## COMP1022Q Introduction to Computing with Excel VBA

### Cell Formula Basics

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### Outcomes

- After completing this presentation, you are expected to be able to:
  - 1. Understand the basics of using cell formulas
  - 2. Write cell formulas using appropriate operations and functions
  - 3. Describe the expected results of some cell formulas

	Α	В
31		
32		=
33		

### In This Presentation

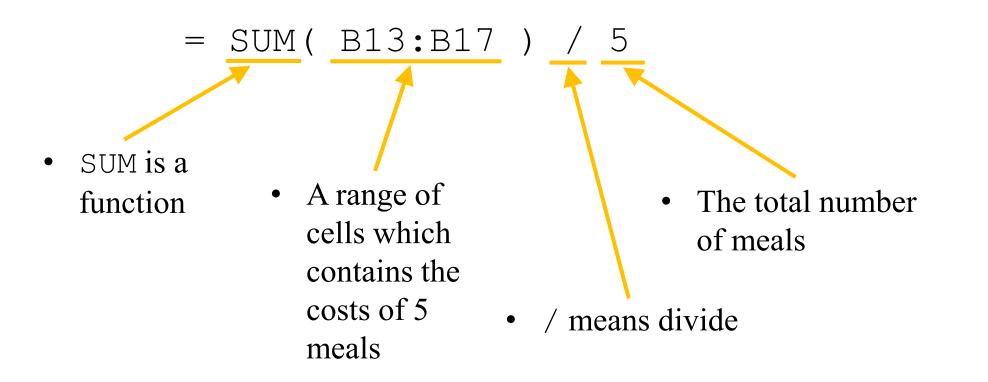
- We will look at the following topics in this presentation:
  - Some basics of cell formulas
  - Arithmetic + \* / ^
  - Handling numbers
  - Comparing things
  - String concatenation
  - String functions
  - What goes first?

- You are strongly recommended to try out the Excel files in the COMP1022Q web site!
- See how the results of the formulas change when you change inputs

### Cell Formulas

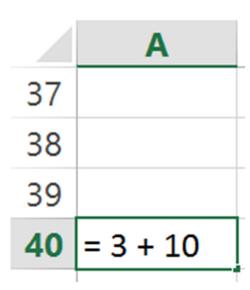
- Every formula starts with a =
- Here is a simple formula calculating the average cost of meals:

	Α	В	С	D
11				
12	Day	Cost of meal		
13	1	20	=SUM(B13	:B17)/5
14	2	22		
15	3	21		
16	4	27		
17	5	20		
18				



### Arithmetic

• In cell formulas you can do basic calculations like those you learned in school:



- + Addition
- Subtraction
- \* Multiplication
- / Division
- ^ Power

### Arithmetic

• For example, if you want to add two numbers 3 and 10, you do this:

$$= 3 + 10$$

- There are only 5 arithmetic operators + \* / ^ but there are also many *functions* (English words) helping you perform other clever calculations
- For example, you can use

=AVERAGE (B13:B17)

to do the same thing as the formula shown before

## Examples Of Arithmetic

These examples show the use of
+ - \* / ^ in cell formulas

4	Α	В	С	D	Е	F	G
1	<b>Examples of Aritl</b>	hmetic Operators					
	These examples show th	ne basic arithmetic opera	ators in cell formu	las. The users	can enter two	numbers in	
2	cells B5 and B6. The re	sults of several calculati	ons are shown in	cells D9 to D	13.		
3							
4	Input Fr	om User	This	aall bas	the nam	. A	
5	Number A	3			the nam		
6	Number B	2	1 1115	cen nas			
7							
8	Arithmetic Oper	ration, in English	Cell Formula	Result			
9	Add	lition	= A + B	5			
10	Subtr	raction	= A - B	1			
11	Multip	lication	= A * B	6			
12	Divi	ision	= A / B	1.5			
13	Po	wer	= A ^ B	9			
1/1							

### Some Commonly Used Number Functions

- There are many functions that can be used in cell formulas
- Here we look at 7 common functions for handling numbers:

```
SUM for finding the total of a group of numbers

AVERAGE for finding the average of a group of numbers

STDEV for finding the standard deviation of a group of numbers

MAX for finding the maximum in a group of numbers

MIN for finding the minimum in a group of numbers

RANK for ranking a number in a group of numbers

COUNTIF for counting the number of occurrences of a value
```

- On the next slide we show an example which uses these
- Remember *Ctrl* `can be used to show all the formulas

#### Example of Some Commonly Used Number Functions

4	А	В	С	D	Ε	F	G	Н	1	J	K	L	M	
1	Some Co	ommon	ly Use	ed Nun	aber F	unctio	ns							
	This example	e uses the j	followin	g 7 cell fi	ınctions	in the cel	ll formula	zs: SUM,	AVERAG	E, STDEV	', ΜΑΧ, λ	IIN, RANK, COUNTIF. (In this course,	each	
2	of the assign	ments is w	orth 14	% and the	e final ex	am is wo	rth 44%.)	)						
3														
4	Student ID	Student		Assig	nment		Final	Total	Rank	Final		Some Statistics		
5	Student ID	Name	Al	A2	A3	A4	Exam	10141	Auna	Grade		Mean	68.40	
6	09677229	David	100	100	90	0	44	59.96	9	C+		Standard Deviation	17.58	
7	09899972	Gigi	80	100	100	0	31.5	53.06	10	C+		Maximum	92.70	
8	09959402	Eddie	100	100	100	96	71	86.68	2	A		Minimum	29.24	
9	09965977	Chris	95	100	100	100	61	82.14	3	B+				
10	10055430	A1ex	100	100	100	95	85	92.70	1	A+		Grade Distribution		
11	10211965	Henry	95	90	60	67	52	66.56	7	B-		Number of students that got an A	2	
12	10217107	James	65	100	100	97	60	77.08	4	B+		Number of students that got a B	6	
13	10251688	Ken	100	96	75	98	42	70.14	6	В		Number of students that got a C	2	
14	10335015	Isaac	98	90	100	91	21	62.30	8	B-		Number of students that failed	1	
15	10683708	Felix	100	100	85	95	44	72.56	5	В				
16	10858690	Bonnie	90	0	78	0	13	29.24	11	F				
17														
18														
19														
20						$T_{\alpha}$	1,00	1001	- 04 4	<b>h</b> o				
21						1 a	ke a	1001	Cat i	ne				
22						ev	amn	le in	the	web	cital			
23						CA	amp.	10 111	uic	WCU	SILC:			
24												T		
25														
26														
27														

#### Here are the Formulas Used

1	Α	В	С	D	Е	F	G	Н	1	J	K	=AVERAGE(H6:H16)	M
1	Some Co	ommon	ly Use	d Nun	nber F	unctio	ns					=STDEV(H6:H16)	
	This example	e uses the j	following	7 cell fi	unctions	in the cel	l formula	ıs: SUM,	AVERAG	E, STDEV	, MAX,	=MAX(H6:H16) in this course,	each
2	of the assign	ments is w	orth 149	6 and the	e final ex	am is wor	rth 44%.)	)				=MIN(H6:H16)	
3												Chu	
4	Student ID	Student		Assig	nment		Final	Total	Rank	Final		Some Statistic	7
5	Studentin	Name	Al	A2	A3	A4	Exam	Total	Kunk	Grade		Mean	68.40
6	09677229	David	100	100	90	0	44	59.96	9	C+		Standard Deviation	17.58
7	09899972	Gigi	80	100	100	0	31.5	53.06	10	C+		Maximum	92.70
8	09959402	Eddie	100	100	100	96	71	86.68	2	A		Minimum	29.24
9	09965977	Chris	95	100	100	100	61	82.14	3	B+			
10	10055430	A1ex	100	100	100	95	85	92.70	1	A+		Grade Distribution	
11	10211965	Henry	95	90	60	67	52	66.56	7	B-		Number of students that got an A	2
12	10217107	James	65	100	100	97	60	77.08	4	B+		Number of students that got a B	6
13	10251688	Ken	100	96	75	98		70.14	6	В		Number of students that got a C	2
14	10335015	Isaac	98	90	100	91	C)/	62.30	8	B-		Number of students that failed	1
15	10683708	Felix	100	100	85	95	44	72.56	5	В			
=S	UM(C6:F6) *	0.14 + G6	5 * 0.44	=RA	NK(H6,	H\$6:H\$1	6) 3	29.24	11	F			/
=S	UM(C7:F7) *	0.14 + G7	7 * 0.44	=RA	NK(H7,	H\$6:H\$1	6)						
=S	UM(C8:F8) *	0.14 + G8	8 * 0.44	=RA	NK(H8,	H\$6:H\$1	6)						
=S	UM(C9:F9) *	0.14 + G9	* 0.44	=RA	NK(H9,	H\$6:H\$1	6)						
=S	UM(C10:F10)	* 0.14 +	G10 * 0.4	4 =RA	NK(H10	, H\$6:H\$	16)						
=S	UM(C11:F11)	* 0.14 +	G11 * 0.4	4 =RA	NK(H11	, H\$6:H\$	16)						
=S	UM(C12:F12)	* 0.14 +	G12 * 0.4	4 =RA	NK(H12	, H\$6:H\$	16)	COLINT	TE(16-11	6 "Δ+") -	+ COII	NTIF(J6:J16, "A") + COUNTIF(J6:J	16 "Δ-")
=S	UM(C13:F13	* 0.14 +	G13 * 0.4	4 =RA	NK(H13	, H\$6:H\$	4 ( )					NTIF(J6:J16, "B") + COUNTIF(J6:J1	The second secon
=S	UM(C14:F14)	* 0.14 +	G14 * 0.4	4 =RA	NK(H14	, H\$6:H\$	16)					NTIF(J6:J16, "C") + COUNTIF(J6:J1	
=S	UM(C15:F15	* 0.14 +	G15 * 0.4	4 =RA	NK(H15	, H\$6:H\$	16)		IF(J6:J1			1111 (30.310, C) + COOMIT (30.3)	10, 0-)
=S	UM(C16:F16	* 0.14 +	G16 * 0.4	4 =RA	NK(H16	, H\$6:H\$	16)	COUNT	11(30,31)	U, F)			
27													
	ı								1			The state of the s	1

## Comparing Things

- Sometimes you need to know about the relationship between two things
- For example, you might need to compare whether two values are equal, or if they are different
- You can do that using these:

```
= equal to <> not equal to
```

< smaller than <= smaller than or equal to

> larger than >= larger than or equal to

#### TRUE and FALSE

- The result of a comparison is TRUE or FALSE
  - In cells these are shown using capital letters
- For example, to test if the value in cell A4 is larger than the value in cell B6, we can write =A4 > B6
- The result won't be a number; it will be either TRUE or FALSE

## Examples Of Comparing Things

• This example shows the most basic ways to compare things

4	Α	В	С	D	Е	F	G	Н		
1	Examples of Rela	Examples of Relational Operators								
	These examples show th	he most common relation	al operators in ce	ell formulas. T	he users can e	enter two				
2	numbers in cells B5 and	d B6. The results of sever	ral comparisons a	re shown in ce	ells D9 to D14					
3										
4	Input Fr	om User	This	cell has	the na	me Z				
5	Number A	3				-				
6	Number B	2	Inis	cell has	s the na	me B				
7										
8	Relational Oper	ration, in English	Cell Formula	Result						
9	Less	than	= A < B	FALSE						
10	Less than	or equal to	= A <= B	FALSE						
11	Equ	ual to	= A = B	FALSE						
12	Greater than	n or equal to	= A >= B	TRUE						
13	Great	er than	= A > B	TRUE						
14	Not e	qual to	= A <> B	TRUE						

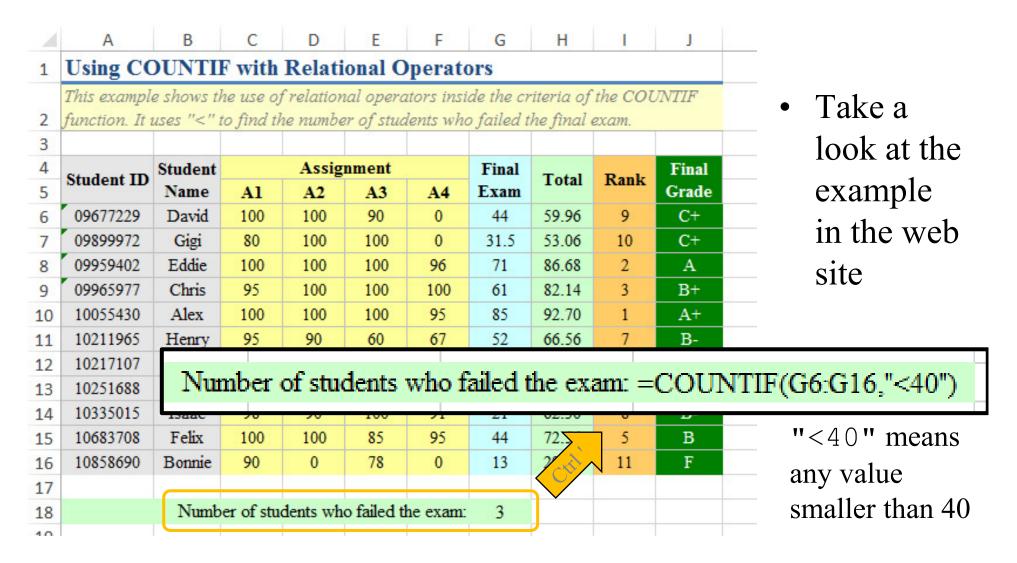
### Comparing Things in COUNTIF

• We have seen COUNTIF helps us count the number of occurrences of something, e.g. =COUNTIF (J6:J16, "A")

- Instead of using an exact value we can do something like =COUNTIF (B2:B6, "<40")
- This will count all the numbers less than 40

## Example of Using COUNTIF

- This extends a previous example
- It counts the number of students who failed a final exam, which had a pass mark of 40



### Other Cell Functions with 'IF'

- As well as COUNTIF (B2:B6, "<40") there's also these cell functions which have 'if' in their name:
- AVERAGEIF (B2:B6, "<40") calculate the average for the cells which have values <40
- SUMIF (B2:B6, "<40") add up the cells, for the cells which have values <40
- You can use any of these:
  - = equal to <> not equal to
  - < smaller than <= smaller than or equal to
  - > larger than >= larger than or equal to

## String Concatenation

- In computer language, 'a string' means 'a piece of text'
- *Concatenate* means putting one string at the end of another string
- In Excel cell formulas, you can concatenate two strings by using & or the CONCATENATE function
- For example, this formula:

```
="Happy" & "Birthday"
```

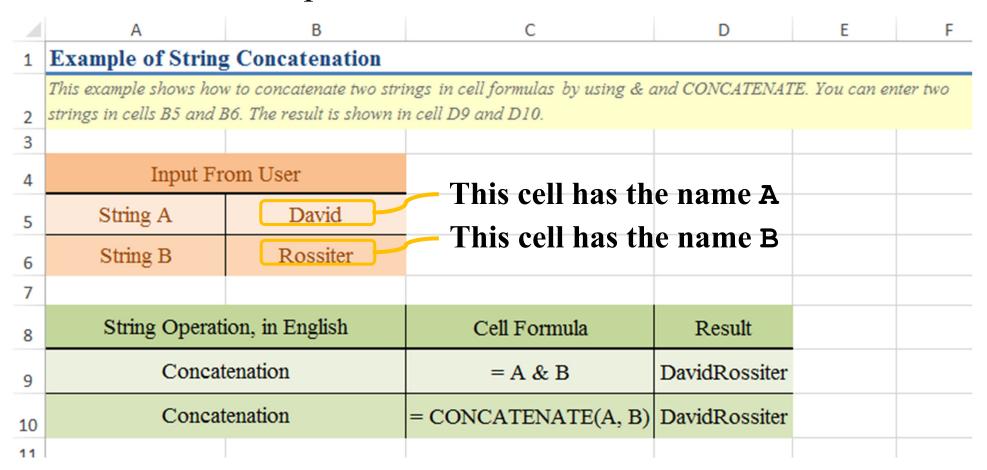
and this formula:

```
=CONCATENATE("Happy", "Birthday")
```

both produce the same result: HappyBirthday

## **String Concatenation**

• Here is an example of both:



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# String Concatenation and the COUNTIF Comparison

- When you use COUNTIF with a comparison, the comparison is written as a string, i.e. COUNTIF (B2:B6, "<40")
- If you want to include a cell in the comparison, you cannot write the cell reference directly inside, i.e. COUNTIF (B2:B6, "<B8")
- You will need to do this instead: X Wrong!

COUNTIF(B2:B6, "<" & B8)

### Some Commonly Used String Functions

- There are many other functions for strings
- Here we look at some:

LĽN	Count the number of characters in a string
UPPER	Convert all letters into upper case letters i.e. ABC
LOWER	Convert all letters into lower case letters i.e. abc
LEFT	Get the first few characters in a string
RIGHT	Get the last few characters in a string
SUBSTITUTE	Substitute (replace) some text in a string

• There are examples of these on the next slide

## Example of Some Commonly Used String Functions

4	Input F		
5	String A	Dave is the best instructor!	This cell has the name A
6	String Old	best	This cell has the name Old
7	String New	most handsome	— This cell has the name New
8			
9	What Does the Example Do?	Cell Formula	Result
10	Count how many characters in a string	= LEN(A)	28
11	Convert all the characters into upper case (large letters)	= UPPER(A)	DAVE IS THE BEST INSTRUCTOR!
12	Convert all the characters into lower case (small letters)	= LOWER(A)	dave is the best instructor!
13	Get the first N characters in the string	= LEFT(A, 4)	Dave
14	Get the last N characters in the string	= RIGHT(A, 11)	instructor!
15	Substitute a piece of text with a new piece of text in a string	= SUBSTITUTE(A, Old, New)	Dave is the most handsome instructor!
10	-		

### What Goes First?

• If you enter the following formula

$$=5+2*3$$

you may think that the answer is 21

- However, Excel actually gives you the answer of 11
- That is because Excel thinks that multiplication is more important than addition
- Therefore 2 \* 3 is performed first, before the addition
- We say multiplication has a higher *precedence* than addition

## Using Brackets

- Of course, if you use brackets that ensures that part of a formula is evaluated first
- Examples:

```
=5+2*3 gives an answer of 11
=(5+2)*3 gives an answer of 21
```

- You might think you can always use brackets in your cell formulas, so you don't have to remember which things are calculated first
- That's true until someone else gives you a formula which doesn't have any brackets in it...

### Precedence in Cell Formulas

• The following table shows you the different levels of precedence, most important at the top:

^	Power
* and /	Multiplication and division
+ and -	Addition and subtraction
&	String concatenation
= <> < <= > >=	Comparisons

## Precedence Example 1

$$= 20 - 10 / 2 * 3 + 2$$

- / and \* have
   higher precedence
   than + and -, so
   they are handled first
- / and \* have equal precedence, so the one on the left (/) is evaluated first, then \*
- So the answer is:

- Then and + are handled
- and + have equal precedence, so the
   one on the left (-) is evaluated first, then +

## Precedence Example 2

$$= 10 / 2 * 4 - 3 ^ 3$$

- ^ has a higher precedence than the others, so it is handled first
- / and \* have equal
   precedence, so the one on
   the left (/) is evaluated
   first, then the \*
- The is handled last

• So the answer is:

$$= ((10/2)*4) - (3^3)$$

$$=((10/2)*4)-27$$

$$= -7$$

## Precedence Example 3

	Α	В
1	Surname:	Rossiter
2	Firstname:	David
3	Age:	20
4		
5	Good?	="Rossiter,David,40" = B1 & "," & B2 & "," & B3*2

• The comparison is done last —

• The concatenation is done next

• For this situation the result of the formula is:

TRUE

• The multiplication is done first

## Quick List of Cell Things We Looked At

- SUM
- AVERAGE
- STDEV
- MAX
- MIN
- RANK

- COUNTIF
- AVERAGEIF
- SUMIF

- &
- CONCATENATE

- LEN
- UPPER
- LOWER
- LEFT
- RIGHT
- SUBSTITUTE