CMPT 155: Computer Applications for Life Sciences

Lecture 7: Formulas and Functions (Part 3)

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Presentation Outline

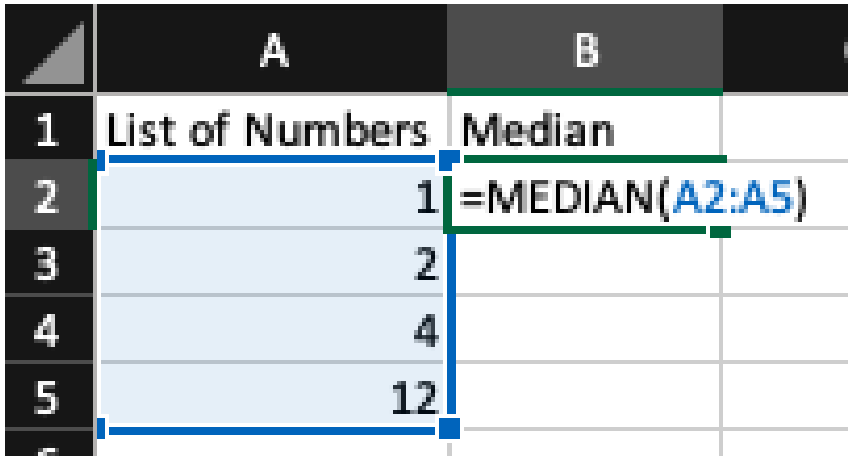
1. Homework & Administrative
2. Range Functions: MEDIAN, MAX/MIN, LARGE/SMALL
3. Value Functions: ABS, ROUND, RAND
4. Counting Functions: COUNT, COUNTA, COUNTBLANK, COUNTIF
5. VLOOKUP

Homework & Administrative Schedule

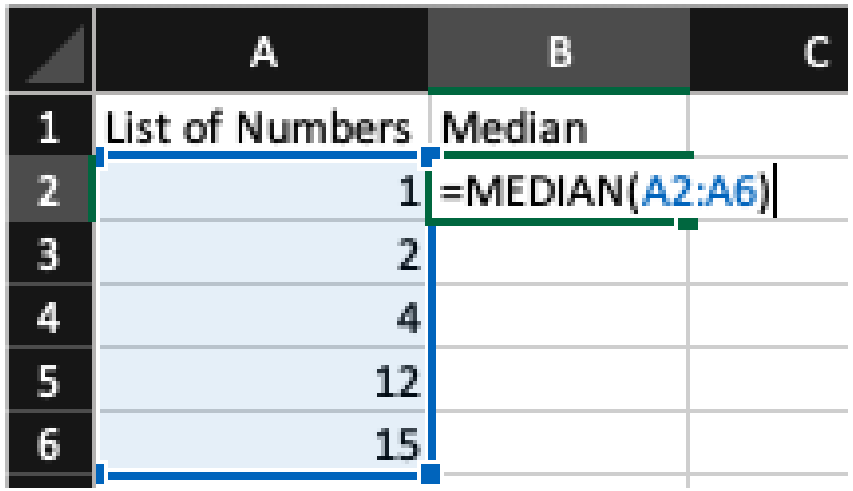
- Homework 2 Due: Tuesday, February 22nd at 6pm
- Homework 3 Due: Tuesday, March 1st at 6pm
- First Midterm Review: Wednesday, March 2nd
- First Midterm Exam: Friday, March, 4th

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)

Try running these functions and seeing what median you return!

MAX() and MIN()

MAX()

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

MIN()

- inputs:
  - `[number1], [number2], ...`
  - selection of cells or single cells containing numerics.
- ouptuts:
  - 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 fist, second, . . . , $\texttt{k}^{\text{th}}$ highest in the list.
- returns:
  - value from the selection that is the $\texttt{k}^{\text{th}}$ highest from the maximum value.

SMALL (range, position)

- inputs
  - `array` : selection of cells that contain numerics
  - `k`: integer that denotes fist, second, . . . , $\texttt{k}^{\text{th}}$ lowest in the list.
- returns:
  - value from the selection that is the $\texttt{k}^{\text{th}}$ lowest from the minimum value.

Exercise 1: Student Grades redux

1. Download *StudentGrades2.xlsx*
2. 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 Loewst 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() $\rightarrow$ number of cells that contain numerics.
  - for COUNTA() $\rightarrow$ number of cells that contain **any** information.
  - for COUNTBLANK() $\rightarrow$ 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_Purcases.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

- returns something.
- 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.

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` ← This is our search term.
   `range : A12:F78` ← The entire dataset.
   `column_index_number : 2` ← We want the second column.
   `FALSE : FALSE` ← We want **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**	**QPts**	**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							

Grading Policy		
Average	Grade	QPts
0	F	0
60	D	1
70	C	2
80	B	3
90	A	4

Further Reading

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