

# Spreadsheets

Lecture 19 - COMPSCI 111/111G SS 2018

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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

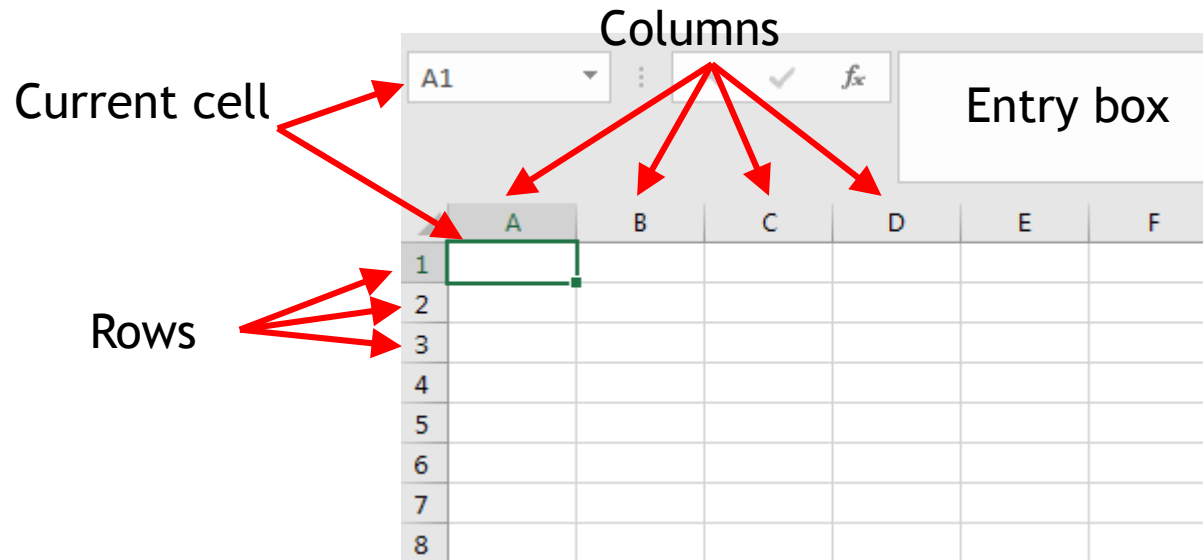
- ▶ Organize calculations as we would on paper - in columns and rows.
- ▶ Supports automatic updating of calculations.
- ▶ Copy formulas so we may apply these to large amounts of data.

C11 (L) TOTAL C1  
25

	A	B	C	D
1	ITEM	NO.	UNIT	COST
2	MUCK RAKE	43	12.95	556.85
3	BUZZ CUT	15	6.75	101.25
4	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

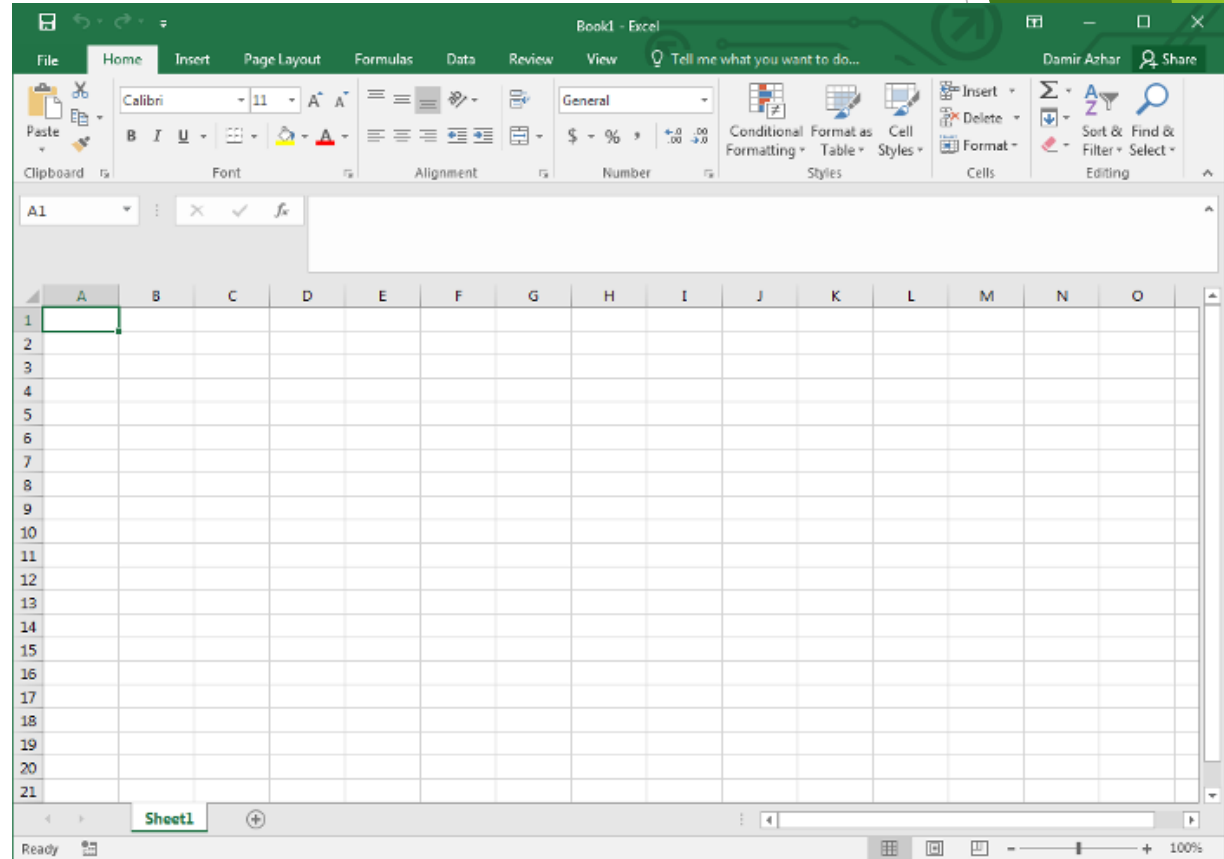
- ▶ Used to represent a table of data
  - ▶ Rows (labelled with numbers)
  - ▶ Columns (labelled with letters)
  - ▶ Cells



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

# Changing appearance of cells

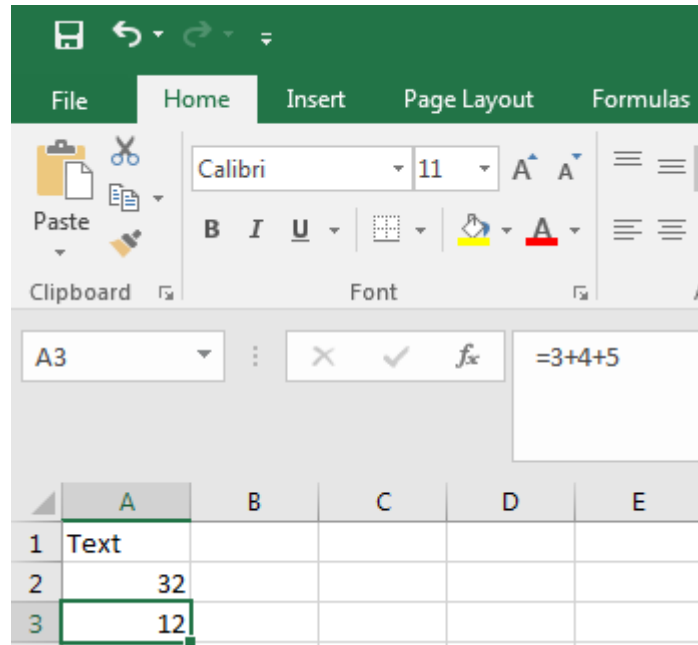
- ▶ Alter Size
  - ▶ Click on cell separator and drag
- ▶ Add Borders
  - ▶ Format Cell
- ▶ Add Shading
  - ▶ Format Cell
- ▶ Font
  - ▶ Style
  - ▶ Size
  - ▶ Alignment
- ▶ Numbers
  - ▶ Decimal points



# Entering Data

- ▶ Cells contain

- ▶ Text
- ▶ Numbers
- ▶ Formulae  
(start with “=“)



- ▶ Entry box

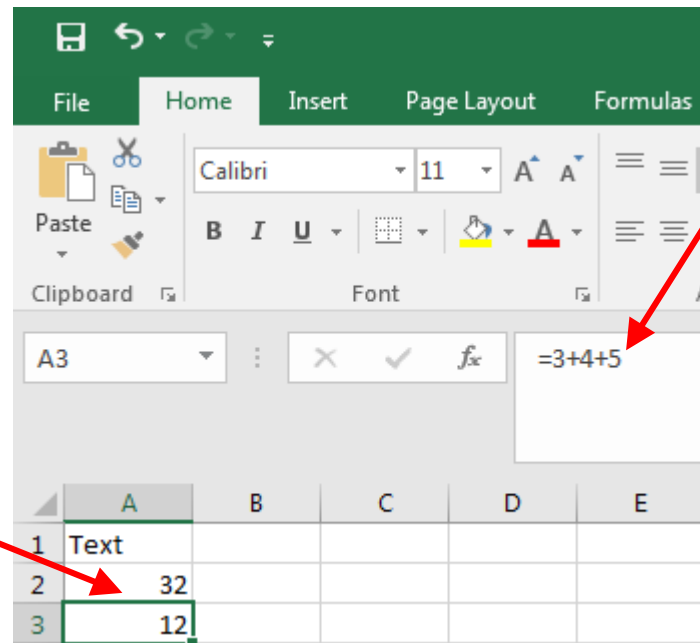
- ▶ Type data in entry box
- ▶ Hit Enter key to accept value
- ▶ All formulae are calculated
- ▶ Results shown in each cell

# 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

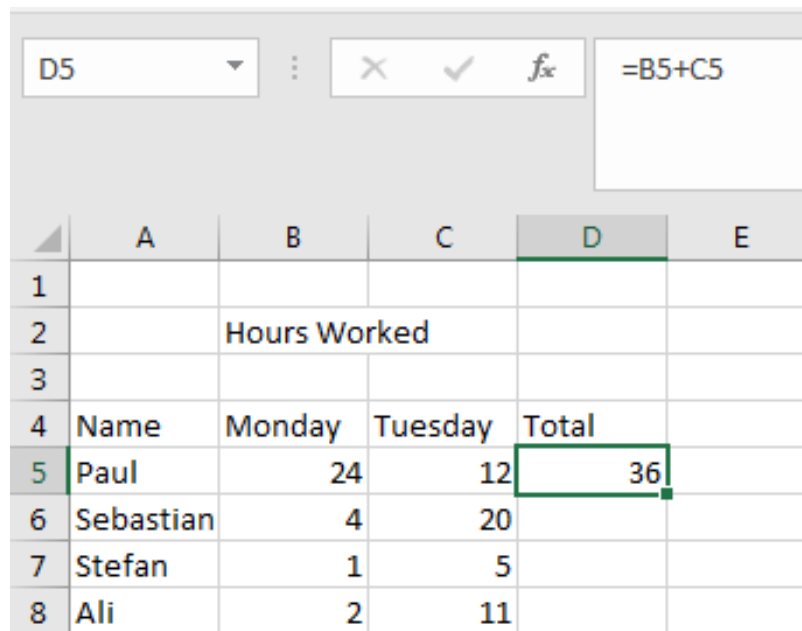




# Using Cell References

## ▶ Cell Reference

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



The screenshot shows an Excel spreadsheet with a formula bar at the top. The formula bar displays the cell address 'D5', a dropdown arrow, a cancel button (X), a confirm button (checkmark), and the formula '=B5+C5'. Below the formula bar is a grid of cells. The grid has columns labeled A, B, C, D, and E, and rows labeled 1 through 8. The data in the grid 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		

# 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'.

**Fill Down:** The first part shows a spreadsheet with cell A1 containing the value '100'. An arrow labeled 'Fill down' points to the second part, where the value '100' has been copied from A1 and pasted into cells A2 through A8.

**Fill Right:** The second part shows a spreadsheet with cell A1 containing the value '100'. An arrow labeled 'Fill right' points to the third part, where the value '100' has been copied from A1 and pasted into cells A2 through E2.

	A	B
1	100	
2		
3		
4		
5		
6		
7		
8		

Fill down

	A	B
1	100	
2	100	
3	100	
4	100	
5	100	
6	100	
7	100	
8	100	

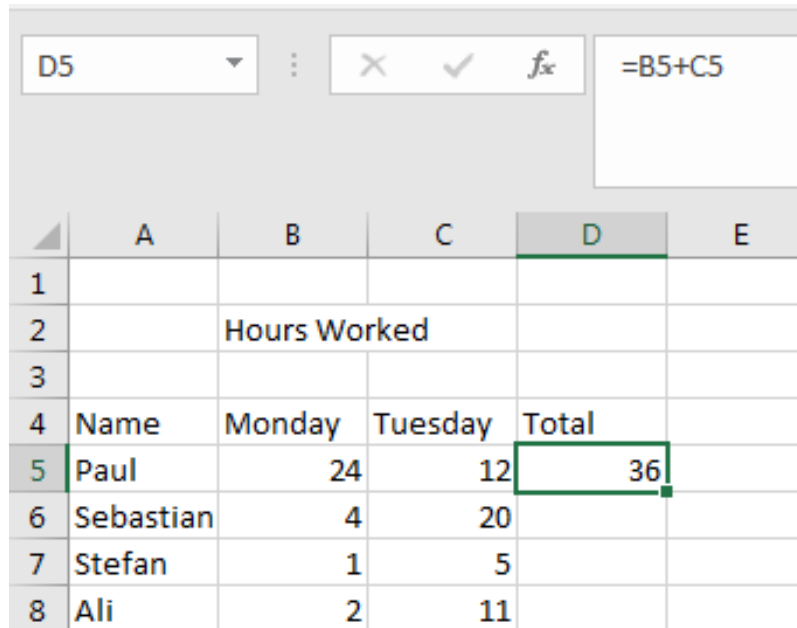
	A	B	C	D	E	F
1	100					

Fill right

	A	B	C	D	E	F
1	100	100	100	100	100	

# 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. The formula bar displays the cell address 'D5' and the formula '=B5+C5'. Below the formula bar is 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		

- ▶ 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

The screenshot shows a spreadsheet with a formula bar at the top displaying '=B5+C5'. Below the formula bar is a table with columns A through E and rows 1 through 8. The table contains 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		

Red arrows point from the formula bar to cell D5 (containing 36) and cell D8 (empty). The formula bar shows '=B5+C5'.

=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

	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.

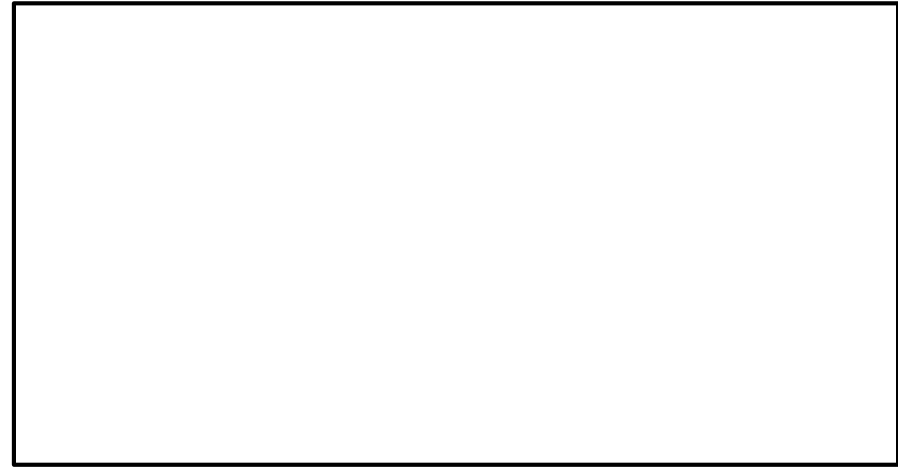
Exercise 2: Given the following spreadsheet, what formula would you use in cell D6 to calculate the number of tickets remaining?

	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



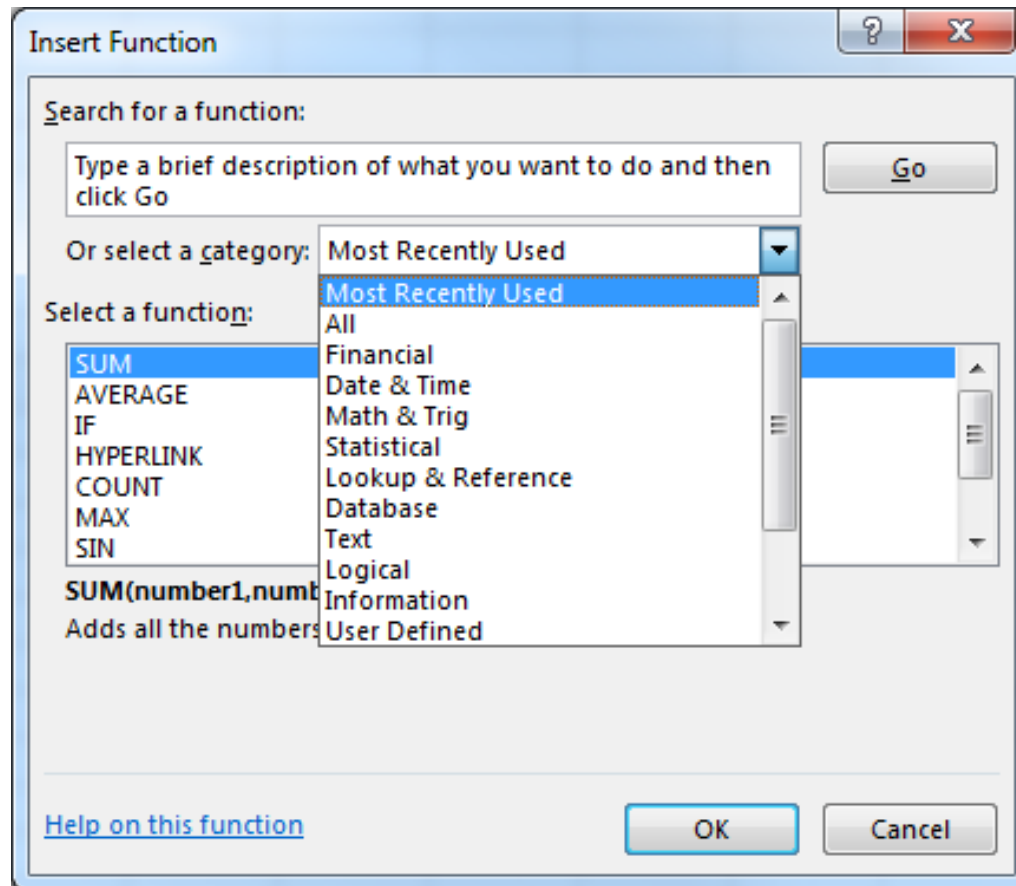
Exercise 4: What formula would you use in cell B11 to calculate the total number of tickets available?

	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



# Using built-in functions

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





# 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							

# 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

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