

CMPT 155: Computer Applications for Life Sciences

Lecture 7: Formulas and Functions (Part 3)

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Presentation Outline

- 1 Homework & Administrative
- 2 Range Functions: MEDIAN, MAX/MIN, LARGE/SMALL
- 3 Value Functions: ABS, ROUND, RAND
- 4 Counting Functions: COUNT, COUNTA, COUNTBLANK, COUNTIF
- 5 VLOOKUP

Homework & Administrative Schedule

- Homework 2 Due: Tuesday, February 22nd at 6pm
- Homework 3 Due: Tuesday, March 1st at 6pm
- First Midterm Review: Wednesday, March 2nd
- First Midterm Exam: Friday, March, 4th

MEDIAN()

- The Median of a set of numbers is the middle number.
- example: given a sequence of numbers 1,2,4,12,15. the median is the middle number. where middle means that there are equal elements before and after the number.

	A	B
1	List of Numbers	Median
2	1	=MEDIAN(A2:A5)
3	2	
4	4	
5	12	

(a)

	A	B	C
1	List of Numbers	Median	
2	1	=MEDIAN(A2:A6)	
3	2		
4	4		
5	12		
6	15		

(b)

Try running these functions and seeing what median you return!

MAX() and MIN()

MAX()

- inputs:
 - ▶ [number1], [number2], ...
 - ▶ selection of or single cells containing numerics.
- ouputs:
 - ▶ single value denoting the **maximum value** from the selection.

MIN()

- inputs:
 - ▶ [number1], [number2], ...
 - ▶ selection of cells or single cells containing numerics.
- ouputs:
 - ▶ single value denoting the **minimum value** from the selection.

LARGE() and SMALL()

We can use Large and small to return the ordinally largest/smallest values from a selection of numerics.

LARGE(range, position)

- inputs
 - ▶ array : selection of cells that contain numerics
 - ▶ k: integer that denotes first, second, ..., k^{th} highest in the list.
- returns:
 - ▶ value from the selection that is the k^{th} highest from the maximum value.

SMALL (range, position)

- inputs
 - ▶ array : selection of cells that contain numerics
 - ▶ k: integer that denotes first, second, ..., k^{th} lowest in the list.
- returns:
 - ▶ value from the selection that is the k^{th} lowest from the minimum value.

Exercise 1: Student Grades redux

- ❶ Download *StudentGrades2.xlsx*
- ❷ Use the functions we learned to add following statistics found at the bottom of the table:
 - ▶ Total
 - ▶ Average
 - ▶ Median
 - ▶ Highest Score
 - ▶ Second Highest Score
 - ▶ Third Highest Score
 - ▶ Lowest Score

Exercise 1: Solution

- 1 See Lecture 06 for solutions to get Weighted Averages entered in Cells E2:E10
- 2 to get Total use SUM() on cells E2:E10
- 3 to get Average use AVERAGE() on cells E2:E10
- 4 to get Median use MEDIAN() on cells E2:E10
- 5 to get Highest Score use MAX() on cells E2:E10
- 6 to get Second Highest Score use LARGE() pass use E2:10 in array and 2 as k
- 7 to get Third Highest Score use LARGE() pass use E2:10 in array and 3 as k item to get Lowest Score use MIN() on cells E2:E10

Exercise 1: Solution (continued)

	A	B	C	D	E
1	Student	Test A (25%)	Test B (25%)	Assignments (50%)	Final Grade
2	Edith Abbott	31	29	90	85.09%
3	Grace DeWitt	23	28	75	71.88%
4	Vittoria Accoramboni	31	26	69	72.45%
5	Abigail Smith	34	31	90	88.39%
6	Annette Yuang	36	32	95	92.86%
7	Hannah Adams	30	25	64	68.61%
8	Janet Chung	37	29	77	82.34%
9	Maresh Di Giorgio	26	26	50	59.82%
10	Katharine Susan	0	25	60	47.86%
11					
12	Total Score Available	40	35	100	
13					
14				Total:	669.29%
15				Average:	74.37%
16				Median:	72.45%
17				Highest:	92.86%
18				Second Highest:	88.39%
19				Lowest:	47.86%

ABS() and ROUND()

ABS:

- The Absolute value function returns the absolute value of a numeric value passed
- inputs : number
- returns : numeric value
- Notes: Is there a way to make ABS() using IF()?

ROUND():

- rounds a numeric value to whatever level of precision you choose.
- inputs :
 - ▶ number_to_round: Numeric value you would like to round
 - ▶ number_of_digits: Number of digits function is rounding to.

	A	B
1	Numbers	Absolute Value
2	-2	=ABS(A2)
3	-1	1
4	0	0
5	1	1

(a)

	A	B
1	Numbers	Rounded
2	3.14145	=ROUND(A2, 2)
3	3.14145	3.14
4	6.2829	=ROUND(A4, 0)
5	6.2829	6

(b)

RAND()

RAND()

- gives you a random fractional number that is less than 1, but greater than or equal to 0.
 - ▶ inputs : None
 - ▶ returns : Numeric value between 0 and 1

Things to Consider...

How would I:

- generate a random whole number between 0 and 10?
- generate a random whole number between 0 and 100?

COUNT(), COUNTA(), COUNTBLANK()

COUNT(), COUNTA(), COUNTBLANK()

- inputs : number1, number2, ...
- returns :
 - ▶ for COUNT() → number of cells that contain numerics.
 - ▶ for COUNTA() → number of cells that contain **any** information.
 - ▶ for COUNTBLANK() → number of empty/**blank** cells.

COUNTIF()

Returns the number of cells that satisfy the logical criteria given.

- inputs :
 - ▶ range : cell range to look over
 - ▶ criteria : criteria/logical argument that must be satisfied
- returns : integer number of cells that satisfy logical argument.

COUNT Example

	A	B	C	D	E	F	G
1	First Name	Last Name	Age	Function	Count		
2	Johnathan	Joestar		COUNT	4		
3	Joseph	Joestar	92	COUNTA	17		
4	Jotaro			COUNTBLANK	4		
5	Josuke	Higashitaka	17	COUNTIF	=COUNTIF(A2:C8, "Joestar")		
6	Giorno	Giovanna	15		3		
7	Jolyne	Cujoh	22				
8	Johnny	Joestar					

Figure: Example of COUNT(), COUNTA(), COUNTBLANK(), COUNTIF() applied over cells A2:C8

Exercise 2: Fruit Purchases *redux revival*

- 1 Download *Fruit_Purchases.xlsx*
- 2 Redo the fruit counting exercise using the counting functions (COUNT, COUNTA, COUNTIF)

Exercise 2: Solution

- 1 For each fruit (apples, kiwi, pear) write a COUNTIF statement that takes a range = B3:B20, and a logical argument as the fruit in quotation marks.
- 2 In cells B22, B23, B24 you can write out
 - ▶ B22 : =COUNTIF(B3:B20, "apples")
 - ▶ B23 : =COUNTIF(B3:B20, "kiwi")
 - ▶ B24 : =COUNTIF(B3:B20, "pears")

21			Excel Function	
22	Total apples:	5	=COUNTIF(B3:B20, "apples")	
23	Total kiwi:	1	=COUNTIF(B3:B20, "kiwi")	
24	Total pears:	3	=COUNTIF(B3:B20, "pears")	
25				

VLOOKUP

- inputs:

- ▶ `lookup_value` : cell reference
Your query (i.e., What it is you are looking for.)
- ▶ `range` : cell range
The range of data you are looking in that contains `lookup_value`.
- ▶ `column_index_number` : integer
The column index starting from 1 that you want to display/retrieve.
- ▶ `FALSE` : `FALSE`
if exact match is needed, `TRUE` if close enough is okay.

- returns:

- ▶ **Cell content** that correspond to the `lookup_value` specified.

VLOOKUP Example

- 1 Download *VLookupExample.xlsx* from moodle.
- 2 Fill out cells C4:C8 using the appropriate VLOOKUP function call, for each search field given a search term in cell B2.

- 3 For Example: If we enter 1 for the product ID in cell B2, then out VLOOKUP arguments for **Product** are:
look_up_value : B3 ← Our search term
range : A12:F78 ← The entire dataset
column_index_number : 2 ← We want the second column
FALSE : FALSE ← To get **exact matches**

	A	B	C	D	E	F	
1							
2	Product ID:	1					
3					Excel Formula		
4		Product:	Chai		=VLOOKUP(B2, A12:F78, 2, FALSE)		
5		Unit Price:	\$18.00		=VLOOKUP(B2, A12:F78, 3, FALSE)		
6		In Stock:	39		← Try these yourself!		
7		On Order:	0		← Try these yourself!		
8		Reorder Level:	10		← Try these yourself!		
9							
10							
11	ID	Product Name	Unit Price	In Stock	On Order	Reorder Level	
12		1 Chai	\$18.00	39	0	10	

Exercise 3: Student Grades 4

- 1 Download *StudentGrades4.xlsx*
- 2 Compute the average for each student.
- 3 Use VLOOKUP to assign letter grades(Grade) and grade points(QPts) based on the computed average.
- 4 Write whether the students Passed or Failed in the comments section.
- 5 Count the number of students that passed and failed.

Exercise 3: Solution

- 1 In cell D2, compute the average for the first cell by typing
▶ `=AVERAGE(A2:C2)`
- 2 Use Autofill to assign averages for from D2:D10.
- 3 In Cell E2, use VLOOKUP to assign grades. The arguments are:
look_up_value : D2 ← This is our search term.
range : \$C\$17:\$D\$21 ← 'Averages' & 'Grade' columns.
column_index_number : 2 ← We want the 'Grade' column.
FALSE : True ← for **approximate matches**.
- 4 Use Autofill to assign further grades

Exercise 3: Solution (continued)

- 5 In Cell F2, use VLOOKUP to assign grade points 'QPts'.

The arguments are:

look_up_value :	E2	← This is our search term.
range :	\$D\$17:\$E\$21	← 'Grade' & 'QPts' columns.
column_index_number :	2	← We want the 'QPts' column.
FALSE :	FALSE	← for exact matches .

- 6 Use Autofill to assign further grade points

Exercise 3: Solution (continued)

- 7 In Cell G2 use IF() to show "Pass" if a student passed and "Fail" if a student failed.
 - ▶ We can use The 'QPts' column to help us determine whether a student passed.
 - ▶ If a student earned **strictly less** than 2 QPts then they did not pass the course.
 - ▶ Cell G2 Should read =IF(F3<2, "Fail", "Pass")
 - ▶ Autofill for the following cells in the column.
- 8 In Cell C12 use COUNTIF() to count only the students who have the comment "Passed".
 - ▶ Cell C12 Should Read: =COUNTIF("Passed", G2:G10)
- 9 In Cell C12 use COUNTIF() to count only the students who have the comment "Passed".
 - ▶ Cell C13 Should Read: =COUNTIF("Failed", G2:G10)

Exercise 3: Solution (continued)

	A	B	C	D	E	F	G
1	Exam 1	Exam 2	Exam 3	Average	Grade	<u>QPts</u>	Comment
2	81	47	78	68.666667	D		1 Failed
3	93	100	81	91.333333	A		4 Passed
4	100	88	83	90.333333	A		4 Passed
5	71	73	75	73	C		2 Passed
6	35	75	57	55.666667	F		0 Failed
7	100	87	79	88.666667	B		3 Passed
8	84	61	65	70	C		2 Passed
9	13	62	65	46.666667	F		0 Failed
10	22	66	68	52	F		0 Failed
11							
12	Number Passed:		5				
13	Number Failed:		4				
14							
15			Grading Policy				
16			Average	Grade	<u>QPts</u>		
17			0	F	0		
18			60	D	1		
19			70	C	2		
20			80	B	3		
21			90	A	4		

Further Reading

Computer Applications for Life Sciences Chapter 1 p. 1-14, covers lectures 4-7.