Logic, and the 'IF' Function

Comparison Operators

You can use comparison operators to compare two numbers, functions, formulas, or labels and return either true or false.

Examples include:

=2*3=4+2
=A1>0
=average(a1:a10)>50

Every conditional test must include at least one comparison operator. As an example, in the formula =A1>0, the comparison operator is >. The following six comparison operators exist in Excel:

Comparison Operator	Definition
=	Equal to
<>	Not equal to
<	Less than
<=	Less than or equal to
>	Greater than
>=	Greater than or equal to

IF Built-In Function

The IF function allows our spreadsheet to ***make a decision*** when analyzing the data. The function asks the question: Is some condition true or false? Based on the answer to that question, you can specify different behaviors.

The IF function checks a condition that must be either true or false. If the condition is true, the function returns one value; if the condition is false, the function returns another value.

The syntax of the IF function is:

=IF(logical_test, value_if_true, value_if_false)

=IF(A1 > 100, "Over 100", "100 or less")

=IF(A1 + A2 < 100, A1 +A2, 100)

Example

	A	B
1		
2		
3		

Place a numeric value in Cell A1, B1, A2, and B2.   In Cell A3, write an **=IF()** formula to display the larger value from A1 or A2. In Cell B3, write an **=IF()** formula to display which value is larger, B1 or B2. For Cell B3, display either the text B1 or the text B2.

Write the formula for Cell A3 here :_____

How many other ways can you write an equivalent **=IF()** formula? _____

What happens if the values in Cell A1 and A2 are equivalent? _____

Example

Examine the following spreadsheet that shows activity on a bank account. For type W the amount is withdrawn from the balance. For type D, the amount is added to the bank balance.

	A	B	C	D
1	**Initial Balance**	$3,874.00		
2				
3	**Date**	**Amount**	**Type**	**Balance**
4	January 2, 2006	$34.50	W	$3,839.50
5	January 4, 2006	$100.00	D	$3,939.50
6	January 5, 2006	$20.00	W	$3,919.50

What is the formula in cell D4 that could correctly be filled down to later transactions on the balance?

Write it here: _____

3.1 Exercise

Name the worksheet "Overtime"

You are the owner of a small business and every month you need to take a person's hours-worked and hourly wage and calculate gross and net pay. Gross pay is hours worked times hourly wage and net pay is gross pay minus: (1) Social Security (7.65%) (2) State Income Tax (8.5%) and (3) Federal Income Tax (15%).

Set up a worksheet that allows the user the ability to enter hours worked, hourly wage, and each of the three tax rates listed above; your worksheet then displays: Gross Pay, Social Security Paid, State Income Tax Paid, Federal Income Tax Paid, Net Pay.

Your worksheet must handle overtime such that any hours over 40 earn time and one half. If a person was making $5.00 per hour and worked 45 hours, for 5 hours they made $7.50 per hour.

Logical Operators

Sometimes our logical_test needs to use a logical function such as AND and OR:

The syntax for each of these statements is:

OR(logical_test#1, logical_test #2)

AND(logical_test#1, logical_test #2)

For the OR construct, a value of TRUE is returned if EITHER of the logical tests returns a value of TRUE; otherwise, a value of FALSE is returned to the cell.

For the AND construct, a value of TRUE is returned if BOTH of the logical tests return a value of TRUE; otherwise, a value of FALSE is returned to the cell.

Note that you can have more than TWO logical tests within an OR or AND statement by simply separating each subsequent logical test with a comma.

Often, the OR and AND constructs are used within an IF statement. For example, the statement

IF(AND(1<2 ,4=3) ,"HELLO" ,"GOODBYE")

will return to the cell "GOODBYE" because both 1<2 and 4=3 are not true. However, the statement

IF(AND(1<2, 4=4) ,"HELLO", "GOODBYE")

will return "HELLO" to the cell.

Examples of the IF function with logical AND and OR

	A	B	C	D	E
1	Name	District	Sales	Emp. Yrs	Job Level
2	Linda	East	$20,000.00	2	
3	Joe	West	$42,302.00	9	
4	Bill	East	$53,001.00	3	
5	Mary	South	$12,000.00	12	
6	Mark	South	$ 2,050.00	6	
7	John	North	$9,000.00	0	
8	Ted	East	$40,000.00	4	

This data shows salespeople's district, annual sales, and number of years employed by a company. Now, let's suppose you want a formula in column E that will assign a job level based on two different criteria: Salespeople who have been employed for more than 5 years AND have annual sales of more than $10,000 should be assigned a job level code of 2, and all others should have a job level code of 1.

Write down the formula here: _____

3.2 Exercise

Name the worksheet "3.2 Difference"

Create a spreadsheet that contains two columns of numbers (X, Y). The third column (Difference) should display the difference between the two numbers as a positive number. Assume the values for X and Y are positive.

X	Y	Difference
43	26	17
75	17	58
23	66	43
87	41	46
32	74	42
17	82	65
98	16	82
68	85	17

Nested IF Functions

Recall that the syntax for IF functions is:

=IF(logical_test, value_if_true, value_if_false)

The (value_if_true) and (value_if_false) arguments can be:
- Values (numbers, strings, etc.)
- References (A1, B1, etc.)
- Functions (INT, SUM, IF)

When you use an IF as an argument in an IF function, then you have nested Ifs.

What does the following IF logic mean:

=IF(A1 < 100, B1*0.01,IF(A1<1000,B1*0.02,B1*0.03))

What is the range of values that produces the result B1*0.01? _____

What is the range of values that produces the result B1*0.02? _____

What is the range of values that produces the result B1*0.03? _____

3.3 Example

Name the worksheet "Commission"

Let's say that you wanted to output the rate of commission that a salesperson receives based on the amount of sales they have generated for that month. Commissions are based on the following:

From $1 to $10 earns 10% commission
From $10.01 to $100 earns 15% commission
Anything over $100 earns 20% commission

	A Amount of Sales	B Percentage of Commission	C Amount of Commission
1	$15.00	15.00%	$2.25
2	$253.00	20.00%	$50.60
3	$10.00	10.00%	$1.00
4	$84.00	15.00%	$12.60
5	$12.00	15.00%	$1.80
6	$5.00	10.00%	$0.50
7	$32.00	15.00%	$4.80
8	$56.00	15.00%	$8.40
9	$150.00	20.00%	$30.00
10	$120.00	20.00%	$24.00

What is the formula that you would write in cell C1 that would fill down up to cell C10?

Write the formula here: _____

3.4 Exercise

Name the worksheet "Grades"

Consider the following data:

Name	ID#	Quiz1	Quiz2	Midterm	Final
Adams	0001	14	23	82	76
James	0002	12	21	76	68
Jones	0003	15	24	91	93
Mann	0004	14	19	88	73
Smith	0005	11	16	79	71
Tolls	0006	10	13	62	65
Wells	0007	5	10	43	55
Max Points		15	25	100	100

Part I: Add two additional columns as follows: (a) ***Average*** is a person's total points divided by the max points possible (b) ***Grade*** is 90-100 A, 80-90 B, 70-80 C, 60-70 D, 0-60 F.

Part II: Create a Pie Chart that shows the percentage of A's, B's, etc. You will need to add cells containing the number of A's, number of B's, etc. Hint: you will need to use the COUNTIF function. You can look up how it works in Excel help.

NPER Financial Function

Another useful financial function is NPER, which calculates the number of periods for an investment based on periodic, constant payment and a constant interest rate.

3.5 Exercise

Name this worksheet "Retirement"

Based on your budget and salary, you have worked out that you will have $1,000,000 (yes one million dollars) when you retire. You estimate that you will draw out $50,000 a year to live on and the remainder will go into a bank account with a 4% interest rate compounded yearly (yearly interest rate).

a. Use the NPER function to work out how many years it will be before you run out of money.

b. Create a payment or amortization schedule for this period and verify that the result of the NPER function is correct. Your table should contain columns for payment period, beginning balance, amount withdrawn, interest added and final balance for every payment period.

   Question: Is the payment period in months or years?

c. Add a chart to your worksheet showing the decline in your balance till it reaches zero.