CMPT 155: Computer Applications for Life Sciences

Lecture 6: Formulas and Functions (Part 2)

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Presentation Outline

Homework 1

- Homework 1 will be due next Friday 2/11 6pm.
- No Late Work
- Begin **detail oriented** will be beneficial for the homework.
- Having trouble Stop by office hours RLC 204 or join office hours via the google meets link!

Conditional Logic: Order Example

1. Download *Order.xlsx*
2. Lets use arithmetic operators to apply a 10% discount on all orders.

it should look like this!

	A	B	C	D
1	**Transaction**	**Order**	**Price**	**Final Price (after discount)**
2	1	1,000	$300	$270,000
3	2	3,000	$900	$2,430,000
4	3	15,000	$4,500	$60,750,000
5	4	6,000	$1,800	$9,720,000
6	5	2,000	$600	$1,080,000
7	6	11,000	$3,300	$32,670,000
8	7	5,500	$1,650	$8,167,500
9	8	18,000	$5,400	$87,480,000
10	9	7,000	$2,100	$13,230,000

Conditional Logic: Order Example Volume Discount

We can add conditions to Excel Formulas to return values depending on different logical cases.
Lets try adding a 10% if the order quantity is over($>$) 5000 units.
It should look like this!

	A	B	C	D
1	**Transaction**	**Order**	**Price**	**Final Price (after discount)**
2	1	1,000	$300	$270,000
3	2	3,000	$900	$2,430,000
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IF()

- **IF**(condition, yes_value, no_return)
- **How IF() works:**
  - IF takes a logical argument (e.g., $1 < 2$, $3 = 4$), and tests whether the argument is **TRUE**.
  - IF the argument is **TRUE**,
  - THEN value displayed in the cell will be 'yes_value'.
  - ELSE it will display the 'no_value'.
- Check out the Microsoft Documentation for IF(). Let's try

  translating the conditional IF(order is greater than 5000, discounted price, original listed price) into excel!

Logical Operators

Operator	Name	Example	Return
=	Equal to	1 = 2	FALSE
>	Greater than	1 > 2	FALSE
<	Less than	1 < 2	TRUE
>=	Greater than or equal to	1 >= 1	TRUE
<=	Less than or equal to	1 <= 1	TRUE
<>	Not equal to	1 <> 1	FALSE

Exercise 1: Catch Divide by Zero

1. In cells A1, B1, and C1 write column headers Dividend, Divisor, and Quotient.
2. Write the numbers 0,1,2,3,4 in cells A2:A6
3. in Column B write the numbers -2,1,0,1,2, in cells B2:B6.
4. In cells C2:C6 take the quotient.
5. what error do we get?
6. **Use IF to return the dividend if dividing by 0.**

	A	B	C
1	Dividend	Divisor	Quotient
2	0	-2	0
3	1	-1	-1
4	2	0	#DIV/0!
5	3	-1	-3
6	4	-2	-2

Exercise 1: Solution

	A	B	C
1	Dividend	Divisor	Quotient
2	0	-2	-2
3	1	-1	-1
4	2	0	1
5	3	1	1
6	4	2	2

1. Assuming the setup is correct...
2. Write '$= \texttt{IF}(\texttt{B2} = 0, \texttt{A2}, \texttt{A2/B2})$'
3. Use Autofill to apply the formula to cells B3:B6.

Exercise 2: Conditional Bonuses

1. Download 'First Quarter Sales and Bonus.xlsx'
2. Calculate the over target sales.
3. **If** the *over target sales* **greater than** *0*, then the sales man gets a 5% commision (based on the *over target sales*).
4. Calculate the total salary.

Exercise 2: Solution

- In cell E4, take the difference between C4 and D4.
- To handle negative over target sales:
  1. use IF() to change negative overtarget sales to 0.
  2. it should be $=\text{IF}(\texttt{D4} - \texttt{C4} < 0, 0, \texttt{D4} - \texttt{C4})$
- Use Autofill to apply the difference to cells E5:E12.
- In cell F4, calculate the 5% comission bonus by mutiplying the 'over target sales', E4, by 0.05.
- Use Autofill to calculate the overtarget sales for each salesman.
- In cell H4, calculate the sum between E4 and F4.
- Use Autofill to calculate the sum for each salesman.

Exercise 2: Solution Table

	A	B	C	D	E	F	G	H
1	**First quarter sales and bonus**							
2								
3	**First Name**	**Last Name**	**Sales**	**Target**	**Over Target Sales**	**Commision Bonus**	**Salary**	**Total**
4	Andrew	Fuller	$7,639	$5,000	$2,639	$132	$2,500	$2,632
5	Anne	Dodsworth	$2,979	$5,000	$0	$0	$2,000	$2,000
6	Janet	Leverling	$29,659	$5,000	$24,659	$1,233	$2,600	$3,833
7	Laura	Callahan	$19,272	$5,000	$14,272	$714	$2,800	$3,514
8	Margaret	Peacock	$44,795	$5,000	$39,795	$1,990	$3,000	$4,990
9	Michael	Suyama	$4,110	$5,000	$0	$0	$1,800	$1,800
10	Nancy	Davolio	$15,330	$5,000	$10,330	$517	$4,500	$5,017
11	Robert	King	$21,462	$5,000	$16,462	$823	$2,000	$2,823
12	Steven	Buchanan	$2,634	$5,000	$0	$0	$3,000	$3,000

Figure: First Quarter Sales and Bonus

Exercise 3: Fruit Purchase

1. Download Fruit_Purchase.xlsx
2. Count the occurrences of each fruit.

Exercise 3: Solution

1. In Cells C2, D2, and E2 write the following column headers; 'Is Apple?', 'Is Kiwi?', 'Is Pear?'.
2. Logical Tests
    1. Check if the corresponding cell matches the Fruit in question.
    2. For apples; In Cell C3, type $= \texttt{IF}(\texttt{B3} = \texttt{"apples"}, 1, 0)$
3. Use Autofill from Cell C3 to apply the logical test down each Column.
4. In Cell B22 use SUM() to sum all the occurences of apples by writing =SUM(C3:C20).
5. Repeat Steps 2-4, for each fruit (Note: Be careful to type the fruit exactly as written).

Exercise 3: Solution

	A	B	C	D	E
2			IS APPLE?	IS KIWI?	IS PEAR?
3	11/12/2011	apples	1	0	0
4	11/15/2011	grapefruit	0	0	0
5	11/28/2011	apples	1	0	0
6	12/14/2011	oranges	0	0	0
7	12/30/2011	grapes	0	0	0
8	1/7/2012	grapefruit	0	0	0
9	1/15/2012	pears	0	0	1
10	1/31/2012	apples	1	0	0
11	2/2/2012	lemons	0	0	0
12	2/16/2012	pears	0	0	1
13	3/3/2012	oranges	0	0	0
14	3/19/2012	grapes	0	0	0
15	3/30/2012	lemons	0	0	0
16	4/4/2012	kiwi	0	1	0
17	4/20/2012	pears	0	0	1
18	5/6/2012	oranges	0	0	0
19	5/22/2012	apples	1	0	0
20	6/7/2012	apples	1	0	0
21					
22	**Total apples:**	**4**			
23	**Total kiwi:**	**1**			
24	**Total pears:**	**3**			

Absolute Cell References

Up to now we have used Autofill to sequentially apply formulas down a column. Sometimes we want to **Lock** a cell reference so that it is used in multiple calculations!
To **Lock** a:

- Column while applying a function across a Row.
  - Type a $ in front of the column reference (e.g., A$1).
- Row while applying a function down a Column.
  - Type a $ in front of the row reference (e.g., $A1).
- Both Columns and Rows:
  - Type $ in front of both (e.g., $A$1)
  - when in doubt just use both!

Exercise 4: Student Grades 2

1. Download *StudentGrades2.xlsx*
2. Use absolute cell references to calculate the Final Score for each student.
3. Calculate the Total and Average Final Score.
4. BONUS: Try to find the Median, Minimum, and Max Scores.

Exercise 4: Solution

1. In Cell E2, Calculate the individual percentage scores for each assignment using absolute cell references.
2. Separate each score by a '+' sign to take an unweighted sum.
   - cell E2 should read
     `=(B2/$B$12) + (C2/$C$12) + (D2/$D$12)`
3. Get a weighted average by multiplying each score by its associated weight.
   - cell E2 should finally read
     `=0.25*(B2/$B$12) + 0.25*(C2/$C$12) + 0.5*(D2/$D$12)`
4. Use Autofill to generate scores for each student.
5. In cell E14, use SUM() over cells E2:E10.
6. In cell E15, use Average over cells E2:10.

Exercise 4: Solution

1. Select cells A2:E10
2. click Home $\rightarrow$ Sort & Filter $\rightarrow$ Custom Sort...
3. In the Sort dialog box Select Column E as the Sort Column.
4. Select Smallest to Largest as the sort order.
5. In cell E16 enter the reference for the median E6.
6. In cell E17 enter the cell reference for the highest score E10.
7. In cell E18 enter the cell reference for the second highest score .
8. In cell E19 enter the cell reference for the lowest score E2.

Exercise 4: Solution Continued

	A	B	C	D	E
1	***Student***	***Test A (25%)***	***Test B (25%)***	***Assignments (50%)***	***Final Grade***
2	Katharine Susan	0	25	60	47.86%
3	Maresh Di Giorgio	26	26	50	59.82%
4	Hannah Adams	30	25	64	68.61%
5	Grace DeWitt	23	28	75	71.88%
6	Vittoria Accoramboni	31	26	69	72.45%
7	Janet Chung	37	29	77	82.34%
8	Edith Abbott	31	29	90	85.09%
9	Abigail Smith	34	31	90	88.39%
10	Annette Yuang	36	32	95	92.86%
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%

AND() Function

- AND() accepts two (or more) conditions, and then returns true if all of them are true.
- If any condition is false, AND() returns false.
- e.g., the new commission rules (5% rate) came into effect after the year 2010.
- `= IF( AND(E6>0, F6>2010), E6*0.05, 0)`

Exercise 5: Student Grades 3

1. Download *StudentGrades3.xlsx*
2. Let the student only pass if they pass **BOTH** tests with a score of **at least** 60.
3. Use conditional formatting to highlight the failed ones in yellow.

Exercise 5: Solution

1. In Cell D2 start an IF() statment.
2. in the IF statmemt begin an AND() statement.
3. In the AND() function write the following logical tests separated by a column.
   - `B2` $>=$ 60
   - `C2` $>=$ 60
4. in the second and third arguments write "FAIL", and "PASS" respectively, to return the correct result
   - Cell D2 should read
     `=IF(AND(B2>=60, C2 >= 60), "PASS", "FAIL")`
5. Use Autofill to check the scores for each student.
6. Select the cells D2:D10 and apply the conditional formatting.

OR() Function

- accepts two (or more) conditions, and then returns true if any one of them is true.
- OR() returns false only if all conditions are false.
- = IF (OR(condition 1, condition 2), value_if_true, value_if_false)

Try it on *StudentGrades3*!

Exercise 5: Solution Continued

	A	B	C	D	E
1	***Student***	***Test A***	***Test B***	***Result (AND)***	***Result (OR)***
2	Edith Abbott	90	88	PASS	PASS
3	Grace DeWitt	75	57	FAIL	PASS
4	Vittoria Accoramboni	59	68	FAIL	PASS
5	Abigail Smith	90	82	PASS	PASS
6	Annette Yuang	95	92	PASS	PASS
7	Hannah Adams	44	61	FAIL	PASS
8	Janet Chung	77	70	PASS	PASS
9	Maresh Di Giorgio	50	55	FAIL	FAIL
10	Katharine Susan	60	48	FAIL	PASS

Exercise 6: Fruit Purchases Redux

1. Download *Fruit_Purchase.xlsx*
2. In Column C Insert a column named "Is Citrus?".
3. Use SUM(), IF() and OR() to count the number of Fruits that could be classified as a Citrus (e.g., grapefruit, orange, lemon).
4. place this result in Cell B25.

Exercise 6: Solution

1. begin by adding a column header “Is Citrus” in Cell C2.
2. In cell A25 add a total label “Total Citrus”.
3. In cell C3 start an if statment followed by an OR statement.
   - The cell should read
     `=IF(OR(`
4. Write the three logical tests separated by columns.
   - The cell should now read
     `=IF(OR(B3="grapefruit", B3="lemons", B3="oranges")`
5. since we are interested in counting the instances where this statement is true, the TRUE and FALSE return statments should be 1, 0 respectively.
   - Cell C3 should finally read
     `=IF(OR(B3="grapefruit", B3="lemons", B3="oranges"), 1, 0)`
6. use autofill to fill out the columns C3:C20.
7. In Cell B25 sum the values in the selection C3:C20.
   - Cell B25 should read `=SUM(C3:C20)`

Exercise 6: Solution Continued

	A	B	C	D	E
1	**Fruit Purchase**				
2					
3	11/12/11	apples	=IF(OR(B3="grapefruit",B3		
4	11/15/11	grapefruit	="lemons", B3="oranges"),1,0)		
5	11/28/11	apples			
6	12/14/11	oranges	1		
7	12/30/11	grapes	0		
8	1/7/12	grapefruit	1		
9	1/15/12	pears	0		
10	1/31/12	apples	0		
11	2/2/12	lemons	1		
12	2/16/12	pears	0		
13	3/3/12	oranges	1		
14	3/19/12	grapes	0		
15	3/30/12	lemons	1		
16	4/4/12	kiwi	0		
17	4/20/12	pears	0		
18	5/6/12	oranges	1		
19	5/22/12	apples	0		
20	6/7/12	apples	0		
21					
22	**Total apples:**				
23	**Total kiwi:**				
24	**Total pears:**				
25	**Total Citrus**	7			

NOT()

- NOT() accepts a condition and reverse it.
  - `= IF ( NOT(B2>0), ..... , ..... )`

Example! Try applying the NOT() statement by replicating the table below:

Statement	T/F	NOT(T/F)
1=2	FALSE	TRUE
2¿1	TRUE	FALSE
10¡=3	FALSE	TRUE

Your table should be entered in this fashion:

Statement	T/F	NOT(T/F)
1=2	=1=2	=NOT(1=2)
2>1	=2>1	=NOT(2>1)
10<=3	=10>=3	=NOT(10>=3)