

# INTRODUCTION

## About Dynamic Array Formulas in Excel

### Summary

- Dynamic Arrays are the biggest change to Excel formulas in years. Maybe the biggest change ever. This is because Dynamic Arrays let you easily work with multiple values at the same time in a formula.
- An array formula is a formula that can perform multiple calculations on one or more items in an array. Array formulas can return either multiple results, or a single result.
- The key benefit of Dynamic Arrays is the ability to work with multiple values at the same time in a formula. This is a big upgrade and a welcome change. Dynamic Arrays solve some really hard problems in Excel, and will fundamentally change the way worksheets are designed. Once you see how they work, you'll never want to go back.

### Availability

- Dynamic arrays and the new functions below are only available Excel 365, Excel 2024, Excel 2021. Excel 2019 and earlier do not offer dynamic array formulas.

### New Functions

- As part of the dynamic array update, Excel now includes 8 new functions that directly leverage dynamic arrays to solve problems that are traditionally hard to solve with conventional formulas. Eg. FILTER, RANDARRAY, SEQUENCE, SORT, SORTBY, UNIQUE, XLOOKUP, XMATCH
- As of September 2024, almost 50 new functions have been added to Excel

### The power of one

- One of the most powerful benefits of the "one formula, many values" approach is less reliance on absolute or mixed references. As a dynamic array formula spills results onto the worksheet, references remain unchanged, but the formula generates correct results.
- It is important to understand that dynamic array behavior is native and deeply integrated. When any formula returns multiple results, these results will spill into multiple cells on the worksheet. This includes older functions not originally designed to work with dynamic arrays.

#### New and old array formulas

- In Dynamic Excel, there is no need to enter array formulas with CTRL + SHIFT + ENTER (CSE). When a formula is created, Excel checks if the formula might return multiple values. If so, it will automatically be saved as a dynamic array formula, but you will not see curly braces.
- If you open the same formula in Legacy Excel, you'll see curly braces.
- If a "traditional" array formula is opened in Dynamic Excel, you will see the curly braces in the formula bar. However, if you re-enter the formula with no changes, the curly braces are removed, and the formula returns the same result. Spilling limitations and the plus (+) operator
- The term "lifting" refers to an array calculation behavior in Excel formulas. When you give a range or array to a function not programmed to accept arrays natively (i.e. an older function), Excel will "lift" the function and call it multiple times, one time for each value in the array. The result is an array with the same dimensions as the input array. Lifting is a built-in behavior that happens automatically.
- In Dynamic Excel, some older functions like EOMONTH "resist" spilling when provided a range. So for example EOMONTH(A1:A5,1) will return #VALUE even with valid dates in A1:A5. This limitation comes from certain functions expecting a single value instead of a range. The #VALUE! error is essentially reporting the range as an unexpected value. However, adding an operator in front of the reference will often fix the problem.
- For example, EOMONTH(+A1:A5,1) will work and spill properly. This is because adding the + in front of A1:A5 forces Excel to evaluate the expression first, before the function runs. The result of +A1:A5 is an array containing 5 values, which are then passed into EOMONTH as the start date. EOMONTH returns 5 results through the normal process of lifting, which is not function-specific.
- Other functions that have this same limitation include EDATE, ISEVEN, ISODD, YEARFRAC, WORKDAY, and WORKDAY.INTL.

### The @ character

- With the introduction of dynamic arrays, you're going to see the @ character appear more often in formulas. The @ character enables a behavior known as "implicit intersection". Implicit intersection is a logical process where many values are reduced to one value.
- In Legacy Excel, implicit intersection is a silent behavior used (when necessary) to reduce multiple values to a single result in one cell. In Dynamic Excel, it is not typically needed, since multiple results can spill onto the worksheet. When it is needed, implicit intersection is invoked manually with the @ character.
- When opening spreadsheets created in an older version of Excel, you may see the @ character added automatically to existing formulas that have the potential to return many values. In Legacy Excel, a formula that returns multiple values won't spill on the worksheet. The @ character forces this same behavior in Dynamic Excel so that the formula behaves the same way and returns the same result as it did in the original Excel version.
- In other words, the @ is added to prevent an older formula from spilling multiple results onto the worksheet. Depending on the formula, you may be able to remove the @ character and the behavior of the formula will not change.

## DYNAMIC ARRAYS & SPILL

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### New Dynamic Array Functions

1. FILTER
2. SORT
3. SORTBY
4. UNIQUE
5. SEQUENCE
6. RANDARRAY
7. @ (*added for backward compatibility*)

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### Important Terms

Legacy Excel: This is the Excel version prior to Dynamic-Array aware Excel.

Dynamic Array: Any formula that returns multiple results is a Dynamic Array Formula.

Spill Range: If a Dynamic Array formula spills the answers to multiple cells, then we have a "SPILL" Range.

# Sign: Hash sign/ Hashtag.

CTRL + SHIFT + ENTER (CSE) Formulas: Array formulas used by more advanced Excel users that requires pressing CSE instead of ENTER when using legacy Excel.

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### Dynamic array formulas and spilled array behavior

Excel formulas that return a set of values, also known as an array, return these values to neighboring cells. This behavior is called spilling.

- When you press Enter to confirm your formula, Excel will dynamically size the output range for you, and place the results into each cell within that range
- Only the first cell in the spill area is editable
- Cannot copy the value in the spilled range (note: but can copy and paste as VALUE only)
- Spilled range comes with shadowed blue border
- Source formatting is not carried over
- #SPILL! error means there is a blockage that prevents it from spilling
- Excel Table as Source Data
- Spilled array NOT supported in Excel Table, you must use it outside Excel Table
- Use # to reference a spilled range
- Legacy array formulas entered via CTRL+SHIFT+ENTER (CSE) are still supported for back compatibility reasons, but should no longer be used.
- Excel has limited support for dynamic arrays between workbooks, and this scenario is only supported when both workbooks are open. If you close the source workbook, any linked dynamic array formulas will return a #REF! error when they are refreshed.

## RULES FOR DYNAMIC ARRAYS

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### Rules for Dynamic Arrays

1. If a formula delivers a single answer, it will return a single answer in one cell.
2. If a formula delivers more than one answer, it will return all answers in more than one cell.  
Meaning the answers "SPILL" into the next cells.
3. The actual formula lives only in the first cell of the spilled range. The rest are based off the first one.
4. If something is in a cell below the spill range, you will get the new #spill error (your values below will never be overwritten). Once the values are removed the formula will spill automatically.
5. Referencing a spilled range is done by referencing the first cell in the range and then putting the # sign.  
The spilled range, will automatically expand or shrink as the formula input changes.
6. Spilled Array formulas are not supported inside Excel Tables. You need to place them outside the table.
7. Dynamic Array functionality is not fully supported between workbooks.  
The workbooks need to be opened.

# THE DOT IN DYNAMIC ARRAY FORMULA

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## About the dot (.) in Formula

The dot (.) in dynamic array formulas is a new operator introduced in Microsoft 365 that refines dynamic ranges by automatically excluding blank or empty cells. Known as the "trim reference dot operator," it allows formulas to adapt more precisely to the size of the actual data, removing unnecessary zeros or blank results that can appear when referencing entire columns.

**Syntax:** The dot is placed adjacent to the colon (:) in a range reference, effectively telling Excel to trim the range.

Trim trailing blanks: C4:C26 creates a dynamic range that starts at cell C4 and ends at the last non-empty cell in column C, but no later than C26.

Trim leading blanks: C4.:C26 creates a dynamic range that starts at the first non-empty cell in column C and ends at cell C26.

Trim both: C4.:C26 trims both leading and trailing blank cells.

**Dynamic and automatic:** As you add or remove data within the specified range, any formulas using the dot operator will automatically adjust their size to include only the relevant data. This makes formulas more robust and prevents errors or misleading results caused by empty cells.

### Key Benefits

- Removes trailing blanks/zeros when referencing columns.
- Makes formulas more dynamic and precise.
- Reduces need for wrapping formulas with FILTER(...,<>"") just to exclude blanks.

### Availability

As a recent feature, the dot operator may not be available to all users. It is a new addition designed for the most recent versions of Excel, particularly Microsoft 365, and its full implementation may still be rolling out.

## NEW FUNCTIONS

### FILTER Function (New Power Lookup)

- To show multiple results for one or more lookup values
- To have a filter that automatically refreshes without the need to press the refresh button.
- To sum or count the filtered values (used as an alternative to SUMIFS or COUNTIFS)
- FILTER Function arguments:

**FILTER(array, include, [if\_empty])**

**Array:** The columns that will be showed in the result; can be the entire data set or a part of the original data set.

**Include:** Test to check what to include for the logical test

**If\_Empty:** If FILTER doesn't filter anything, what would you like to returned. If you leave it blank, it will show #CALC!

### Using FILTER Function

1. Open the sample file: DYNAMIC ARRAYS BASICS
2. Go to Sheet: FILTER

|    | A                                            | B          | C         | D | E         | F         | G | H | I       | J       |
|----|----------------------------------------------|------------|-----------|---|-----------|-----------|---|---|---------|---------|
| 1  | <b>Filter (The New Power Lookup)</b>         |            |           |   |           |           |   |   |         |         |
| 2  |                                              |            |           |   |           |           |   |   |         |         |
| 3  | Syntax is FILTER(array, include, [if_empty]) |            |           |   |           |           |   |   |         |         |
| 4  |                                              |            |           |   |           |           |   |   |         |         |
| 5  | Segment                                      | Container  | Sales     |   | Container | Small Box |   |   | Sales > | 500,000 |
| 6  | Consumer                                     | Jumbo Box  | 604,363   |   |           |           |   |   |         |         |
| 7  | Consumer                                     | Jumbo Drum | 654,929   |   |           |           |   |   |         |         |
| 8  | Consumer                                     | Large Box  | 523,912   |   |           |           |   |   |         |         |
| 9  | Consumer                                     | Medium Box | 157,490   |   |           |           |   |   |         |         |
| 10 | Consumer                                     | Small Box  | 928,652   |   |           |           |   |   |         |         |
| 11 | Consumer                                     | Small Pack | 102,462   |   |           |           |   |   |         |         |
| 12 | Consumer                                     | Wrap Bag   | 54,066    |   |           |           |   |   |         |         |
| 13 | Corporate                                    | Jumbo Box  | 1,031,034 |   |           |           |   |   |         |         |
| 14 | Corporate                                    | Jumbo Drum | 1,292,622 |   |           |           |   |   |         |         |
| 15 | Corporate                                    | Large Box  | 595,742   |   |           |           |   |   |         |         |

3. Set the following formulas:

| Cell | Formula                               |
|------|---------------------------------------|
| E7   | =FILTER(A6:C33,B6:B33=F5,"Not Found") |
| I7   | =FILTER(A6:C33,C6:C33>J5,"Not Found") |

Try to highlight B6:B33=F5, and press F9

```
=FILTER(A6:C33,{FALSE;FALSE;FALSE;FALSE;TRUE;FALSE;FALSE;
FALSE;FALSE;FALSE;FALSE;TRUE;FALSE;FALSE;FALSE;FALSE;
FALSE;TRUE;FALSE;FALSE;FALSE;FALSE;FALSE;FALSE;TRUE;FALSE;
FALSE},"Not Found")
```

## Using TABLE as Data Source

1. Open the sample file: DYNAMIC ARRAYS BASICS
2. Go to Sheet: FILTER (Using Table)
3. To convert the current range to a TABLE, click on CELL A5, Press CTRL + T  
OR  
Go to INSERT menu → TABLE → OK Button
4. Select the table, go to TABLE DESIGN menu → Change the table name under PROPERTIES group:

Table Name:

TableSales

|    | A                                            | B          | C         | D         | E         | F | G | H       | I         | J       |
|----|----------------------------------------------|------------|-----------|-----------|-----------|---|---|---------|-----------|---------|
| 1  | <b>Filter (The New Power Lookup)</b>         |            |           |           |           |   |   |         |           |         |
| 2  |                                              |            |           |           |           |   |   |         |           |         |
| 3  | Syntax is FILTER(array, include, [if_empty]) |            |           |           |           |   |   |         |           |         |
| 4  |                                              |            |           |           |           |   |   |         |           |         |
| 5  | Segment                                      | Container  | Sales     | Container | Small Box |   |   | Segment | Corporate |         |
| 6  | Consumer                                     | Jumbo Box  | 604,363   |           |           |   |   | Sales > |           | 500,000 |
| 7  | Consumer                                     | Jumbo Drum | 654,929   |           |           |   |   |         |           |         |
| 8  | Consumer                                     | Large Box  | 523,912   |           |           |   |   |         |           |         |
| 9  | Consumer                                     | Medium Box | 157,490   |           |           |   |   |         |           |         |
| 10 | Consumer                                     | Small Box  | 928,652   |           |           |   |   |         |           |         |
| 11 | Consumer                                     | Small Pack | 102,462   |           |           |   |   |         |           |         |
| 12 | Consumer                                     | Wrap Bag   | 54,066    |           |           |   |   |         |           |         |
| 13 | Corporate                                    | Jumbo Box  | 1,031,034 |           |           |   |   |         |           |         |
| 14 | Corporate                                    | Jumbo Drum | 1,292,622 |           |           |   |   |         |           |         |

5. Set the following formulas:

| Cell | Formula                                                                         |
|------|---------------------------------------------------------------------------------|
| E7   | =FILTER(TableSales,TableSales[Container]=F5,"Not Found")                        |
| I7   | =FILTER(TableSales,(TableSales[Segment]=J4)*(TableSales[Sales]>J5),"Not Found") |

Note: The (\*) asterisk here means AND logic.



## SORT & SORTBY Functions

- To automatically sort categories alphabetically without the need to “refresh” a query.
- To sort numbers in ascending or descending order together with their categories.
- Use SORT if needs to sort the entire data set.
- Use SORTBY if needs to sort by a category not in the result.
- SORT Function arguments:

**SORT(array, [sort\_index], [sort\_order], [by\_col])**

**Array:** The data set to be sorted.

**Sort\_index:** The column index number to sort on. Default is 1.

**Sort\_order:** Default is 1 (ascending), -1 for descending.

**By\_col:** Default is FALSE. If the data is in columns instead of rows, you can switch to TRUE.

- SORTBY Function arguments:

**SORTBY(array, by\_array1, [sort\_order1] ...)**

**Array:** The part of the original data set that includes your result.

**By\_array1:** Decide the sort order of the final answer (the array).

**Sort\_order1:** Default is ascending, -1 for descending. This is the sort order to apply to by\_array1.

1. Open the sample file: DYNAMIC ARRAYS BASICS
2. Go to Sheet: SORT

|    | A                                                           | B          | C         | D                                 | E         | F     | G                 | H         | I     |
|----|-------------------------------------------------------------|------------|-----------|-----------------------------------|-----------|-------|-------------------|-----------|-------|
| 1  | <b>SORT Function &amp; SORTBY Formula</b>                   |            |           |                                   |           |       |                   |           |       |
| 2  |                                                             |            |           |                                   |           |       |                   |           |       |
| 3  | Syntax is SORT(array, [sort index], [sort order], [by_col]) |            |           |                                   |           |       |                   |           |       |
| 4  |                                                             |            |           | Sort by SALES in descending order |           |       | Sort by CONTAINER |           |       |
| 5  | Segment                                                     | Container  | Sales     | Segment                           | Container | Sales | Segment           | Container | Sales |
| 6  | Consumer                                                    | Jumbo Box  | 604,363   |                                   |           |       |                   |           |       |
| 7  | Consumer                                                    | Jumbo Drum | 654,929   |                                   |           |       |                   |           |       |
| 8  | Consumer                                                    | Large Box  | 523,912   |                                   |           |       |                   |           |       |
| 9  | Consumer                                                    | Medium Box | 157,490   |                                   |           |       |                   |           |       |
| 10 | Consumer                                                    | Small Box  | 928,652   |                                   |           |       |                   |           |       |
| 11 | Consumer                                                    | Small Pack | 102,462   |                                   |           |       |                   |           |       |
| 12 | Consumer                                                    | Wrap Bag   | 54,066    |                                   |           |       |                   |           |       |
| 13 | Corporate                                                   | Jumbo Box  | 1,031,034 |                                   |           |       |                   |           |       |
| 14 | Corporate                                                   | Jumbo Drum | 1,292,622 |                                   |           |       |                   |           |       |
| 15 | Corporate                                                   | Large Box  | 595,742   |                                   |           |       |                   |           |       |
| 16 | Corporate                                                   | Medium Box | 235,242   |                                   |           |       |                   |           |       |
| 17 | Corporate                                                   | Small Box  | 1,969,260 |                                   |           |       |                   |           |       |

3. Set the following formulas:

| Cell | Formula                    |
|------|----------------------------|
| E6   | =SORT(A6:C33,3,-1)         |
| I6   | =SORT(A6:C33,{2,1})        |
| M6   | =SORT(A6:C33,{2,3},{1,-1}) |

- 4.

## 4. Go to sheet: SORT (BY)

| 1  | A                                                  | B         | C          | D         | E | F   | G       | H         | I | J |
|----|----------------------------------------------------|-----------|------------|-----------|---|-----|---------|-----------|---|---|
| 2  | <b>SORTBY Function</b>                             |           |            |           |   |     |         |           |   |   |
| 3  | Syntax of SORTBY(array, by_array1, sort_order1...) |           |            |           |   |     |         |           |   |   |
| 4  |                                                    |           |            |           |   |     |         |           |   |   |
| 5  | Ref                                                | Segment   | Container  | Sales     |   | Ref | Segment | Container |   |   |
| 6  | 1                                                  | Consumer  | Jumbo Box  | 604,363   |   |     |         |           |   |   |
| 7  | 2                                                  | Consumer  | Jumbo Drum | 654,929   |   |     |         |           |   |   |
| 8  | 3                                                  | Consumer  | Large Box  | 523,912   |   |     |         |           |   |   |
| 9  | 4                                                  | Consumer  | Medium Box | 157,490   |   |     |         |           |   |   |
| 10 | 5                                                  | Consumer  | Small Box  | 928,652   |   |     |         |           |   |   |
| 11 | 6                                                  | Consumer  | Small Pack | 102,462   |   |     |         |           |   |   |
| 12 | 7                                                  | Consumer  | Wrap Bag   | 54,066    |   |     |         |           |   |   |
| 13 | 8                                                  | Corporate | Jumbo Box  | 1,031,034 |   |     |         |           |   |   |
| 14 | 9                                                  | Corporate | Jumbo Drum | 1,292,622 |   |     |         |           |   |   |
| 15 | 10                                                 | Corporate | Large Box  | 595,742   |   |     |         |           |   |   |
| 16 | 11                                                 | Corporate | Medium Box | 335,343   |   |     |         |           |   |   |

- Convert the data to TABLE by pressing CTRL + T
- Assume the table name now is TABLE2
- Set the following formula:

| Cell | Formula                                                   |
|------|-----------------------------------------------------------|
| F6   | =SORTBY(Table2[Ref]:Table2[Container], Table2[Sales], -1) |

## UNIQUE Function (Get a Unique List of Values)

- To get a unique list of items from data set.
- To get a distinct list of items from data set.
- To update unique list automatically without the need to refresh a query.

UNIQUE(array, [by\_col], [occurs\_once])

**Array:** The part of the original data set that includes in the results.  
**By\_col:** Default is FALSE to compare by row. TRUE to compare by column.

**Occurs\_once:** Default is FALSE means the values occur one or more times. TRUE means the values returned occur only once in the data set.

- Open the sample file: DYNAMIC ARRAYS BASICS
- Go to Sheet: UNIQUE

| 1  | A                                                | B          | C       | D               | E | F         | G | H         | I | J         | K         | L |
|----|--------------------------------------------------|------------|---------|-----------------|---|-----------|---|-----------|---|-----------|-----------|---|
| 2  | <b>UNIQUE Function</b>                           |            |         |                 |   |           |   |           |   |           |           |   |
| 3  | Syntax of UNIQUE(array, [by_col], [occurs_once]) |            |         |                 |   |           |   |           |   |           |           |   |
| 4  |                                                  |            |         |                 |   |           |   |           |   |           |           |   |
| 5  | Segment                                          | Container  | Sales   | No of Segment : |   | Segment : |   | Segment : |   | Segment : | Container |   |
| 6  | Others                                           | Jumbo Box  | 604,363 |                 |   |           |   |           |   |           |           |   |
| 7  | Consumer                                         | Jumbo Drum | 654,929 |                 |   |           |   |           |   |           |           |   |
| 8  | Consumer                                         | Large Box  | 523,912 |                 |   |           |   |           |   |           |           |   |
| 9  | Consumer                                         | Medium Box | 157,490 |                 |   |           |   |           |   |           |           |   |
| 10 | Consumer                                         | Small Box  | 928,652 |                 |   |           |   |           |   |           |           |   |
| 11 | Consumer                                         | Small Pack | 102,462 |                 |   |           |   |           |   |           |           |   |

- Set the following formulas:

| Cell | Formula         |
|------|-----------------|
| F6   | =UNIQUE(A6:A40) |
| F6   | =COUNTA(F6#)    |

- In Cell A6, type **OTHERS**
- Then set the following formulas:

| Cell | Formula               |
|------|-----------------------|
| I6   | =UNIQUE(A6:A40,,TRUE) |
| K7   | =UNIQUE(A6:B40)       |

SEQUENCE  
Function  
(Generate a  
list of  
sequential  
numbers)

- To generate a list of index numbers.
- To simulate dates based on specific intervals.
- Modeling and simulations.
- To transform legacy Excel formulas to power formulas.
- The power of SEQUENCE lies when used in combination with other functions.

SEQUENCE(rows, [column], [start], [step])

*Rows:* The number of rows the result should spill to.  
*Columns:* Default is 1. The number of columns the result should spill to.  
*Start:* Default is 1. The starting number.  
*Step:* Default is 1. The number to increment (step) by.

- 6. Open the sample file: DYNAMIC ARRAYS BASICS
- 7. Go to Sheet: SEQUENCE

|   |                                                      |                                       |                  |    |      |  |  |  |  |  |  |                       |  |
|---|------------------------------------------------------|---------------------------------------|------------------|----|------|--|--|--|--|--|--|-----------------------|--|
| 1 | SEQUENCE Function                                    |                                       |                  |    |      |  |  |  |  |  |  |                       |  |
| 2 |                                                      |                                       |                  |    |      |  |  |  |  |  |  |                       |  |
| 3 | Syntax of SEQUENCE(rows, [columns], [start], [step]) |                                       |                  |    |      |  |  |  |  |  |  |                       |  |
| 4 |                                                      |                                       |                  |    |      |  |  |  |  |  |  |                       |  |
| 5 | Generate an Index                                    | Generate 5 continuous days from today | Sample Text Here | No | Text |  |  |  |  |  |  | Generate Month Header |  |
| 6 |                                                      |                                       |                  |    |      |  |  |  |  |  |  |                       |  |
| 7 |                                                      |                                       |                  |    |      |  |  |  |  |  |  |                       |  |

- 8. Set the following formulas:

| Cell | Formula                                                          |
|------|------------------------------------------------------------------|
| A6   | =SEQUENCE(10)                                                    |
| C6   | SEQUENCE(10,,TODAY())<br>=TEXT(SEQUENCE(10,,TODAY()),"dd/mm/yy") |
| D6   | =TEXT(C6#,"dddd")                                                |
| G6   | =MID(G5,SEQUENCE(LEN(G5)),1)                                     |
| L6   | =SEQUENCE(1,12)<br>=TEXT(DATE(2025,SEQUENCE(1,12),1),"mmm")      |

'@ Prefix  
for  
Compatibili  
ty in  
Formulas

- Older Excel files opened in the new Dynamic Array Excel might have formulas with the @ symbol as prefix. This is to ensure that the formula behaves as before and spilling is prevented.
- This was first called the SINGLE function. SINGLE function will be placed before the original array formulas. It was changed to the @ symbol in February 2029 to avoid confusion and is easier to apply than a whole new function.
- @ behaves like a table row reference. It avoids spillage and returns the value on the same row for range references – or the first result in an array (also referred to as implicit intersection).

@(Formula or Reference)

where the value is generally a reference to many cells, or an array formula.

# XLOOKUP FUNCTION

## About

XLOOKUP and VLOOKUP are both handy tools that help find specific information in a dataset. XLOOKUP was introduced in 2022 and is more flexible, works faster, and finds data more accurately than VLOOKUP. Limitations of VLOOKUP

- It takes data only from the right side of the search column and cannot pull data exclusively from the left of the search column.
- VLOOKUP is not case-sensitive, treating uppercase and lowercase letters identically, and potentially causing mismatches.
- Limited search mode.
- As the dataset gets bigger, VLOOKUP may become less efficient, leading to slower response times

XLOOKUP can overcome those limitations. XLOOKUP easily handles two-way searches and manages large data without any difficulty. It simplifies complex tasks, making your work hassle-free.

`=XLOOKUP(lookup_value, lookup_array, result_array, [if_not_found], [match_mode], [search_mode])`

*Lookup\_value:* The value you want to search for in the lookup\_range.

*lookup\_array:* The range where the search\_key will be located.

*Result\_array:* The range where the related result is found.

*If\_not\_found:* Specifies the value or action if no match is found.

*Match\_mode:* Default is 0 – EXACT MATCH. Determines the match type - exact match, partial match, etc.

*Search\_mode:* Default is 1 – Search FIRST TO LAST. Defines how to handle different types of matches.

Advantages of using XLOOKUP:

- Bidirectional lookup: XLOOKUP can search both horizontally and vertically within a table, offering greater flexibility in searching.
- Handling errors: It handles errors more effectively than VLOOKUP, providing an alternative value or message when a lookup fails.
- Multiple criteria: It supports multiple criteria, enabling more complex search operations than VLOOKUP.
- Flexibility: Returns an exact match, the next smaller item, or the next larger item when an exact match is not found.

## Use Wildcard Characters in Searches

Use wildcard characters as comparison criteria for text filters and when content searching and replacing.

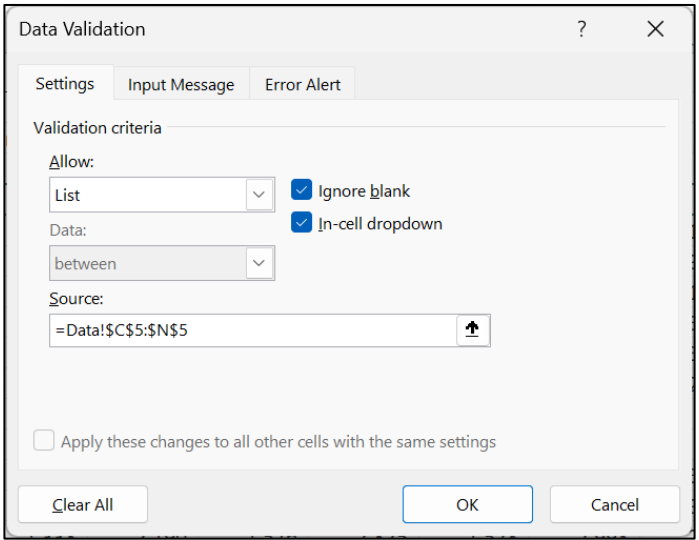
| Symbol                   | To find                                                                  |
|--------------------------|--------------------------------------------------------------------------|
| ?                        | Any single character.<br>Eg. Te?t finds "Test" and "Text"                |
| *                        | Any number of characters.<br>Eg. *east finds "Northeast" and "Southeast" |
| ~ followed by ?, *, or ~ | A question mark, asterisk, or tilde.<br>Eg. Sure~? finds "Sure?"         |

## Using XLOOKUP

1. Open the sample file: DYNAMIC\_ARRAYS\_XLOOKUP
2. Go to Sheet: SUMMARY

|    | A              | B     |
|----|----------------|-------|
| 1  | <b>XLOOKUP</b> |       |
| 2  |                |       |
| 3  | Find Item      | Paper |
| 4  |                |       |
| 5  | ID is:         |       |
| 6  | Total is:      |       |
| 7  |                |       |
| 8  | Select Month   |       |
| 9  | Total is:      |       |
| 10 |                |       |

3. Set the following formulas/ actions:

| Cell | Formula / Action                                                                                                                              |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| B8   | Set data validation for selection of Jan to Dec<br>        |
| B5   | =XLOOKUP(B3,Data!B:B,Data!A:A)<br>=XLOOKUP(B3,Data!B:B,Data!A:A,,2)                                                                           |
| B6   | =XLOOKUP(B3,Data!B:B,Data!O:O)<br>=XLOOKUP(B3,Data!B:B,Data!O:O,,2)                                                                           |
| B9   | =XLOOKUP(B3,Data!B6:B22,XLOOKUP(Summary!B8,Data!C5:N5,Data!C6:N22))<br>=XLOOKUP(B3,Data!B6:B22,XLOOKUP(Summary!B8,Data!C5:N5,Data!C6:N22),,2) |

## Using XLOOKUP with TABLE

1. Open the sample file: DYNAMIC\_ARRAYS\_XLOOKUP
2. Go to Sheet: DATATABLE

|    | A                                                                                                        | B                              | C      | D      | E      | F      | G      | H      | I      | J      | K      | L      | M      | N      | O       |
|----|----------------------------------------------------------------------------------------------------------|--------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
| 1  | <b>XLOOKUP</b>                                                                                           |                                |        |        |        |        |        |        |        |        |        |        |        |        |         |
| 2  |                                                                                                          |                                |        |        |        |        |        |        |        |        |        |        |        |        |         |
| 3  | Syntax is XLOOKUP(lookup_value, lookup_array, result_array, [if_not_found], [match_mode], [search_mode]) |                                |        |        |        |        |        |        |        |        |        |        |        |        |         |
| 4  |                                                                                                          |                                |        |        |        |        |        |        |        |        |        |        |        |        |         |
| 5  | Item ID                                                                                                  | Item                           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    | Total   |
| 6  | ID65                                                                                                     | Appliances                     | 1,887  | 1,728  | 3,798  | 5,668  | 5,319  | 8,804  | 4,593  | 1,701  | 1,774  | 10,698 | 5,678  | 6,762  | 58,410  |
| 7  | ID66                                                                                                     | Binders and Binder Accessories | 3,042  | 5,001  | 13,357 | 8,658  | 1,396  | 4,321  | 6,849  | 3,236  | 1,873  | 2,466  | 7,308  | 7,914  | 65,421  |
| 8  | ID67                                                                                                     | Bookcases                      | 377    | 3,942  | 12,333 | 5,797  | 6,907  | 1,971  | 442    | 1,966  | 4,797  | 7,628  | 593    | 8,470  | 55,223  |
| 9  | ID68                                                                                                     | Chairs & Chairmats             | 23,617 | 7,412  | 6,751  | 2,078  | 14,875 | 10,485 | 9,878  | 5,008  | 4,568  | 13,418 | 12,827 | 14,275 | 125,192 |
| 10 | ID69                                                                                                     | Computer Peripherals           | 3,449  | 3,354  | 5,340  | 8,952  | 10,534 | 5,309  | 1,145  | 5,336  | 7,611  | 7,680  | 5,760  | 4,453  | 68,923  |
| 11 | ID70                                                                                                     | Copiers and Fax                | 6,628  | 6,220  | 12,013 | 587    | 5,418  | 305    | 6,228  | 2,642  | 1,706  | 4,582  | -      | 12,874 | 59,203  |
| 12 | ID71                                                                                                     | Envelopes                      | 1,520  | 110    | 206    | 1,485  | 2,005  | 1,086  | 464    | 811    | 1,759  | 543    | 1,899  | 711    | 12,599  |
| 13 | ID76                                                                                                     | Labels                         | 107    | 231    | 67     | 100    | 250    | 47     | 95     | 183    | 362    | 239    | 101    | 109    | 1,891   |
| 14 | ID77                                                                                                     | Office Furnishings             | 2,515  | 1,717  | 4,718  | 775    | 2,529  | 5,633  | 5,529  | 8,800  | 3,264  | 2,262  | 3,679  | 47,044 |         |
| 15 | ID78                                                                                                     | Office Machines                | 15,491 | 7,729  | 9,135  | 11,306 | 17,317 | 3,675  | 5,459  | 23,405 | 16,239 | 13,888 | 19,047 | 10,421 | 153,112 |
| 16 | ID80                                                                                                     | Paper                          | 2,600  | 1,338  | 2,190  | 1,576  | 2,825  | 1,528  | 2,998  | 2,240  | 1,958  | 2,977  | 1,539  | 857    | 24,626  |
| 17 | ID81                                                                                                     | Pens & Art Supplies            | 1,020  | 711    | 1,069  | 362    | 626    | 1,733  | 754    | 954    | 1,293  | 1,047  | 721    | 345    | 10,635  |
| 18 | ID82                                                                                                     | Rubber Bands                   | 23     | 126    | 95     | 56     | 84     | -      | 148    | 149    | 113    | 126    | 72     | 95     | 1,087   |
| 19 | ID83                                                                                                     | Scissors, Rulers and Trimmers  | 57     | 381    | 103    | 67     | 92     | 155    | 148    | 197    | 516    | 14,655 | 111    | 719    | 17,201  |
| 20 | ID84                                                                                                     | Storage & Organization         | 16,873 | 1,703  | 5,802  | 3,404  | 13,153 | 17,024 | 6,466  | 9,095  | 10,080 | 1,513  | 3,774  | 3,610  | 92,497  |
| 21 | ID85                                                                                                     | Tables                         | 11,155 | 28,935 | 5,421  | 11,137 | 14,273 | 7,249  | 9,737  | 24,856 | 20,761 | 12,792 | 5,255  | 25,335 | 176,906 |
| 22 | ID86                                                                                                     | Telephones and Communication   | 10,319 | 20,391 | 19,347 | 16,706 | 25,403 | 21,491 | 13,196 | 11,185 | 20,000 | 11,882 | 9,873  | 10,131 | 189,924 |

3. Select the dataset, press CTRL + T to convert to TABLE FORMAT. Let's say the table name is TABLE1
4. Go to Sheet: SUMMARY TABLE

|    | A                           | B     |
|----|-----------------------------|-------|
| 1  | <b>XLOOKUP (with Table)</b> |       |
| 2  |                             |       |
| 3  | Find Item                   | Paper |
| 4  |                             |       |
| 5  | ID is:                      |       |
| 6  | Total is:                   |       |
| 7  |                             |       |
| 8  | Select Month                |       |
| 9  | Total is:                   |       |
| 10 |                             |       |

5. Set the following formulas/actions:

| Cell | Formula / Action                                                                                                                                |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| B8   | Set data validation for selection of Jan to Dec<br>=INDIRECT("Table1[["&#x2191;Headers],["&#x2191;Jan]:["&#x2191;Dec]]")                        |
| B5   | =XLOOKUP(B3,Table1[Item],Table1[Item ID])<br>=XLOOKUP(B3,Table1[Item],Table1[Item ID],,2)                                                       |
| B6   | =XLOOKUP(B3,Table1[Item],Table1[Total])<br>=XLOOKUP(B3,Table1[Item],Table1[Total],,2)                                                           |
| B9   | =XLOOKUP(B3,Table1[Item],XLOOKUP(B8,Table1[#Headers],Table1[#Data]))<br>=XLOOKUP(B3,Table1[Item],XLOOKUP(B8,Table1[#Headers],Table1[#Data]),,2) |

# CELL REFERENCES IN DYNAMIC ARRAY FORMULAS

## Intro

Dynamic Arrays simplify complex data tasks, making Excel faster, smarter, and more efficient by generating ranges (i.e., arrays) of values/data, rather than individual return values like traditional Excel formulas.

Dynamic Arrays are resizable arrays that calculate automatically and return values into multiple cells based on a formula entered in a single cell.

Through over 30 years of history, Excel has undergone many changes, but one thing remained constant - one formula, one cell. Even with traditional array formulas, it was necessary to enter a formula into each cell where you want a result to appear. With dynamic arrays, this rule is no longer true.

Now, any formula that returns an array of values automatically spills into neighboring cells, without you having to press CTRL + SHIFT + ENTER or do any other moves. In other words, operating dynamic arrays becomes as easy as working with a single cell.

1. Open file: DYNAMIC\_ARRAYS\_SAMPLE

## Example 1

1. Go to Sheet: SAMPLE1

|    | A                 | B                | C            | D | E |
|----|-------------------|------------------|--------------|---|---|
| 1  | <b>Cell Links</b> |                  |              |   |   |
| 2  |                   |                  |              |   |   |
| 3  | <b>Segment</b>    | <b>Container</b> | <b>Sales</b> |   |   |
| 4  | Consumer          | Jumbo Box        | 604,363      |   |   |
| 5  | Consumer          | Jumbo Drum       | 654,929      |   |   |
| 6  | Consumer          | Large Box        | 523,912      |   |   |
| 7  | Consumer          | Medium Box       | 157,490      |   |   |
| 8  | Consumer          | Small Box        | 928,652      |   |   |
| 9  | Consumer          | Small Pack       | 102,462      |   |   |
| 10 | Consumer          | Wrap Bag         | 54,066       |   |   |

| Cell | Formula / Action |
|------|------------------|
| E4   | =A4:C31          |

## Example 2

1. Go to Sheet: SAMPLE2

|    | A                           | B                | C            | D                 |
|----|-----------------------------|------------------|--------------|-------------------|
| 1  | <b>Easy Cell References</b> |                  |              |                   |
| 2  |                             |                  |              |                   |
| 3  | <b>Commission Rate</b>      | 5%               |              |                   |
| 4  |                             |                  |              |                   |
| 5  | <b>Segment</b>              | <b>Container</b> | <b>Sales</b> | <b>Commission</b> |
| 6  | Consumer                    | Jumbo Box        | 604,363      |                   |
| 7  | Consumer                    | Jumbo Drum       | 654,929      |                   |
| 8  | Consumer                    | Large Box        | 523,912      |                   |
| 9  | Consumer                    | Medium Box       | 157,490      |                   |
| 10 | Consumer                    | Small Box        | 928,652      |                   |
| 11 | Consumer                    | Small Pack       | 102,462      |                   |
| 12 | Consumer                    | Wrap Bag         | 54,066       |                   |
| 13 | Corporate                   | Jumbo Box        | 1,031,034    |                   |

| Cell | Formula / Action |
|------|------------------|
| D6   | =C6:C33*B3       |

## Example 3

1. Go to Sheet: SAMPLE3

|    | A                           | B                | C            | D            | E             | F             | G             |
|----|-----------------------------|------------------|--------------|--------------|---------------|---------------|---------------|
| 1  | <b>Easy Cell References</b> |                  |              |              |               |               |               |
| 2  |                             |                  |              |              |               |               |               |
| 3  |                             |                  |              | USD          | GBP           | EUR           | JPY100        |
| 4  | <b>Segment</b>              | <b>Container</b> | <b>Sales</b> | <b>4.466</b> | <b>5.6234</b> | <b>4.6453</b> | <b>2.9751</b> |
| 5  | Consumer                    | Jumbo Box        | 604,363      |              |               |               |               |
| 6  | Consumer                    | Jumbo Drum       | 654,929      |              |               |               |               |
| 7  | Consumer                    | Large Box        | 523,912      |              |               |               |               |
| 8  | Consumer                    | Medium Box       | 157,490      |              |               |               |               |
| 9  | Consumer                    | Small Box        | 928,652      |              |               |               |               |
| 10 | Consumer                    | Small Pack       | 102,462      |              |               |               |               |
| 11 | Consumer                    | Wrap Bag         | 54,066       |              |               |               |               |
| 12 | Corporate                   | Jumbo Box        | 1,031,034    |              |               |               |               |
| 13 | Corporate                   | Jumbo Drum       | 1,292,622    |              |               |               |               |
| 14 | Corporate                   | Large Box        | 595,742      |              |               |               |               |
| 15 | Corporate                   | Medium Box       | 235,242      |              |               |               |               |
| 16 | Corporate                   | Small Box        | 1,969,260    |              |               |               |               |
| 17 | Corporate                   | Small Pack       | 206,158      |              |               |               |               |
| 18 | Corporate                   | Wrap Bag         | 104,376      |              |               |               |               |
| 19 | Home Office                 | Jumbo Box        | 647,919      |              |               |               |               |
| 20 | Home Office                 | Jumbo Drum       | 694,431      |              |               |               |               |
| 21 | Home Office                 | Large Box        | 529,449      |              |               |               |               |

| Cell | Formula / Action |
|------|------------------|
| D5   | =C5:C32/D4:J4    |



## Example 4

- Go to Sheet: SAMPLE4

|    | A                                | B | C              | D |
|----|----------------------------------|---|----------------|---|
| 1  | <b>Easy Data Linking using #</b> |   |                |   |
| 2  |                                  |   |                |   |
| 3  |                                  |   |                |   |
| 4  | (link to Sample1 Sales Column)   |   |                |   |
| 5  | <b>Sales</b>                     |   |                |   |
| 6  |                                  |   | Total Sales    |   |
| 7  |                                  |   | Average Sales  |   |
| 8  |                                  |   | Count of Sales |   |
| 9  |                                  |   | Max Sales      |   |
| 10 |                                  |   | Min Sales      |   |

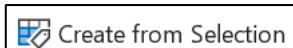
| Cell | Formula / Action |
|------|------------------|
| A6   | =Sample1!C4:C31  |
| D6   | =SUM(A6#)        |
| D7   | =AVERAGE(A6#)    |
| D8   | =COUNT(A6#)      |
| D9   | =MAX(A6#)        |
| D10  | =MIN(A6#)        |

## Example 5

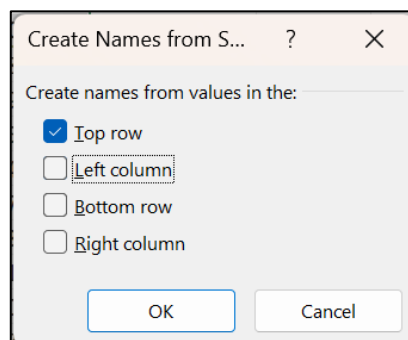
- Go to Sheet: SAMPLE5

|    | A                   | B                | C           | D           | E              | F            |
|----|---------------------|------------------|-------------|-------------|----------------|--------------|
| 1  | <b>Naming Cells</b> |                  |             |             |                |              |
| 2  |                     |                  |             |             |                |              |
| 3  | <b>Segment</b>      | <b>Container</b> | <b>East</b> | <b>West</b> | <b>Central</b> | <b>Total</b> |
| 4  | Consumer            | Jumbo Box        | 151,091     | 362,618     | 181,309        |              |
| 5  | Consumer            | Jumbo Drum       | 163,732     | 392,957     | 196,479        |              |
| 6  | Consumer            | Large Box        | 130,978     | 314,347     | 157,174        |              |
| 7  | Consumer            | Medium Box       | 39,373      | 94,494      | 47,247         |              |
| 8  | Consumer            | Small Box        | 232,163     | 557,191     | 278,596        |              |
| 9  | Consumer            | Small Pack       | 25,616      | 61,477      | 30,739         |              |
| 10 | Consumer            | Wrap Bag         | 13,517      | 32,440      | 16,220         |              |
| 11 | Corporate           | Jumbo Box        | 257,759     | 618,620     | 309,310        |              |

- Select the dataset (A3:E31), go to FORMULAS menu →



→ Select TOP ROW → OK Button.



| Cell | Formula / Action   |
|------|--------------------|
| F4   | =East+West+Central |

# WORKING DYNAMIC ARRAY WITH OTHER FUNCTIONS

## Return More Values from VLookup

1. Open file: DYNAMIC\_ARRAYS\_WITH\_OTHER\_FUNCTIONS
2. Go to sheet: VLOOKUP

|   | A                                    | B                      | C         | D        | E | F            | G    |
|---|--------------------------------------|------------------------|-----------|----------|---|--------------|------|
| 1 | Return multiple values using VLOOKUP |                        |           |          |   |              |      |
| 2 |                                      |                        |           |          |   |              |      |
| 3 |                                      |                        |           |          |   |              |      |
| 4 | ID                                   | Item                   | Warehouse | Supplier |   | Seach ID     | ID05 |
| 5 | ID01                                 | Computer Peripherals   | East      | Coo      |   | Return Value |      |
| 6 | ID02                                 | Paper                  | West      | Wmart    |   |              |      |
| 7 | ID03                                 | Copiers and Fax        | East      | Coo      |   |              |      |
| 8 | ID04                                 | Pens & Art Supplies    | West      | Coo      |   |              |      |
| 9 | ID05                                 | Storage & Organization | Central   | Wmart    |   |              |      |

3. Set the following formula:

| Cell | Formula / Action                |
|------|---------------------------------|
| G5   | =VLOOKUP(G4,A5:D21,{2,4},0)     |
| G6   | =VLOOKUP(G4,A5:D21,{1,2,3,4},0) |

## More Criteria Matching from SUMIFS

1. Open file: DYNAMIC\_ARRAYS\_WITH\_OTHER\_FUNCTIONS
2. Go to sheet: SUMIFS

|    | A                                  | B        | C              | D                      | E      | F | G                           | H | I | J | K | L |
|----|------------------------------------|----------|----------------|------------------------|--------|---|-----------------------------|---|---|---|---|---|
| 1  | Return multiple values using SUMIF |          |                |                        |        |   |                             |   |   |   |   |   |
| 2  |                                    |          |                |                        |        |   |                             |   |   |   |   |   |
| 3  |                                    |          |                |                        |        |   |                             |   |   |   |   |   |
| 4  | Month                              | Segment  | Ship Mode      | Item                   | Sales  |   | (Create drop-down for Item) |   |   |   |   |   |
| 5  | Jan                                | Consumer | Delivery Truck | Office Furnishings     | 1,200  |   |                             |   |   |   |   |   |
| 6  | Jan                                | Consumer | Delivery Truck | Storage & Organization | 11,816 |   |                             |   |   |   |   |   |
| 7  | Jan                                | Consumer | Delivery Truck | Tables                 | 15,890 |   |                             |   |   |   |   |   |
| 8  | Jan                                | Consumer | Delivery Truck | Bookcases              | 35,836 |   |                             |   |   |   |   |   |
| 9  | Jan                                | Consumer | Delivery Truck | Chairs & Chairmats     | 35,934 |   |                             |   |   |   |   |   |
| 10 | Jan                                | Consumer | Delivery Truck | Office Machines        | 40,304 |   |                             |   |   |   |   |   |
| 11 | Jan                                | Consumer | Express Air    | Office Furnishings     | 120    |   |                             |   |   |   |   |   |
| 12 | Jan                                | Consumer | Express Air    | Paper                  | 221    |   |                             |   |   |   |   |   |
| 13 | Jan                                | Consumer | Express Air    | Labels                 | 223    |   |                             |   |   |   |   |   |
| 14 | Jan                                | Consumer | Express Air    | Pens & Art Supplies    | 231    |   |                             |   |   |   |   |   |
| 15 | Jan                                | Consumer | Express Air    | Computer Peripherals   | 671    |   |                             |   |   |   |   |   |
| 16 | Jan                                | Consumer | Express Air    | Foodstuffs             | 718    |   |                             |   |   |   |   |   |

3. Convert dataset to a TABLE named it as TABLE1.
4. Create Data Validation in G5:

Data Validation

Settings

Input Message

Error Alert

Validation criteria

Allow:

List

Ignore blank

Data:

between

Source:

=INDIRECT("Table1[Item]")

Apply these changes to all other cells with the same settings

Clear All

OK

Cancel

5. Set the following formula:

| Cell | Formula / Action                                                  |
|------|-------------------------------------------------------------------|
| H5   | =SUM(SUMIFS(Table1[Sales],Table1[Item],\$G5,Table1[Month],H1:H3)) |

6. Copy H5 formula, highlight I5:K5, right click the selection and select PASTE OPTION: FORMULA

## Using # in INDEX & MATCH

1. Open file: DYNAMIC\_ARRAYS\_WITH\_OTHER FUNCTIONS
2. Go to sheet: INDEX & MATCH

|    | A                                          | B        | C              | D                      | E      | F | G            | H |
|----|--------------------------------------------|----------|----------------|------------------------|--------|---|--------------|---|
| 1  | Return multiple values using INDEX & MATCH |          |                |                        |        |   | Select Item  |   |
| 2  |                                            |          |                |                        |        |   | Select Month |   |
| 3  |                                            |          |                |                        |        |   | Total Sales  |   |
| 4  |                                            |          |                |                        |        |   |              |   |
| 5  | Month                                      | Segment  | Ship Mode      | Item                   | Sales  |   | Item         |   |
| 6  | Jan                                        | Consumer | Delivery Truck | Office Furnishings     | 1,200  |   |              |   |
| 7  | Jan                                        | Consumer | Delivery Truck | Storage & Organization | 11,816 |   |              |   |
| 8  | Jan                                        | Consumer | Delivery Truck | Tables                 | 15,890 |   |              |   |
| 9  | Jan                                        | Consumer | Delivery Truck | Bookcases              | 35,836 |   |              |   |
| 10 | Jan                                        | Consumer | Delivery Truck | Chairs & Chairmats     | 35,934 |   |              |   |
| 11 | Jan                                        | Consumer | Delivery Truck | Office Machines        | 40,304 |   |              |   |
| 12 | Jan                                        | Consumer | Express Air    | Office Furnishings     | 120    |   |              |   |
| 13 | Jan                                        | Consumer | Express Air    | Paper                  | 221    |   |              |   |
| 14 | Jan                                        | Consumer | Express Air    | Labels                 | 223    |   |              |   |
| 15 | Jan                                        | Consumer | Express Air    | Pens & Art Supplies    | 231    |   |              |   |

3. Set the following formulas:

| Cell | Formula / Action                            |
|------|---------------------------------------------|
| G6   | =UNIQUE(D6:D1400)                           |
| H5   | =TRANSPOSE(UNIQUE(A6:A1400))                |
| H6   | =SUMIFS(E6:E1400,D6:D1400,G6#,A6:A1400,H5#) |
| H1   | Bookcases                                   |
| H2   | Mar                                         |
| H3   | =INDEX(H6#,MATCH(H1,G6#,0),MATCH(H2,H5#,0)) |

## Exercise

1. Go to sheet: INDEX & MATCH (TABLE)
2. Convert the dataset to TABLE and name it as TABLE2
3. Set the relevant formulas as above.

## Combining FILTER, SUMIFS, VLOOKUP, IF

1. Open file: DYNAMIC\_ARRAYS\_WITH\_OTHER FUNCTIONS
2. Go to sheet: FILTER

|    | A                                 | B              | C                      | D      | E | F                 | G           | H | I | J | K | L | M |
|----|-----------------------------------|----------------|------------------------|--------|---|-------------------|-------------|---|---|---|---|---|---|
| 1  | Using FILTER, SUMIFS, VLOOKUP, IF |                |                        |        |   |                   |             |   |   |   |   |   |   |
| 2  |                                   |                |                        |        |   |                   |             |   |   |   |   |   |   |
| 3  |                                   |                |                        |        |   |                   |             |   |   |   |   |   |   |
| 4  | Segment                           | Ship Mode      | Item                   | Sales  |   | Select Ship Mode: | Total Sales |   |   |   |   |   |   |
| 5  | Consumer                          | Delivery Truck | Office Furnishings     | 1,200  |   |                   |             |   |   |   |   |   |   |
| 6  | Consumer                          | Delivery Truck | Storage & Organization | 11,816 |   |                   |             |   |   |   |   |   |   |
| 7  | Consumer                          | Delivery Truck | Tables                 | 15,890 |   |                   |             |   |   |   |   |   |   |
| 8  | Consumer                          | Delivery Truck | Bookcases              | 35,836 |   |                   |             |   |   |   |   |   |   |
| 9  | Consumer                          | Delivery Truck | Chairs & Chairmats     | 35,934 |   |                   |             |   |   |   |   |   |   |
| 10 | Consumer                          | Delivery Truck | Office Machines        | 40,304 |   |                   |             |   |   |   |   |   |   |
| 11 | Consumer                          | Express Air    | Office Furnishings     | 120    |   |                   |             |   |   |   |   |   |   |
| 12 | Consumer                          | Express Air    | Paper                  | 221    |   |                   |             |   |   |   |   |   |   |
| 13 | Consumer                          | Express Air    | Labels                 | 223    |   |                   |             |   |   |   |   |   |   |
| 14 | Consumer                          | Express Air    | Pens & Art Supplies    | 231    |   |                   |             |   |   |   |   |   |   |
| 15 | Consumer                          | Express Air    | Computer Peripherals   | 671    |   |                   |             |   |   |   |   |   |   |
| 16 | Consumer                          | Express Air    | Envelopes              | 718    |   |                   |             |   |   |   |   |   |   |
| 17 | Consumer                          | Express Air    | Office Machines        | 1,114  |   |                   |             |   |   |   |   |   |   |
| 18 | Consumer                          | Express Air    | Storage & Organization | 1,288  |   |                   |             |   |   |   |   |   |   |

3. Create SHIP MODE List in F5 using Data Validation.
4. Set the following formulas:

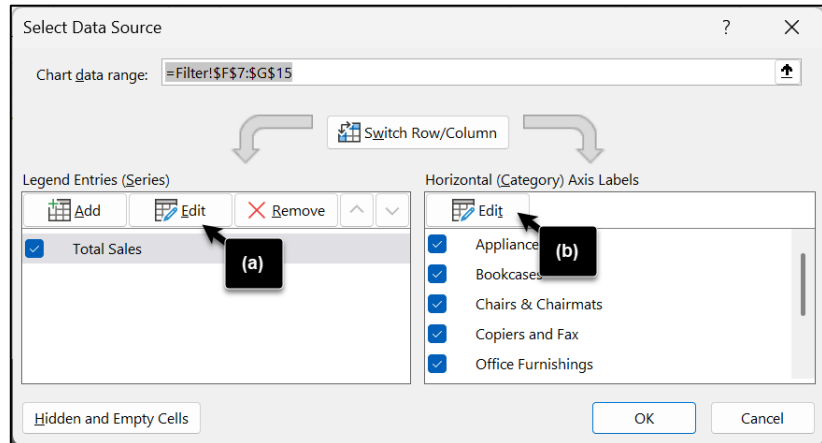
| Cell | Formula / Action                            |
|------|---------------------------------------------|
| F8   | =SORT(UNIQUE(FILTER(C5:C1399,B5:B1399=F5))) |
| G8   | =SUMIFS(D5:D1399,C5:C1399,F8#,B5:B1399,F5)  |
| H8   | =G8#*VLOOKUP(G8#,K8:M13,3,1)                |
| I8   | =IF(G8#>=AVERAGE(G8#),"Good","")            |
| L18  | =VLOOKUP(L17,F8#:I8#,2,0)                   |

## EXCEL CHART WITH DYNAMIC ARRAY

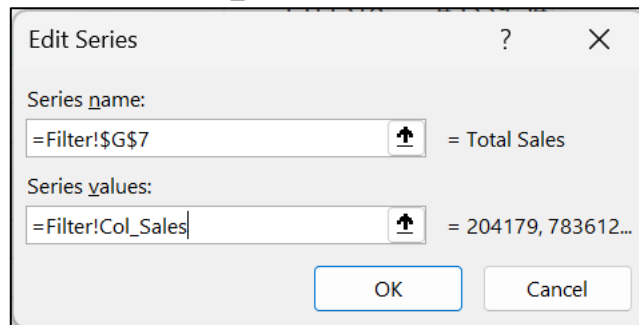
## Set Dynamic Array in Data Series

1. Open file: DYNAMIC\_ARRAYS\_WITH\_OTHER\_FUNCTIONS
2. Go to sheet: FILTER  
(Continue from the previous settings)

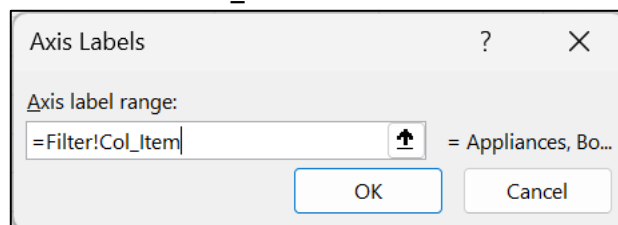
7. Right-click the COLUMN CHART, select SELECT DATA option:



8. Click EDIT (a) Button and set the SERIES VALUES:  
<sheetname>!Col\_Sales



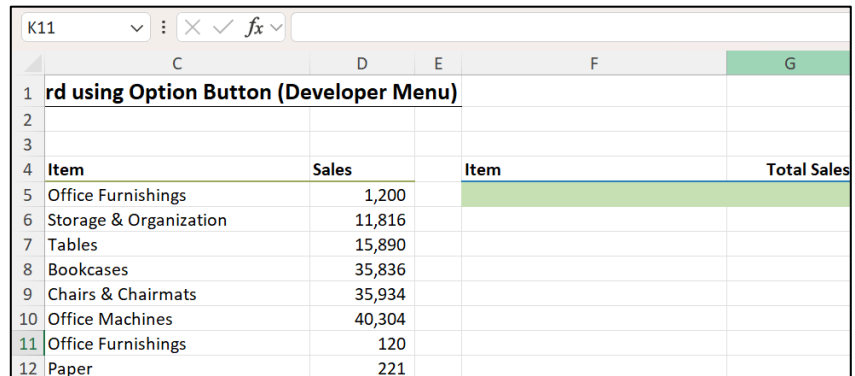
9. Click OK button.  
10. Click EDIT (b) Button and set the AXIS LABEL RANG:  
<sheetname>!Col\_Item



11. Click OK button.  
Now, the data series changes according to the SHIP MODE selection.

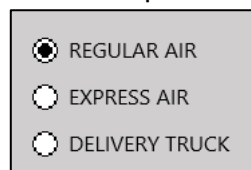
## Create Simple Excel Dashboard with Controls

1. Open file: DYNAMIC\_ARRAYS\_WITH\_OTHER\_FUNCTIONS
2. Go to sheet: SIMPLE DASHBOARD



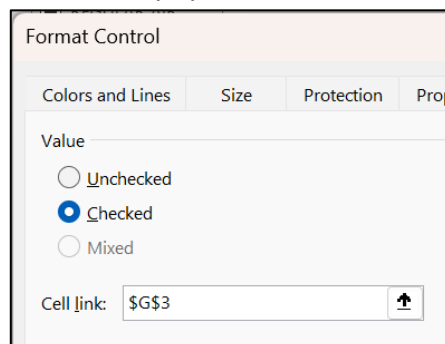
| Item                   | Sales  | Item | Total Sales |
|------------------------|--------|------|-------------|
| Office Furnishings     | 1,200  |      |             |
| Storage & Organization | 11,816 |      |             |
| Tables                 | 15,890 |      |             |
| Bookcases              | 35,836 |      |             |
| Chairs & Chairmats     | 35,934 |      |             |
| Office Machines        | 40,304 |      |             |
| Office Furnishings     | 120    |      |             |
| Paper                  | 221    |      |             |

3. Turn on DEVELOPER Ribbon.
4. Create 3 Option Button as below:



☒ REGULAR AIR  
☐ EXPRESS AIR  
☐ DELIVERY TRUCK

5. Right-click one of the OPTION BUTTONS → FORMAT CONTROL → CELL LINK: \$G\$3



Format Control

Colors and Lines   Size   Protection   Properties

Value

☐ Unchecked  
☒ Checked  
☐ Mixed

Cell link: \$G\$3

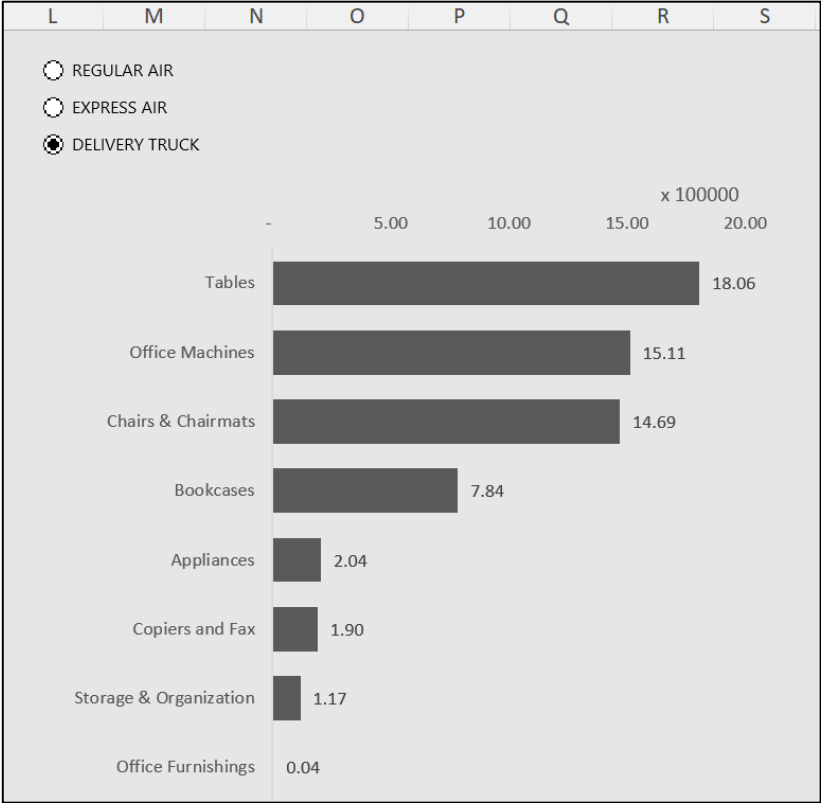
6. Set the following formula:

| Cell | Formula / Action                                                                                      |
|------|-------------------------------------------------------------------------------------------------------|
| F5   | =UNIQUE(FILTER(C5:C1399,B5:B1399=SWITCH(G3,1,"Regular Air",2,"Express Air",3,"Delivery Truck")))      |
| G5   | =SUMIFS(D5:D1399,C5:C1399,F5#,B5:B1399,SWITCH(G3,1,"Regular Air",2,"Express Air",3,"Delivery Truck")) |
| I4   | =SORT(FILTER(F:G,F<>"",""),2,1)                                                                       |

7. Highlight I4:J12 (Current data set).
8. Go to INSERT menu → CLUSTERED BAR.
9. Right-click Y-AXIS → FORMAT AXIS → Check CATEGORIES IN

REVERSE ORDER ☒ Categories in reverse order

10. Select SHIP MODE and the following chart will be updated:



## MORE ABOUT FILTER FUNCTION

### Boolean Logic is Important When Using FILTER

- TRUE in Excel takes many forms.
- It can be 1 or any non-zero number. It can be POSITIVE or NEGATIVE number.
- FALSE in Excel is a 0 or empty cell.
- Do not put a quotation mark on Boolean e.g. "TRUE", "FALSE"
- Text form is not TRUE or FALSE.
- Math Operations on TRUE FALSE Values:  
(Use IF to test the logic, eg. Type a value in cell A1, then type the following formula in cell A2: =IF(A1, "T", "F")

| Operator           | Formula / Action                                                                                                                                                                                                                                    |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Multiplication (*) | TRUE * TRUE = 1<br>TRUE * FALSE = 0<br>FALSE * FALSE = 0<br>TRUE * 1 = 1<br>FALSE * 1 = 0<br>TRUE * 123 = 123<br>FALSE * 123 = 0<br>TRUE * <blank cell> = 0<br>FALSE * <blank cell> = 0<br>TRUE * <text> = #VALUE!<br>FALSE * <text> = #VALUE!      |
| Addition (+)       | TRUE + TRUE = 2<br>TRUE + FALSE = 1<br>FALSE + FALSE = 0<br>TRUE + 1 = 2<br>FALSE + 1 = 1<br>TRUE + 123 = 124<br>FALSE + 123 = 123<br>TRUE + <blank cell> = 1<br>FALSE + <blank cell> = 0<br>TRUE + <text> = #VALUE!<br>FALSE + <text> = #VALUE!    |
| Subtraction (-)    | TRUE - TRUE = 0<br>TRUE - FALSE = 1<br>FALSE - FALSE = 0<br>TRUE - 1 = 0<br>FALSE - 1 = -1<br>TRUE - 123 = -122<br>FALSE - 123 = -123<br>TRUE - <blank cell> = 1<br>FALSE - <blank cell> = 0<br>TRUE - <text> = #VALUE!<br>FALSE - <text> = #VALUE! |



## Exclude Blank, Zero-Value Cells or Text

1. Open file: DYNAMIC\_ARRAYS\_WITH\_FILTER
2. Go to sheet: EXCLUDE BLANK OR ZERO

|    | A                              | B                  | C           | D            |
|----|--------------------------------|--------------------|-------------|--------------|
| 1  | <b>Exclude Blank or Zero</b>   |                    |             |              |
| 2  |                                |                    |             |              |
| 3  |                                |                    |             |              |
| 4  |                                |                    |             |              |
| 5  | <b>Item</b>                    | <b>Total Sales</b> | <b>Item</b> | <b>Total</b> |
| 6  | Appliances                     | 703,192            |             |              |
| 7  | Binders and Binder Accessories | 0                  |             |              |
| 8  | Bookcases                      | 783,910            |             |              |
| 9  | Chairs & Chairmats             | 1,674,053          |             |              |
| 10 | Computer Peripherals           | 743,948            |             |              |
| 11 | Copiers and Fax                | 1,034,149          |             |              |
| 12 | Envelopes                      | 156,227            |             |              |
| 13 | Labels                         | 0                  |             |              |
| 14 | Office Furnishings             | 664,158            |             |              |
| 15 | Office Machines                | 2,135,147          |             |              |
| 16 | Paper                          | 425,850            |             |              |

3. Set the following formula:

| Cell | Formula / Action                                                                                                                                                                                                               |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| D6   | =FILTER(A6:B22,B6:B22<>0) <ul style="list-style-type: none"> <li>• Highlight B6:B22 and press F9 Key to view the data in the array</li> <li>• Highlight B6:B22&lt;&gt;0 and press F9 Key to view the returned logic</li> </ul> |
| G6   | =FILTER(A6:B22,B6:B22)                                                                                                                                                                                                         |
| B7   | Type a word: PENDING                                                                                                                                                                                                           |

4. You will notice that the second FILTER is not working as TEXT is not taken as TRUE or FALSE by Excel.

## Applying AND Logic

1. Open file: DYNAMIC\_ARRAYS\_WITH\_FILTER
2. Go to sheet: AND LOGIC

|    | A                         | B                      | C                | D               | E                  |
|----|---------------------------|------------------------|------------------|-----------------|--------------------|
| 1  | <b>Applying AND Logic</b> |                        |                  |                 |                    |
| 2  |                           |                        |                  |                 |                    |
| 3  |                           |                        |                  |                 |                    |
| 4  |                           |                        |                  |                 |                    |
| 5  | <b>ID</b>                 | <b>Item</b>            | <b>Warehouse</b> | <b>Supplier</b> | <b>Total Sales</b> |
| 6  | ID01                      | Computer Peripherals   | East             | Coo             | 743,948            |
| 7  | ID02                      | Paper                  | West             | Wmart           | 425,850            |
| 8  | ID03                      | Copiers and Fax        | East             | Coo             | 1,034,149          |
| 9  | ID04                      | Pens & Art Supplies    | West             | Coo             | 0                  |
| 10 | ID05                      | Storage & Organization | Central          | Wmart           | 1,019,270          |
| 11 | ID06                      | Chairs & Chairmats     | East             | Wmart           | 1,674,053          |
| 12 | ID07                      | Envelopes              | Central          | Wmart           | 156,227            |
| 13 | ID08                      | Office Machines        | Central          | Coo             | 2,135,147          |

3. Set the following formula:

| Cell | Formula / Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |           |          |             |   |   |  |  |  |  |  |  |  |           |      |  |  |  |  |          |     |  |  |  |  |  |  |  |  |  |  |    |      |           |          |             |  |  |  |  |  |  |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|----------|-------------|---|---|--|--|--|--|--|--|--|-----------|------|--|--|--|--|----------|-----|--|--|--|--|--|--|--|--|--|--|----|------|-----------|----------|-------------|--|--|--|--|--|--|
| G6   | Filter for Warehouse(West), Sales>0<br><br>=FILTER(A6:E22,(C6:C22="west")*(ISNUMBER(E6:E22)*(E6:E22>0)))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |           |          |             |   |   |  |  |  |  |  |  |  |           |      |  |  |  |  |          |     |  |  |  |  |  |  |  |  |  |  |    |      |           |          |             |  |  |  |  |  |  |
| M6   | Filter data based on the value in cell N2 & N3<br><table border="1"><thead><tr><th>L</th><th>M</th><th>N</th><th>O</th><th>P</th><th>Q</th></tr></thead><tbody><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>Warehouse</td><td>east</td><td></td><td></td><td></td></tr><tr><td></td><td>Supplier</td><td>Coo</td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>ID</td><td>Item</td><td>Warehouse</td><td>Supplier</td><td>Total Sales</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></tbody></table><br><br>=FILTER(A6:E22,(C6:C22=N2)*(D6:D22=N3)*(ISNUMBER(E6:E22)*(E6:E22>0)),"No Data") | L    | M         | N        | O           | P | Q |  |  |  |  |  |  |  | Warehouse | east |  |  |  |  | Supplier | Coo |  |  |  |  |  |  |  |  |  |  | ID | Item | Warehouse | Supplier | Total Sales |  |  |  |  |  |  |
| L    | M                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | N    | O         | P        | Q           |   |   |  |  |  |  |  |  |  |           |      |  |  |  |  |          |     |  |  |  |  |  |  |  |  |  |  |    |      |           |          |             |  |  |  |  |  |  |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |           |          |             |   |   |  |  |  |  |  |  |  |           |      |  |  |  |  |          |     |  |  |  |  |  |  |  |  |  |  |    |      |           |          |             |  |  |  |  |  |  |
|      | Warehouse                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | east |           |          |             |   |   |  |  |  |  |  |  |  |           |      |  |  |  |  |          |     |  |  |  |  |  |  |  |  |  |  |    |      |           |          |             |  |  |  |  |  |  |
|      | Supplier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Coo  |           |          |             |   |   |  |  |  |  |  |  |  |           |      |  |  |  |  |          |     |  |  |  |  |  |  |  |  |  |  |    |      |           |          |             |  |  |  |  |  |  |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |           |          |             |   |   |  |  |  |  |  |  |  |           |      |  |  |  |  |          |     |  |  |  |  |  |  |  |  |  |  |    |      |           |          |             |  |  |  |  |  |  |
|      | ID                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Item | Warehouse | Supplier | Total Sales |   |   |  |  |  |  |  |  |  |           |      |  |  |  |  |          |     |  |  |  |  |  |  |  |  |  |  |    |      |           |          |             |  |  |  |  |  |  |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |           |          |             |   |   |  |  |  |  |  |  |  |           |      |  |  |  |  |          |     |  |  |  |  |  |  |  |  |  |  |    |      |           |          |             |  |  |  |  |  |  |
| S6   | Assume ALL if no value in N2 or N3<br><br>=FILTER(A6:E22,(IF(T2="",1,C6:C22=T2))*(IF(T3="",1,D6:D22=T3))*(ISNUMBER(E6:E22)*(E6:E22>0)),"No Data")                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |           |          |             |   |   |  |  |  |  |  |  |  |           |      |  |  |  |  |          |     |  |  |  |  |  |  |  |  |  |  |    |      |           |          |             |  |  |  |  |  |  |

## Applying OR Logic

1. Open file: DYNAMIC\_ARRAYS\_WITH\_FILTER
2. Make a copy of Sheet AND LOGIC and name it as OR Logic
3. Relace all (\*) with (+)

## Using Subtraction

1. Open file: DYNAMIC\_ARRAYS\_WITH\_FILTER
2. Go to sheet: USING SUBTRACTION
3. Set the following formula:

| Cell | Formula / Action                                            |
|------|-------------------------------------------------------------|
| G6   | =FILTER(A6:E22,(C6:C22<>"west")-(D6:D22="wmart"),"No Data") |

Try to understand and interpret the output.

## WORKING WITH DATA VALIDATION

### Searchable Drop-Down

4. Open file: DYNAMIC\_ARRAYS\_WITH\_DATA\_VALIDATION
5. Go to sheet: SEARCHABLE DROP-DOWN

|    | A                                                                   | B | C                     | D |
|----|---------------------------------------------------------------------|---|-----------------------|---|
| 1  | <b>Searchable Drop Down</b>                                         |   |                       |   |
| 2  | However, it only can search the word that started with search text. |   |                       |   |
| 3  |                                                                     |   |                       |   |
| 4  | <b>Item</b>                                                         |   |                       |   |
| 5  | Appliances                                                          |   | <b>Item Drop Down</b> |   |
| 6  | Binders and Binder Accessories                                      |   |                       |   |
| 7  | Bookcases                                                           |   |                       |   |
| 8  | Chairs & Chairmats                                                  |   |                       |   |
| 9  | Computer Peripherals                                                |   |                       |   |
| 10 | Copiers and Fax                                                     |   |                       |   |
| 11 | Envelopes                                                           |   |                       |   |

6. In cell D5, set the data validation for Item.

Data Validation

Settings Input Message Error Alert

Validation criteria

Allow: List

Data: between

Source: =\$A\$5:\$A\$21

☒ Ignore blank

☒ In-cell dropdown

☐ Apply these changes to all other cells with the same settings

Clear All OK Cancel

Note: It only filters for any word that starting with the text you type in the cell.

## Using TABLE in Data Validation

1. Open file: DYNAMIC\_ARRAYS\_WITH\_DATA\_VALIDATION
2. Go to sheet: CELL REFERENCING

| Handling Drop-Down List using TABLE |                                |                |  |                                |                |
|-------------------------------------|--------------------------------|----------------|--|--------------------------------|----------------|
| 1                                   |                                |                |  |                                |                |
| 2                                   |                                |                |  |                                |                |
| 3                                   | (Convert to Table)             |                |  | (Named Table)                  |                |
| 4                                   | Item                           |                |  | Item                           |                |
| 5                                   | Appliances                     | Item Drop Down |  | Appliances                     | Item Drop Down |
| 6                                   | Binders and Binder Accessories |                |  | Binders and Binder Accessories |                |
| 7                                   | Bookcases                      |                |  | Bookcases                      |                |
| 8                                   | Chairs & Chairmats             |                |  | Chairs & Chairmats             |                |
| 9                                   | Computer Peripherals           |                |  | Computer Peripherals           |                |
| 10                                  | Copiers and Fax                |                |  | Copiers and Fax                |                |
| 11                                  | Envelopes                      |                |  | Envelopes                      |                |
| 12                                  | Labels                         |                |  | Labels                         |                |
| 13                                  | Office Furnishings             |                |  | Office Furnishings             |                |
| 14                                  | Office Machines                |                |  | Office Machines                |                |
| 15                                  | Paper                          |                |  | Paper                          |                |
| 16                                  | Pens & Art Supplies            |                |  | Pens & Art Supplies            |                |
| 17                                  | Rubber Bands                   |                |  | Rubber Bands                   |                |
| 18                                  | Scissors, Rulers and Trimmers  |                |  | Scissors, Rulers and Trimmers  |                |
| 19                                  | Storage & Organization         |                |  | Storage & Organization         |                |
| 20                                  | Tables                         |                |  | Tables                         |                |
| 21                                  | Telephones and Communication   |                |  | Telephones and Communication   |                |

3. Highlight cell A4:A21 and press CTRL + T, named it as TABLE1
4. Set Data Validation in cell D5,  
SOURCE → =INDIRECT("Table1[#Data]")

Data Validation

Settings Input Message Error Alert

Validation criteria

Allow: List

Data: between

Source: =INDIRECT("Table1[#Data]")

☐ Ignore blank

☒ In-cell dropdown

☐ Apply these changes to all other cells with the same settings

Clear All OK Cancel

5. Highlight cell F4:F21 and press CTRL + T, named it as TABLE2
6. Go to FORMULAS menu → NAME MANAGER → NEW button → Set the following name:

Edit Name

Name: TableItem

Scope: Workbook

Comment:

Refers to: =Table2[#Data]

OK Cancel

7. Click OK button.
8. Set Data Validation in cell D5,  
SOURCE → =TABLEITEM

## Example 1: Dependent Drop Down List in Data Validation

1. Open file: DYNAMIC\_ARRAYS\_WITH\_DATA VALIDATION
2. Go to sheet: DEPENDENT DROP DOWN (1)

|    | A                                               | B               | C | D                      |
|----|-------------------------------------------------|-----------------|---|------------------------|
| 1  | <b>Creating Simple Dependent Drop-Down List</b> |                 |   |                        |
| 2  |                                                 |                 |   |                        |
| 3  |                                                 |                 |   |                        |
| 4  | <b>Item</b>                                     | <b>Supplier</b> |   | <b>Select Supplier</b> |
| 5  | Computer Peripherals                            | Coo             |   |                        |
| 6  | Paper                                           | Wmart           |   |                        |
| 7  | Copiers and Fax                                 | Coo             |   |                        |
| 8  | Pens & Art Supplies                             | Coo             |   | <b>Item</b>            |
| 9  | Storage & Organization                          | Wmart           |   |                        |
| 10 | Chairs & Chairmats                              | Wmart           |   |                        |
| 11 | Envelopes                                       | Wmart           |   |                        |
| 12 | Office Machines                                 | Coo             |   |                        |
| 13 | Telephones and Communication                    | Coo             |   |                        |
| 14 | Office Furnishings                              | Pop             |   |                        |
| 15 | Binders and Binder Accessories                  | Pop             |   |                        |
| 16 | Labels                                          | Wmart           |   |                        |
| 17 | Scissors, Rulers and Trimmers                   | Wmart           |   |                        |
| 18 | Appliances                                      | Pop             |   |                        |
| 19 | Tables                                          | Pop             |   |                        |
| 20 | Rubber Bands                                    | Coo             |   |                        |
| 21 | Bookcases                                       | Wmart           |   |                        |

3. In cell D5, set the data validation for Supplier.
4. Set the following formula:

| Cell | Formula / Action          |
|------|---------------------------|
| D9   | =FILTER(A5:A21,B5:B21=D5) |

## Example 2: Dependent Drop Down List in Data Validation

1. Open file: DYNAMIC\_ARRAYS\_WITH\_DATA VALIDATION
2. Go to sheet: DEPENDENT DROP DOWN (2)

|    | A                                                      | B               | C           | D                | E          | F                             | G                             | H                              | I               |
|----|--------------------------------------------------------|-----------------|-------------|------------------|------------|-------------------------------|-------------------------------|--------------------------------|-----------------|
| 1  | <b>Creating Dependant Drop-Down List using XLOOKUP</b> |                 |             |                  |            |                               |                               |                                |                 |
| 2  |                                                        |                 |             |                  |            |                               |                               |                                |                 |
| 3  |                                                        |                 |             |                  |            |                               |                               |                                |                 |
| 4  | <b>Date</b>                                            | <b>Supplier</b> | <b>Item</b> | <b>Ship Mode</b> | <b>Qty</b> |                               |                               |                                |                 |
| 5  |                                                        |                 |             |                  |            | Coo                           | Wmart                         | Pop                            |                 |
| 6  |                                                        |                 |             |                  |            | Computer Peripherals          | Paper                         | Office Furnishings             |                 |
| 7  |                                                        |                 |             |                  |            | Copiers and Fax               | Storage & Organization        | Binders and Binder Accessories |                 |
| 8  |                                                        |                 |             |                  |            | Pens & Art Supplies           | Chairs & Chairmats            | Appliances                     |                 |
| 9  |                                                        |                 |             |                  |            | Office Machines               | Envelopes                     | Tables                         |                 |
| 10 |                                                        |                 |             |                  |            | Telephones and Communication  | Labels                        |                                |                 |
| 11 |                                                        |                 |             |                  |            | Rubber Bands                  | Scissors, Rulers and Trimmers |                                |                 |
| 12 |                                                        |                 |             |                  |            | Bookcases                     |                               |                                |                 |
| 13 |                                                        |                 |             |                  |            |                               |                               |                                |                 |
| 14 |                                                        |                 |             |                  |            | <b>Item</b>                   | <b>Option 1</b>               | <b>Option 2</b>                | <b>Option 3</b> |
| 15 |                                                        |                 |             |                  |            | Computer Peripherals          | Delivery Truck                | Express Air                    | Regular Air     |
| 16 |                                                        |                 |             |                  |            | Copiers and Fax               | Delivery Truck                | Express Air                    |                 |
| 17 |                                                        |                 |             |                  |            | Pens & Art Supplies           | Regular Air                   |                                |                 |
| 18 |                                                        |                 |             |                  |            | Office Machines               | Delivery Truck                | Express Air                    |                 |
| 19 |                                                        |                 |             |                  |            | Telephones and Communication  | Delivery Truck                | Express Air                    | Regular Air     |
| 20 |                                                        |                 |             |                  |            | Rubber Bands                  | Delivery Truck                | Express Air                    | Regular Air     |
| 21 |                                                        |                 |             |                  |            | Paper                         | Express Air                   |                                |                 |
| 22 |                                                        |                 |             |                  |            | Storage & Organization        | Delivery Truck                | Regular Air                    |                 |
| 23 |                                                        |                 |             |                  |            | Chairs & Chairmats            | Express Air                   | Regular Air                    |                 |
| 24 |                                                        |                 |             |                  |            | Envelopes                     | Delivery Truck                | Express Air                    |                 |
| 25 |                                                        |                 |             |                  |            | Labels                        | Delivery Truck                | Regular Air                    |                 |
| 26 |                                                        |                 |             |                  |            | Scissors, Rulers and Trimmers | Self Collect                  | Delivery Truck                 | Express Air     |
| 27 |                                                        |                 |             |                  |            | Bookcases                     | Self Collect                  |                                |                 |

3. Highlight SUPPLIER column and set data validation.
4. Set the following formula:

| Cell   | Formula / Action                             |
|--------|----------------------------------------------|
| C5:C15 | =XLOOKUP(B5,\$G\$4:\$I\$4,\$G\$5:\$I\$12)    |
| D5:D15 | =XLOOKUP(C5,\$G\$15:\$G\$31,\$H\$15:\$J\$32) |

# TRANSPOSE & FREQUENCY FUNCTION

## Intro

- Both are great for report creation and data analysis.
- You need to use CTRL + SHIFT + ENTER in Legacy Excel, now is much easier in Dynamic Array.

## Using Transpose Function

- Open file: DYNAMIC\_ARRAYS\_WITH\_TRANSPOSE & FREQUENCY
- Go to sheet: TRANSPOSE
- Convert dataset A24:B41 to TABLE format, named it as TABLE1

|    | A                               | B                       | C | D                               | E | F |
|----|---------------------------------|-------------------------|---|---------------------------------|---|---|
| 1  | <b>Using TRANSPOSE Function</b> |                         |   |                                 |   |   |
| 2  |                                 |                         |   |                                 |   |   |
| 3  |                                 |                         |   |                                 |   |   |
| 4  | <b>Item</b>                     | <b>Price Change (%)</b> |   | <b>Transpose Here</b>           |   |   |
| 5  | Appliances                      | 7%                      |   |                                 |   |   |
| 6  | Binders and Binder Accessories  | 37%                     |   |                                 |   |   |
| 7  | Bookcases                       | 40%                     |   |                                 |   |   |
| 8  | Chairs & Chairmats              | 34%                     |   |                                 |   |   |
| 9  | Computer Peripherals            | 8%                      |   |                                 |   |   |
| 10 | Copiers and Fax                 | 9%                      |   |                                 |   |   |
| 11 | Envelopes                       | 25%                     |   |                                 |   |   |
| 12 | Labels                          | 25%                     |   |                                 |   |   |
| 13 | Office Furnishings              | 27%                     |   |                                 |   |   |
| 14 | Office Machines                 | 18%                     |   |                                 |   |   |
| 15 | Paper                           | 36%                     |   |                                 |   |   |
| 16 | Pens & Art Supplies             | 6%                      |   |                                 |   |   |
| 17 | Rubber Bands                    | 31%                     |   |                                 |   |   |
| 18 | Scissors, Rulers and Trimmers   | 24%                     |   |                                 |   |   |
| 19 | Storage & Organization          | 41%                     |   |                                 |   |   |
| 20 | Tables                          | 32%                     |   |                                 |   |   |
| 21 | Telephones and Communication    | 36%                     |   |                                 |   |   |
| 22 |                                 |                         |   |                                 |   |   |
| 23 |                                 |                         |   |                                 |   |   |
| 24 | <b>Item</b>                     | <b>Price Change (%)</b> |   | <b>Transpose the Table Here</b> |   |   |
| 25 | Appliances                      | 7%                      |   |                                 |   |   |
| 26 | Binders and Binder Accessories  | 37%                     |   |                                 |   |   |
| 27 | Bookcases                       | 40%                     |   |                                 |   |   |
| 28 | Chairs & Chairmats              | 34%                     |   |                                 |   |   |

- Set the following formulas:

| Cell | Formula / Action         |
|------|--------------------------|
| D5   | =TRANSPOSE(A4:B21)       |
| D25  | =TRANSPOSE(TABLE1[#All]) |

## Using Frequency Function

- Go to Sheet: Frequency

|    |                                 |                         |  |                                               |            |  |
|----|---------------------------------|-------------------------|--|-----------------------------------------------|------------|--|
| 1  | <b>Using FREQUENCY Function</b> |                         |  |                                               |            |  |
| 2  |                                 |                         |  |                                               |            |  |
| 3  |                                 |                         |  |                                               |            |  |
| 4  | <b>Item</b>                     | <b>Price Change (%)</b> |  | <b>Distribution frequency of Price Change</b> |            |  |
| 5  | Appliances                      | 7%                      |  |                                               |            |  |
| 6  | Binders and Binder Accessories  | 37%                     |  | <b>up to</b>                                  | <b>10%</b> |  |
| 7  | Bookcases                       | 40%                     |  |                                               | <b>20%</b> |  |
| 8  | Chairs & Chairmats              | 34%                     |  |                                               | <b>30%</b> |  |
| 9  | Computer Peripherals            | 8%                      |  |                                               | <b>40%</b> |  |
| 10 | Copiers and Fax                 | 10%                     |  | <b>&gt; 40%</b>                               |            |  |
| 11 | Envelopes                       | 25%                     |  |                                               |            |  |

- Set the following formulas:

| Cell | Formula / Action         |
|------|--------------------------|
| F6   | =FREQUENCY(B5:B21,E6:E9) |

## ARRAY SYNTAX

### Array Constants & Array Syntax

Rules for inputting array constants in new Dynamic Array Excel:

- Wrap array constants in curly brackets { }
- For Legacy Excel, select enough number of cells, type the item in { } and press CTRL + SHIFT + ENTER
- Comma (,) represents column split  
Eg.     ={1,2,3}  
          ={"Coffee","Tea","Milk"}
- Semicolon (;) represents row split  
Eg.     ={1;2;3}  
          ={"Coffee";"Tea";"Milk"}
- Using Comma & Semicolon  
Eg.     ={1,"Coffee";2,"Tea";3,"Milk"}

### Debugging Formula Trick

Why Debug?

- Understand why formula return wrong values
- Write complex formulas and view results one step at a time

Debugging Formula Trick

- Press F9 key on parts of the formula in the formula bar.
- Make sure correctly include brackets before pressing F9 Key.
- Highlight and press CTRL + C if you want to copy the result.
- After pressing CTRL + C, press ESC or CTRL + Z before leaving the formula.

### Array Syntax for Different Regional Settings

The following notes apply to those who use Excel with regional settings that are different to the US. For example, European regional settings.

| Description       | US Version     | Europea Version |
|-------------------|----------------|-----------------|
| Decimal Separator | . (dot)        | , (Comma)       |
| Column Separator  | , (Comma)      | \ (Backslash)   |
| Row Separator     | ; (Semi-colon) | ; (Semi-colon)  |

## Named Array Constant

1. Open a blank worksheet.
2. Type the following array in cell A1:

```
={"Planning";"Manufacturing";"Quality Control";"Material  
Management"}
```

Press ENTER key and the result will appear as below:

|   | A                   |
|---|---------------------|
| 1 | Planning            |
| 2 | Manufacturing       |
| 3 | Quality Control     |
| 4 | Material Management |

3. Copy the formula.
4. Go to FORMULAS menu → DEFINE NAME button
5. Paste the formula and name it as PRODUCTION → OK button.

The 'New Name' dialog box is shown with the following details:

- Name:** Production
- Scope:** Workbook
- Refers to:** ={"Planning";"Manufacturing";"Quality Control";"Material Management"}

6. Select a cell and type:

```
=PRODUCTION
```

```
=TRANSPOSE(PRODUCTION)
```

```
=ARRAYTOTEXT(PRODUCTION,1)
```

```
=ARRAYTOTEXT(PRODUCTION,0)
```

7. To retrieve single value (Eg. MANUFACTURING) from the array, type:

```
=INDEX(PRODUCTION,2)
```



### Example 1: Add More Values for "NOT FOUND"

1. Open file: DYNAMIC\_ARRAYS\_WITH\_ARRAY CONSTANT
2. Go to sheet: FOR NOT FOUND

|    | A                            | B        | C           | D    | E           | F           | G |
|----|------------------------------|----------|-------------|------|-------------|-------------|---|
| 1  | Array Constant for NOT FOUND |          |             |      |             |             |   |
| 2  |                              |          |             |      | Sales above |             |   |
| 3  |                              |          |             |      | 100,000     |             |   |
| 4  |                              |          |             |      |             |             |   |
| 5  | Item                         | Supplier | Total Sales | Item | Supplier    | Total Sales |   |
| 6  | Computer Peripherals         | Coo      | 743,948     |      |             |             |   |
| 7  | Paper                        | Wmart    | 425,850     |      |             |             |   |
| 8  | Copiers and Fax              | Coo      | 1,034,149   |      |             |             |   |
| 9  | Pens & Art Supplies          | Coo      | 158,651     |      |             |             |   |
| 10 | Storage & Organization       | Wmart    | 1,019,270   |      |             |             |   |
| 11 | Chairs & Chairmats           | Wmart    | 1,674,053   |      |             |             |   |
| 12 | Envelopes                    | Wmart    | 156,227     |      |             |             |   |
| 13 | Office Machines              | Coo      | 2,135,147   |      |             |             |   |
| 14 | Telephones and Communication | Coo      | 2,098,187   |      |             |             |   |
| 15 | Office Furnishings           | Coo      | 664,158     |      |             |             |   |

3. Highlight cell A5:C22 and press CTRL + T, named it is TABLE1.
4. Set the following formula:

| Cell        | Formula / Action                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |   |   |  |  |  |             |  |  |           |  |  |  |  |  |      |          |             |         |             |          |  |  |  |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---|---|--|--|--|-------------|--|--|-----------|--|--|--|--|--|------|----------|-------------|---------|-------------|----------|--|--|--|
| E6          | =FILTER(Table1,Table1[Total Sales]>=E3,"No Data")                                                                                                                                                                                                                                                                                                                                                                                                                           |             |   |   |  |  |  |             |  |  |           |  |  |  |  |  |      |          |             |         |             |          |  |  |  |
| E3          | Type: 3,000,000<br><br>You will only see NO DATA appears in E6.                                                                                                                                                                                                                                                                                                                                                                                                             |             |   |   |  |  |  |             |  |  |           |  |  |  |  |  |      |          |             |         |             |          |  |  |  |
| E6          | =FILTER(Table1,Table1[Total Sales]>=E3,{"No Item","No Supplier","No Sales"})<br><br><table><tr><th>E</th><th>F</th><th>G</th></tr><tr><td></td><td></td><td></td></tr><tr><td>Sales above</td><td></td><td></td></tr><tr><td>3,000,000</td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td>Item</td><td>Supplier</td><td>Total Sales</td></tr><tr><td>No Item</td><td>No Supplier</td><td>No Sales</td></tr><tr><td></td><td></td><td></td></tr></table> | E           | F | G |  |  |  | Sales above |  |  | 3,000,000 |  |  |  |  |  | Item | Supplier | Total Sales | No Item | No Supplier | No Sales |  |  |  |
| E           | F                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | G           |   |   |  |  |  |             |  |  |           |  |  |  |  |  |      |          |             |         |             |          |  |  |  |
|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |   |   |  |  |  |             |  |  |           |  |  |  |  |  |      |          |             |         |             |          |  |  |  |
| Sales above |                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |   |   |  |  |  |             |  |  |           |  |  |  |  |  |      |          |             |         |             |          |  |  |  |
| 3,000,000   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |   |   |  |  |  |             |  |  |           |  |  |  |  |  |      |          |             |         |             |          |  |  |  |
|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |   |   |  |  |  |             |  |  |           |  |  |  |  |  |      |          |             |         |             |          |  |  |  |
| Item        | Supplier                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Total Sales |   |   |  |  |  |             |  |  |           |  |  |  |  |  |      |          |             |         |             |          |  |  |  |
| No Item     | No Supplier                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | No Sales    |   |   |  |  |  |             |  |  |           |  |  |  |  |  |      |          |             |         |             |          |  |  |  |
|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |   |   |  |  |  |             |  |  |           |  |  |  |  |  |      |          |             |         |             |          |  |  |  |

### Example 2: Find TOP & BOTTOM Values

1. Open file: DYNAMIC\_ARRAYS\_WITH\_ARRAY CONSTANT
2. Go to sheet: TOP BOTTOM VALUE

|    | A                                     | B        | C           | D            | E | F             | G | H |
|----|---------------------------------------|----------|-------------|--------------|---|---------------|---|---|
| 1  | Array Constant for TOP & BOTTOM Value |          |             |              |   |               |   |   |
| 2  |                                       |          |             |              |   | Total Sales   |   |   |
| 3  |                                       |          |             |              |   | Average Sales |   |   |
| 4  |                                       |          |             |              |   |               |   |   |
| 5  | Item                                  | Supplier | Total Sales | Top 3 Values |   | Top           |   | 3 |
| 6  | Computer Peripherals                  | Coo      | 743,948     |              |   |               |   |   |
| 7  | Paper                                 | Wmart    | 425,850     |              |   |               |   |   |
| 8  | Copiers and Fax                       | Coo      | 1,034,149   |              |   |               |   |   |
| 9  | Pens & Art Supplies                   | Coo      | 158,651     |              |   |               |   |   |
| 10 | Storage & Organization                | Wmart    | 1,019,270   |              |   |               |   |   |
| 11 | Chairs & Chairmats                    | Wmart    | 1,674,053   |              |   |               |   |   |
| 12 | Envelopes                             | Wmart    | 156,227     |              |   |               |   |   |

3. Highlight cell A5:C22 and press CTRL + T, named it is TABLE2.
4. Set the following formula:

| Cell | Formula / Action                         |
|------|------------------------------------------|
| E6   | =LARGE(Table2[Total Sales],{1;2;3})      |
| G6   | =SEQUENCE(H5)                            |
| H6   | =LARGE(Table2[Total Sales],SEQUENCE(H5)) |
| H2   | =SUM(H6#)                                |
| H3   | =AVERAGE(H6#)                            |

### Example 3: Different Sort Order

1. Open file: DYNAMIC\_ARRAYS\_WITH\_ARRAY\_CONSTANT
2. Go to sheet: DIFFERENT SORT ORDER

|    | A                                      | B                              | C        | D           | E       | F         | G         | H         | I           |
|----|----------------------------------------|--------------------------------|----------|-------------|---------|-----------|-----------|-----------|-------------|
| 1  | Array Constant for Different Sort Oder |                                |          |             |         |           |           |           |             |
| 2  |                                        |                                |          |             |         |           |           |           |             |
| 3  |                                        |                                |          |             |         |           |           |           |             |
| 4  |                                        |                                |          |             |         |           |           |           |             |
| 5  | Item ID                                | Item                           | Supplier | Total Sales |         | Ascending | Ascending | Ascending | Descending  |
| 6  | ID01                                   | Computer Peripherals           | Coo      | 743,948     | Item ID | Item      |           | Supplier  | Total Sales |
| 7  | ID02                                   | Paper                          | Wmart    | 425,850     |         |           |           |           |             |
| 8  | ID03                                   | Copiers and Fax                | Coo      | 1,034,149   |         |           |           |           |             |
| 9  | ID04                                   | Pens & Art Supplies            | Coo      | 158,651     |         |           |           |           |             |
| 10 | ID05                                   | Storage & Organization         | Wmart    | 1,019,270   |         |           |           |           |             |
| 11 | ID06                                   | Chairs & Chairmats             | Wmart    | 1,674,053   |         |           |           |           |             |
| 12 | ID07                                   | Envelopes                      | Wmart    | 156,227     |         |           |           |           |             |
| 13 | ID08                                   | Office Machines                | Coo      | 2,135,147   |         |           |           |           |             |
| 14 | ID09                                   | Telephones and Communication   | Coo      | 2,098,187   |         |           |           |           |             |
| 15 | ID10                                   | Office Furnishings             | Pop      | 664,158     |         |           |           |           |             |
| 16 | ID11                                   | Binders and Binder Accessories | Pop      | 978,700     |         |           |           |           |             |

3. Set the following formula:

| Cell | Formula / Action                                                                                                                                                                                                                     |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| F6   | =SORT(A6:D22,{3,4,1})<br><br>Assumption: All in Ascending Orders<br>Sort by SUPPLIER first,<br>then by TOTAL SALES,<br>then by ITEM ID.                                                                                              |
| F6   | =SORT(A6:D22,{3,4,1},{1,-1,1})<br><br>Assumption:<br>Sort by SUPPLIER first in Ascending Order<br>then by TOTAL SALES in Descending Order<br>then by ITEM ID in Ascending Order<br><br>Sort Order (1 is Ascending, -1 is Descending) |

# DYNAMIC REPORTING

## Pivot-Style Report with Dynamic Array

1. Open file: DYNAMIC\_ARRAYS\_WITH\_INTERACTIVE REPORT
2. Go to sheet: PIVOT-STYLE (1)

|    | A                            | B              | C                              | D            | E             |
|----|------------------------------|----------------|--------------------------------|--------------|---------------|
| 1  | <b>Pivot-Style Reporting</b> |                |                                |              |               |
| 2  |                              |                |                                |              |               |
| 3  |                              |                |                                |              |               |
| 4  |                              |                |                                |              |               |
| 5  | <b>Country</b>               | <b>Segment</b> | <b>Category</b>                | <b>Sales</b> | <b>Profit</b> |
| 6  | Penang                       | Consumer       | Appliances                     | 39208        | 11658         |
| 7  | Penang                       | Consumer       | Binders and Binder Accessories | 24144        | 5466          |
| 8  | Penang                       | Consumer       | Bookcases                      | 46027        | 17334         |
| 9  | Penang                       | Consumer       | Chairs & Chairmats             | 36882        | 12109         |
| 10 | Penang                       | Consumer       | Computer Peripherals           | 12662        | 4264          |
| 11 | Penang                       | Consumer       | Copiers and Fax                | 48955        | 13835         |
| 12 | Penang                       | Consumer       | Envelopes                      | 1873         | 432           |
| 13 | Penang                       | Consumer       | Labels                         | 649          | 153           |
| 14 | Penang                       | Consumer       | Office Furnishings             | 15092        | 4729          |

3. Convert the dataset to TABLE by pressing CTRL + T, name it as TABLE1.
4. Set the following formula:

| Cell   | Formula / Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| G4     | Set Data Validation → LIST → Source:<br>=INDIRECT("TABLE1[Country]")                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| G6     | =SORT(UNIQUE(Table1[Category]))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| J5     | =TRANSPOSE(UNIQUE(Table1[Segment]))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| N5     | =J5#                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| R5     | =J5#                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| H6     | =SUMIFS(Table1[Sales],Table1[Category],G6#,Table1[State],G4)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| I6     | =SUMIFS(Table1[Profit],Table1[Category],G6#,Table1[State],G4)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| J6     | =SUMIFS(Table1[Sales],Table1[Category],G6#,Table1[Segment],J5#,Table1[State],G4)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| N6     | =SUMIFS(Table1[Profit],Table1[Category],G6#,Table1[Segment],J5#,Table1[State],G4)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| R6     | =IFERROR(N6#/J6#,"")                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| G6:U66 | Conditional Formatting → Formula <div> <div> Edit Formatting Rule ? X </div> <div> Select a Rule Type: <ul style="list-style-type: none"> <li>Format all cells based on their values</li> <li>Format only cells that contain</li> <li>Format only top or bottom ranked values</li> <li>Format only values that are above or below average</li> <li>Format only unique or duplicate values</li> <li>Use a formula to determine which cells to format</li> </ul> </div> <div> Edit the Rule Description: <div> Format values where this formula is true: =OR(\$H6=LARGE(\$H:\$H,1),\$H6=LARGE(\$H:\$H,2),\$H6=LARGE(\$H:\$H,3)) </div> </div> <div> Preview: <div> AaBbCcYyZz Format... </div> </div> <div> OK Cancel </div> </div> |

R6:U22

Conditional Formatting → Icon Set

5.

Edit Formatting Rule

Select a Rule Type:

Format all cells based on their values

Format only cells that contain

Format only top or bottom ranked values

Format only values that are above or below average

Format only unique or duplicate values

Use a formula to determine which cells to format

Edit the Rule Description:

Format all cells based on their values:

Format Style: Icon Sets

Reverse Icon Order

Icon Style: Custom

Show Icon Only

Display each icon according to these rules:

| Icon                                                                              |                 | Value                                      | Type   |
|-----------------------------------------------------------------------------------|-----------------|--------------------------------------------|--------|
|  | when value is   | <div><div>&gt;=</div><div>0.38</div></div> | Number |
| No Cell Icon                                                                      | when < 0.38 and | <div><div>&gt;=</div><div>0</div></div>    | Number |
| No Cell Icon                                                                      | when < 0        |                                            |        |

OK

Cancel

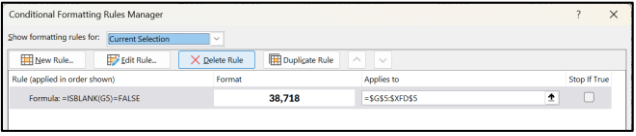
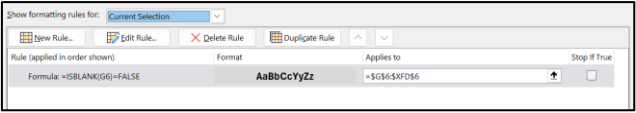
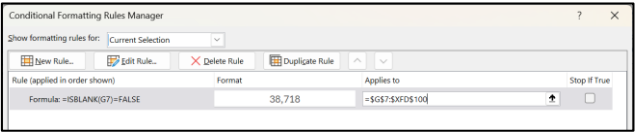
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## Dynamic Row & Column in Pivot-Style Report

1. Open file: DYNAMIC\_ARRAYS\_WITH\_INTERACTIVE REPORT
2. Go to sheet: PIVOT-STYLE (2)

|    | A                                                              | B              | C                              | D            | E             | F | G                  | H              |
|----|----------------------------------------------------------------|----------------|--------------------------------|--------------|---------------|---|--------------------|----------------|
| 1  | <b>Pivot-Style Reporting (with Row &amp; Column Selection)</b> |                |                                |              |               |   | Select Row :       |                |
| 2  |                                                                |                |                                |              |               |   | Select Column :    |                |
| 3  |                                                                |                |                                |              |               |   | Select Value :     |                |
| 4  |                                                                |                |                                |              |               |   |                    |                |
| 5  | <b>Country</b>                                                 | <b>Segment</b> | <b>Category</b>                | <b>Sales</b> | <b>Profit</b> |   | <b>Grand Total</b> |                |
| 6  | Penang                                                         | Consumer       | Appliances                     | 39208        | 11658         |   |                    | 0 <b>Total</b> |
| 7  | Penang                                                         | Consumer       | Binders and Binder Accessories | 24144        | 5466          |   |                    |                |
| 8  | Penang                                                         | Consumer       | Bookcases                      | 46027        | 17334         |   |                    |                |
| 9  | Penang                                                         | Consumer       | Chairs & Chairmats             | 36882        | 12109         |   |                    |                |
| 10 | Penang                                                         | Consumer       | Computer Peripherals           | 12662        | 4264          |   |                    |                |
| 11 | Penang                                                         | Consumer       | Copiers and Fax                | 48955        | 13835         |   |                    |                |
| 12 | Penang                                                         | Consumer       | Envelopes                      | 1873         | 432           |   |                    |                |
| 13 | Penang                                                         | Consumer       | Labels                         | 649          | 153           |   |                    |                |
| 14 | Penang                                                         | Consumer       | Office Furnishings             | 15092        | 4729          |   |                    |                |
| 15 | Penang                                                         | Consumer       | Office Machines                | 153793       | 41302         |   |                    |                |
| 16 | Penang                                                         | Consumer       | Paper                          | 71505        | 4946          |   |                    |                |

3. Convert the dataset to TABLE by pressing CTRL + T, name it as TABLE2.
4. Set the following formula:

| Cell      | Formula / Action                                                                                                                                                               |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| H1:H2     | Data Validation → List → Source: =\$A\$5:\$C\$5                                                                                                                                |
| H3        | Data Validation → List → Source: =\$D\$5:\$E\$5                                                                                                                                |
| I5        | =SUMIFS(SWITCH(H3,"sales",Table2[Sales],"profit",Table2[Profit]),INDEX(Table2,,MATCH(H2,Table2[#Headers],0)),I6#)                                                              |
| I6        | =TRANSPOSE(UNIQUE(INDEX(Table2[Country]:Table2[Category],,MATCH(H2,Table2[#Headers],0))))                                                                                      |
| G7        | =UNIQUE(INDEX(Table2[Country]:Table2[Category],,MATCH(H1,Table2[#Headers],0)))                                                                                                 |
| I7        | =SUMIFS(SWITCH(H3,"sales",Table2[Sales],"profit",Table2[Profit]),INDEX(Table2,,MATCH(H1,Table2[#Headers],0)),G7#,INDEX(Table2,,MATCH(H2,Table2[#Headers],0)),I6#)              |
| H7        | =SUMIFS(SWITCH(H3,"sales",Table2[Sales],"profit",Table2[Profit]),INDEX(Table2,,MATCH(H1,Table2[#Headers],0)),G7#)                                                              |
| H5        | =SUM(I5#)                                                                                                                                                                      |
| G5:XFD5   | Conditional Formatting → Set Formula → Set Bold, Number Format with thousand separator<br> |
| G6:XFD6   | Conditional Formatting → Set Formula → Set Bold, Grey Shading<br>                          |
| G7:XFD100 | Conditional Formatting → Set Formula → Set White Shading, Bottom border line<br>           |

## Quick Calendar Preparation

1. Open file: DYNAMIC\_ARRAYS\_WITH\_INTERACTIVE\_REPORT
2. Go to sheet: CALENDAR

|    | A                                                     | B    | C | D | E | F |
|----|-------------------------------------------------------|------|---|---|---|---|
| 1  | <b>Creating Calendar using SEQUENCE &amp; WEEKDAY</b> |      |   |   |   |   |
| 2  |                                                       |      |   |   |   |   |
| 3  | Select Year                                           | 2025 |   |   |   |   |
| 4  | Select Month                                          | Mar  |   |   |   |   |
| 5  |                                                       |      |   |   |   |   |
| 6  |                                                       |      |   | S | M | T |
| 7  |                                                       |      |   |   |   |   |
| 8  |                                                       |      |   |   |   |   |
| 9  |                                                       |      |   |   |   |   |
| 10 |                                                       |      |   |   |   |   |

3. Set the following formula:

| Cell   | Formula / Action                                                                        |
|--------|-----------------------------------------------------------------------------------------|
| D5     | =DATE(B3,MONTH(DATEVALUE(B4&"1")),1)                                                    |
| D7     | =WEEKDAY(D5)                                                                            |
| D7     | =D5-WEEKDAY(D5)                                                                         |
| D7     | =D5-WEEKDAY(D5)+1                                                                       |
| D7     | =SEQUENCE(6,7,D5-WEEKDAY(D5)+1)                                                         |
| D7     | =IF(MONTH(SEQUENCE(6,7,D5-WEEKDAY(D5)+1))<>MONTH(D5),"",SEQUENCE(6,7,D5-WEEKDAY(D5)+1)) |
| D7:J12 | Press CTRL + 1 to FORMAT CELL → Select CUSTOM in NUMBER Tab → Type: dd                  |
| D5     | Press CTRL + 1 to FORMAT CELL → Select CUSTOM in NUMBER Tab → Type: mmmm yyyy           |

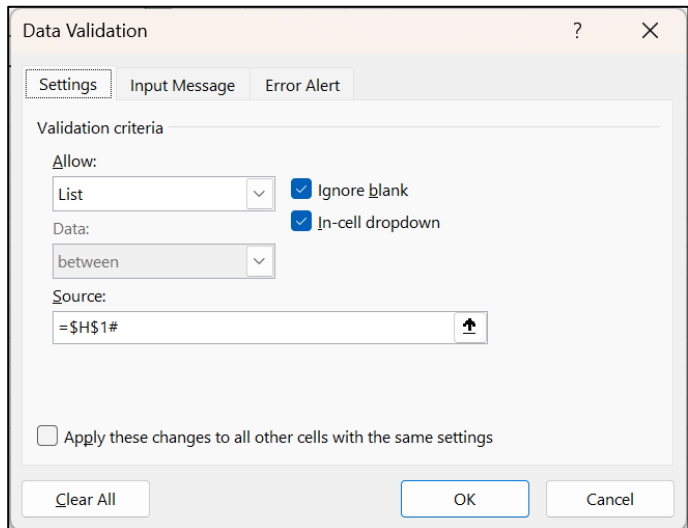
4. Adjust the column width for the calendar.

## Searchable Drop-Down Based on Partial Text

1. Open file: DYNAMIC\_ARRAYS\_WITH\_INTERACTIVE\_REPORT
2. Go to sheet: DATA VALIDATION

|    | A                                                 | B               | C | D           | E |
|----|---------------------------------------------------|-----------------|---|-------------|---|
| 1  | <b>Searchable Drop-Down using Data Validation</b> |                 |   |             |   |
| 2  |                                                   |                 |   |             |   |
| 3  |                                                   |                 |   |             |   |
| 4  |                                                   |                 |   |             |   |
| 5  | <b>Item</b>                                       | <b>Supplier</b> |   | <b>Item</b> |   |
| 6  | Appliances                                        | Pop             |   | Supplier    |   |
| 7  | Binders and Binder Accessories                    | Pop             |   |             |   |
| 8  | Bookcases                                         | Wmart           |   |             |   |
| 9  | Chairs & Chairmats                                | Wmart           |   |             |   |
| 10 | Computer Peripherals                              | Coo             |   |             |   |
| 11 | Copiers and Fax                                   | Coo             |   |             |   |
| 12 | Envelopes                                         | Wmart           |   |             |   |
| 13 | Labels                                            | Wmart           |   |             |   |
| 14 | Office Furnishings                                | Pop             |   |             |   |

3. Set the following formula:

| Cell | Formula / Action                                                                                                                   |
|------|------------------------------------------------------------------------------------------------------------------------------------|
| H1   | =SEARCH(E5,A6:A22)                                                                                                                 |
| H1   | =ISNUMBER(SEARCH(E5,A6:A22))                                                                                                       |
| H1   | =FILTER(A6:A22,ISNUMBER(SEARCH(E5,A6:A22)),"Not Found")                                                                            |
| E5   | Set Data Validation → LIST → Type: =\$H\$1#<br> |

## Multiple Match Results Across Multiple Columns

1. Open file: DYNAMIC\_ARRAYS\_WITH\_INTERACTIVE\_REPORT
2. Go to sheet: DATA IN COLUMN

|    | A                                                    | B            | C | D | E                                           | F | G |
|----|------------------------------------------------------|--------------|---|---|---------------------------------------------|---|---|
| 1  | <b>Finding Multiple Match Results Across Columns</b> |              |   |   |                                             |   |   |
| 2  |                                                      |              |   |   |                                             |   |   |
| 3  |                                                      |              |   |   |                                             |   |   |
| 4  |                                                      |              |   |   |                                             |   |   |
| 5  | <b>Product</b>                                       | <b>Color</b> |   |   | <b>Product / Color (across columns)</b>     |   |   |
| 6  | Pocket Tee                                           | green        |   |   |                                             |   |   |
| 7  | V-neck T-Shirt                                       | pink         |   |   |                                             |   |   |
| 8  | Polo Shirt                                           | red          |   |   |                                             |   |   |
| 9  | Pocket Tee                                           | black        |   |   |                                             |   |   |
| 10 | Crew Neck Shirt                                      | white        |   |   |                                             |   |   |
| 11 | Graphic Tees                                         | brown        |   |   |                                             |   |   |
| 12 | V-neck T-Shirt                                       | black        |   |   |                                             |   |   |
| 13 | Pocket Tee                                           | red          |   |   |                                             |   |   |
| 14 | Baseball Cap                                         | black        |   |   |                                             |   |   |
| 15 | Graphic Tees                                         | green        |   |   |                                             |   |   |
| 16 | Crew Neck Shirt                                      | red          |   |   | <b>Product / Color (join colors with ;)</b> |   |   |
| 17 | Baseball Cap                                         | blue         |   |   |                                             |   |   |

3. Convert the dataset to TABLE and name it as TABLE3
4. Set the following formula:

| Cell | Formula / Action                                                        |
|------|-------------------------------------------------------------------------|
| E6   | =UNIQUE(Table3[Product])                                                |
| F6   | = TRANSPOSE(FILTER(Table3[Color],Table3[Product]=E6))                   |
| E17  | =E6#                                                                    |
| F17  | =TEXTJOIN(";",TRUE,TRANSPOSE(FILTER(Table3[Color],Table3[Product]=E6))) |

## Approximate Match in Filter

1. Open file: DYNAMIC\_ARRAYS\_WITH\_INTERACTIVE\_REPORT
2. Go to sheet: APPROXIMATE MATCH

|    | A                                  | B            | C | D | E                  | F            |
|----|------------------------------------|--------------|---|---|--------------------|--------------|
| 1  | <b>Approximate Match in Filter</b> |              |   |   |                    |              |
| 2  |                                    |              |   |   |                    |              |
| 3  |                                    |              |   |   | Enter Partial Text |              |
| 4  |                                    |              |   |   |                    |              |
| 5  | <b>Product</b>                     | <b>Color</b> |   |   | <b>Product</b>     | <b>Color</b> |
| 6  | Pocket Tee                         | green        |   |   |                    |              |
| 7  | V-neck T-Shirt                     | pink         |   |   |                    |              |
| 8  | Polo Shirt                         | red          |   |   |                    |              |
| 9  | Pocket Tee                         | black        |   |   |                    |              |
| 10 | Crew Neck Shirt                    | white        |   |   |                    |              |
| 11 | Graphic Tees                       | brown        |   |   |                    |              |
| 12 | V-neck T-Shirt                     | black        |   |   |                    |              |

3. Convert the dataset to TABLE and name it as TABLE4
4. Set the following formula:

| Cell | Formula / Action                                                                                                                                                        |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E6   | =FILTER(Table4,Table4[Product]="*&F3&")                                                                                                                                 |
| E6   | #N/A Error is not numeric value. Therefore you can use ISNUMBER to check the validity of the data searched:<br><br>=FILTER(Table4,ISNUMBER(SEARCH(F3,Table4[Product]))) |



## Find TOP/BOTTOM N in Filter

1. Open file: DYNAMIC\_ARRAYS\_WITH\_INTERACTIVE\_REPORT
2. Go to sheet: TOP AND BOTTOM N

|    | A                                  | B                              | C     | D | E | F                  | G        | H     |
|----|------------------------------------|--------------------------------|-------|---|---|--------------------|----------|-------|
| 1  | Find Top N / Bottom N using FILTER |                                |       |   |   |                    |          |       |
| 2  |                                    |                                |       |   |   |                    |          |       |
| 3  |                                    |                                |       |   |   | Top/Bottom N Value | 5        |       |
| 4  |                                    |                                |       |   |   |                    |          |       |
| 5  | Segment                            | Category                       | Sales |   |   | Segment            | Category | Sales |
| 6  | Consumer                           | Appliances                     | 39208 |   |   |                    |          |       |
| 7  | Consumer                           | Binders and Binder Accessories | 24144 |   |   |                    |          |       |
| 8  | Consumer                           | Bookcases                      | 46027 |   |   |                    |          |       |
| 9  | Consumer                           | Chairs & Chairmats             | 36882 |   |   |                    |          |       |
| 10 | Consumer                           | Computer Peripherals           | 12662 |   |   |                    |          |       |
| 11 | Consumer                           | Copiers and Fax                | 48955 |   |   |                    |          |       |
| 12 | Consumer                           | Envelopes                      | 1873  |   |   |                    |          |       |
| 13 | Consumer                           | Labels                         | 649   |   |   |                    |          |       |
| 14 | Consumer                           | Office Furnishings             | 15092 |   |   |                    |          |       |

3. Convert the dataset to TABLE and name it as TABLE5
4. Set the following formula:

| Cell | Formula / Action                                                                  |
|------|-----------------------------------------------------------------------------------|
| F6   | <code>SORT(FILTER(Table5,Table5[Sales]&gt;=LARGE(Table5[Sales],G3)),3,-1)</code>  |
| K6   | <code>=SORT(FILTER(Table5,Table5[Sales]&lt;=SMALL(Table5[Sales],G3)),3,-1)</code> |
| E6   | <code>=SEQUENCE(G3)</code>                                                        |
| J6   | <code>=SEQUENCE(G3,,G3,-1)</code>                                                 |

## EXCEL ARRAYS BEHAVIOR

### Lifting Array Behavior

- If a formula expects a scalar (one value) but is given an array, the function lifts the multiple values to provide an output with multiple results.

Examples:

MONTH function expects one value (Date)

If more than one value is provided, the MONTH function will return many values:

|   | A          | B             |
|---|------------|---------------|
| 1 | 01/04/2025 | =month(A1:A3) |
| 2 | 01/08/2025 |               |
| 3 | 01/12/2025 |               |

Highlight the formula MONTH(A1:A3), press F9 to debug the values. You will see the value in array format: {4;8;12}

|   | A          | B          |
|---|------------|------------|
| 1 | 01/04/2025 | = {4;8;12} |
| 2 | 01/08/2025 | 8          |
| 3 | 01/12/2025 | 12         |

### Pairwise Lifting Array Behavior

- When multiple arrays of the same size are provided instead of two scalars, they are lifted in pairs.

Examples:

|   | A | B | C            |
|---|---|---|--------------|
| 1 | 1 | 2 | =A1:A3+B1:B3 |
| 2 | 3 | 4 |              |
| 3 | 5 | 6 |              |

Same number of values are provided.

Excel lifts them in a pairwise fashion:

1+2 ; 3+4 ; 5+6

In Legacy Excel they could not spill on the grid – There were visible in the formula bar but Excel was not able to show all these values in one cell. It only showed one result.

## Broadcasting Excel Array Behavior

- When we have arrays of different sizes, we need to expand the smaller ones to the same size as the big one so we can do pairwise lifting.

Example 1:

|   | A | B | C         |
|---|---|---|-----------|
| 1 | 1 | 2 | =A1:A3+B1 |
| 2 | 3 | 2 |           |
| 3 | 5 | 2 |           |

Two ranges of different size added together, the 2 in cell B1 is broadcasted down so Excel can do pairwise lifting.

B1 value will be broadcasted down and B2:B3 will take the 2 value.

|   | A | B | C |
|---|---|---|---|
| 1 | 1 | 2 | 3 |
| 2 | 3 | 2 | 5 |
| 3 | 5 | 2 | 7 |

If arrays of different sizes are added together, the size of the resulting array is equal to the largest height and the largest width of the source arrays.

Example 2:

|   |   |   |   |   |              |
|---|---|---|---|---|--------------|
| 6 | 1 | 1 | 1 | 2 | =A6:A8+D6:E6 |
| 7 | 2 | 2 | 1 | 2 |              |
| 8 | 3 | 3 | 1 | 2 |              |

Result shown as:

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 6 | 1 | 1 | 1 | 2 | 2 | 3 |
| 7 | 2 | 2 | 1 | 2 | 3 | 4 |
| 8 | 3 | 3 | 1 | 2 | 4 | 5 |

## Implicit Intersection in Legacy Excel

- Multi values provided to Scalar Arguments.

Example:

We type the =MONTH(A1:A3) in cell B2 instead of cell B1.

In Legacy Excel, you will get 8 only in cell B2

In Dynamic Array, you will get all results starting from cell B2 to B4

|   | A          | B             | C |
|---|------------|---------------|---|
| 1 | 01/04/2025 |               |   |
| 2 | 01/08/2025 | =MONTH(A1:A3) |   |
| 3 | 01/12/2025 |               |   |

Implicit intersection applied to regular formulas.

The CTRL + SHIFT + ENTER formulas turned OFF Implicit Intersection in Legacy Excel.

## Excel CSE Formula in the Future

- Suggestion from Microsoft:

CSE array formulas are only retained for compatibility reason.

Going forward, you should use dynamic arrays formulas instead.

## Quiz

Question 1:

If we type this formula in Excel =SUM({1;1;1}+1) what do we get?

- Error
- 4
- 6
- 12

Question 2:

Now if we type this formula in Excel =SUM({1;1;1}+{1;1}) what do we get?

- Error
- 4
- 6
- 12

Question 3:

What about this one =SUM({1;1;1}+{1,1})?

- Error
- 4
- 6
- 12

Question 4: The problem with legacy formulas was implicit intersection.

Dynamic Array formulas don't do implicit intersection unless we use the @ prefix.

- True
- False

## MORE EXCEL ARRAYS EXAMPLE

### Unique Value from Non-adjacent Columns

1. Open file: DYNAMIC\_ARRAYS\_WITH\_MORE EXAMPLE
2. Go to sheet: UNIQUE VALUE-NON-ADJACENT COLUMNS

|    | A                                       | B              | C               | D              | E     | F | G       | H    |
|----|-----------------------------------------|----------------|-----------------|----------------|-------|---|---------|------|
| 1  | Unique Values from Non-adjacent Columns |                |                 |                |       |   |         |      |
| 2  |                                         |                |                 |                |       |   |         |      |
| 3  |                                         |                |                 |                |       |   |         |      |
| 4  |                                         |                |                 |                |       |   |         |      |
| 5  | Date                                    | Segment        | Type            | Ship Mode      | Sale  |   | Segment | Type |
| 6  | 01/01/2016                              | Home Office    | Office Supplies | Express Air    | 795   |   |         |      |
| 7  | 01/01/2016                              | Small Business | Office Supplies | Regular Air    | 172   |   |         |      |
| 8  | 02/01/2016                              | Consumer       | Office Supplies | Regular Air    | 116   |   |         |      |
| 9  | 02/01/2016                              | Corporate      | Furniture       | Delivery Truck | 1,167 |   |         |      |
| 10 | 02/01/2016                              | Corporate      | Furniture       | Delivery Truck | 4,038 |   |         |      |
| 11 | 02/01/2016                              | Corporate      | Office Supplies | Regular Air    | 4,714 |   |         |      |
| 12 | 02/01/2016                              | Consumer       | Office Supplies | Express Air    | 133   |   |         |      |

3. Convert the dataset to TABLE and name it as TABLE1
4. Set the following formula:

| Cell | Formula / Action                                                           |
|------|----------------------------------------------------------------------------|
| G6   | =UNIQUE(Table1[Segment]:Table1[Type])                                      |
| J6   | =UNIQUE(CHOOSE({1,2},Table1[Segment],Table1[Ship Mode]))                   |
| J6   | =SORT(UNIQUE(CHOOSE({1,2},Table1[Segment],Table1[Ship Mode])),{1,2},{1,1}) |

### Filter Only for Non-Blank Criteria

1. Open file: DYNAMIC\_ARRAYS\_WITH\_MORE EXAMPLE
2. Go to sheet: NON-BLANK CRITERIA FILTERING

|    | A                                       | B              | C               | D              | E      | F | G              | H           | I         | J              | K      |
|----|-----------------------------------------|----------------|-----------------|----------------|--------|---|----------------|-------------|-----------|----------------|--------|
| 1  | Unique Values from Non-adjacent Columns |                |                 |                |        |   |                |             |           |                |        |
| 2  |                                         |                |                 |                |        |   | Select Segment | Home Office |           |                |        |
| 3  |                                         |                |                 |                |        |   | Select Type    | Furniture   |           |                |        |
| 4  |                                         |                |                 |                |        |   |                |             |           |                |        |
| 5  | Date                                    | Segment        | Type            | Ship Mode      | Sale   |   | Date           | Segment     | Type      | Ship Mode      | Sale   |
| 6  | 01/01/2016                              | Home Office    | Office Supplies | Express Air    | 795    |   | 03/01/2016     | Home Office | Furniture | Regular Air    | 239    |
| 7  | 01/01/2016                              | Small Business | Office Supplies | Regular Air    | 172    |   | 03/01/2016     | Home Office | Furniture | Delivery Truck | 774    |
| 8  | 02/01/2016                              | Consumer       | Office Supplies | Regular Air    | 116    |   | 04/01/2016     | Home Office | Furniture | Delivery Truck | 990    |
| 9  | 02/01/2016                              | Corporate      | Furniture       | Delivery Truck | 1,167  |   | 06/01/2016     | Home Office | Furniture | Delivery Truck | 25,372 |
| 10 | 02/01/2016                              | Corporate      | Furniture       | Delivery Truck | 4,038  |   | 08/01/2016     | Home Office | Furniture | Regular Air    | 66     |
| 11 | 02/01/2016                              | Corporate      | Office Supplies | Regular Air    | 4,714  |   | 12/01/2016     | Home Office | Furniture | Delivery Truck | 4,001  |
| 12 | 02/01/2016                              | Consumer       | Office Supplies | Express Air    | 133    |   | 13/01/2016     | Home Office | Furniture | Regular Air    | 33     |
| 13 | 02/01/2016                              | Consumer       | Office Supplies | Regular Air    | 595    |   | 15/01/2016     | Home Office | Furniture | Express Air    | 186    |
| 14 | 03/01/2016                              | Home Office    | Office Supplies | Regular Air    | 120    |   | 21/01/2016     | Home Office | Furniture | Delivery Truck | 11,277 |
| 15 | 03/01/2016                              | Corporate      | Technology      | Regular Air    | 477    |   | 22/01/2016     | Home Office | Furniture | Delivery Truck | 27,628 |
| 16 | 03/01/2016                              | Corporate      | Technology      | Regular Air    | 26,754 |   | 22/01/2016     | Home Office | Furniture | Express Air    | 3,977  |
| 17 | 03/01/2016                              | Corporate      | Office Supplies | Regular Air    | 117    |   | 31/01/2016     | Home Office | Furniture | Delivery Truck | 6,153  |
| 18 | 03/01/2016                              | Home Office    | Furniture       | Regular Air    | 239    |   |                |             |           |                |        |
| 19 | 03/01/2016                              | Corporate      | Technology      | Delivery Truck | 854    |   |                |             |           |                |        |

3. The dataset is a TABLE and the name is MYTABLE.  
And the formula already set in cell G6:  
=FILTER(myTable,(myTable[Segment]=H2)\*(myTable[Type]=H3),"No Records")
4. Try to blank the SEGMENT or TYPE selection, it will display as NO RECORDS.
5. Refine the formula as below:

| Cell | Formula / Action                                                                                   |
|------|----------------------------------------------------------------------------------------------------|
| G6   | =FILTER(myTable,(ISBLANK(H2)+(myTable[Segment]=H2))*(ISBLANK(H3)+(myTable[Type]=H3)),"No Records") |

6. Try to draft the logic behinds this formula.

## Split Text & Numbers from 1 Cell to Multiple Cell

1. Open file: DYNAMIC\_ARRAYS\_WITH\_MORE EXAMPLE
2. Go to sheet: SPLIT DATA

|    | A                 | B             |
|----|-------------------|---------------|
| 1  | <b>Split Data</b> |               |
| 2  |                   |               |
| 3  |                   |               |
| 4  |                   |               |
| 5  | <b>Code</b>       | <b>Number</b> |
| 6  | AC8478            |               |
| 7  | 82783BBLM         |               |
| 8  | JKR89KK           |               |
| 9  | 123AA             |               |
| 10 | YY8P              |               |

3. Set the following formula:

| Cell | Formula / Action                                         |
|------|----------------------------------------------------------|
| D5   | = "Text " &SEQUENCE(,MAX(LEN(A6:A10)))                   |
| D6   | =MID(A6:A10,SEQUENCE(,MAX(LEN(A6:A10))),1)               |
| B6   | =TEXTJOIN(" ",TRUE,FILTER(D6:L6,ISNUMBER(VALUE(D6:L6)))) |

4. Copy formulas to other cells.
5. The result displayed as below:

|    | A                 | B             | C | D             | E             | F             | G             | H             | I             | J             | K             | L             |
|----|-------------------|---------------|---|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| 1  | <b>Split Data</b> |               |   |               |               |               |               |               |               |               |               |               |
| 2  |                   |               |   |               |               |               |               |               |               |               |               |               |
| 3  |                   |               |   |               |               |               |               |               |               |               |               |               |
| 4  |                   |               |   |               |               |               |               |               |               |               |               |               |
| 5  | <b>Code</b>       | <b>Number</b> |   | <b>Text 1</b> | <b>Text 2</b> | <b>Text 3</b> | <b>Text 4</b> | <b>Text 5</b> | <b>Text 6</b> | <b>Text 7</b> | <b>Text 8</b> | <b>Text 9</b> |
| 6  | AC8478            | 8478          |   | A             | C             | 8             | 4             | 7             | 8             |               |               |               |
| 7  | 82783BBLM         | 82783         |   | 8             | 2             | 7             | 8             | 3             | B             | B             | L             | M             |
| 8  | JKR89KK           | 89            |   | J             | K             | R             | 8             | 9             | K             | K             |               |               |
| 9  | 123AA             | 123           |   | 1             | 2             | 3             | A             | A             |               |               |               |               |
| 10 | YY8P              | 8             |   | Y             | Y             | 8             | P             |               |               |               |               |               |
| 11 |                   |               |   |               |               |               |               |               |               |               |               |               |

## Choose Columns to Display in a FILTER

1. Open file: DYNAMIC\_ARRAYS\_WITH\_MORE EXAMPLE
2. Go to sheet: CHOOSE COLUMNS

|    | A                                | B              | C               | D                | E           | F | G              | H           | I            |
|----|----------------------------------|----------------|-----------------|------------------|-------------|---|----------------|-------------|--------------|
| 1  | <b>Choose Columns to Display</b> |                |                 |                  |             |   |                |             |              |
| 2  |                                  |                |                 |                  |             |   |                |             |              |
| 3  |                                  |                |                 |                  |             |   |                |             |              |
| 4  |                                  |                |                 |                  |             |   | Ship Mode      | Regular Air |              |
| 5  | <b>Date</b>                      | <b>Segment</b> | <b>Type</b>     | <b>Ship Mode</b> | <b>Sale</b> |   | <b>Segment</b> | <b>Type</b> | <b>Sales</b> |
| 6  | 01/01/2016                       | Home Office    | Office Supplies | Express Air      | 795         |   |                |             |              |
| 7  | 01/01/2016                       | Small Business | Office Supplies | Regular Air      | 172         |   |                |             |              |
| 8  | 02/01/2016                       | Consumer       | Office Supplies | Regular Air      | 116         |   |                |             |              |
| 9  | 02/01/2016                       | Corporate      | Furniture       | Delivery Truck   | 1,167       |   |                |             |              |
| 10 | 02/01/2016                       | Corporate      | Furniture       | Delivery Truck   | 4,038       |   |                |             |              |
| 11 | 02/01/2016                       | Corporate      | Office Supplies | Regular Air      | 4,714       |   |                |             |              |
| 12 | 02/01/2016                       | Consumer       | Office Supplies | Express Air      | 133         |   |                |             |              |
| 13 | 02/01/2016                       | Consumer       | Office Supplies | Regular Air      | 595         |   |                |             |              |
| 14 | 03/01/2016                       | Home Office    | Office Supplies | Regular Air      | 120         |   |                |             |              |
| 15 | 03/01/2016                       | Corporate      | Technology      | Regular Air      | 477         |   |                |             |              |
| 16 | 03/01/2016                       | Corporate      | Technology      | Regular Air      | 26,754      |   |                |             |              |
| 17 | 03/01/2016                       | Corporate      | Office Supplies | Regular Air      | 117         |   |                |             |              |
| 18 | 03/01/2016                       | Home Office    | Furniture       | Regular Air      | 239         |   |                |             |              |

3. The dataset is a TABLE and the name is TABLE
4. Set the following formula:

| Cell | Formula / Action                                        |
|------|---------------------------------------------------------|
| G6   | =CHOOSECOLS(FILTER(Table,Table[Ship Mode]=H3,""),2,3,5) |

## Stack Results from Different Data Sources / Tables

1. Open file: DYNAMIC\_ARRAYS\_WITH\_MORE EXAMPLE
2. Go to sheet: STACK DATA

|    | A                                         | B           | C               | D              | E     | F | G       | H    | I     |
|----|-------------------------------------------|-------------|-----------------|----------------|-------|---|---------|------|-------|
| 1  | Stack More Results from Different Sources |             |                 |                |       |   |         |      |       |
| 2  |                                           |             |                 |                |       |   |         |      |       |
| 3  |                                           |             |                 |                |       |   |         |      |       |
| 4  |                                           |             |                 |                |       |   |         |      |       |
| 5  | Date                                      | Segment     | Type            | Ship Mode      | Sales |   | Segment | Type | Sales |
| 6  | 01/02/2024                                | Corporate   | Office Supplies | Regular Air    | 52    |   |         |      |       |
| 7  | 01/02/2024                                | Consumer    | Technology      | Delivery Truck | 3,121 |   |         |      |       |
| 8  | 01/02/2024                                | Corporate   | Technology      | Regular Air    | 1,572 |   |         |      |       |
| 9  | 02/02/2024                                | Corporate   | Technology      | Regular Air    | 3,031 |   |         |      |       |
| 10 | 02/02/2024                                | Corporate   | Furniture       | Regular Air    | 3,554 |   |         |      |       |
| 11 | 02/02/2024                                | Corporate   | Furniture       | Regular Air    | 4,300 |   |         |      |       |
| 12 | 02/02/2024                                | Corporate   | Office Supplies | Regular Air    | 42    |   |         |      |       |
| 13 | 02/02/2024                                | Consumer    | Furniture       | Regular Air    | 356   |   |         |      |       |
| 14 | 02/02/2024                                | Corporate   | Furniture       | Delivery Truck | 5,484 |   |         |      |       |
| 15 | 03/02/2024                                | Home Office | Furniture       | Regular Air    | 165   |   |         |      |       |
| 16 | 03/02/2024                                | Home Office | Technology      | Regular Air    | 917   |   |         |      |       |
| 17 | 04/02/2024                                | Home Office | Office Supplies | Regular Air    | 66    |   |         |      |       |
| 18 | 04/02/2024                                | Home Office | Office Supplies | Regular Air    | 220   |   |         |      |       |

3. The dataset is a TABLE and the name is TABLE2
4. Set the following formula:

| Cell | Formula / Action                        |
|------|-----------------------------------------|
| G6   | =VSTACK(Table,Table2)                   |
| G6   | =CHOOSECOLS(VSTACK(Table,Table2),2,3,4) |

## Take Number of Top/Bottom Rows; Number of Left/Right Columns

1. Open file: DYNAMIC\_ARRAYS\_WITH\_MORE EXAMPLE
2. Go to sheet: TAKE DATA

|    | A                      | B           | C               | D     | E | F | G | H | I |
|----|------------------------|-------------|-----------------|-------|---|---|---|---|---|
| 1  | Taking Data from Array |             |                 |       |   |   |   |   |   |
| 2  |                        |             |                 |       |   |   |   |   |   |
| 3  |                        |             |                 |       |   |   |   |   |   |
| 4  |                        |             |                 |       |   |   |   |   |   |
| 5  | Date                   | Segment     | Type            | Sales |   |   |   |   |   |
| 6  | 01/02/2024             | Corporate   | Office Supplies | 52    |   |   |   |   |   |
| 7  | 01/02/2024             | Consumer    | Technology      | 3,121 |   |   |   |   |   |
| 8  | 01/02/2024             | Corporate   | Technology      | 1,572 |   |   |   |   |   |
| 9  | 02/02/2024             | Corporate   | Technology      | 3,031 |   |   |   |   |   |
| 10 | 02/02/2024             | Corporate   | Furniture       | 3,554 |   |   |   |   |   |
| 11 | 02/02/2024             | Corporate   | Furniture       | 4,300 |   |   |   |   |   |
| 12 | 02/02/2024             | Corporate   | Office Supplies | 42    |   |   |   |   |   |
| 13 | 02/02/2024             | Consumer    | Furniture       | 356   |   |   |   |   |   |
| 14 | 02/02/2024             | Corporate   | Furniture       | 5,484 |   |   |   |   |   |
| 15 | 03/02/2024             | Home Office | Furniture       | 165   |   |   |   |   |   |
| 16 | 03/02/2024             | Home Office | Technology      | 917   |   |   |   |   |   |

3. The dataset is a TABLE and the name is TABLETAKE
4. Set the following formula:

| Cell | Formula / Action                                                                         |
|------|------------------------------------------------------------------------------------------|
| F6   | =TAKE(TableTake,H3)                                                                      |
| K6   | =TAKE(SORT(TableTake,4,-1),M3)                                                           |
| P6   | =CHOOSECOLS(TAKE(FILTER(TableTake,(TableTake[Segment]=P2)*(TableTake[Type]=P3)),-1),1,4) |

## Magic 1: GROUPBY Function

1. Open file: DYNAMIC\_ARRAYS\_WITH\_MORE EXAMPLE
2. Go to sheet: GROUPBY (1)

|    | A                  | B              | C               | D              | E     |
|----|--------------------|----------------|-----------------|----------------|-------|
| 1  | <b>Data Source</b> |                |                 |                |       |
| 2  |                    |                |                 |                |       |
| 3  |                    |                |                 |                |       |
| 4  |                    |                |                 |                |       |
| 5  | Date               | Segment        | Type            | Ship Mode      | Sales |
| 6  | 01/01/2024         | Home Office    | Office Supplies | Express Air    | 795   |
| 7  | 01/01/2024         | Small Business | Office Supplies | Regular Air    | 172   |
| 8  | 02/01/2024         | Consumer       | Office Supplies | Regular Air    | 116   |
| 9  | 02/01/2024         | Corporate      | Furniture       | Delivery Truck | 1,167 |
| 10 | 02/01/2024         | Corporate      | Furniture       | Delivery Truck | 4,038 |
| 11 | 02/01/2024         | Corporate      | Office Supplies | Regular Air    | 4,714 |
| 12 | 02/01/2024         | Consumer       | Office Supplies | Express Air    | 133   |
| 13 | 02/01/2024         | Consumer       | Office Supplies | Regular Air    | 595   |

3. The dataset is a TABLE and the name is TABLE3
4. Set the following formula:

| Cell | Formula / Action                                                                                                                                                                                                                                                             |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| G5   | =GROUPBY(Table3[[Segment]:[Type]],Table3[Sales],SUM)<br>*No header but with Total Row at Bottom                                                                                                                                                                              |
| K5   | =GROUPBY(HSTACK(Table3[Segment],Table3[Ship Mode]),Table3[Sales],SUM)<br>*For adjacent columns                                                                                                                                                                               |
| O5   | =GROUPBY(HSTACK(Table3[Segment],Table3[Ship Mode]),Table3[Sales],HSTACK(SUM,AVERAGE,MEDIAN,COUNT,PERCENTOF))<br>*Add more aggregated data                                                                                                                                    |
| W5   | =GROUPBY(Table3[[#All],[Segment]:[Type]],Table3[[#All],[Sales]],LAMBDA(x,SUM(FILTER(x,ISNUMBER(x))),3)<br>*Include Field Names                                                                                                                                               |
| W:Y  | Set Conditional Formatting using FORMULA:<br><br>=OR(\$W1="Total",\$W1="Grand Total")<br><br>And set font to BOLD, add TOP Border Line                                                                                                                                       |
| W5   | =GROUPBY(Table3[[#All],[Segment]:[Type]],Table3[[#All],[Sales]],SUM)<br>Add 2 for the TOTAL_DEPTH to display Subtotal<br><br>Try to change the Conditional Formatting formula rules to apply the same format style (set font to BOLD, add TOP Border Line) for the subtotal. |



## Magic 2: GROUPBY Function

1. Open file: DYNAMIC\_ARRAYS\_WITH\_MORE EXAMPLE
2. Go to sheet: GROUPBY (2)
3. The dataset is a TABLE and the name is TABLE4
4. Set the following formula:

| Cell | Formula / Action                                                                                                                                                                   |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| G6   | =GROUPBY(HSTACK(YEAR(Table4[Date]),TEXT(Table4[Date],"mmm")),Table4[Sales],SUM)<br>*You will notice that the month name is not sorted accordingly                                  |
| G6   | =GROUPBY(HSTACK(YEAR(Table4[Date]),MONTH(Table4[Date]),TEXT(Table4[Date],"mmm")),Table4[Sales],SUM)<br>*By adding more month number, it will solve                                 |
| G6   | =CHOOSECOLS(GROUPBY(HSTACK(YEAR(Table4[Date]),MONTH(Table4[Date]),TEXT(Table4[Date],"mmm")),Table4[Sales],SUM),1,3,4)<br>*To skip the Month Number column, use CHOOSECOLS Function |

| Group by Year & Month |  |         |
|-----------------------|--|---------|
| 2024 Jan              |  | 503480  |
| 2024 Feb              |  | 330448  |
| 2024 Mar              |  | 402065  |
| 2024 Apr              |  | 385176  |
| 2024 May              |  | 228871  |
| 2024 Jun              |  | 255980  |
| 2024 Jul              |  | 378147  |
| 2024 Aug              |  | 332651  |
| 2024 Sep              |  | 324591  |
| 2024 Oct              |  | 355187  |
| 2024 Nov              |  | 245346  |
| 2024 Dec              |  | 402538  |
| Total                 |  | 4144480 |

5. Continue set the following formula:

| Cell | Formula / Action                                                                                                                                                                                |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| K6   | =GROUPBY(Table4[Segment],HSTACK(Table4[Sales],Table4[Sales],Table4[Ship Mode]),HSTACK(SUM,AVERAGE,LAMBDA(x,COUNTA(UNIQUE(x)))))<br>*The headers might be not user-friendly.                     |
| K6   | =DROP(GROUPBY(Table4[Segment],HSTACK(Table4[Sales],Table4[Sales],Table4[Ship Mode]),HSTACK(SUM,AVERAGE,LAMBDA(x,COUNTA(UNIQUE(x))))),1)<br>*Use DROP function to remove the 1 <sup>st</sup> Row |
| K6   | Change the COUNTA to ARRAYTOTEXT Function.                                                                                                                                                      |

| Segment        | Total Sales | Avg Sales   | Distinct Ship Mode Count |
|----------------|-------------|-------------|--------------------------|
| Consumer       | 952932      | 2151.088036 | 3                        |
| Corporate      | 1489525     | 1887.864385 | 3                        |
| Home Office    | 960932      | 1899.075099 | 4                        |
| Small Business | 741091      | 1785.761446 | 3                        |
| Total          | 4144480     | 1924.979099 | 4                        |

## How About PIVOTBY Function

1. Open file: DYNAMIC\_ARRAYS\_WITH\_MORE EXAMPLE
2. Go to sheet: PIVOTBY
3. The dataset is a TABLE and the name is pTABLE
4. Set the following formula:

| Cell | Formula / Action                                                                                                                                                |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| H5   | =PIVOTBY(pTable[Segment],MONTH(pTable[Date]),pTable[Sales],SUM)                                                                                                 |
| H5   | =PIVOTBY(pTable[Segment],TEXT(pTable[Date],"mm m"),pTable[Sales],SUM)<br>*Month is sorted but not in standard order of the month                                |
| H5   | =PIVOTBY(pTable[Segment],1*(1&TEXT(pTable[Date],"mmm")),pTable[Sales],SUM)<br>*Convert it to a valid date format and Press CTRL + 1 to format the header to mmm |

Try to use HSTACK Function to cater more fields in the PIVOTBY.

# INTRODUCTION TO LAMBDA & LET FUNCTION

## LAMBDA Function:

### Use Function to Create Function

The *LAMBDA* function in Excel is designed to create custom functions that can be called by user-friendly names and reused throughout a workbook. Due to the fact that a LAMBDA-defined function can call other functions or even itself as many times as needed. This feature is called "recursion", and this is what makes LAMBDA so effective.

Example: Create new function named: GSTPRICE to get the price including GST rate (8%)

Type the original formula first:

| 7  | Product | Normal Price | Price Incl. GST |
|----|---------|--------------|-----------------|
| 8  | P1      | 29.99        | =B8*(1+8%)      |
| 9  | P2      | 39.99        |                 |
| 10 | P3      | 49.99        |                 |
| 11 | P4      | 59.99        |                 |

Convert to LAMBDA format:

| 6  |         |              |                 |                         |
|----|---------|--------------|-----------------|-------------------------|
| 7  | Product | Normal Price | Price Incl. GST |                         |
| 8  | P1      | 29.99        | 32.3892         | =LAMBDA(p,p*(1+8%))(B8) |
| 9  | P2      | 39.99        | 43.1892         |                         |
| 10 | P3      | 49.99        | 53.9892         |                         |
| 11 | P4      | 59.99        | 64.7892         |                         |
| 12 | P5      | 69.99        | 75.5892         |                         |

Copy the LAMBDA formula together with = sign, and assign name in NAME MANAGER:

Edit Name

Name: GstPrice

Scope: Workbook

Comment: p = price

Refers to: =LAMBDA(p,p\*(1+8%))

OK

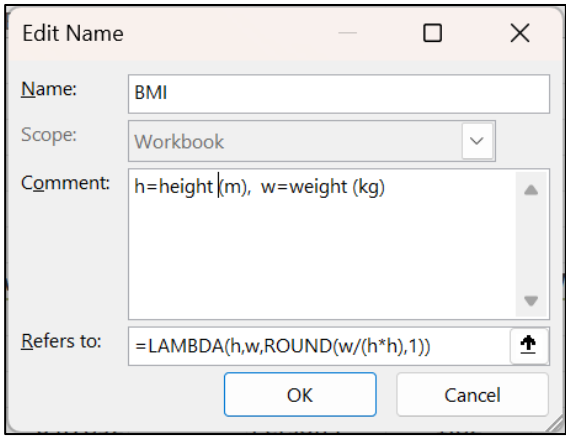
Cancel

Now, try to use the new Function name: GSTPRICE as below:

| 6  |         |              |                 |                       |
|----|---------|--------------|-----------------|-----------------------|
| 7  | Product | Normal Price | Price Incl. GST |                       |
| 8  | P1      | 29.99        | 32.3892         | 32.3892 =GstPrice(B8) |
| 9  | P2      | 39.99        | 43.1892         | 43.1892               |
| 10 | P3      | 49.99        | 53.9892         | 53.9892               |
| 11 | P4      | 59.99        | 64.7892         | 64.7892               |
| 12 | P5      | 69.99        | 75.5892         | 75.5892               |

Example: Create a new Function named: BMI to find the bmi of a person with Height and Weight provided.

|    | G           | H                | I                 | J          | K                   | L                         |
|----|-------------|------------------|-------------------|------------|---------------------|---------------------------|
| 1  |             |                  |                   |            |                     |                           |
| 2  |             |                  |                   |            |                     |                           |
| 3  |             |                  |                   |            |                     |                           |
| 4  |             |                  |                   |            |                     |                           |
| 5  | Example 2   |                  |                   |            |                     |                           |
| 6  |             |                  |                   |            |                     |                           |
| 7  | <b>Name</b> | <b>Height(m)</b> | <b>Weight(kg)</b> | <b>BMI</b> | <b>Using LAMBDA</b> | <b>Using New Function</b> |
| 8  | Person1     | 1.7              | 90                |            |                     |                           |
| 9  | Person2     | 1.56             | 55                |            |                     |                           |
| 10 | Person3     | 1.78             | 78                |            |                     |                           |
| 11 | Person4     | 1.82             | 101               |            |                     |                           |
| 12 | Person5     | 1.5              | 44                |            |                     |                           |
| 13 | Person6     | 1.66             | 57                |            |                     |                           |
| 14 | Person7     | 1.8              | 84                |            |                     |                           |
| 15 | Person8     | 1.63             | 63                |            |                     |                           |

| Cell | Formula / Action                                                                                                                |
|------|---------------------------------------------------------------------------------------------------------------------------------|
| J8   | =ROUND(I8/(H8*H8),1)                                                                                                            |
| K8   | =LAMBDA(h,w,ROUND(w/(h*h),1))(H8,I8)                                                                                            |
|      | <p>Create a name for this new function:</p>  |
| L8   | =BMI(H8,I8)                                                                                                                     |

Try to change the Parameter name:

- h changes to Height\_m
- w changes to Weight\_kg

## Exercise: Using LAMBDA

Use LAMBDA to create a new function called LEAP using the following formula:

| Year       | Leap?     | Using LAMBDA                                                             | Create LEAP Function |
|------------|-----------|--------------------------------------------------------------------------|----------------------|
| 01/12/2021 |           | =IFERROR(IF(MONTH(DATE(YEAR(08),2,29))=2,"Leap Year",""),"Invalid Date") |                      |
| 01/12/2022 |           |                                                                          |                      |
| 01/12/2023 |           |                                                                          |                      |
| 01/12/2024 | Leap Year |                                                                          |                      |
| 01/12/2025 |           |                                                                          |                      |
| 01/12/2026 |           |                                                                          |                      |
| 01/12/2027 |           |                                                                          |                      |
| 01/12/2028 | Leap Year |                                                                          |                      |

## LEN Function:

Concept is same as naming cells, ranges and formulas in Name Manager

The Excel LET function allows you to assign names to calculation results and define variables inside a formula, so that the formula looks clearer and works faster.

Essentially, the concept is the same as naming cells, ranges and formulas in the Name Manager. What makes the LET function different is that the declared names only exist in the scope of a given formula and nowhere else.

Example: Commission will be given if Actual more than Budget:

|    |               |               |                 |                           |                   |
|----|---------------|---------------|-----------------|---------------------------|-------------------|
| 6  |               |               |                 |                           |                   |
| 7  | <b>Actual</b> | <b>Budget</b> | <b>Variance</b> | <b>Variance using LET</b> | <b>Commission</b> |
| 8  | 893           | 700           |                 |                           | 0.00              |
| 9  | 792           | 700           |                 |                           | 0.00              |
| 10 | 811           | 700           |                 |                           | 0.00              |
| 11 | 146           | 700           |                 |                           | 0.00              |
| 12 | 989           | 700           |                 |                           | 0.00              |
| 13 | 200           | 700           |                 |                           | 0.00              |
| 14 | 105           | 700           |                 |                           | 0.00              |
| 15 | 717           | 700           |                 |                           | 0.00              |

| Cell | Formula / Action                                             |
|------|--------------------------------------------------------------|
| C8   | =IF((A8-B8)<0,0,(A8-B8))                                     |
| D8   | =LET(var,(A8-B8),IF(var<0,0,var))<br>*var to replace (A8-B8) |

# ASSIGNMENT

## Question:

Create the following data

|    | A    | B                | C                        | D | E | F                |
|----|------|------------------|--------------------------|---|---|------------------|
| 1  | Task |                  |                          |   |   |                  |
| 2  |      |                  |                          |   |   |                  |
| 3  |      | <b>Task Name</b> | <b>Done</b>              |   |   | <b>DONE LIST</b> |
| 4  |      | Task 1           | <input type="checkbox"/> |   |   |                  |
| 5  |      | Task 2           | <input type="checkbox"/> |   |   |                  |
| 6  |      | Task 3           | <input type="checkbox"/> |   |   |                  |
| 7  |      | Task 4           | <input type="checkbox"/> |   |   |                  |
| 8  |      | Task 5           | <input type="checkbox"/> |   |   |                  |
| 9  |      | Task 6           | <input type="checkbox"/> |   |   |                  |
| 10 |      | Task 7           | <input type="checkbox"/> |   |   |                  |
| 11 |      | Task 8           | <input type="checkbox"/> |   |   |                  |
| 12 |      | Task 9           | <input type="checkbox"/> |   |   |                  |
| 13 |      | Task 10          | <input type="checkbox"/> |   |   |                  |

Use FILTER Function and Conditional Formatting to achieve the following result:

|    | A    | B                 | C                                   | D | E | F                |
|----|------|-------------------|-------------------------------------|---|---|------------------|
| 1  | Task |                   |                                     |   |   |                  |
| 2  |      |                   |                                     |   |   |                  |
| 3  |      | <b>Task Name</b>  | <b>Done</b>                         |   |   | <b>DONE LIST</b> |
| 4  |      | Task 1            | <input type="checkbox"/>            |   |   | Task 4           |
| 5  |      | Task 2            | <input type="checkbox"/>            |   |   | Task 6           |
| 6  |      | Task 3            | <input type="checkbox"/>            |   |   | Task 8           |
| 7  |      | <del>Task 4</del> | <input checked="" type="checkbox"/> |   |   |                  |
| 8  |      | Task 5            | <input type="checkbox"/>            |   |   |                  |
| 9  |      | <del>Task 6</del> | <input checked="" type="checkbox"/> |   |   |                  |
| 10 |      | Task 7            | <input type="checkbox"/>            |   |   |                  |
| 11 |      | <del>Task 8</del> | <input checked="" type="checkbox"/> |   |   |                  |
| 12 |      | Task 9            | <input type="checkbox"/>            |   |   |                  |
| 13 |      | Task 10           | <input type="checkbox"/>            |   |   |                  |
| 14 |      |                   |                                     |   |   |                  |