

# Spreadsheets

Lecture 11 - COMPSCI 111/111G S2 2020

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"Autosum aside, these numbers just don't add up."

# The 1st Killer App. VisiCalc

- ▶ The idea for the electronic spreadsheet came to me while I was a student at the Harvard Business School, working on my MBA degree, in the spring of 1978. Sitting in Aldrich Hall, room 108, I would daydream. "Imagine if my calculator had a ball in its back, like a mouse..." (I had seen a mouse previously, I think in a demonstration at a conference by Doug Engelbart, and maybe the Alto).
- ▶ And "...imagine if I had a heads-up display, like in a fighter plane, where I could see the virtual image hanging in the air in front of me. I could just move my mouse/keyboard calculator around, punch in a few numbers, circle them to get a sum, do some calculations, and answer '10% will be fine!'" (10% was always the answer in those days when we couldn't do very complicated calculations...)

[www.bricklin.com/history/intro.htm](http://www.bricklin.com/history/intro.htm)

# Development

- ▶ Background
  - ▶ Dan Bricklin and Bob Frankston
  - ▶ VisiCalc released in 1979.



# Design

## ▶ Visible Calculator

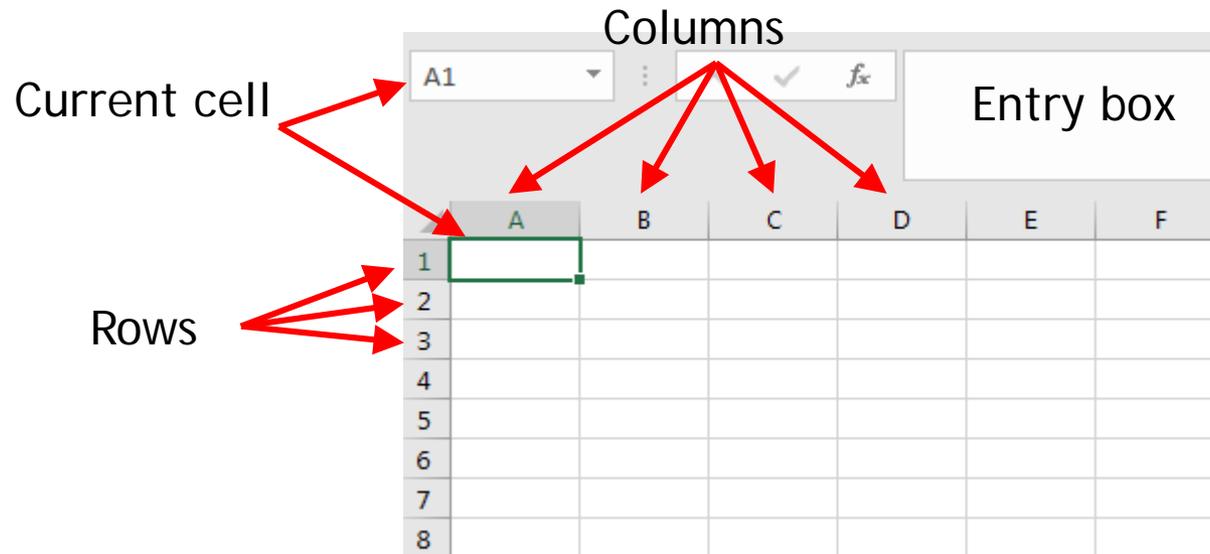
- ▶ Organize calculations as we would on paper - in columns and rows.
- ▶ Supports automatic updating of calculations.
- ▶ Copy formulas so we may apply these to large amounts of data.

C11 (L) TOTAL C1  
25

	A	B	C	D
1	ITEM	NO.	UNIT	COST
2	MUCK RAKE	43	12.95	556.85
3	BUBBZ CUT	15	6.75	101.25
4	TOFF TONER	250	49.95	12487.50
5	EYE SNUFF	2	4.95	9.90
			SUBTOTAL	13155.50
			9.75% TAX	1282.66
			<b>TOTAL</b>	<b>14438.16</b>

# Microsoft Excel - Overview

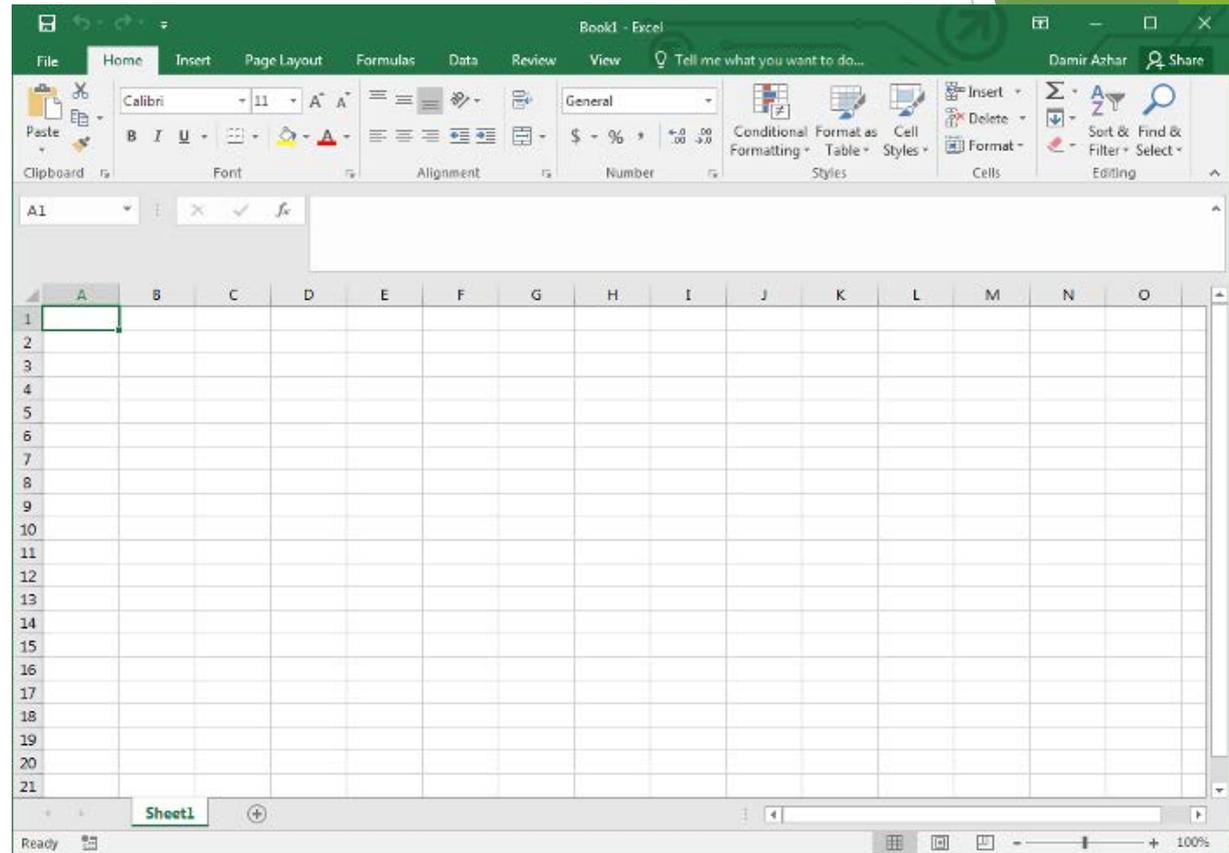
- ▶ Used to represent a table of data
  - ▶ Rows (labelled with numbers)
  - ▶ Columns (labelled with letters)
  - ▶ Cells



[http://en.wikipedia.org/wiki/Microsoft\\_Excel](http://en.wikipedia.org/wiki/Microsoft_Excel)

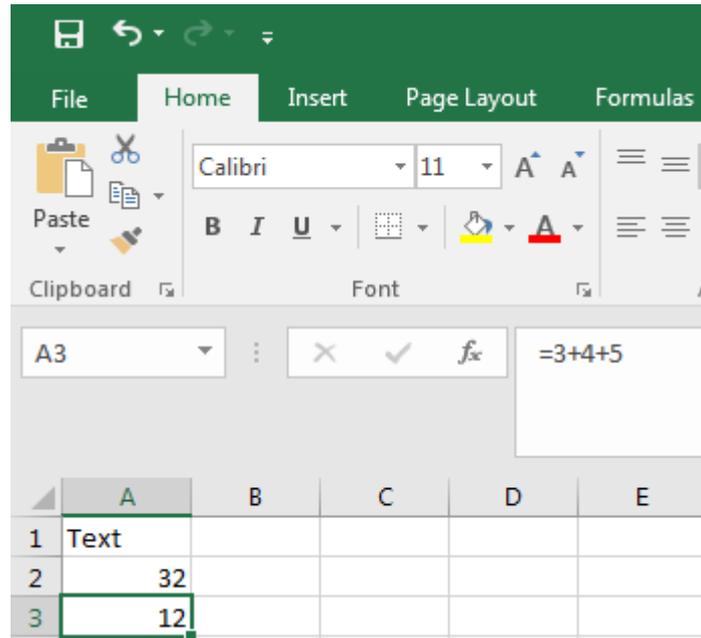
# Changing appearance of cells

- ▶ Alter Size
  - ▶ Click on cell separator and drag
- ▶ Add Borders
  - ▶ Format Cell
- ▶ Add Shading
  - ▶ Format Cell
- ▶ Font
  - ▶ Style
  - ▶ Size
  - ▶ Alignment
- ▶ Numbers
  - ▶ Decimal points



# Entering Data

- ▶ Cells contain
  - ▶ Text
  - ▶ Numbers
  - ▶ Formulae (start with "=")



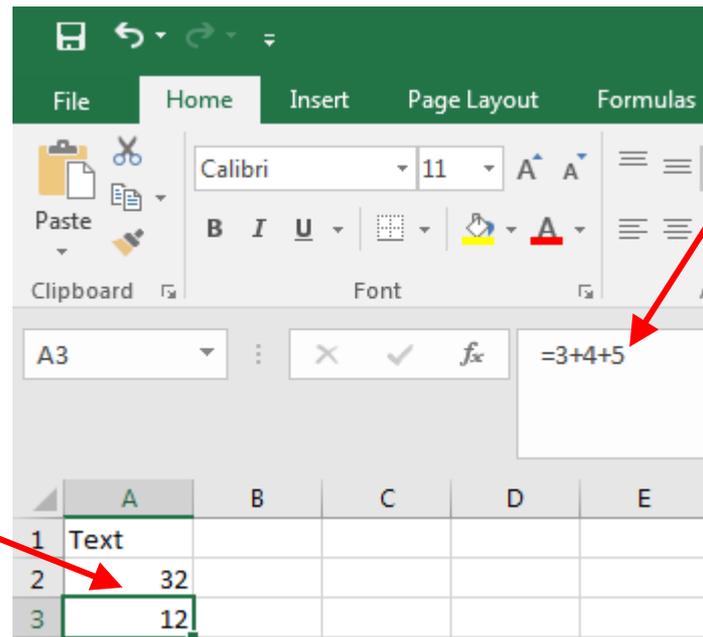
- ▶ Entry box
  - ▶ Type data in entry box
  - ▶ Hit Enter key to accept value
  - ▶ All formulae are calculated
  - ▶ Results shown in each cell

# Formulae

- ▶ Entering formulae
  - ▶ Always begin with an equals sign
  - ▶ Calculation typed into cell/entry box
  - ▶ Result displayed in the cell
  - ▶ Formula displayed in the entry box

Formula

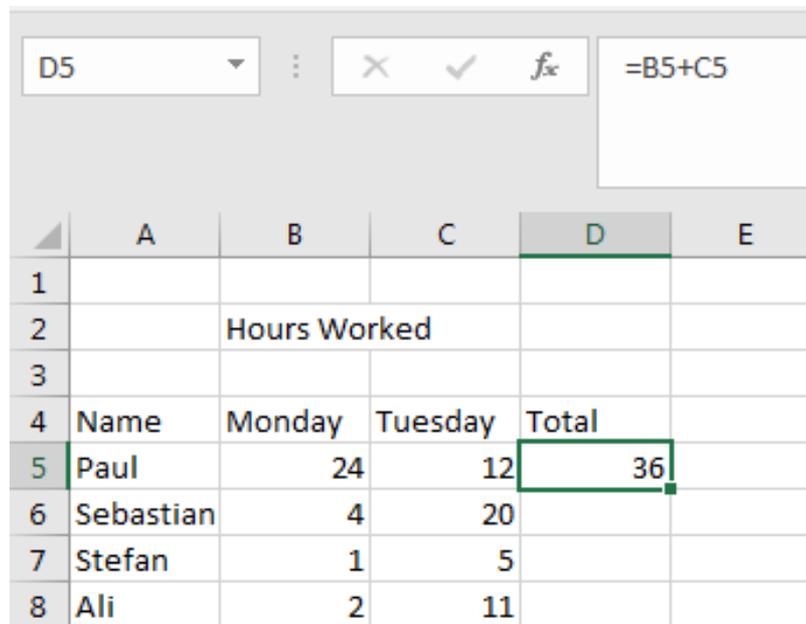
Result



# Using Cell References

## ▶ Cell Reference

- ▶ Formulae refer to other cells
- ▶ Specify cell location using Row and Column IDs



The image shows a screenshot of an Excel spreadsheet. The formula bar at the top displays the formula `=B5+C5` for cell D5. The spreadsheet contains a table with the following data:

	A	B	C	D	E
1					
2		Hours Worked			
3					
4	Name	Monday	Tuesday	Total	
5	Paul	24	12	36	
6	Sebastian	4	20		
7	Stefan	1	5		
8	Ali	2	11		

# Filling Down and Filling Right

- ▶ Save time
  - ▶ Fill many cells with same contents
  - ▶ Select a group of cells
  - ▶ Fill Right
  - ▶ Fill Down

The diagram illustrates two spreadsheet operations: 'Fill down' and 'Fill right'. It consists of three panels showing the progression of data filling.

**Panel 1 (Left):** A spreadsheet with columns A and B, and rows 1 through 8. Cell A1 contains the value '100'. The range A1:A8 is selected, indicated by a green border.

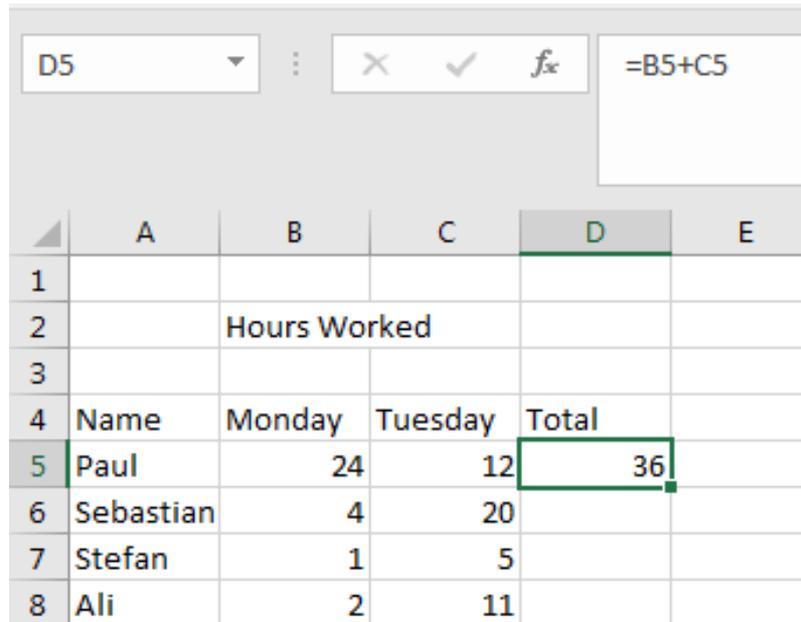
**Panel 2 (Middle):** An arrow labeled 'Fill down' points from the first panel to this one. The value '100' from cell A1 has been copied down to fill all cells in column A from row 2 to row 8. The range A1:A8 remains selected.

**Panel 3 (Right):** An arrow labeled 'Fill right' points from the second panel to this one. The value '100' from cell A1 has been copied horizontally to fill all cells in row 1 from column B to column F. The range A1:F1 remains selected.

The top of each panel shows the spreadsheet interface, including the active cell reference (A1), a formula bar containing '100', and a grid of columns A through F and rows 1 through 8.

# Filling Cells with Formulae

- ▶ Use Fill Down/ Fill Right on formulae
  - ▶ Saves us entering new formula for each row



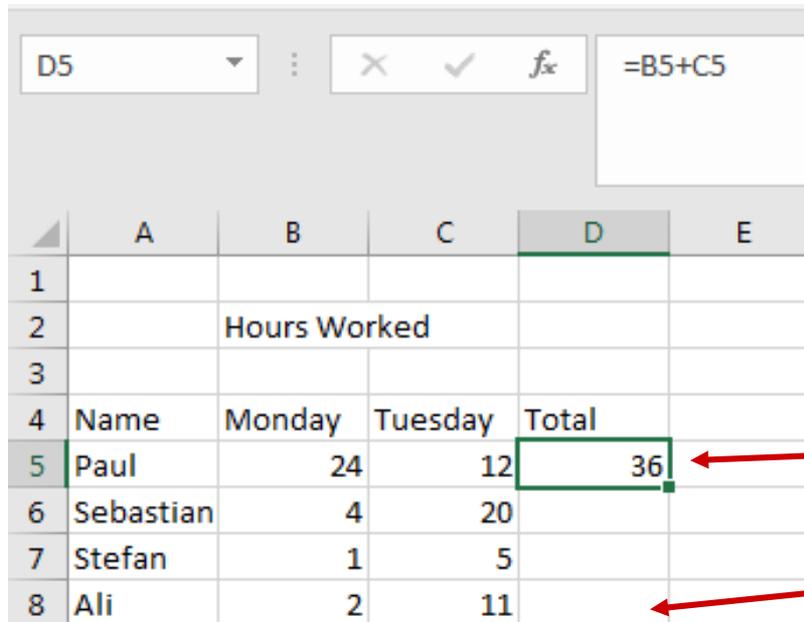
The screenshot shows an Excel spreadsheet with a formula bar at the top displaying the formula  $=B5+C5$  for cell D5. The spreadsheet data is as follows:

	A	B	C	D	E
1					
2		Hours Worked			
3					
4	Name	Monday	Tuesday	Total	
5	Paul	24	12	36	
6	Sebastian	4	20		
7	Stefan	1	5		
8	Ali	2	11		

- ▶ D5 should contain  $=B5 + C5$
- ▶ D6 should contain  $=B6 + C6$
- ▶ D7 should contain  $=B7 + C7$
- ▶ D8 should contain  $=B8 + C8$

# Relative References

- ▶ Cell reference in formula
  - ▶ Use same formula, different cell references
  - ▶ Cell reference is relative to position of formula
  - ▶ Spreadsheets adjust formula automatically during fill operation



	A	B	C	D	E
1					
2		Hours Worked			
3					
4	Name	Monday	Tuesday	Total	
5	Paul	24	12	36	
6	Sebastian	4	20		
7	Stefan	1	5		
8	Ali	2	11		

=B5 + C5

=B8 + C8

# Absolute references

- ▶ Absolute references
  - ▶ Sometimes the cell reference should not change
    - ▶ Eg. for constants
  - ▶ Use a dollar sign \$ before the row or column

The screenshot shows a spreadsheet with the following data:

	A	B	C	D	E
1					
2		Hours Worked			
3					
4	Pay rate:	12			
5					
6	Name	Monday	Tuesday	Total	Total Pay
7	Paul	24	12	36	432
8	Sebastian	4	20	24	288
9	Stefan	1	5	6	72
10	Ali	2	11	13	156

= D7 \* \$B\$4

# Exercises

Exercise 1: Is the reference to cell D6 in the formula  $=\$D\$6*2$  a relative or an absolute reference?

Imagine that you are keeping track of the sales for tickets at the Olympic games. A number of different sports are located in different venues. Each venue has a number of seats available. Your spreadsheet will keep track of the number of tickets available and the number actually sold.

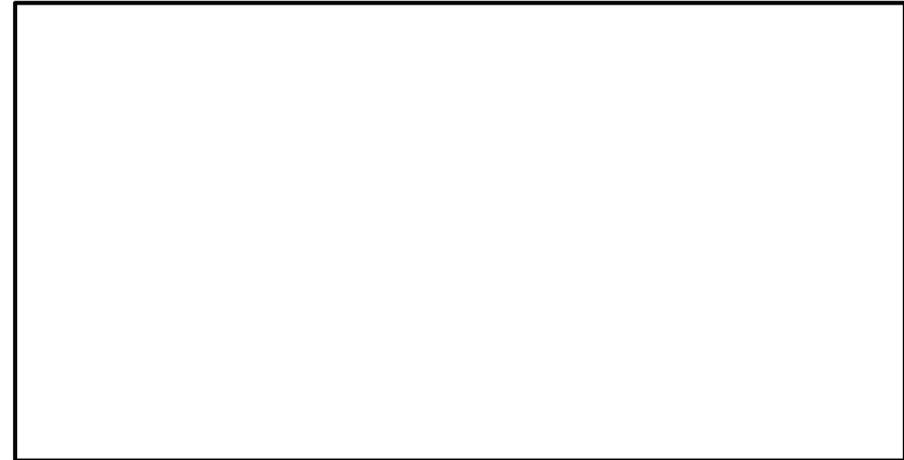
Exercise 2: Given the following spreadsheet, what formula would you use in cell D6 to calculate the number of tickets remaining?

	A	B	C	D
1	<b>Ticket Sales</b>			
2				
3	<b>Price</b>	\$10.00		
4				
5	<b>Event</b>	<b>Tickets Available</b>	<b>Tickets Sold</b>	<b>Remaining</b>
6	Cycling	4000	2000	2000
7	Weightlifting	2000	750	1250
8	Triathlon	1000	100	900
9	Football	3000	3000	0
10	Badminton	5000	4500	500
11		15000	10350	4650

# Exercises

Exercise 3: What formula would you use in cell E8 to calculate the money made from ticket sales?

	A	B	C	D	E
1	<b>Ticket Sales</b>				
2					
3	<b>Price</b>	\$10.00			
4					
5	<b>Event</b>	<b>Tickets Available</b>	<b>Tickets Sold</b>	<b>Remaining</b>	<b>Sales</b>
6	Cycling	4000	2000	2000	\$20,000.00
7	Weightlifting	2000	750	1250	\$7,500.00
8	Triathlon	1000	100	900	\$1,000.00
9	Football	3000	3000	0	\$30,000.00
10	Badminton	5000	4500	500	\$45,000.00



Exercise 4: What formula would you use in cell B11 to calculate the total number of tickets available?

	A	B	C	D	E
1	<b>Ticket Sales</b>				
2					
3	<b>Price</b>	\$10.00			
4					
5	<b>Event</b>	<b>Tickets Available</b>	<b>Tickets Sold</b>	<b>Remaining</b>	<b>Sales</b>
6	Cycling	4000	2000	2000	\$20,000.00
7	Weightlifting	2000	750	1250	\$7,500.00
8	Triathlon	1000	100	900	\$1,000.00
9	Football	3000	3000	0	\$30,000.00
10	Badminton	5000	4500	500	\$45,000.00
11		15000	10350	4650	\$103,500.00



# Functions

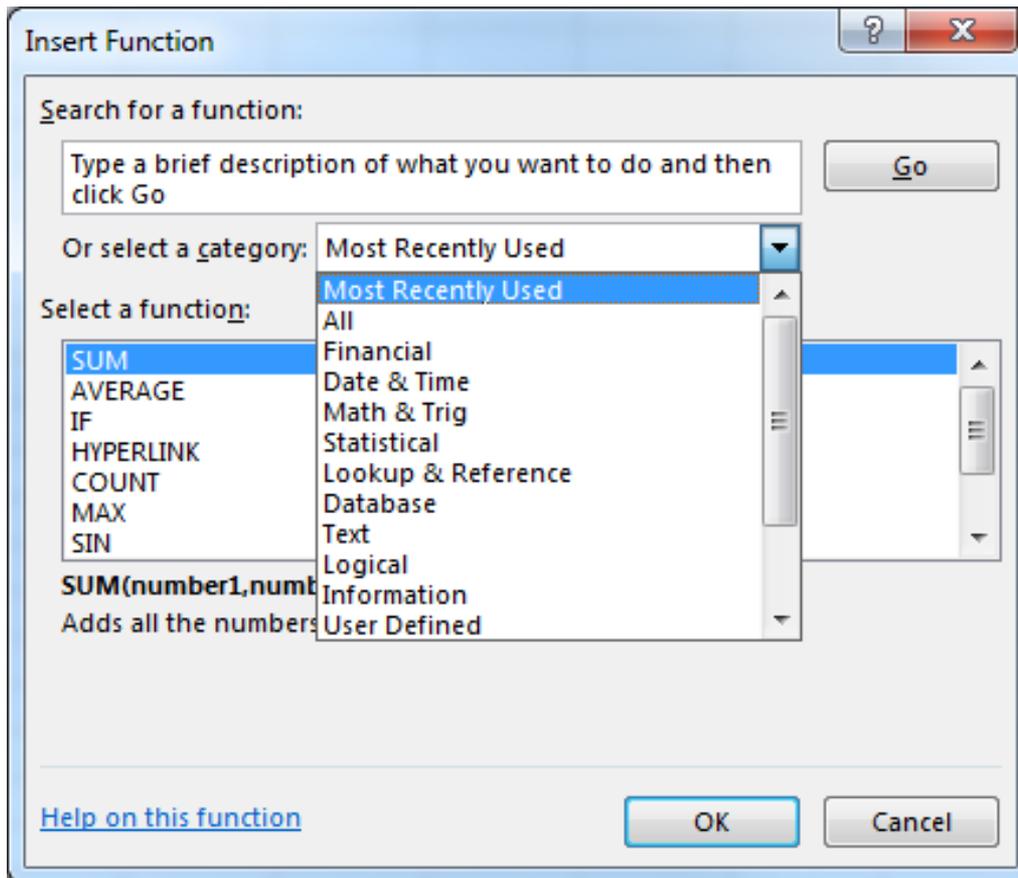
- ▶ Many functions exist
  - ▶ Allow us to make more complicated formulae
  - ▶ Examples
    - ▶ SUM
    - ▶ MAX
    - ▶ MIN
    - ▶ AVERAGE

- ▶ Specifying a range of cells
  - ▶ Top Left cell
  - ▶ Bottom Right cell
  - ▶ B6:C10

	A	B	C	D	E	F	G
1							
2		Hours Worked					
3							
4	Pay rate:	12					
5							
6	Name	Monday	Tuesday	Total	Pay rate	Total Pay	
7	Paul	24	12	36	12	432	
8	Sebastian	4	20	24	12	288	
9	Stefan	1	5	6	12	72	
10	Ali	2		11	13	12	156
11							

# Using built-in functions

- ▶ Insert a Function
  - ▶ Many categories
  - ▶ Help is useful



# Functions

- ▶ Format of Excel functions:

`=nameOfFunction(comma separated list of parameters)`

- ▶ Examples:

`=SUM(5,6,7)`

`=AVERAGE(A2:D2)`

# Boolean Logic

- ▶ Boolean value
  - ▶ True or False
  - ▶ 2-valued logic
- ▶ Compare two different values
  - ▶ =
  - ▶ >
  - ▶ <
  - ▶ >=
  - ▶ <=
- ▶ Example. Are the following true or false?
  - ▶ =(3 = 4)
  - ▶ =(4 < 6)
  - ▶ =(MAX(5, 6) = 5)
  - ▶ =(SUM(1,2,3) = 6)

# Boolean Functions

- ▶  $\text{AND}( a, b )$ 
  - ▶ True only when a and b are both true
- ▶  $\text{OR}( a, b )$ 
  - ▶ True if either a is true or b is true
- ▶  $\text{NOT}( a )$ 
  - ▶ True only when a is false
- ▶ Are the following formulae TRUE or FALSE?
  - ▶  $=\text{AND}( 3 = 4, 2 = 2 )$
  - ▶  $=\text{OR}( 7 < 5, 3 > 3 )$
  - ▶  $=\text{NOT}( 3 = 2 )$
  - ▶  $=\text{OR}( \text{AND}( 2 = 3, 4 > 3 ), \text{NOT}( 2 = 3 ) )$

# IF functions

- ▶ Makes a decision
  - ▶ Different values used in the cell depending on the logical test
  - ▶ IF( logical\_test , value\_if\_true, value\_if\_false )

Must be either true or false

- value
- condition (test)
- boolean function

This value appears  
in the cell if the  
boolean is true

This value appears  
in the cell if the  
boolean is false