FIT1013 - Week 3 Resources

Advanced functions in Excel

Week 3 Resources

Reference:

Microsoft Excel 2016, New Perspectives Series, Parsons, Oja, Carey, Desjardins Comprehensive Edn., Cengage Learning, **Module 8**

1. Objectives

- Use the IF, AND and OR functions
- Nest the IF function
- Use the VLOOKUP, HLOOKUP, IFERROR functions
- Use conditional formatting
- Summarise data using the COUNTIF, SUMIF, and AVERAGEIF functions

2. Use the IF, AND and OR functions

Working with Logical Functions

- Logical functions (IF, AND, and OR) determine whether a condition is true or false
- Conditions use a comparison operator (<, <=, =, <>, >, or >=) to compare two values
- Combine two or more functions in one formula to create more complex conditions
- 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
  - Store smallest unit of data possible in a field
  - Apply a text format to fields with numerical text data
- Using the IF Function
  - A logical function that evaluates a single condition and results in only one value
  - Returns one value if the condition is true and another value if the condition is false
  - Syntax:

IF(*logical_test*, *value_if_true*, *value_if_false*)

Figure 8-2 Flowchart with logic to determine if an employee's birthday is in the specified month

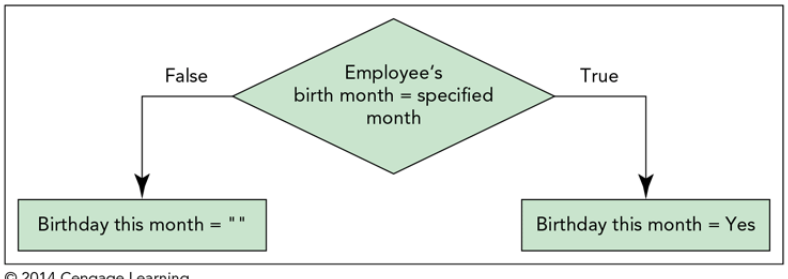


Figure 8-3 Function Arguments dialog box for the IF function

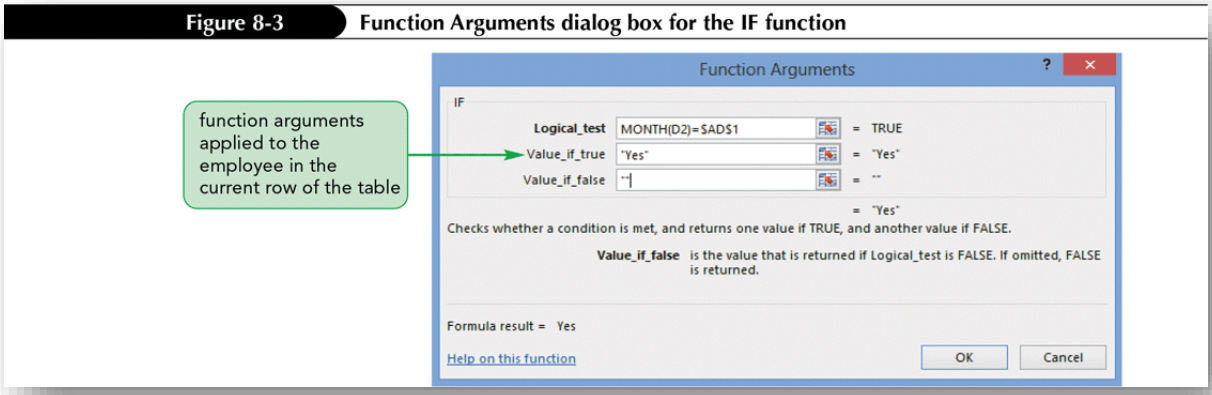
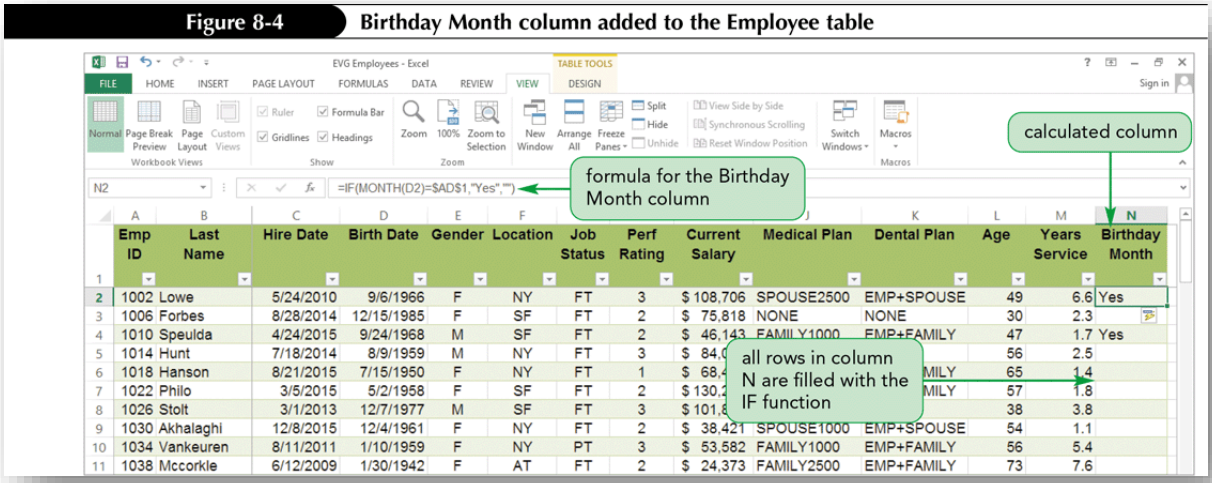


Figure 8-4 Birthday Month column added to the Employee table



	Emp ID	Last Name	Hire Date	Birth Date	Gender	Location	Job Status	Perf Rating	Current Salary	Medical Plan	Dental Plan	Age	Years Service	Birthday Month
2	1002	Lowe	5/24/2010	9/6/1966	F	NY	FT	3	$ 108,706	SPOUSE2500	EMP+SPOUSE	49	6.6	Yes
3	1006	Forbes	8/28/2014	12/15/1985	F	SF	FT	2	$ 75,818	NONE	NONE	30	2.3	
4	1010	Speulda	4/24/2015	9/24/1968	M	SF	FT	2	$ 46,143	FAMILY1000	EMP+FAMILY	47	1.7	Yes
5	1014	Hunt	7/18/2014	8/9/1959	M	NY	FT	3	$ 84,0			56	2.5	
6	1018	Hanson	8/21/2015	7/15/1950	F	NY	FT	1	$ 68,4		MILY	65	1.4	
7	1022	Philo	3/5/2015	5/2/1958	F	SF	FT	2	$ 130,2		MILY	57	1.8	
8	1026	Stolt	3/1/2013	12/7/1977	M	SF	FT	3	$ 101,8			38	3.8	
9	1030	Akhalaghi	12/8/2015	12/4/1961	F	NY	FT	2	$ 38,421	SPOUSE1000	EMP+SPOUSE	54	1.1	
10	1034	Vankeuren	8/11/2011	1/10/1959	F	NY	PT	3	$ 53,582	FAMILY1000	EMP+FAMILY	56	5.4	
11	1038	Mccorkle	6/12/2009	1/30/1942	F	AT	FT	2	$ 24,373	FAMILY2500	EMP+FAMILY	73	7.6	

- Using the AND Function
  - A logical function that tests two or more conditions (up to 255) and determines whether all conditions are true
  - Returns the value TRUE if all logical conditions are true and the value FALSE if any or all logical conditions are false
  - Syntax:

    AND(logical1[,logical2]...)

Figure 8-6 Flowchart illustrating AND logic for the 401(k) benefit

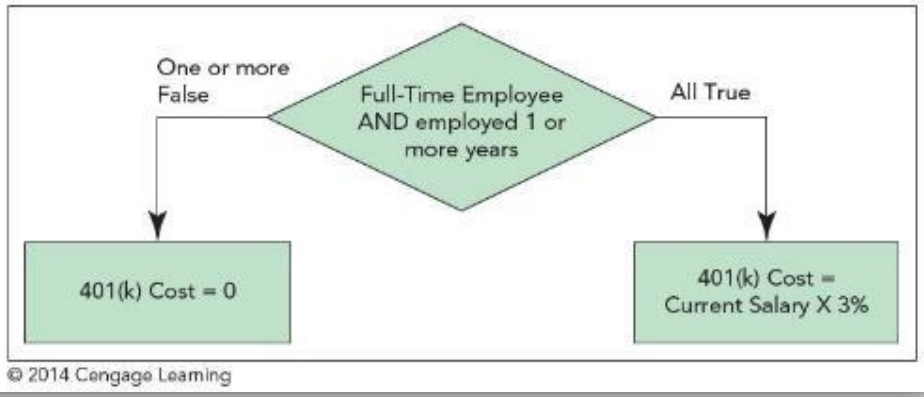
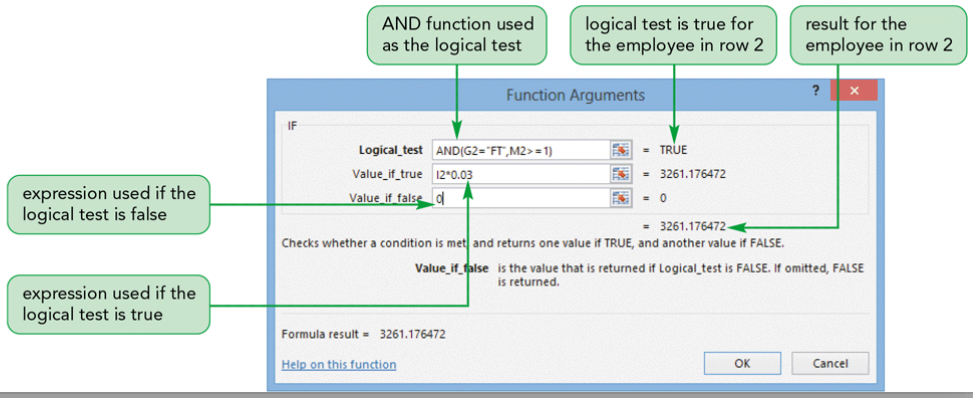


Figure 8-8 Function Arguments dialog box for the IF function with the AND function

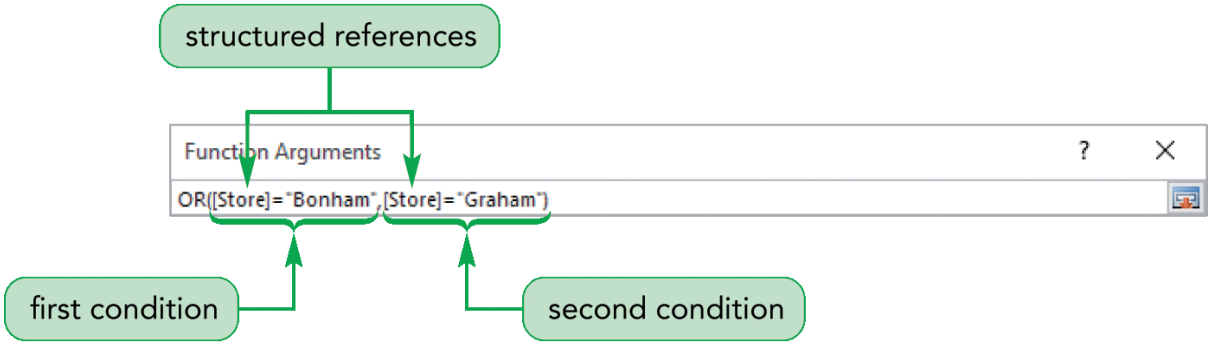


- Using the OR Function
  - A logical function that returns a TRUE value if any of the logical conditions (up to 255) are true and a FALSE value if all the logical conditions are false
  - Syntax:

    OR(logical1[,logical2]...)

Using Structured References to Create Formulas in Excel Tables

- Replace specific cell or range address with a structured reference, the actual table name, or a column header
- A formula that includes a structured reference can be fully qualified or unqualified



Examples:

Unqualified structured reference: [Current Salary], [Store], [Job Status] etc.
Qualified structured reference: EmployeeTbl[Current Salary], EmployeeTbl[Store], etc.

Structured References

- https://www.youtube.com/watch?v=NBLtGWVyXmo
  - 8.3 mins

- https://support.office.com/en-us/article/Using-structured-references-with-Excel-tables-f5ed2452-2337-4f71-bed3-c8ae6d2b276e
  - Useful explanation and examples on how to use Structured References

3. Nest the IF function

Creating Nested Ifs

- To allow for three or more outcomes
- One IF function is placed inside another IF function to test an additional condition
- More than one IF function can be nested

Purpose: To determine the outcome of football games for the home team

Logic Scenario: Display Won, Lost, or Tie based on home team and visitor team scores

Formula: Nested IF functions

```
=IF(B1>B2,"Won",IF(B2>B1,"Lost","Tie"))
```

Data: cell B1 stores the home team score
cell B2 stores the visitor team score

Example:

Data		Condition1	Condition2	Results
Cell B1	**Cell B2**	**B1>B2**	**B2>B1**	**(Outcome)**
21	18	True	Not evaluated	Won
17	24	False	True	Lost
9	9	False	False	Tie

Figure 8-17 Additional example of nested IF functions

Purpose: To determine the fee for a driver's license

Logic Scenario: Driver's license fee varies by age

Below 16	"Too Young"
16–45	$30
46–60	$25
61 and older	$20

Formula: Nested IF functions

```
=IF(B1<16,"Too Young",IF(B1<=45,30,IF(B1<=60,25,20)))
```

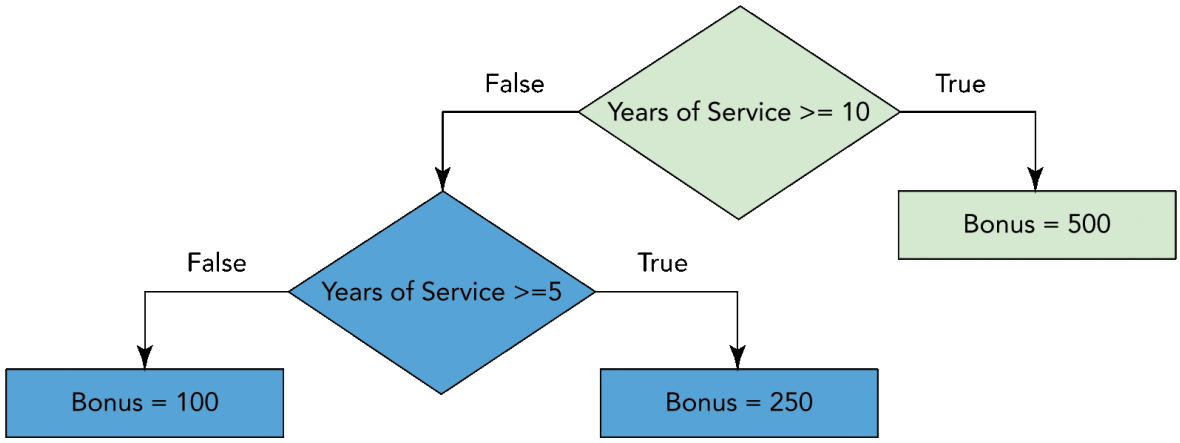
Data: cell B1 stores the driver's age

Example:

Data	Condition1	Condition2	Condition3	Results
Cell B1	B1<16	B1<=45	B1<=60	(Fee)
15	True	Not evaluated	Not evaluated	Too Young
25	False	True	Not evaluated	30
55	False	False	True	25
65	False	False	False	20

- The following formula and flowchart convey the same nested IF function

  =IF([Years of Service]>=10,500, IF([Years of Service]>=5, 250, 100))



4. Use the VLOOKUP, HLOOKUP, IFERROR functions

Using LOOKUP Functions

- Lookup functions allow you to use tables of data to find values in a table and insert them in another worksheet location
- Both the VLOOKUP and HLOOKUP functions are used to return a value from a lookup table
  - The VLOOKUP function always searches for a value in the first column of the lookup table
  - The HLOOKUP function always searches for a value in the first row of the lookup table
- Lookup tables can be constructed as either exact match or approximate match lookups
  - Exact match lookup occurs when the lookup value must match one of the values in the first column (or row) of the lookup table
  - An approximate match lookup occurs when the lookup value is found within a range of numbers in the first column (or row) of the lookup table
- Using the VLOOKUP Function to Find an Exact Match
  - Searches vertically down the first column of the lookup table
  - Syntax:

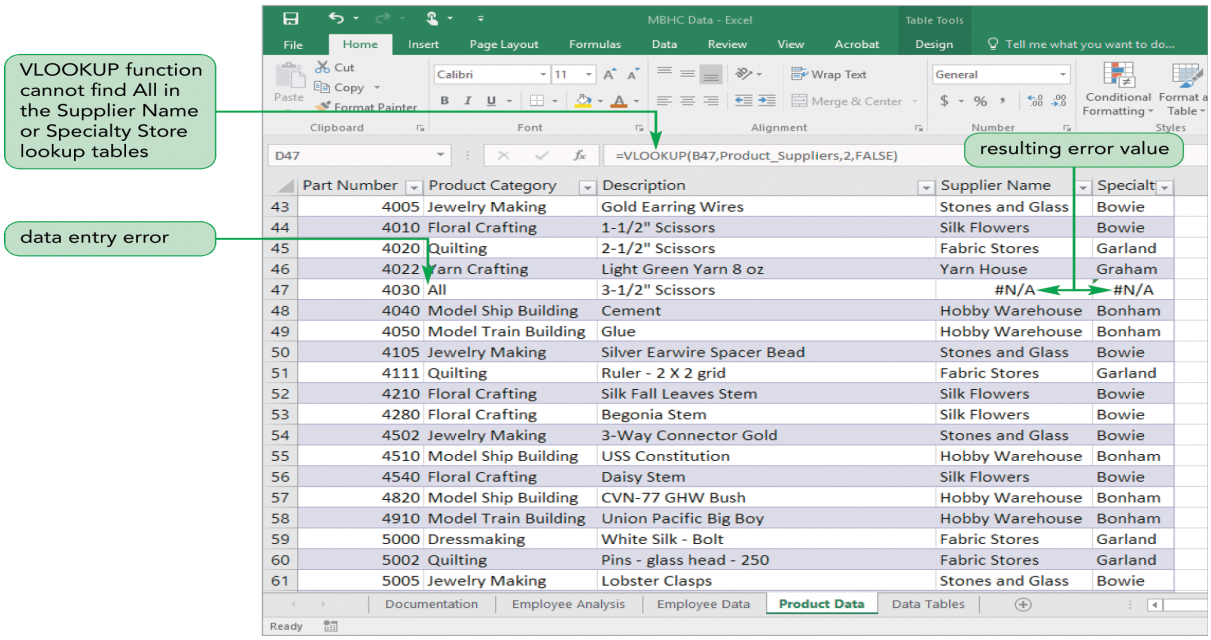
VLOOKUP(lookup_value,table_array,col_index_num[range_lookup])

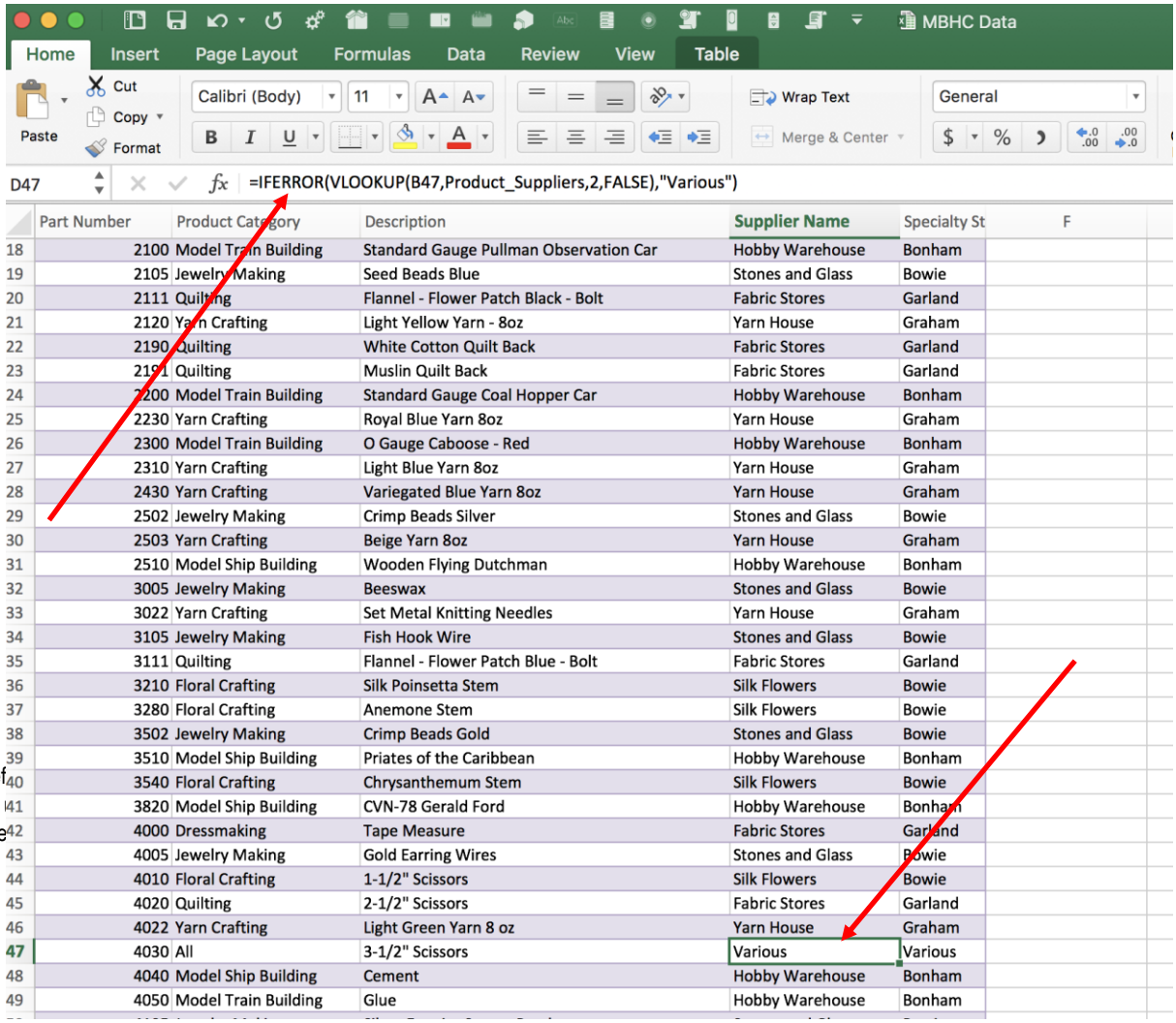
- Using the VLOOKUP Function to Find an Approximate Match
  - Returns a value based on an approximate match lookup in the first column of the table
  - The values in the first column or row of a lookup table can represent a range of values
  - Quantity discounts, shipping charges, and income tax rates are a few examples of approximate match lookups

Using the IFERROR Function

- Error values
  - Indicate that an element in a formula or a cell referenced in a formula is preventing Excel from returning a calculated value
  - Begin with a number sign (#) followed by an error name that indicates the type of error
- Displays a more descriptive message that helps users fix the problem
- Can determine if a cell contains an error value and then display the message you choose rather than the default error value
- Use the IFERROR function to find and handle formula errors

- Syntax: IFERROR(expression,valueIfError)





Ref
for
use

Activity 1

Convert the following criteria used to determine a student's degree classification to a table that can be used in a VLOOKUP function to display the level of each student:

Marks	Classification
>=0 and <=50	Fail
>=51 and <=60	Ordinary Degree
>=61 and <=70	Second Lower
>=71 and <=90	Second Upper
>=91	First Class

Answer:

Marks	Classification
0	Fail
51	Ordinary Degree
61	Second Lower
71	Second Upper
91	First Class

Exercise

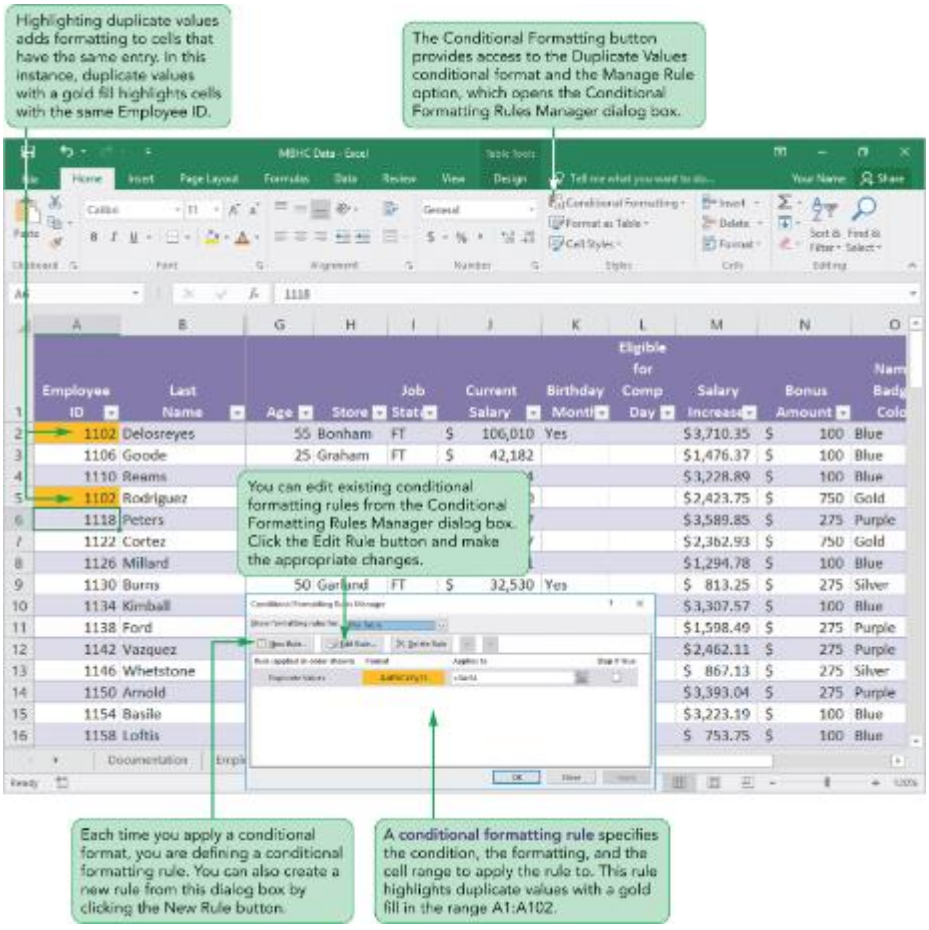
Which function could be used with the following Sales Tax Rate table to display the sales tax rate for a customer in one of these four states?

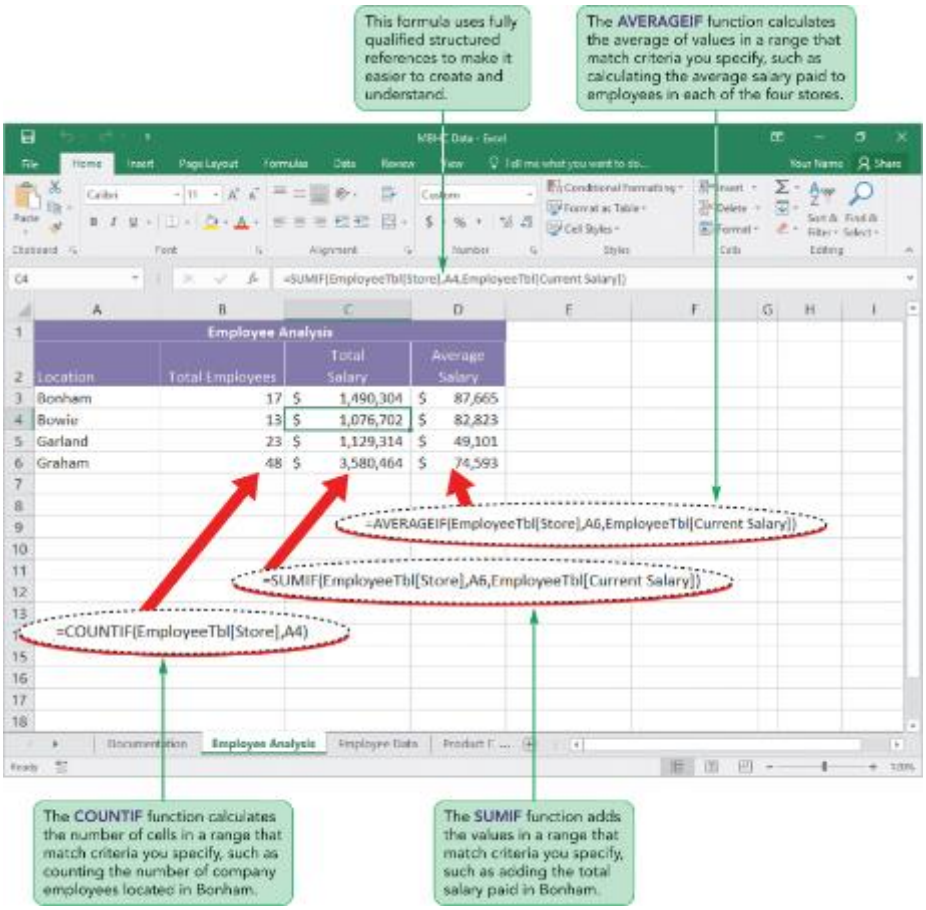
State	VIC	NSW	QLD	WA
Sales Tax Rate	10%	7%	9%	9.5%

Answer: HLOOKUP

5. Use conditional formatting

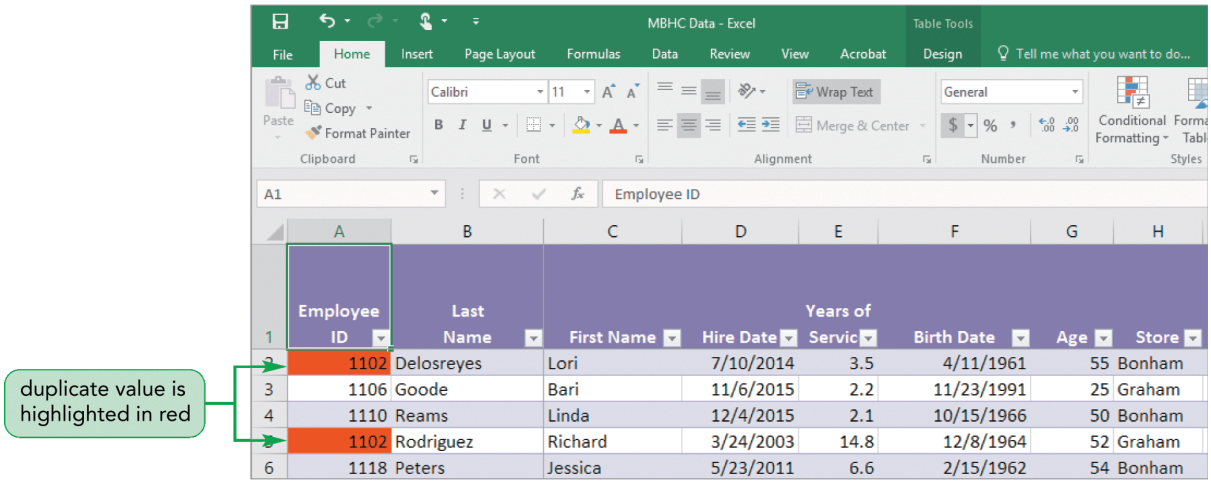
Visual Overview: Conditional Formatting and Functions





Applying Conditional Formatting

- Changes a cell's formatting when its contents match a specified condition
- Can be used to:
  - Highlight cells based on their values
  - Add data bars that graph relative values in a range
  - Highlight duplicate values in a column of data
- Highlighting Duplicate Values
  - Excel is often used to manage lists of data, such as:
    - Employee information
    - Inventory
    - Phone numbers
  - Some of the data is unique for each record, such as an employee ID or a social security number
  - One way to identify unintended duplicate entries is to use conditional formatting to highlight duplicate values in a range with a font and/or fill color



- Using the Conditional Formatting Rules Manager
  - A conditional formatting rule specifies:
    - Type of condition
    - Type of formatting when that condition occurs
    - Cell or range the formatting is applied to
  - Use Conditional Formatting Rules Manager dialog box to edit existing conditional formatting rules

- Changes a cell's formatting when its contents match a specified condition
- Can be used to:
  - Highlight cells based on their values
  - Add data bars that graph relative values in a range
  - Highlight duplicate values in a column of data

on	Location	Appraised Value
t	East Pavilion	$ 18,000
t	East Pavilion	$ 10,000
t	East Pavilion	$ 2,400
t	Courtyard	$ 52,000
t	East Pavilion	$ 8,000
	East Pavilion	$ 700
t	East Pavilion	$ 1,200
t	East Pavilion	$ 1,900
t	East Pavilion	$ 3,000
t	East Pavilion	$ 800
t	East Pavilion	$ 975
	East Pavilion	$ 8,000

6. Summarise data using the COUNTIF, SUMIF, and AVERAGEIF functions

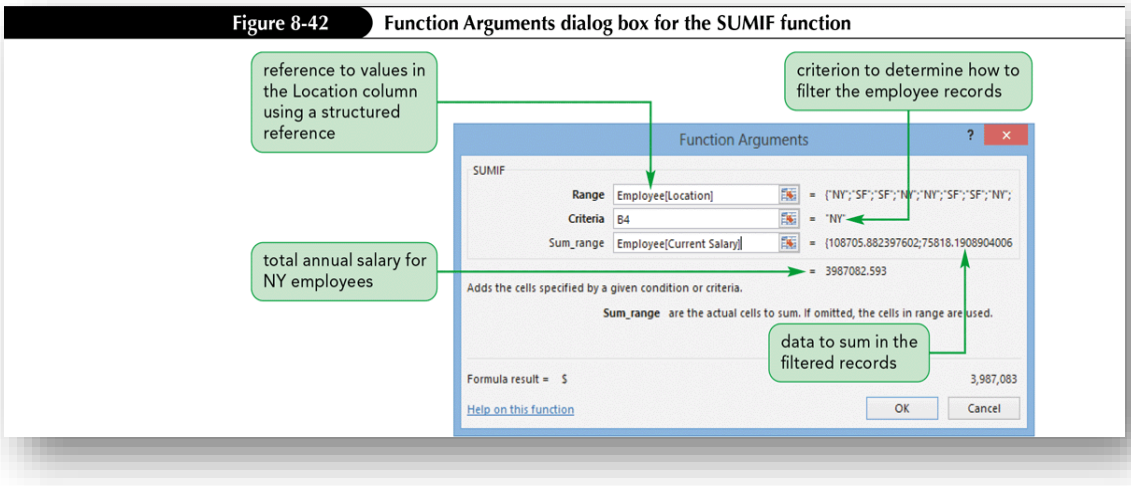
Using Functions to Summarize Data Conditionally

- Use COUNTIF, SUMIF, and AVERAGEIF functions to calculate a conditional count, sum, or average using only cells that meet a particular condition
- Using the COUNTIF Function
  - Calculates the number of cells in a range that match specified criteria
  - Sometimes referred to as a **conditional count**
  - Syntax: COUNTIF(*range*, *criteria*)

Formula	Explanation of Formula	Result
=COUNTIF(H2:H101,"Bonham")	Number of employees in Bonham	17
=COUNTIF(H2:H101,H3)	Number of employees in cell H3 (Graham)	48
=COUNTIF(J2:J101,<50000)	Number of employees with salary <50000	22
=COUNTIF(J2:J101, ">=" &J2)	Number of employees with salary >= value in cell J2 (106010)	7

- Using the SUMIF Function
  - Adds values in a range that meet your criteria
  - Also called a **conditional sum**
  - Syntax: SUMIF(*range*, *criteria*[, *sum_range*])

Figure 8-42 Function Arguments dialog box for the SUMIF function



- Using the AVERAGEIF Function
  - Similar to SUMIF function
  - Calculates the average of values in a range that meet criteria you specify
  - Syntax: AVERAGEIF(*range*, *criteria*[, *average_range*])

Figure 8-43 Function Arguments dialog box for the AVERAGEIF function

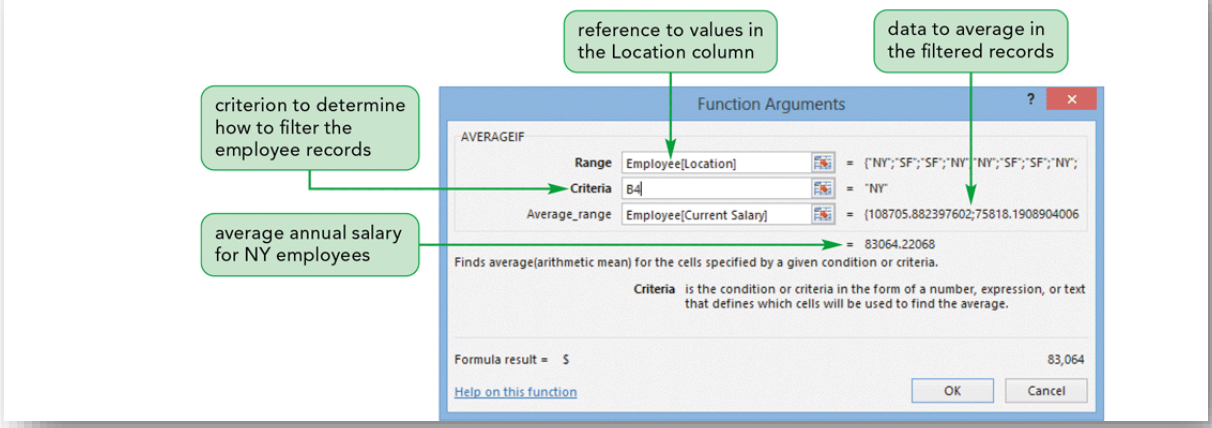
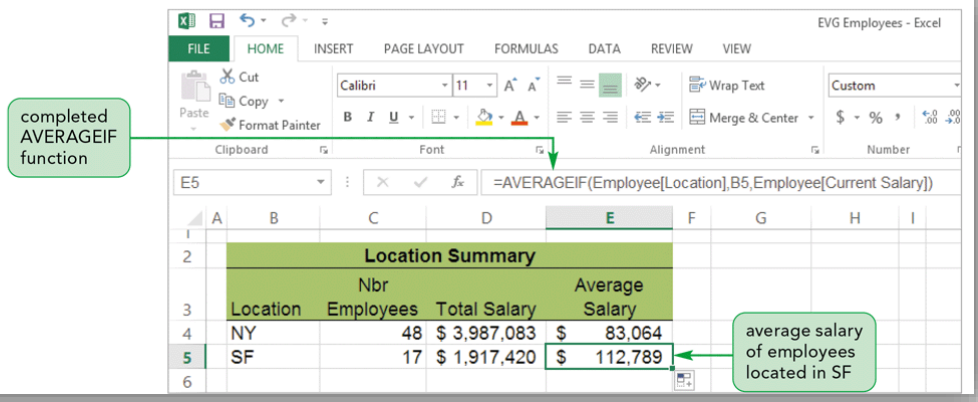


Figure 8-44 Completed Location Analysis report



Exercise

Explain what the following formula calculates:

=AVERAGEIF(Employee[Age],”>50”,Employee[Current Salary])

Answer: It calculates the average salary for all employees over age 50.

To display the number of employees working in Dallas (DA), which function would you use?

a. VLOOKUP
b. COUNTIF
c. IF
d. COUNT

Answer: b

Using the CHOOSE function (see Grades.xlsx)

CHOOSE(*index_num,value1,value2,...*)

- **Index_num** specifies which value argument is selected. Index_num must be a number between 1 and 254, or a formula or reference to a cell containing a number between 1 and 254.
- If index_num is 1, CHOOSE returns *value1*; if it is 2, CHOOSE returns *value2*; and so on.
- If index_num is less than 1 or greater than the number of the last value in the list, CHOOSE returns the #VALUE! error value.
- If index_num is a fraction, it is truncated to the lowest integer before being used.
- **Value1,value2,...** are 1 to 254 value arguments from which CHOOSE selects a value or an action to perform based on index_num. The arguments can be numbers, cell references, defined names, formulas, functions, or text.
- Uses index_num to return a value from the list of value arguments. Use CHOOSE to select one of up to 254 values based on the index number. For example, if value1 through value7 are the days of the week, CHOOSE returns one of the days when a number between 1 and 7 is used as index_num.
- E.g. Grades.xlsx (Choose worksheet)
- =CHOOSE(WEEKDAY(B3,2),"Mon","Tues","Wed","Thurs","Fri","Sat","Sun")
- WEEKDAY(3/8/2010,2) = 2
  - Converts the date in cell B3 to the corresponding number of a day of the week
  - E.g. WEEKDAY(B3,2) =
- =CHOOSE(WEEKDAY(B3,2),"Mon","Tues","Wed","Thurs","Fri","Sat","Sun")
  - Converts the number into the name of the day of the week
  - E.g. CHOOSE(3,"Mon","Tues","Wed","Thurs","Fri","Sat","Sun") = Wed

Advanced Filters

See Excel New Perspectives Appendix B (B2-B5)

If **two or more** columns/fields are required in the filter and **ALL conditions** must be satisfied, then applying Custom autofilters to each field in turn will suffice (e.g. Garage=Oak AND Status=O)

However if **two or more** fields/columns are required with **at least one OR** conjunction then the Advanced Filter command should be used.

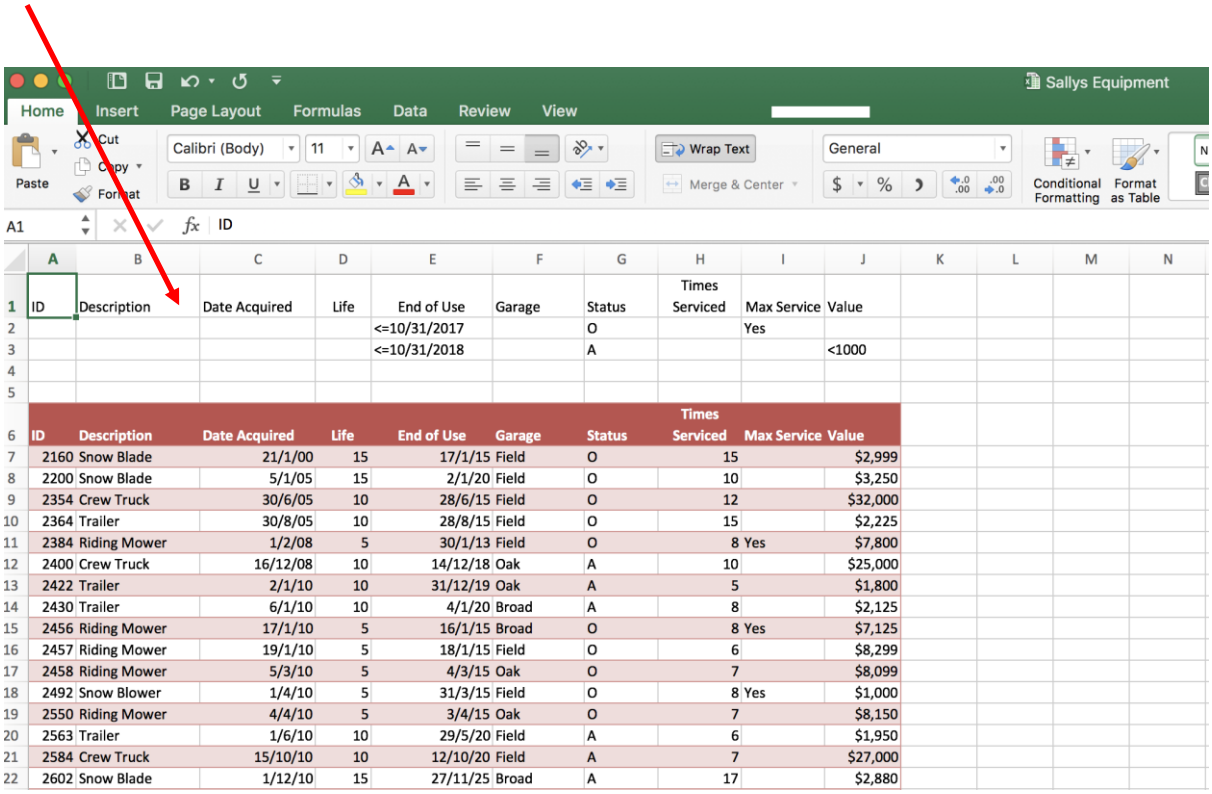
e.g. (Garage=Oak AND Status=O) OR (Garage=Oak AND Times Service >3)

Example file: Sallys Equipment

To use advanced filter

- Set up a criteria range, separate from the table or structured range (above is a good idea).
- The column headings in the criteria range must comprise one or more of the columns in the table. (A good idea is to make a copy of the table column headings wherever you want to locate the criteria).

Set up a criteria region



	A	B	C	D	E	F	G	H	I	J
1	ID	Description	Date Acquired	Life	End of Use	Garage	Status	Times Serviced	Max Service	Value
2					<=10/31/2017		O		Yes	
3					<=10/31/2018		A			<1000
4										
5										

6	ID	Description	Date Acquired	Life	End of Use	Garage	Status	Times Serviced	Max Service	Value
7	2160	Snow Blade	21/1/00	15	17/1/15	Field	O	15		$2,999
8	2200	Snow Blade	5/1/05	15	2/1/20	Field	O	10		$3,250
9	2354	Crew Truck	30/6/05	10	28/6/15	Field	O	12		$32,000
10	2364	Trailer	30/8/05	10	28/8/15	Field	O	15		$2,225
11	2384	Riding Mower	1/2/08	5	30/1/13	Field	O	8	Yes	$7,800
12	2400	Crew Truck	16/12/08	10	14/12/18	Oak	A	10		$25,000
13	2422	Trailer	2/1/10	10	31/12/19	Oak	A	5		$1,800
14	2430	Trailer	6/1/10	10	4/1/20	Broad	A	8		$2,125
15	2456	Riding Mower	17/1/10	5	16/1/15	Broad	O	8	Yes	$7,125
16	2457	Riding Mower	19/1/10	5	18/1/15	Field	O	6		$8,299
17	2458	Riding Mower	5/3/10	5	4/3/15	Oak	O	7		$8,099
18	2492	Snow Blower	1/4/10	5	31/3/15	Field	O	8	Yes	$1,000
19	2550	Riding Mower	4/4/10	5	3/4/15	Oak	O	7		$8,150
20	2563	Trailer	1/6/10	10	29/5/20	Field	A	6		$1,950
21	2584	Crew Truck	15/10/10	10	12/10/20	Field	A	7		$27,000
22	2602	Snow Blade	1/12/10	15	27/11/25	Broad	A	17		$2,880

Advanced filter criteria

- If 2 or more conditions occur on the **same** line, this is specifying that all conditions must be met e.g.:

Garage	Status
Oak	A

- Is interpreted as find all artworks whose Garage is Oak and Status is A

- If 2 or more conditions occur on different lines, this is specifying that at least one condition must be met e.g.:

Garage	Appraised Value
Excellent	
	>10,000

- Is interpreted as find all art works whose Condition is Excellent **OR** whose Appraised values is greater than $10,000

Advanced filter

- Select: **Data** tab, **Sort and Filter** group, **Advanced Filter**
- Filter with List in place or Copy to Another Location
- Specify list range
- Specify criteria range

Specifying text criteria with advanced filter

- Single letter means accept any value that starts with this letter (e.g. E in Condition field will select all Conditions starting with E)
- >,< symbols means accept any values that come after this or before this point in the alphabet (e.g. >M)

Functions for Summarising and Analysing a table

- The Database Functions
- SUMIF and SUMIFS
- COUNTIF and COUNTIFS
- AVERAGEIF and AVERAGEIFS
- Example Workbook **Sallys Equipment (See Module Appendix B)**

Using Database Functions to Summarize Data

Functions that perform summary data analysis (SUM, AVERAGE, COUNT, and so on) on a table of values based on criteria that you set are called the **Database functions**, or **Dfunctions**

Syntax: DfunctionName(*table range, column to summarize, criteria range)*

Reference Excel New Perspectives Excel 2016 Appendix B

Database functions

Function Name	Description
DAVERAGE	Returns the average of the values that meet specified criteria
DCOUNT	Returns the number of cells containing numbers that meet specified criteria
DCOUNTA	Returns the number of nonblank cells that meets specified criteria
DMAX	Returns the maximum value in search column that meets specified criteria
DMIN	Returns the minimum value in search column that meets specified criteria
DSTDEV	Returns the estimate of standard deviation based on a sample of entries that meet the specified criteria
DSUM	Returns the sum of the values in the summary column that meets specified criteria

Figure B-10 NP Excel 2016 Textbook

e.g. DAVERAGE function:

Syntax:

Daverage(*database, field, criteria*)

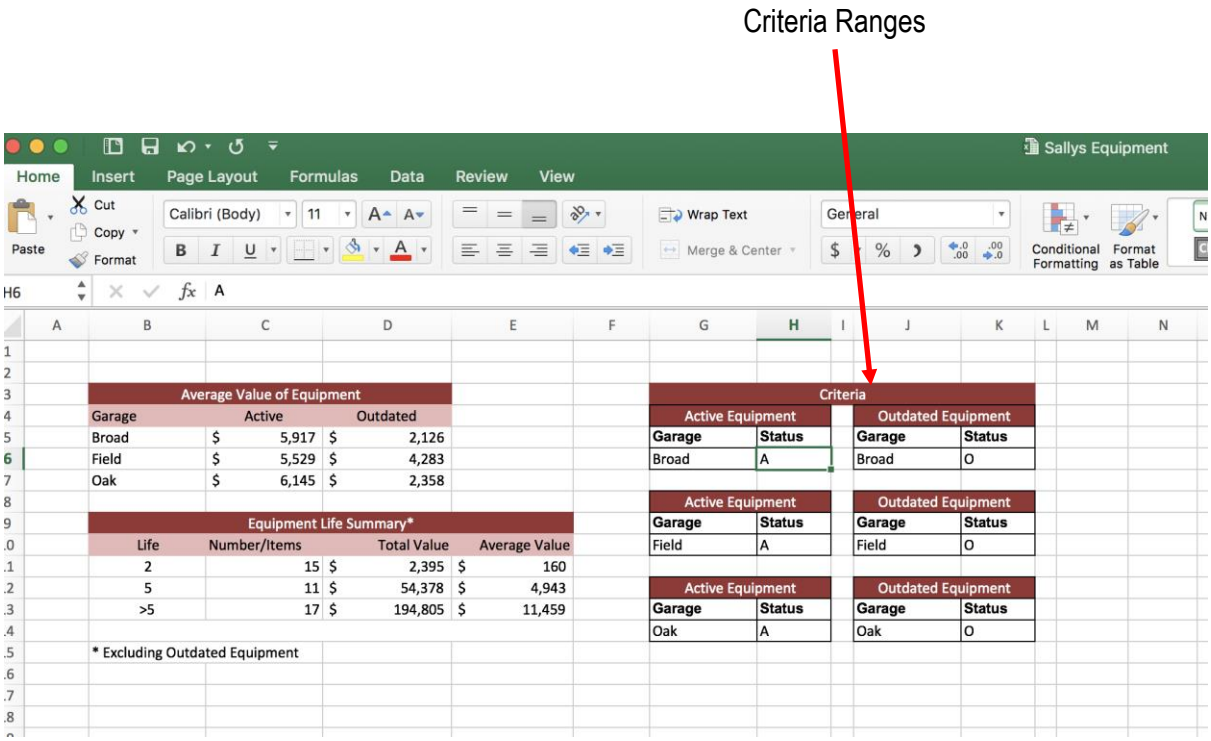
…….

Range of cells that includes the conditions specified – criteria region

Name of a field, or the fields position in the list

Range of cells that make up the table or list

Using Database Functions to Summarize Data



The COUNTIFS function

Syntax:

COUNTIFS(criteria_*range1, criteria1 [, criteria_range2,criteria2, …]*)

Where:

- *criteria_range1, criteria_range2, and so on represent up to 127 ranges (columns of data) in which to evaluate the associated criteria;*
- *criteria1, criteria2, and so on represent up to 127 criteria*

e.g. **=COUNTIFS(EquipTbl[Status], "A",EquipTbl[Garage], "Broad", EquipTbl[Value], ">500")**

Counts the number of pieces of Active(A) equipment in the Broad garage (Broad) and with a value more than $500

The SUMIFS function

Syntax:

SUMIFS(sum*_range, criteria_range1, criteria1*

[,criteria_range2,criteria2,…])

Where:

- *sum_range* is the range you want to add
- *criteria_range1,criteria_range2, and so on represent up to 127 ranges (columns of data) in which to evaluate the associated criteria*
- *criteria1,criteria2, and so on represent up to 127 criteria in the form of a number, expression, a cell reference or text that define which cells will be added*

e.g. **=SUMIFS(EquipTbl[Value],EquipTbl[Status],"A", EquipTbl[Life], "2")**

To calculate the total value of **active** equipment whose **lifetime** is **2**

AVERAGEIFS function

Syntax:

=AVERAGEIFS(average*_range,criteria_range1, criteria1 [,criteria_range2,criteria2,…])*

Where:

- *average_range is the range to average*
- *criteria_range1, criteria_range2, and so on represent up to 127 ranges in which to evaluate the associated criteria*
- *Criteria1, criteria2, and so on represent up to 127 criteria in the form of a number, expression, a cell reference, or text that define which cells will be averaged*

e.g.**=AVERAGEIFS(EquipTbl[Value],EquipTbl[Status],"A", EquipTbl[Life],"2")**

To calculate the value of active equipment that has a 2-year life

COUNTIFS, SUMIFS, AVERAGIFS

COUNTIFS, SUMIFS, AVERAGIFS are similar to COUNTIF, SUMIF, and AVERAGIF except that more than one criteria range and criteria may be used:

- The **COUNTIFS function** counts the number of cells within a range that meet multiple criteria
  - COUNTIFS(*criteria_range1,criteria1[,criteria_range2,criteria2...])*
- The **SUMIFS function** adds values in a range that meet multiple criteria
  - SUMIFS(*sum_range,criteria_range1,criteria1[,criteria_range2, criteria2...])*
- The **AVERAGEIFS function** calculates the average of values within a range of cells that meet multiple conditions
  - AVERAGEIFS(*average_range,criteria_range1,criteria1[,criteria_range2, criteria2...])*

6. Practice and Apply

1. Understanding the IF, AND and OR functions
2. Understanding nested IF function
3. Understanding the VLOOKUP, HLOOKUP, IFERROR functions
4. Understanding the COUNTIF, SUMIF, and AVERAGEIF functions
5. Complete Tutorial 3 exercises