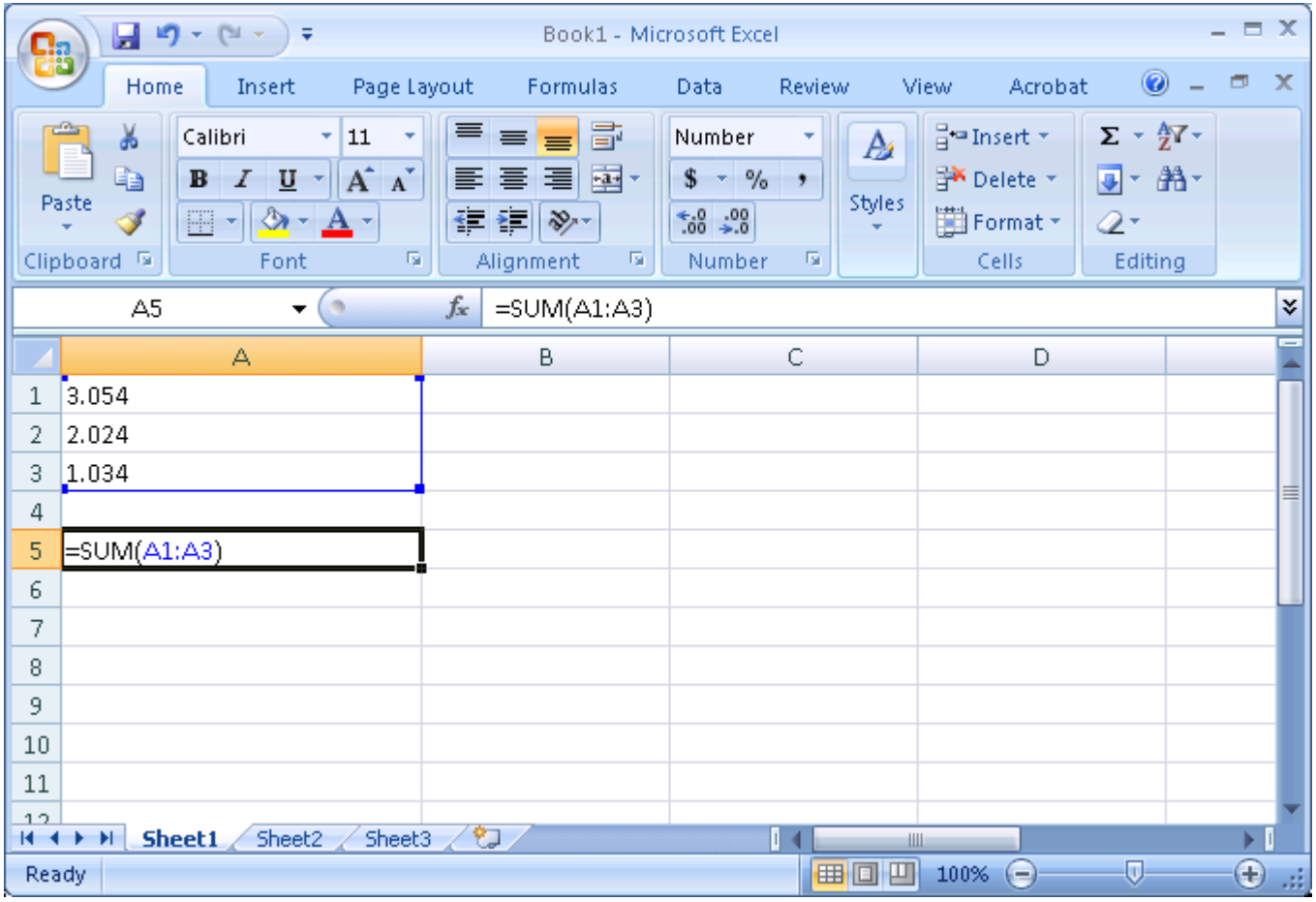
  2.02

  1.03

  is 6.11

- That is not mathematically correct!
- The next slide shows what is actually in each cell. (Control / ~)

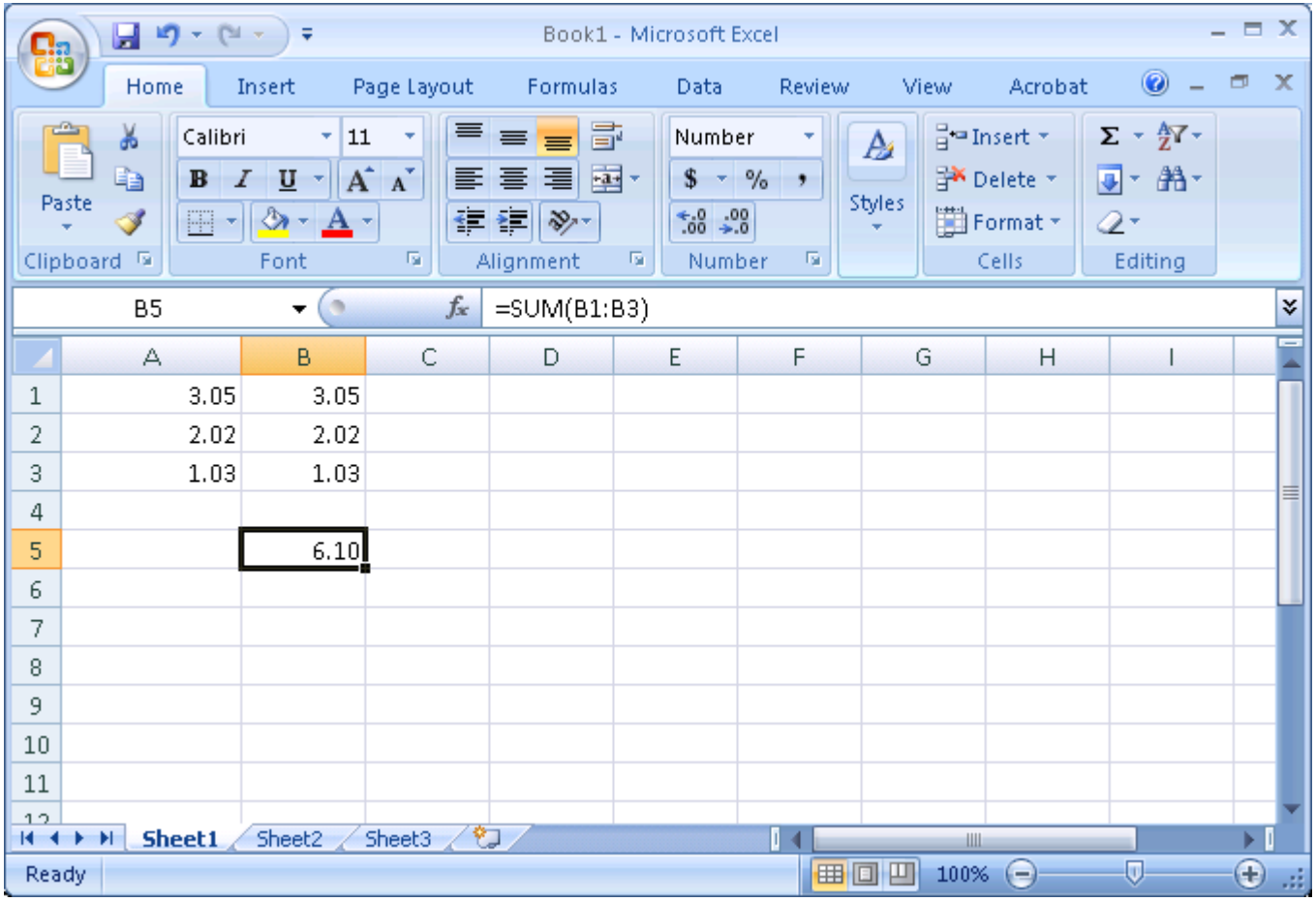
Formatting Example with Control / ~



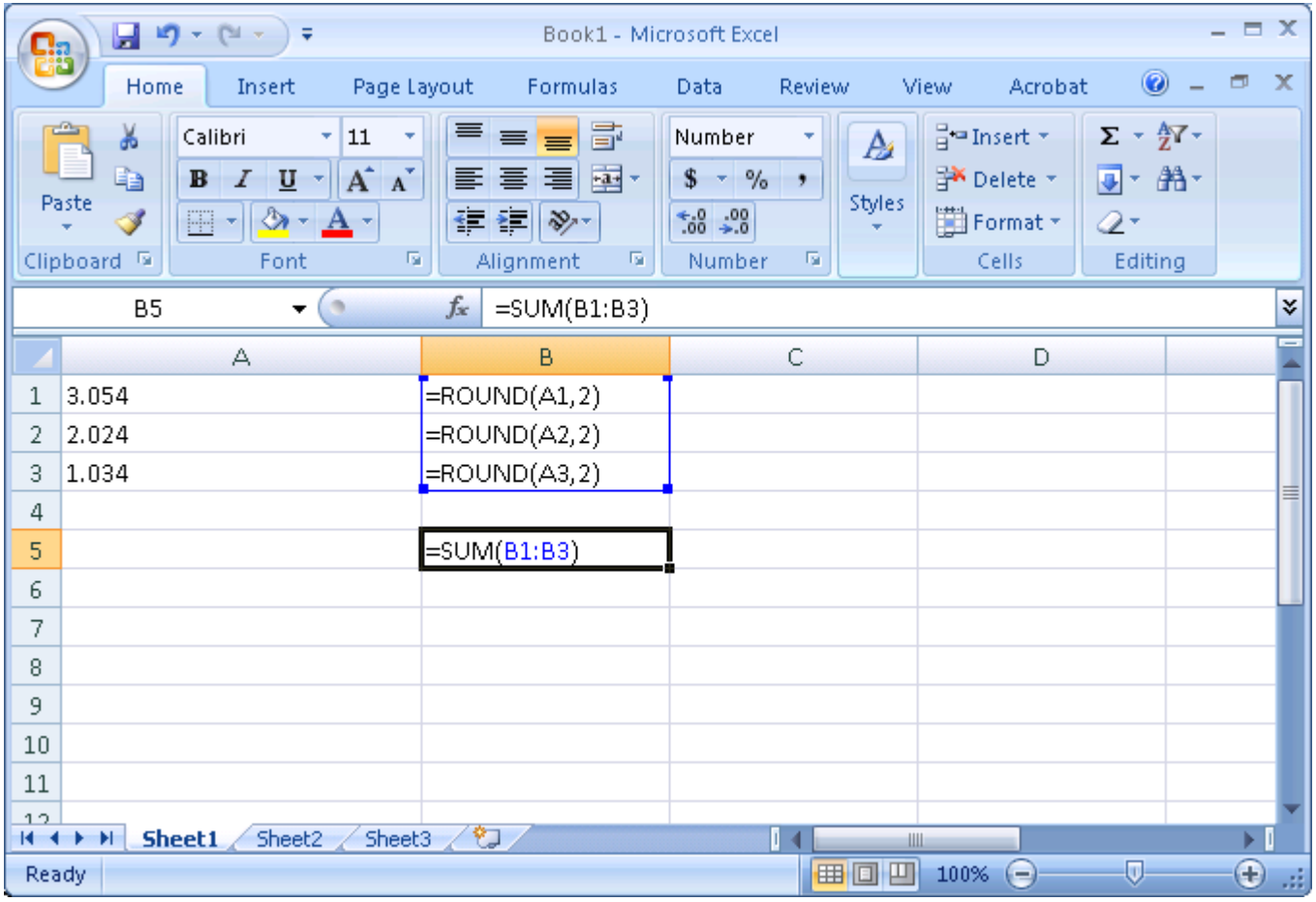
What happened?

- What happened is that the cells in column ‘A’ were formatted to show only 2 digits after the decimal point.
- However, the numbers in column ‘A’ actually had more than 2 digits after the decimal point. The last digits were “hidden”.
- Hiding some of the digits can yield results that appear to be wrong.

Rounding Example



Rounding Example with Control / ~



Rounding Example

- The addition in column ‘B’ is now mathematically correct.
- The value that appears in cell B5 is in fact the sum of the numbers appearing in cells B1:B3

Warning!

- The values ***displayed*** by a computer application are often not the values that are ***used*** inside that application.
- If you need a value that has only a certain number of digits after the decimal place, you must ***round*** that value, not merely ***format*** it.
- Excel: ROUND(Range, Decimal Places)

Bottom Line

- If a computer's arithmetic appears incorrect, it is may be a formatting / rounding error.
- Excel: fix these errors with the ROUND function.

Hiding Columns or Rows

- To make spreadsheets easier to read, you may wish to hide rows or columns that contain auxiliary (or supporting) values or temporary calculations.
- Right-Click on the row or column header and select “Hide”.

Click here to watch demonstration…

The **IF** Function

- The IF function allows a cell to be filled with one of two possible values.
- General form of IF:

```
=IF(condition,value_if_true,value_if_false)
```

- Example:

	A	B
1	*Tax Exempt?*	**Yes**
2	*Sales Tax:*	5.65%
3	*Order Total:*	$100.00
4	*Tax Due:*	=IF(B1="Yes",0,B2*B3)

Cell B4 is either $0 if the customer is tax exempt or the tax due is the order total multiplied by the tax rate.

Taking a Closer Look at **IF**

	A	B
1	*Tax Exempt?*	**Yes**
2	*Sales Tax:*	5.65%
3	*Order Total:*	$100.00
4	*Tax Due:*	

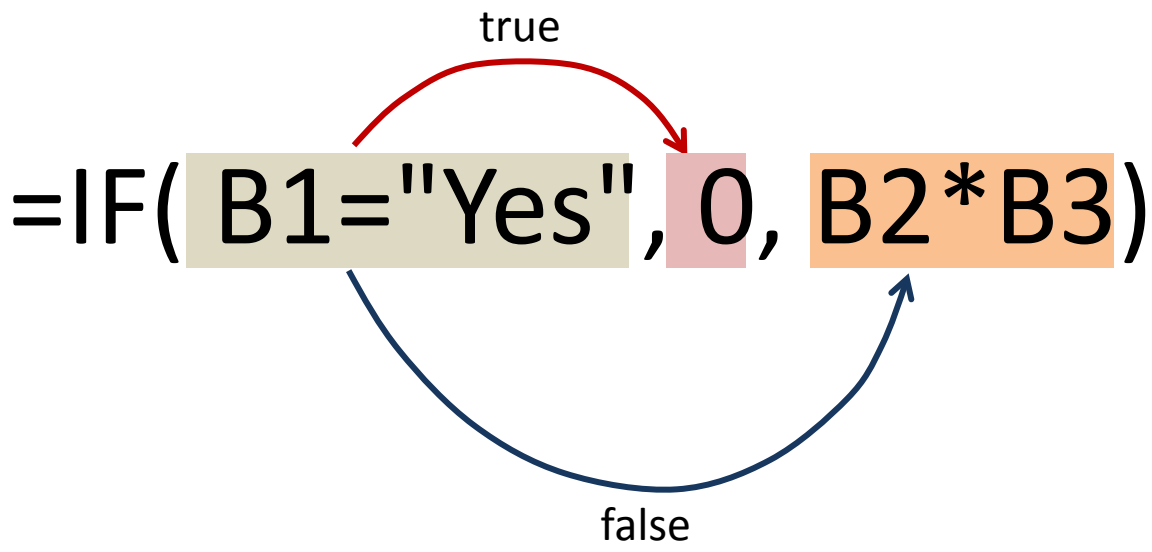
Does cell *B1* contain "Yes"?

If so, then cell *B4* will be filled with the value 0

=IF(B1="Yes", 0, B2*B3)

If not, then cell *B4* will be filled with the result of the formula *B2*B3*

A Closer Look at the Statement



How Does **IF** Work?

- **IF** does not perform any calculation, it simply fills a cell with one of two values.
- The values can be:
  - literals (actual numbers or text), *e.g.*, 0
  - results of functions or formulas
  - empty cells ("") are two double-quotes
  - some cell reference, *e.g.*, B2

The **IF** Condition

- The **IF** condition is a logical expression, I.E. it evaluates to true or false.
- Examples:
  - equality (=)
  - less than (<) or less than or equal (<=)
  - greater than (>) or greater than or equal (>=)
- Complex conditions can be built with the **AND** and **OR** functions.

A Complete Spreadsheet Model

- Spreadsheet to calculate the market value of a precious metals portfolio.

	A	B	C	D	E
1	**Market Price of Silver per OZ:**			$ 30.00	
2	**Market Price of Gold per OZ:**			$1,401.00	
3					
4	**Metal**	**Amt (oz)**	**Date**	**Basis (oz)**	**Gain/Loss**
5	Gold	10.00	5/7/2008	$ 392	$ 10,090
6	Silver	100	9/1/2009	13.75	$ 1,625
7	Gold	2	9/5/2009	899	$ 1,004
8					
9			Total Portfolio Value:		$ 12,719
10			Total Gold Value:		$11,094.00
11			Total Silver Value:		$ 1,625.00

=B5*(IF(A5="Gold",D2,D1)-D5)

=SUM(E5:E7)

=SUMIFS(E5:E7,A5:A7,"Gold")

Filtering Data

- An alternative way of summing data.

	A	B	C	D	E	F	G
1	**Market Price of Silver per OZ:**			$ 30.00			
2	**Market Price of Gold per OZ:**			$1,401.00			
3							
4	**Metal**	**Amt (oz)**	**Date**	**Basis (oz)**	**Gain/Loss**	**Gold**	**Silver**
5	Gold	10.00	5/7/2008	$ 392	$ 10,090	$ 10,090	$ -
6	Silver	100	9/1/2009	13.75	$ 1,625	$ -	$ 1,625
7	Gold	2	9/5/2009	899	$ 1,004	$ 1,004	$ -
8							
9				Total Portfolio Value:	$ 12,719	$ 11,094	$ 1,625

=IF($A5=F$4,$E5,0)

=SUM(F5:F7)

[Try it out online with Zoho Sheet]

COUNTIF

- COUNTIF allows you to display the number of cells in a range whose values meets specific criteria.
- The syntax of the COUNTIF function is: COUNTIF(**range**,**criteria**) … where range is a group of cells, and criteria is the value a cell must have to be counted.
- The default operator for criteria is "equals" and should not be specified.
- Operators (>, <, >=, <=, <> and =) must be enclosed in quotation marks and <> means "not equal”.

COUNTIF

- Example:

D6 | =COUNTIF(D2:D5, ">.2")

	A	B	C	D	E	F
1	Stock	Opening	Closing	Change		
2	DNDN	5.88	6.02	0.14		
3	FB	27.77	28.76	0.99		
4	MSFT	27.25	26.74	-0.51		
5	BAC	11.96	12.11	0.15		
6				1		

Excel Basics

FLEXIBLE MODELS

Assume Data May Change!

- It is best practice to write your spreadsheets in such a way that they give correct results for given data, regardless of what that data might be, and not merely the correct results for a particular data set.
- If the data changes, the answer should be correct for the new data set.

Don’t Duplicate Data!

- Since the given data for a problem may change, this data should appear as given data in one place only.
- If data given for a problem is repeated in many places, then changing that data will require changes in many places.
  - This can be a source of errors as well as a source of unnecessary work.

Building Flexible Models

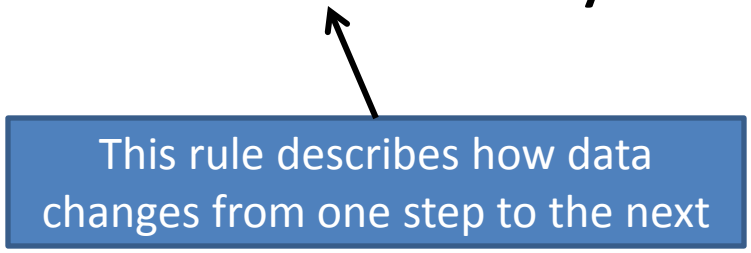
- Don’t use actual numbers of text in your formulas and functions, i.e., don’t “hard code” values.
- To keep your model general and flexible when data change, use only cell references.

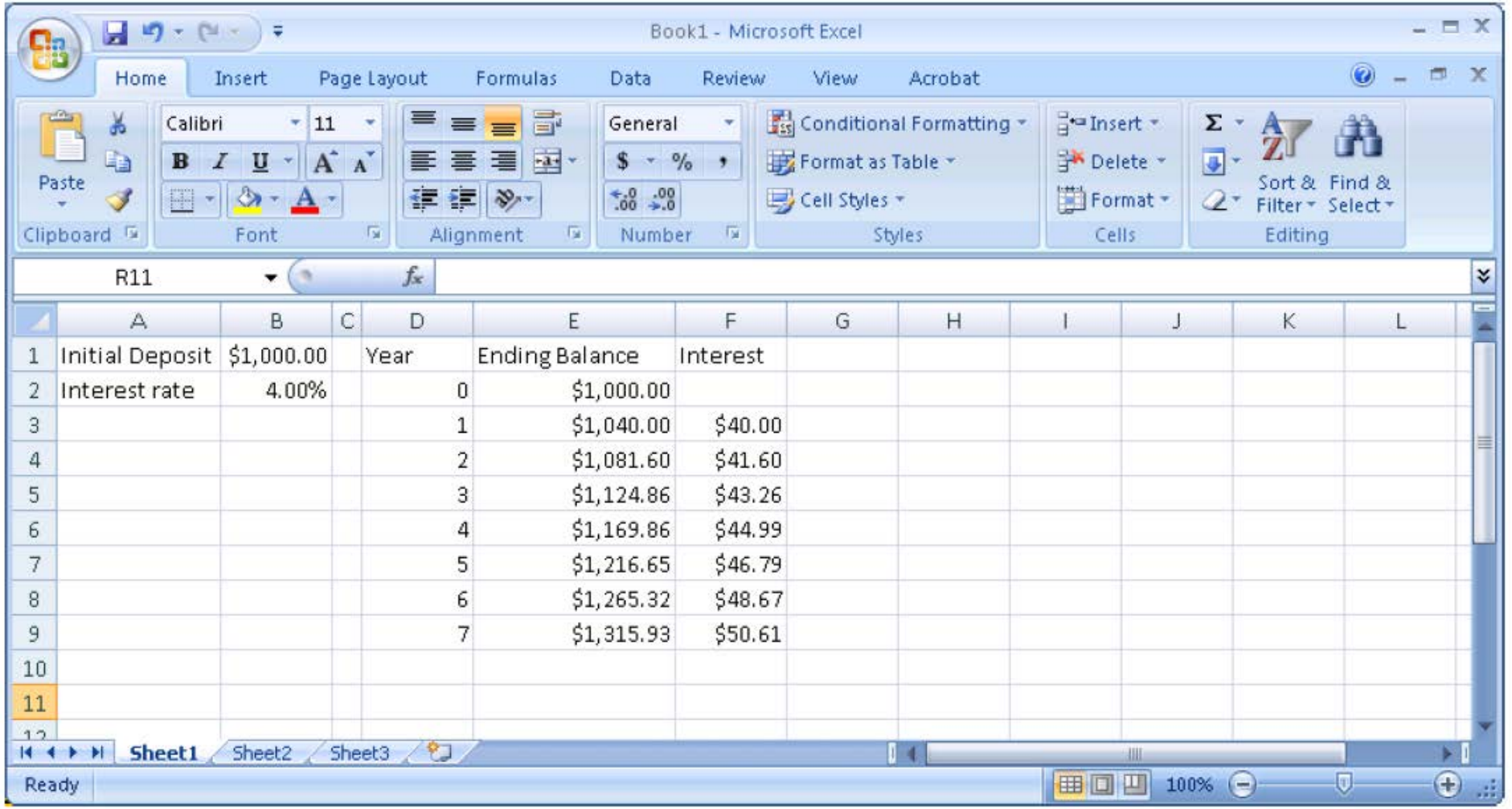
Inductively Defined Problems

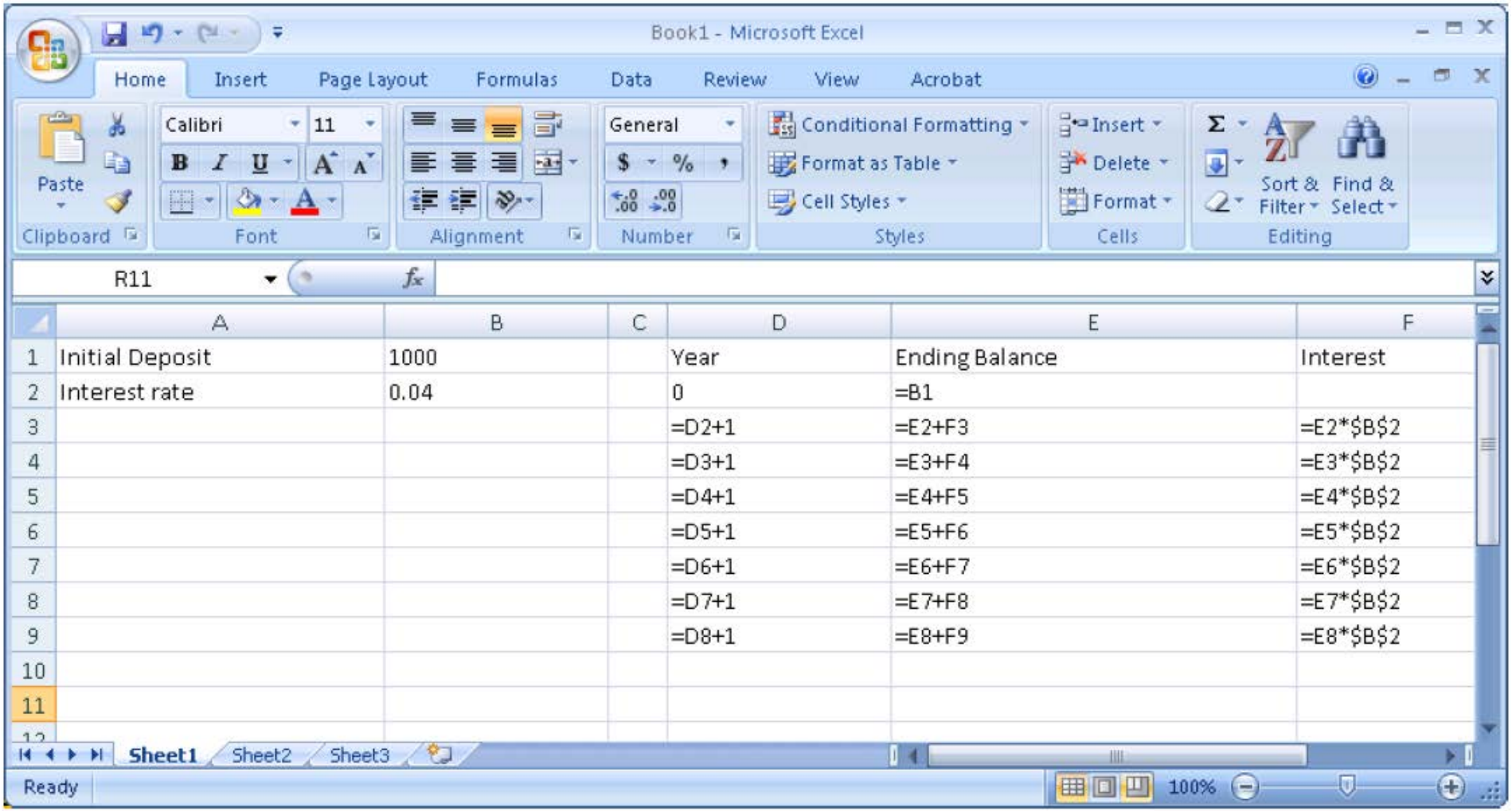
- An inductively defined problem has 2 parts:
  - A set of starting conditions
  - A set of rules that describe how data changes from one step to the next.

Inductively Defined Problems

- Example:
  - You deposit $1000 in a savings account
  - At the end of each year, you receive 4% interest on the balance in your account.







	A	B	C	D	E	F
1	Initial Deposit	1000		Year	Ending Balance	Interest
2	Interest rate	0.04		0	=B1	
3				=D2+1	=E2+F3	=E2*B2
4				=D3+1	=E3+F4	=E3*B2
5				=D4+1	=E4+F5	=E4*B2
6				=D5+1	=E5+F6	=E5*B2
7				=D6+1	=E6+F7	=E6*B2
8				=D7+1	=E7+F8	=E7*B2
9				=D8+1	=E8+F9	=E8*B2
10						
11						

Inductively Defined Problems

- The parameters of our problem appear separately from the calculations that model our problem (columns A and B).
- There is a special year 0 in our solution that serves as a place holder for our starting condition.
- The formulas for the data for each year other than year 0 are similar, differing only in the cells that they reference.