

CMPT 155: Computer Applications for Life Sciences

Lecture 6: Formulas and Functions (Part 2)

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Presentation Outline

- 1 Homework
- 2 Conditional Logic
- 3 Logical Operators
- 4 Functions and Formulas
- 5 Absolute Cell References
- 6 AND() Function, & Nested Functions

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
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
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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 ' $= A2/(IF(B2 = 0, 1, B2))$ '
- 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.
- handling negative over target sales:
 - ① use IF() to change negative overtarget sales to 0.
 - ② it should be $=IF(D4 - C4 < 0, 0, D4 - C4)$
- 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 = IF(B3 = "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 occurrences 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

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

Exercise 4: Solution

- 1 Select cells A2:E10
- 2 click Home → 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 E??
- 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.

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 statment begin an AND() statement.
- 3 In the AND() function write the following logical tests separated by a column.
 - ▶ $B2 \leq 60$
 - ▶ $C2 \leq 60$
- 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 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

- ❶ begin by adding a column header "Is Citrus" in Cell C2.
- ❷ In cell A25 add a total label "Total Citrus".
- ❸ In cell C3 start an if statment followed by an OR statement.
 - ▶ The cell should read
`=IF(OR(`
- ❹ Write the three logical tests separated by columns.
 - ▶ The cell should now read
`=IF(OR(B3="grapefruit", B3="lemons", B3="oranges")`
- ❺ 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)`
- ❻ use autofill to fill out the columns C3:C20.
- ❼ In Cell B25 sum the values in the selection C3:C20.
 - ▶ Cell B25 should read `=SUM(C3:C20)`

NOT()

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

Example! Try:

- 1 Download *NotExample.xlsx*
- 2 In column C Take note of the logical argument!
- 3 Use NOT() to reverse the output of the logical argument in Column C.