OBJECTIVES

Session 8.1
- Use the IF function
- Use the AND function
- Use the OR function
- Use structured references in formulas

Session 8.2
- Nest the IF function
- Use the VLOOKUP function
- Use the HLOOKUP function
- Use the IFERROR function

Session 8.3
- Use conditional formatting to highlight duplicate values
- Summarize data using the COUNTIF, SUMIF, and AVERAGEIF functions
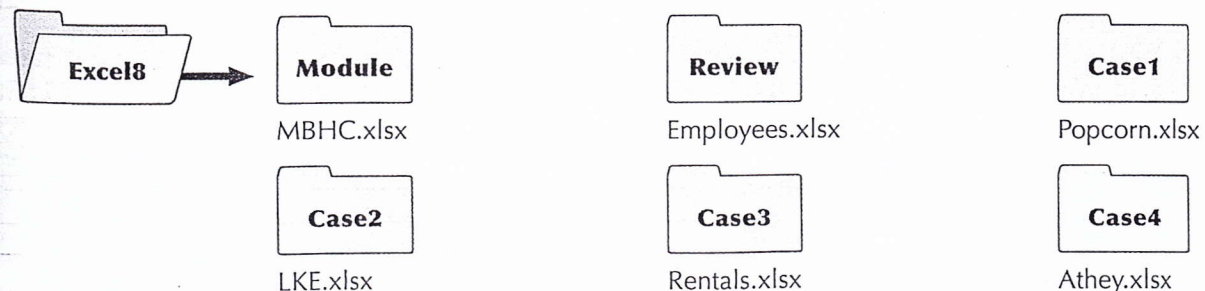
Working with Advanced Functions

Analyzing Employee and Product Data

Case | *MB Hobbies & Crafts*

Vanessa Beals is the managing director for MB Hobbies & Crafts (MBHC), a Texas-based craft and hobby supplier. MBHC has nearly 100 employees employed at its four stores, which are located in Bonham, Bowie, Garland, and Graham. The MBHC product list includes more than 10,000 items for dressmaking, floral crafting, jewelry making, model ship or boat building, quilting, or yarn crafting. Each store has a focus on specific crafts, although all of the stores stock a large selection of supplies for all crafts. For example, Garland stocks a wide range of items from the product list, but its main focus is on quilting supplies.

Vanessa has an Excel worksheet that she uses to track basic employee information, including each employee's ID, name, hire date, birth date, job status, and current salary. She wants to analyze this data in different ways. For example, she wants to send each employee a birthday greeting during their birthday month, create name badges that are color-coded by years of employment, identify part-time employees who are eligible for comp days, and calculate salary increases and bonuses. Vanessa is also developing a product data worksheet for analyzing the store suppliers. So far, the worksheet includes basic data such as part number, category, and description. Vanessa wants to expand the data to include the supplier name for each product and which store specializes in that product. To provide Vanessa with all this information, you'll use a variety of logical and lookup functions.

STARTING DATA FILES

Excel8 → Module

MBHC.xlsx

Review

Employees.xlsx

Case1

Popcorn.xlsx

Case2

LKE.xlsx

Case3

Rentals.xlsx

Case4

Athey.xlsx

Session 8.1 Visual Overview:

When you create a formula that references all or parts of an Excel table, you can replace a specific cell or range address with a **structured reference**, which is the actual table name or column header.

MBHC Data – Excel

File | Home | Insert | Page Layout | Formulas | Data | Review | View

Calibri | 11 | A A
B I U
Paste
Clipboard | Font | Alignment | Number

M80 | f_x | =IF(OR([Store]="Bonham",[Store]="Grah...

The IF function is a logical function that evaluates a condition, and then returns one value if the condition is true and a different value if the condition is false.

	A	B	F	G	H
1	Employee ID ▼	Last Name ▼	Birth Date ▼	Age ▼	Store
80	3214	Web	9/24/1974	42	Graham
81	3218	Whiting			
82	3222	Lloyd	=IF(MONTH(F80)='Data Tables'!...		
83	3226	Baker	10/9/1991	25	Garland
84	3230	Rosenberg	2/1/1949	=IF(AND(I80="...	
85	3234	George	5/12/1969	47	Graham
86	3238	Trottier			
87	=IF(OR([Store]="Bonham",[Store]="Graham"),[Current Salary]...				
88	3246	Pope	3/3/1961	55	Garland
89	3250	Burgess	5/13/1978	38	Graham
90	3254	Floyd	9/24/1986	30	Graham
91	3258	Guerrero	6/16/1953	63	Graham
92	3262	Roeder	10/11/1955	61	Graham
93	3266	Joe	3/3/1974	42	Graham
94	3270	Holland	6/5/1959	57	Bonham

A **logical condition** is an expression such as I80="PT" that returns either a TRUE or FALSE value.

The **AND function** is a logical function that returns a TRUE value if all of the logical conditions are true and a FALSE value if any of the logical conditions are false.

The **OR function** is a logical function that returns a TRUE value if any of the logical conditions are true and a FALSE value if none of the logical conditions are true.

◄ ► | Documentation | Employee Analysis | **Employee Data** | Product D...

Ready

Logical Functions

In this formula, the structured reference [Current Salary] references the cells in column J of the EmployeeTbl table.

Table Tools

View   Design   ♡ Tell me what you want to do...   Your Na...   ♀ Share

Accounting

🔲 Conditional Formatting ▾   🔲 Insert ▾   Σ ▾   A🔽Z
🔲 Format as Table ▾   🔲 Delete ▾   🔽   Sort & Find &
🔲 Cell Styles ▾   🔲 Format ▾   ◇▾   Filter ▾ Select ▾

Number   Styles   Cells   Editing

[Store]="Graham"),[Current Salary]*0.035,[Current Salary]*0.025)

Store ▾	Job Statu▾	Current Salary ▾	Eligible for Birthday Month▾	Eligible for Comp Day ▾	Salary Increase ▾
Graham	FT	$ 58,309			$2,040.82
		37.00			$ 927.25
Tables'!$E$16,"Yes","")		51,639	Yes		$1,290.98
Garland	FT	$ 59,138			$1,478.45
es",(I80="PT",E80>=2),"Yes","")					$2,856.35
Graham	PT	$ 64,598		Yes	$2,260.93
		94,896			$3,321.36
ry]*0.035,[Current Salary]*0.025)					$2,040.19
Garland	F				
Graham	F				
raham	F				
Graham	F				
raham	F				
Graham	F				
nham	F				
oduct [...					

When a formula is entered in a cell within an Excel table, the formula is automatically copied to all cells in that column. The column is referred to as a **calculated column.**

To test two or more conditions and determine whether *all* conditions are true, you use an AND function as the logical test of the IF function.

To test two or more conditions and determine whether *any* condition is true, you use the OR function as the logical test of the IF function.

The Function Arguments dialog box makes it simpler to build an IF function with a nested OR function (shown here) for the logical test.

Function Arguments   ? ✕

IF

Logical_test   OR([Store]="Bonham",[Store]=1 🔢   = TRUE

Value_if_true   [Current Salary]*0.035   🔢   = {3710.35;1476.37;3228.89;2423.75;35...

Value_if_false   [Current Salary]*0.025   🔢   = {2650.25;1054.55;2306.35;1731.25;25...

= {3710.35;1476.37;3228.89;2423.75;35...

Checks whether a condition is met, and returns one value if TRUE, and another value if FALSE.

Logical_test is any value or expression that can be evaluated to TRUE or FALSE.

Formula result = $ 3,710.35

Help on this function   OK   Cancel

⊞ ▤ ⊔   —   +   120%

Working with Logical Functions

Logical functions such as IF, AND, and OR determine whether a condition is true or false. A condition uses one of the comparison operators <, <=, =, <>, >, or >= to compare two values. You can combine two or more functions in one formula, creating more complex conditions.

Vanessa created a workbook that contains data for each MBHC employee. She stored this information in an Excel table. The table includes each employee's ID, last name, first name, hire date, years of service, birth date, age, store, job status, and current salary. Vanessa wants you to determine if employee birth dates occur in a specified month, determine comp day eligibility of part-time employees, and compute employee salary increases. You will use IF, AND, and OR functions to do this after you open Vanessa's workbook and review the employee data.

To open and review the MBHC workbook:

1. Open the **MBHC** workbook located in the **Excel8 > Module** folder included with your Data Files, and then save the workbook as **MBHC Data** in the location specified by your instructor.

2. In the Documentation worksheet, enter your name and the date.

3. Go to the **Employee Data** worksheet. The worksheet contains an Excel table named EmployeeTbl, which includes each employee's ID, last name, first name, hire date, years of service, birth date, age, store, job status, and current salary. See Figure 8-1.

Figure 8-1   Employee Data worksheet

	A	B	C	D	E	F	G	H	I	J
1	Employee ID	Last Name	First Name	Hire Date	Years of Service	Birth Date	Age	Store	Job Stat	Current Salary
2	1102 Delosreyes	Lori		7/10/2014	3.5	4/11/1961	55	Bonham	FT	$ 106,010
3	1106 Goode	Bari		11/6/2015	2.2	11/23/1991	25	Graham	FT	$ 42,182
4	1110 Reams	Linda		12/4/2015	2.1	10/15/1966	50	Bonham	FT	$ 92,254
5	1114 Rodriguez	Richard		3/24/2003	14.8	12/8/1964	52	Graham	FT	$ 69,250
6	1118 Peters	Jessica		5/23/2011	6.6	2/15/1962	54	Bonham	FT	$ 102,567
7	1122 Cortez	Nick		8/12/2002	15.4	10/15/1968	48	Bowie	FT	$ 94,517
8	1126 Millard	Melissa		11/6/2015	2.2	3/20/1973	43	Garland	FT	$ 51,791
9	1130 Burns	Brenda		6/10/2010	7.6	4/20/1966	50	Garland	FT	$ 32,530
10	1134 Kimball	Susan		1/20/2016	1.9	3/21/1957	59	Graham	FT	$ 94,502
11	1138 Ford	Charles		5/4/2012	5.7	6/28/1967	49	Bonham	PT	$ 45,671
12	1142 Vazquez	Johnny		7/16/2011	6.5	2/8/1986	30	Graham	FT	$ 70,346
13	1146 Whetstone	William		4/12/2008	9.7	7/13/1986	30	Garland	FT	$ 34,685
14	1150 Arnold	Leroy		3/13/2012	5.8	7/8/1949	67	Bonham	FT	$ 96,944
15	1154 Basile	Santos		8/8/2015	2.4	12/1/1956	60	Bonham	FT	$ 92,091
16	1158 Loftis	Robert		7/17/2015	2.5	7/12/1959	57	Garland	FT	$ 30,150
17	1162 Olson	Ruth		1/8/2015	3.0	3/6/1970	46	Bonham	FT	$ 81,536
18	1166 Gridley	Marjorie		10/4/2013	4.2	10/25/1959	57	Bowie	FT	$ 96,021

Documentation | Employee Analysis | Employee Data | Product Data | Data Tables

Ready

4. Scroll down and to the right. Although the column headers remain visible as you scroll down, the employee ID and last name disappear as you scroll to the right.

5. Select cell **C2**, and then freeze the panes so columns A and B remain on the screen as you scroll across the screen.

Inserting Calculated Columns in an Excel Table

An Excel table does not have a fixed structure. When you add a column to an Excel table, the table expands, and the new column has the same table formatting style as the other columns. If you enter a formula in one cell of a column, the formula is automatically copied to all cells in that column. These calculated columns are helpful as you add formulas to an Excel table.

If you need to modify the formula in a calculated column, you edit the formula in any cell in the column, and the formulas in all of the cells in that table column are also modified. If you want to edit only one cell in a calculated column, you need to enter a value or a formula that is different from all the others in that column. A green triangle appears in the upper-left corner of the cell with the custom formula in the calculated column, making the inconsistency easy to find. After a calculated column contains one inconsistent formula or value, any other edits you make to that column are no longer automatically copied to the rest of the cells in that column. Excel does not overwrite custom values.

PROSKILLS

Written Communication: Creating Excel Table Fields

Excel tables should be both easy to use and easy to understand. This requires labeling and entering data in a way that effectively communicates a table's content or purpose. If a field is entered in a way that is difficult to use and understand, it becomes more difficult to find and present data in a meaningful way.

To effectively communicate a table's function, keep the following guidelines in mind when creating fields in an Excel table:

- **Create fields that require the least maintenance.** For example, hire date and birth date require no maintenance after they are entered, unlike age and years of service, whose values change each year. If you need to know the specific age or years of service, use calculations to determine them based on values in the Hire Date and Birth Date columns.
- **Store the smallest unit of data possible in a field.** For example, use three separate fields for city, state, and zip code rather than one field. Using separate fields for each unit of data enables you to sort or filter each field. If you want to display data from two or more fields in one column, you can use a formula to reference the City, State, and zip Code columns. For example, you can use the & operator to combine the city, state, and zip code in one cell as follows: =C2&D2&E2
- **Apply a text format to fields with numerical text data.** For example, formatting fields such as zip codes and Social Security numbers as text ensures that leading zeros are stored as part of the data. Otherwise, the zip code 02892 is stored as a number and displayed as 2892.

Using these guidelines means that you and others will spend less time interpreting data and more time analyzing results. This lets you more effectively communicate the data in an Excel table.

Using the IF Function

In many situations, the value you store in a cell depends on certain conditions. Consider the following examples:

- An employee's gross pay depends on whether that employee worked overtime.
- A sales tax depends on the sales tax rate and the value of the purchase.
- A shipping charge depends on the dollar amount of an order.

To evaluate these types of conditions, you use the IF function. Recall that the IF function is a logical function that evaluates a condition and then returns one value if the condition is true and another value if the condition is false. The value can be text, numbers, cell references, formulas, or functions. The IF function has the syntax

```
IF(logical_test,value_if_true,value_if_false)
```

where *logical_test* is a condition that is either true or false, *value_if_true* is the value returned by the function if the condition is true, and *value_if_false* is the value returned by the function if the condition is false. The IF function results in only one value—either the *value_if_true* or the *value_if_false*.

You will use an IF function to alert Vanessa that an employee has a birth date during a specified month. MBHC employees who have an upcoming birthday receive a birthday card with a gift card to MBHC. A Yes value in the Birthday Month column will indicate that an employee has a birthday during the specified month, and a blank cell will indicate that an employee does not have a birthday during the specified month.

The flowchart shown in Figure 8-2 illustrates Vanessa's logic for determining whether an employee's birthday occurs in a specified month. The flowchart shows that if an employee's birthday month occurs in the specified month (*birthday month = specified month* is True), "Yes" is entered in the cell. If the employee does not have a birthday in the specified month, the cell is left blank.

Figure 8-2 **Flowchart with logic to determine if an employee's birthday is in the specified month**
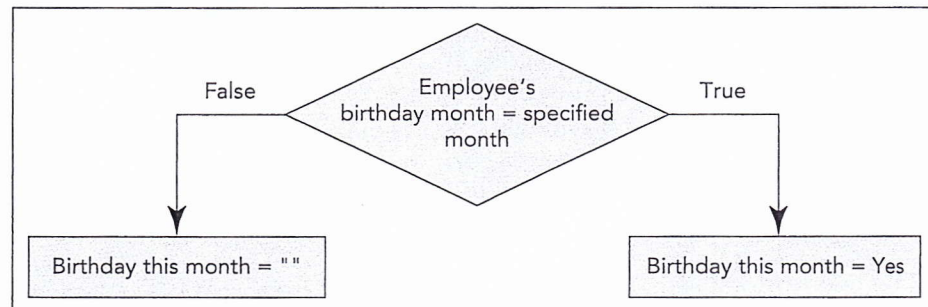
The EmployeeTbl table doesn't include a column that lists only the birthday month; this information is included as part of the employee's complete birth date, which is stored in column F. To extract the month portion of the employee's birth date, you will use the MONTH function. This function is a Date function that returns the month as a number from 1 (January) to 12 (December). The MONTH function has the syntax

```
MONTH(date)
```

where *date* is a date that includes the month you want to extract. Recall that Excel stores dates as a number equal to the number of days between January 1, 1900 and the specified date so they can be used in calculations. For example, January 1, 2017 is stored as the serial number 42736 because it occurs 42,736 days since the start of the Excel calendar. The MONTH function determines the month number from the stored serial number. For example, the birth date of the employee in row 2 of the EmployeeTbl table is 4/11/1961, which is stored in cell F2. The following MONTH function extracts the month portion of this stored date, which is 4:

```
=MONTH(F2)
```

You'll use the MONTH function in the logical test of the IF function, which will check whether the employee's birth month matches the month number entered in cell E16 of the Data Tables worksheet. Vanessa wants to know which employees have birthdays in April, so she entered 4 as the month number in cell E16. The following formula includes the complete IF function to determine if an employee has a birthday in April:

```
=IF(MONTH(F2)='Data Tables'$E$16,"Yes","")
```

The logical test MONTH(F2)='Data Tables'$E$16 determines if the employee's birth month is equal to the birthday month stored in cell E16 of the Data Tables worksheet. If the condition is TRUE, Yes is displayed in the Birthday Month column; otherwise, the cell is left blank.

You'll add a column to the EmployeeTbl table to display the results of the IF function that determines if an employee's birthday occurs in the specified month.

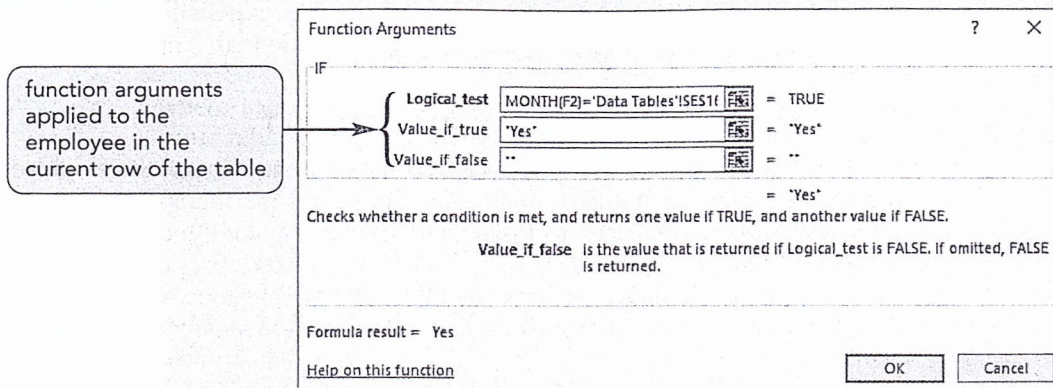## To determine which employees have birthdays in the specified month:

1. In cell **K1**, enter **Birthday Month** as the column header. The Excel table expands to include this column and applies the table formatting to all the rows in the new column.

2. Make sure cell **K2** is the active cell, and then click the **Insert Function** f_x button next to the formula bar. The Insert Function dialog box opens.

3. Click **Logical** in the Or select a category list, click **IF** in the Select a function box, and then click the **OK** button. The Function Arguments dialog box for the IF function opens.

4. In the Logical_test box, type **MONTH(F2)='Data Tables'!$E$16** and then press the **Tab** key. This condition tests whether the employee's birth month is equal to the month specified in cell E16 of the Data Tables worksheet. The function MONTH returns the month number of the date specified in cell F2. TRUE appears to the right of the Logical_test argument box, indicating this employee has a birthday in the specified month.

5. In the Value_if_true box, type **Yes** and then press the **Tab** key. This argument specifies that if the condition is true (the employee's birth month matches the value in cell E16 of the Data Tables worksheet), display Yes as the formula result. The value to the right of the Value_if_true argument box is Yes because the condition is true. Notice that Excel inserts quotation marks around the text value because you did not include them.

6. In the Value_if_false box, type **""**. This argument specifies that if the condition is false (the employee's birth month does not match the value in cell E16 of the Data Tables worksheet), display nothing in cell K2. The value to the right of the Value_if_false argument box is "", which indicates that cell K2 appears blank if the condition is false. See Figure 8-3.

Figure 8-3 Function Arguments dialog box for the IF function

function arguments applied to the employee in the current row of the table

Function Arguments ? ×

IF

Logical_test	MONTH(F2)='Data Tables'!E1f	= TRUE
Value_if_true	"Yes"	= "Yes"
Value_if_false	""	= ""

= "Yes"

Checks whether a condition is met, and returns one value if TRUE, and another value if FALSE.

Value_if_false is the value that is returned if Logical_test is FALSE. If omitted, FALSE is returned.

Formula result = Yes

Help on this function   OK   Cancel

> **7.** Click the **OK** button. The formula =IF(MONTH(F2)="Data Tables'!$E$16, "Yes","") appears in the formula bar, and Yes appears in cell K2 because the condition is true. The formula is automatically copied to all cells in column K of the table. See Figure 8-4.

Figure 8-4 Birthday Month column added to the EmployeeTbl table

K2 =IF(MONTH(F2)='Data Tables'!$E$16,"Yes","")

	A	B	D	E	F	G	H	I	J	K
1	Employee ID	Last Name	Hire Date	Years of Service	Birth Date	Age	Store	Job Stat	Current Salary	Birthday Month
2	1102	Delosreyes	7/10/2014	3.5	4/11/1961	55	Bonham	FT	$ 106,010	Yes
3	1106	Goode	11/6/2015	2.2	11/23/1991	25	Graham	FT	$ 42,182	
4	1110	Reams	12/4/2015	2.1	10/15/19				$ 92,254	
5	1114	Rodriguez	3/24/2003	14.8	12/8/19				$ 69,250	
6	1118	Peters	5/23/2011	6.6	2/15/19				$ 102,567	
7	1122	Cortez	8/12/2002	15.4	10/15/19				$ 94,517	
8	1126	Millard	11/6/2015	2.2	3/20/1973	43	Garland	FT	$ 51,791	
9	1130	Burns	6/10/2010	7.6	4/20/1966	50	Garland	FT	$ 32,530	Yes
10	1134	Kimball	1/20/2016	1.9	3/21/1957	59	Graham	FT	$ 94,502	

formula for the birthday month column

calculated column

all rows in column K are filled with the IF function

Using the AND Function

The IF function evaluates a single condition. However, you often need to test two or more conditions and determine whether *all* conditions are true. You can do this with the AND function. The AND function is a logical function that returns the value TRUE if all of the logical conditions are true and returns the value FALSE if any or all of the logical conditions are false. The syntax of the AND function is

AND(*logical1*[,*logical2*]...)

where *logical1* and *logical2* are conditions that can be either true or false. If all of the logical conditions are true, the AND function returns the logical value TRUE; otherwise, the function returns the logical value FALSE. You can include up to 255 logical conditions in an AND function. However, keep in mind that *all* of the logical conditions listed in the AND function must be true for the AND function to return a TRUE value.

Figure 8-5 illustrates how the AND function is used to determine student eligibility for the dean's list. In this scenario, when students have 12 or more credits (stored in cell B1) *and* their GPA is greater than 3.5 (stored in cell B2), they are placed on the dean's list. Both conditions must be true for the AND function to return the logical value TRUE.

Figure 8-5   AND function example

Purpose:	To determine dean's list requirements
Logic Scenario:	12 or more semester credits and GPA above 3.5
Formula:	AND function with two conditions =AND(B1>=12,B2>3.5)
Data:	cell B1 stores number of credits cell B2 stores student's GPA

Example:

Data		Condition1	Condition2	Results
Cell B1	**Cell B2**	**B1>=12**	**B2>3.5**	**(Dean's List?)**
15	3.6	True	True	True
12	3.25	True	False	False
6	3.8	False	True	False
10	3.0	False	False	False

Vanessa wants you to use an AND function to determine part-time employees' eligibility for comp days. MBHC part-time employees are eligible for comp days if they are part-time employees (PT in Job Status) *and* have worked for the company for two or more years (equal to or greater than 2 in Years of Service). As long as *both* conditions are true, the employee is eligible for comp days. If neither condition is true or if only one condition is true, the employee is not eligible for comp days. Vanessa outlined these eligibility conditions in the flowchart shown in Figure 8-6.

Figure 8-6   Flowchart illustrating AND logic for the comp day eligibility
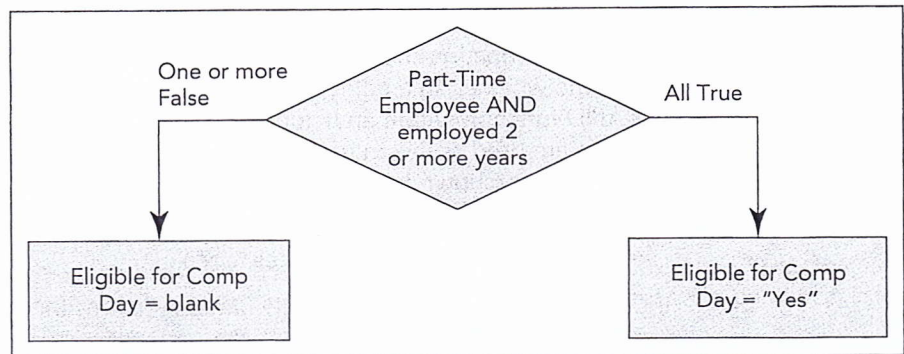
To calculate eligibility of each part-time employee, you need to use the AND function with the IF function. You use the AND function shown in the following formula as the logical test to evaluate whether each employee in the EmployeeTbl table fulfills the eligibility requirements:

```
=AND(I2="PT",E2>=2)
```

This formula tests whether the value in cell I2 (the job status for the first employee) is equal to PT (an abbreviation for part time), and whether the value in cell E2 (the years of service for the first employee) is greater than or equal to 2 (indicating two or more years of employment at MBHC). When an employee is a part-time employee (I2="PT") *and* has worked two or more years at MBHC (E2>=2), the AND function returns the value TRUE; otherwise, the AND function returns the value FALSE. Figure 8-7 shows the result returned by the AND function for four different sets of employee values for job status and years of service.

Figure 8-7 AND function results for comp day eligibility

Purpose:	To determine eligibility for comp days			
Logic Scenario:	A part-time employee is eligible for comp days if the employee has part-time (PT) job status and has two or more years of service.			
Formula:	AND function with two conditions =AND(I2="PT",E2>=2)			
Data:	cell I2 stores Job Status cell E2 stores Years of Service			

Example:

Data		Condition1	Condition2	Results
Cell I2	Cell E2	I2="PT"	E2>=2	(Comp Day?)
FT	2.5	False	True	False
FT	1.5	False	False	False
PT	2.5	True	True	True
PT	1.5	True	False	False

The AND function shows only whether an employee is eligible for comp days. To determine whether an employee is eligible *and* to display "Yes" in column L, you nest this AND function within an IF function. Functions are nested when the results of one function are used as the argument of another function. In the following formula, the AND function (shown in red) is nested within the IF function and is used as the logical test that determines whether the employee is eligible for comp days:

```
=IF(AND(I2="PT",E2>=2),"Yes","")
```

If the employee is eligible, the AND function returns the logical value TRUE and the IF function places "Yes" in column L. If the AND function returns the logical value FALSE, the IF function displays nothing in the cell.

You'll insert a new column in the EmployeeTbl table, and then enter the formula to determine whether the employee is qualified for comp days.

## To determine if part-time employees are eligible for comp days:

1. In cell **L1**, enter **Eligible for Comp Day** as the column header. The Excel table expands to include the new column, and cell L2 is the active cell.

2. AutoFit column L so that the entire heading is visible.

3. Make sure cell **L2** is the active cell, and then click the **Insert Function** button f_x next to the formula bar. The Insert Function dialog box opens.

4. Click **IF** in the Select a function box, and then click the **OK** button. The Function Arguments dialog box opens.

5. In the Logical_test box, type **AND(I2="PT",E2>=2)** and then press the **Tab** key. This logical test evaluates whether the employee is part time, indicated by PT in cell I2, *and* has worked at MBHC for two years or more. FALSE appears to the right of the Logical_test box, indicating that this condition for the employee in row 2 is false. This employee's job status is full time, so one of the conditions is not true.

6. In the Value_if_true box, type **Yes** and then press the **Tab** key. This argument specifies that if the condition is true (the employee is eligible for comp time as determined by the AND function), the word Yes appears to the right of the Value_if_true box.

7. In the Value_if_false box, type **""**. This argument specifies that if the condition is false (the employee is not eligible for comp time as determined by the AND function), nothing is displayed in cell L2, as specified by "" to the right of the Value_if_false box. See Figure 8-8.

| Figure 8-8 | Function Arguments dialog box for the IF function with nested AND function |
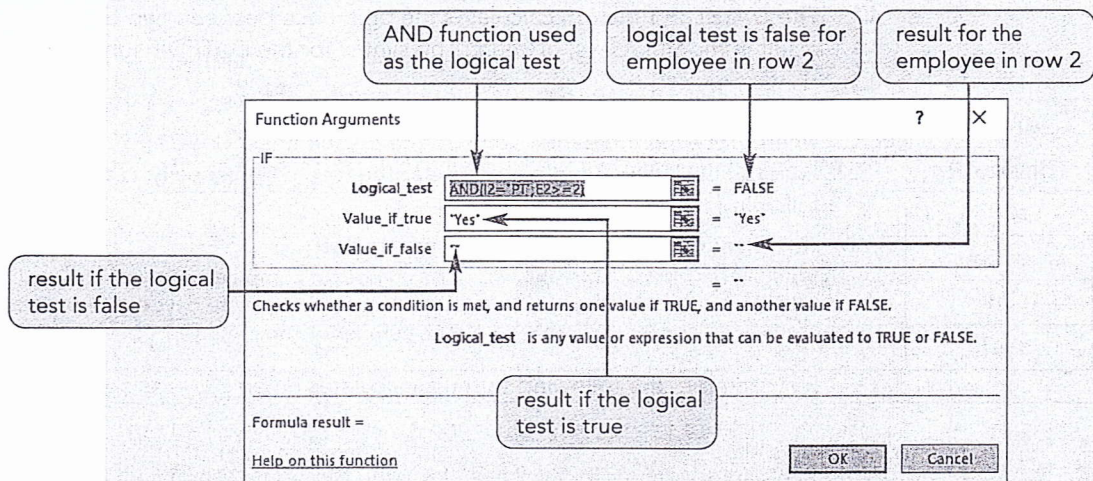
8. Click the **OK** button. The formula with the IF function that you just created is entered in cell L2 and copied to all rows in column L of the table.

9. Select cell **L2**. The formula =IF(AND(I2="PT",E2>=2),"Yes","") appears in the formula bar and nothing appears in cell L2 because the condition is false. See Figure 8-9.

Figure 8-9	IF function with the AND function to determine comp day eligibility

formula in cell L2 uses the IF and AND functions

L2 =IF(AND(I2="PT",E2>=2),"Yes","")

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Employee ID	Last Name	First Name	Hire Date	Years of Service	Birth Date	Age	Store	Job Status	Current Salary	Birthday Month	Eligible for Comp Day		
2	1102	Delosreyes	Lori	7/10/2014	3.5	4/11/1961	55	Bonham	FT	$ 106,010	Yes			
3	1106	Goode	Bari	11/6/2015	2.2	11/23/1991	25	Graham	FT	$ 42,182				
4	1110	Reams	Linda	12/4/2015	2.1	10/15/1966	50	Bonham	FT	$ 92,254				
5	1114	Rodriguez	Richard	3/24/2003	14.8	12/8/1964	52	Graham	FT	$ 69,250				
6	1118	Peters	Jessica	5/23/2011	6.6	2/15/1962	54	Bonham	FT	$ 102,567				
7	1122	Cortez	Nick	8/12/2002	15.4	10/15/1968	48	Bowie	FT	$ 94,517				
8	1126	Millard	Melissa	11/6/2015	2.2	3/20/1973	43	Garland	FT	$ 51,791				
9	1130	Burns	Brenda	6/10/2010	7.6	4/20/1966	50	Garland	FT	$ 32,530	Yes			
10	1134	Kimball	Susan	1/20/2016	1.9	3/21/1957	59	Bonham	FT	$ 94,502				
11	1138	Ford	Charles	5/4/2012	5.7	6/28/1967	49	Bonham	PT	$ 45,671		Yes		
12	1142	Vazquez	Johnny	7/16/2011	6.5	2/8/1986	30	Graham	FT	$ 70,346				

this part-time employee is eligible for comp days

All part-time employees who qualify for comp days have been identified.

INSIGHT

Using the DATEDIF Function to Calculate Employee Age

In the EmployeeTbl table, the Age column was calculated using the DATEDIF function. The **DATEDIF function** calculates the difference between two dates and shows the result in months, days, or years. The syntax for the DATEDIF function is

DATEDIF(*Date1*,*Date2*,*Interval*)

where *Date1* is the earliest date, *Date2* is the latest date, and *Interval* is the unit of time the DATEDIF function will use in the result. You specify *Interval* with one of the following interval codes:

Interval Code	Meaning	Description
"m"	Months	The number of complete months between *Date1* and *Date2*
"d"	Days	The number of complete days between *Date1* and *Date2*
"y"	Years	The number of complete years between *Date1* and *Date2*

For example, the following formula calculates an employee's age in complete years:

=DATEDIF(F2,'Data Tables'!$E$17,"y")

The earliest date is located in cell F2, the birth date. The latest date is in cell E17 in the Data Tables worksheet, which shows the date used to compare against the birth date—as of a cut-off date. The interval "y" indicates that you want to display the number of complete years between these two dates.

The DATEDIF function is undocumented in Excel, but it has been available since Excel 97. To learn more about this function, search the web using "DATEDIF function in Excel" as the search text in your favorite search engine.

Using the OR Function

The OR function is a logical function that returns a TRUE value if any of the logical conditions are true, and returns a FALSE value if all of the logical conditions are false. The syntax of the OR function is

```
OR(logical1[,logical2]...)
```

where *logical1* and *logical2* are conditions that can be either true or false. If any of the logical conditions are true, the OR function returns the logical value TRUE; otherwise, the function returns the logical value FALSE. You can include up to 255 logical conditions in the OR function. However, keep in mind that if any logical condition listed in the OR function is true, the OR function returns a TRUE value.

Figure 8-10 illustrates how the OR function is used to determine eligibility for a 10 percent discount. In this scenario, anyone who is 65 years or older (stored in cell B1) or anyone who is a college student (stored in cell B2) receives a 10 percent discount. At least one condition must be true for the OR function to return the logical value TRUE.

Figure 8-10   **Example of the OR function**

|	
Purpose:	To determine who is eligible for a discount
Logic Scenario:	Discount is 10 percent for seniors (65 or older) or college students (Status =STU)
Formula:	OR function with two conditions =OR(B1>=65,B2="STU")
Data:	cell B1 stores Age cell B2 stores Status (STU, FAC, STF)

Example:

Data		Condition1	Condition2	Results
Cell B1	Cell B2	B1>=65	B2="STU"	(Discount?)
22	STU	False	True	True
67	FAC	True	False	True
65	STU	True	True	True
45	STF	False	False	False

MBHC is considering awarding a 3.5 percent raise to employees working in the original stores (Bonham or Graham) and a 2.5 percent raise for all other employees. The criteria for awarding a salary increase are based on location. If the employee is working in either Bonham or Graham, the employee will receive the 3.5 percent raise. In other words, if either Store equals Bonham or Store equals Graham is True, the condition is true, and the employee will receive the 3.5 percent raise. If the condition is false—meaning the employee works at a store other than Bonham or Graham—the employee receives a 2.5 percent raise. Vanessa outlined the salary increase criteria in the flowchart shown in Figure 8-11.

Figure 8-11	Flowchart of the OR function to calculate salary increase
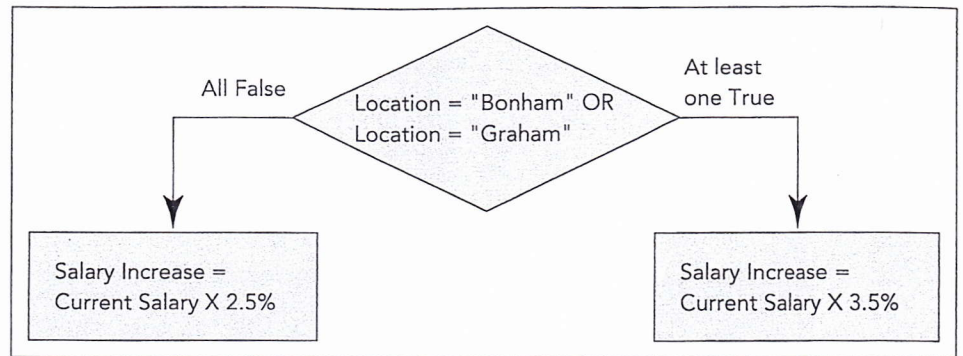
You need to use the OR function to test whether an employee meets the criteria for the 3.5 percent or 2.5 percent salary increase. The following formula uses the OR function to test whether the value in cell H2 (the store for the first employee) is equal to Bonham *or* whether the value in cell H2 is equal to Graham:

```
=OR(H2="Bonham",H2="Graham")
```

If the employee works in the Bonham store *or* the employee works in the Graham store, the OR function returns the value TRUE; otherwise, the OR function returns the value FALSE.

Figure 8-12 shows the results returned using the OR function for four different employee work locations—Bonham, Bowie, Garland, and Graham.

Figure 8-12	OR function results for four employee work locations

Purpose: To determine an employee's salary increase percentage

Logic Scenario: Proposed 3.5 percent salary increase to full-time (FT) employees located in Graham or Bonham

Formula: OR function with two conditions
             =OR(F2="Graham",F2="Bonham")

Data: cell F2 stores Location

Example:

Data	Condition1	Condition2	Results.
Cell F2	F2="Graham"	B2="Bonham"	(OR function)
Graham	True	False	True
Bonham	False	True	True
Garland	False	False	False
Bowie	False	False	False

The OR function only determines which raise an employee is eligible for. It does not calculate the amount of the salary increase. To determine the amount of the salary increase, the OR function must be nested within an IF function. In the formula

```
=IF(OR(H2="Bonham",H2="Graham"),J2*0.035,J2*0.025)
```

the logical test of the IF function uses the OR function (shown in red) to determine whether an employee is either working in the Bonham store *or* working in the Graham store. If the OR function returns a TRUE value, the IF function multiplies the Current Salary by 3.5 percent. If the OR function returns a FALSE value, the IF function multiplies the Current Salary by 2.5 percent.

Using Structured References to Create Formulas in Excel Tables

When you create a formula that references all or parts of an Excel table, you can replace the specific cell or range address with a structured reference, the actual table name, or a column header. This makes the formula easier to create and understand. The default Excel table name is Table1, Table2, and so forth unless you enter a more descriptive table name, as Vanessa did for the EmployeeTbl table. Column headers provide a description of the data entered in each column. Structured references make it easier to create formulas that use portions or all of an Excel table because the names or headers are usually simpler to identify than cell addresses. For example, in the EmployeeTbl table, the table name EmployeeTbl refers to the range A2:L101, which is the range of data in the table excluding the header row and the Total row. When you want to reference an entire column of data in a table, you create a column qualifier, which has the syntax

```
Tablename[qualifier]
```

where *Tablename* is the name entered in the Table Name box in the Properties group on the Table Tools Design tab, and *qualifier* is the column header enclosed in square brackets. For example, the following structured reference references the Current Salary data in the range J2:J101 of the EmployeeTbl table (excluding the column header and total row, if any):

```
EmployeeTbl[Current Salary]
```

You can use structured references in formulas. The following formula adds the Current Salary data in the range J2:J101 of the EmployeeTbl table; in this case, [Current Salary] is the column qualifier:

```
=SUM(EmployeeTbl[Current Salary])
```

When you create a calculated column you can use structured references in the formula. A formula that includes a structured reference can be fully qualified or unqualified. In a fully qualified structured reference, the table name precedes the column qualifier. In an unqualified structured reference, only the column qualifier (column header enclosed in square brackets) appears in the reference.

If you are creating a calculated column or formula within an Excel table, you can use either the fully qualified structured reference or the unqualified structured reference in the formula. If you use a structured reference outside the table or in another worksheet to reference an Excel table or portion of the table, you must use a fully qualified reference.

You'll use structured references to calculate the salary increases for MBHC Employees.

To calculate the salary increases using the IF and OR functions:

1. In cell **M1**, enter **Salary Increase** as the column header. The Excel table expands to include the new column, and cell M2 is the active cell.

2. Make sure cell **M2** is the active cell, and then click the **Insert Function** button f_x next to the formula bar. The Insert Function dialog box opens.

3. Click **IF** in the Select a function box, and then click the **OK** button. The Function Arguments dialog box opens.

4. In the Logical_test box, type **OR([Store]="Bonham",[Store]="Graham")** to enter the OR function with structured references. This logical test evaluates whether the employee works in the Bonham store or works in the Graham.

Be sure to type square brackets and use the exact spelling and location shown. Otherwise, the formula will return an error.

5. Click the **Collapse dialog box** button so you can see the entire function in the Logical_test box. See Figure 8-13.

Figure 8-13 Logical_test argument for the OR function
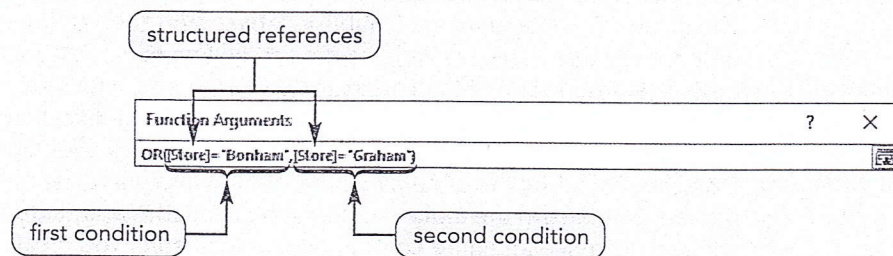
6. Click the **Expand dialog box** button , and then press the **Tab** key. TRUE appears to the right of the Logical_test box because the employee in the active row, row 2, is eligible for the 3.5 percent salary increase.

Trouble? If Invalid appears instead of TRUE as the logical test results, you probably mistyped the logical test. Compare the function in your Logical_test box to the one shown in Figure 8-13, confirming that you used square brackets around the structured reference [Store] and typed all the text correctly.

7. In the Value_if_true box, type **[Current Salary]*0.035** and then press the **Tab** key. This argument specifies that if the logical test is true (the employee is eligible for the 3.5 percent increase), the amount in the employee's salary cell is multiplied by 3.5 percent. The salary increases for all employees, beginning in row 2, whose logical test is true appear to the right of the Value_if_true box.

8. In the Value_if_false box, type **[Current Salary]*0.025**. This argument specifies that if the logical test is false (the employee is not eligible for the 3.5 percent salary increase), the amount in the employee's salary cell is multiplied by 2.5 percent. The salary increases for all employees, beginning in row 2, whose logical test is false appear to the right of the Value_if_false box. See Figure 8-14.

Figure 8-14	Function Arguments dialog box for the IF function with an OR function

9. Click the **OK** button. The formula =IF(OR([Store]="Bonham",[Store]="Bonham"), [Current Salary]*0.035,[Current Salary]*0.025) appears in the formula bar, and the value 3710.35 appears in cell M2 because the condition is true. The formula is automatically copied to all rows in column M of the table.

10. Position the pointer at the top of cell **M1** until the pointer changes to ↓, and then click the left mouse button to select the Salary Increase data values.

TIP

Double-click above the header row to select the column header and data.

11. Format the range with the **Accounting** style with two decimal places, and then increase the column width to display all values, if necessary.

12. Select cell **M2** to deselect the column. See Figure 8-15.

Figure 8-15   IF function with the OR function calculates salary increase

formula uses structured references to calculate the salary increases

M2   =IF(OR([Store]="Bonham",[Store]="Graham"),[Current Salary]*0.035,[Current Salary]*0.025)

salary increase for employees

	Employee ID	Last Name	First Name	Hire Date	Years of Service	Birth Date	Age	Store	Job Stat	Current Salary	Birthday Month	Eligible for Comp Day	Salary Increase
2	1102	Delosreyes	Lori	7/10/2014	3.5	4/11/1961	55	Bonham	FT	$ 106,010	Yes		$3,710.35
3	1106	Goode	Bari	11/6/2015	2.2	11/23/1991	25	Graham	FT	$ 42,182			$1,476.37
4	1110	Reams	Linda	12/4/2015	2.1	10/15/1966	50	Bonham	FT	$ 92,254			$3,228.89
5	1114	Rodriguez	Richard	3/24/2003	14.8	12/8/1964	52	Graham	FT	$ 69,250			$2,423.75
6	1118	Peters	Jessica	5/23/2011	6.6	2/15/1962	54	Bonham	FT	$ 102,567			$3,589.85
7	1122	Cortez	Nick	8/12/2002	15.4	10/15/1968	48	Bowie	FT	$ 94,517			$2,362.93
8	1126	Millard	Melissa	11/6/2015	2.2	3/20/1973	43	Garland	FT	$ 51,791			$1,294.78
9	1130	Burns	Brenda	6/10/2010	7.6	4/20/1966	50	Garland	FT	$ 32,530	Yes		$ 813.25
10	1134	Kimball	Susan	1/20/2016	1.9	3/21/1957	59	Graham	FT	$ 94,502			$3,307.57
11	1138	Ford	Charles	5/4/2012	5.7	6/28/1967	49	Bonham	PT	$ 45,671		Yes	$1,598.49
12	1142	Vazquez	Johnny	7/16/2011	6.5	2/8/1986	30	Graham	FT	$ 70,346			$2,462.11
13	1146	Whetstone	William	4/12/2008	9.7	7/13/1986	30	Garland	FT	$ 34,685			$ 867.13
14	1150	Arnold	Leroy	3/13/2012	5.8	7/8/1949	67	Bonham	FT	$ 96,944			$3,393.04
15	1154	Basile	Santos	8/8/2015	2.4	12/1/1956	60	Bonham	FT	$ 92,091			$3,223.19
16	1158	Loftis	Robert	7/17/2015	2.5	7/12/1959	57	Garland	FT	$ 30,150			$ 753.75

Documentation   Employee Analysis   **Employee Data**   Product Data   Data Tables

In this session, you used the IF, AND, and OR functions to determine if employees' birth dates occur in a specified month, to determine if part-time employees are eligible for comp days, and to calculate employees' salary increases for next year. Vanessa still needs to calculate the employee bonuses and complete the product data worksheet with the product supplier and specialty store for each product. In the next session, you will create formulas with functions to perform these calculations.

Session 8.1 Quick Check

REVIEW

1. What changes occur in the appearance and size of an Excel table after you enter a new column header named "Phone"?

2. Whenever you enter a formula in an empty column of an Excel table, Excel automatically fills the column with the same formula. What is this called?

3. If an Excel worksheet stores the cost per meal in cell Q5, the number of attendees in cell Q6, and the total cost of meals in cell Q7, what IF function would you enter in cell Q7 to calculate the total cost of meals (cost per meal times the number of attendees) with a minimum cost of $10,000?

4. When does the AND function return a TRUE value?

5. Write the formula that displays the label "Outstanding" in cell Y5 if the amount owed (cell X5) is greater than 0 and the transaction date (cell R5) is after 3/1/2016 (stored in cell R1) but otherwise leaves the cell blank.

6. When you create a formula that references all or parts of an Excel table, what can you use to replace the specific cell or range addresses with the actual table or column header names?

7. If the formula `=IF(OR(B25="NY",B25="CA",B25="TX"),"Select","Ignore")` is entered in cell B26, and `"PA"` is entered in cell B25, what is displayed in cell B26?

8. Write the OR function that represents the following rule—"A potential enlistee in the army is not eligible to enlist if younger than 17 or older than 42." The age is stored in cell B25. Display "Eligible" if the potential enlistee can enlist, and display "Not Eligible" if the potential enlistee cannot enlist.