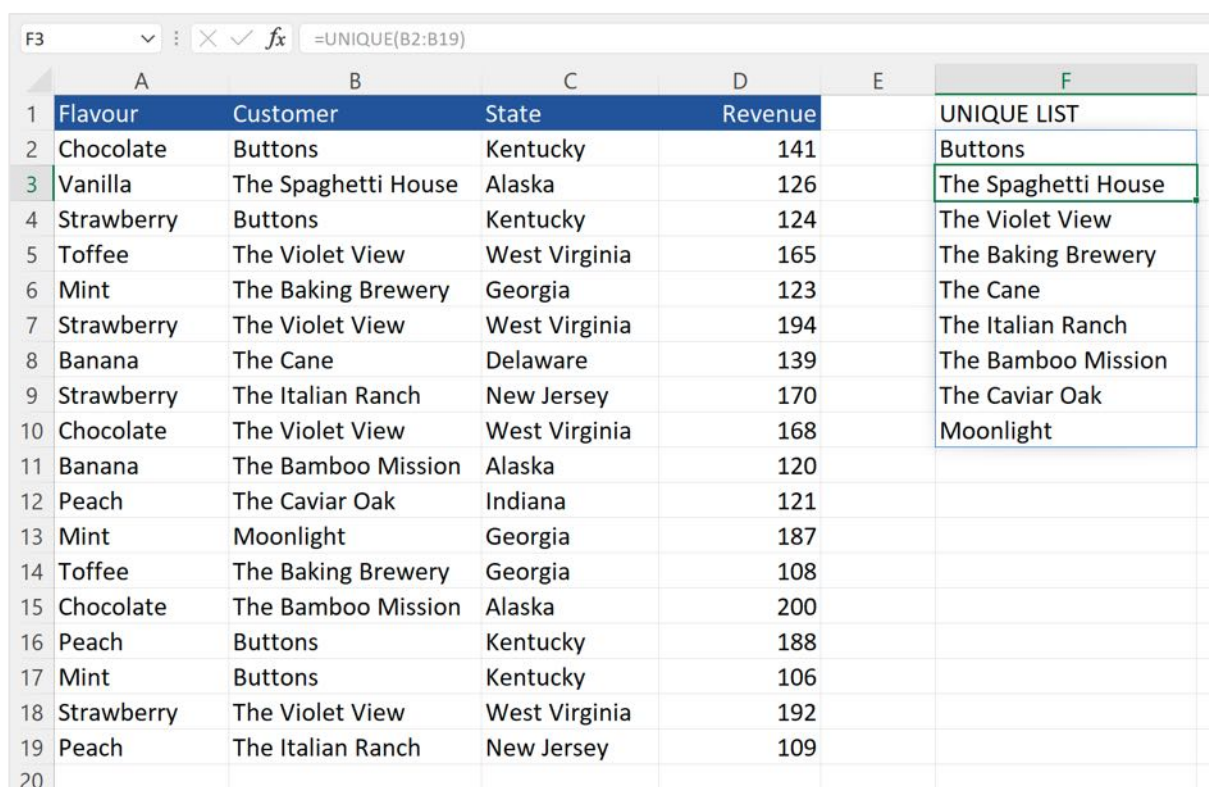# Dynamic Array Functions in Excel

Mike Thomas

UNIQUE

Returns a list of unique values from a range.

The worksheet below contains a list or orders for a company that sells ice cream. The owner of the business needs a list of customers to be displayed in column F. This could be done by copying the list from column B into column F and then removing the duplicates by using the Data > Remove Duplicates command on the Ribbon.

However, the Unique function offers a much simpler way to obtain the same information.

Cell F2 contains the following: **=UNIQUE(B2:B19)**

This tells Excel to look at the range B2:B19 and list one instance of each value.

	A	B	C	D	E	F
1	Flavour	Customer	State	Revenue		UNIQUE LIST
2	Chocolate	Buttons	Kentucky	141		Buttons
3	Vanilla	The Spaghetti House	Alaska	126		The Spaghetti House
4	Strawberry	Buttons	Kentucky	124		The Violet View
5	Toffee	The Violet View	West Virginia	165		The Baking Brewery
6	Mint	The Baking Brewery	Georgia	123		The Cane
7	Strawberry	The Violet View	West Virginia	194		The Italian Ranch
8	Banana	The Cane	Delaware	139		The Bamboo Mission
9	Strawberry	The Italian Ranch	New Jersey	170		The Caviar Oak
10	Chocolate	The Violet View	West Virginia	168		Moonlight
11	Banana	The Bamboo Mission	Alaska	120		
12	Peach	The Caviar Oak	Indiana	121		
13	Mint	Moonlight	Georgia	187		
14	Toffee	The Baking Brewery	Georgia	108		
15	Chocolate	The Bamboo Mission	Alaska	200		
16	Peach	Buttons	Kentucky	188		
17	Mint	Buttons	Kentucky	106		
18	Strawberry	The Violet View	West Virginia	192		
19	Peach	The Italian Ranch	New Jersey	109		
20						

Unlike traditional formulas and functions, it is not necessary to manually copy the function down column F. The cells below F2 are automatically populated. Each cell contains the same function =UNIQUE (B2:B19)

Filling multiple cells with a single formula or function is called *spilling* and the populated range of cells is called *the spill range*.

A blue border appears around F2:F10, indicating that the function in F2 is a dynamic array function. The formulas in F3:F10 cannot be edited – they appear dimmed out in the formula bar. Any amendments must be made in F2

If one of the cells in the range B2:B19 is changed and the value entered is a new value (i.e. it does not already exist in B2:B19), the spill range automatically expands, so in this example the new value will appear in F11

#SPILL

In the screenshot below, there is data in F6. The dynamic array function in F2 should return 9 values (the blue border is around F2:F10).

Rather than overwriting the contents of F6 with a value from the dynamic array, Excel displays #SPILL in F2. As soon as the current contents of F6 are deleted, the values from the dynamic array function "spill" down column F.

F2			fx	=UNIQUE(B2:B19)		
	A	B	C	D	E	F
1	Flavour	Customer	State	Revenue		UNIQUE LIST
2	Chocolate	Buttons	Kentucky	141	⚠	#SPILL!
3	Vanilla	The Spaghetti House	Alaska	126		
4	Strawberry	Buttons	Kentucky	124		
5	Toffee	The Violet View	West Virginia	165		
6	Mint	The Baking Brewery	Georgia	123		DATA Here
7	Strawberry	The Violet View	West Virginia	194		
8	Banana	The Cane	Delaware	139		
9	Strawberry	The Italian Ranch	New Jersey	170		
10	Chocolate	The Violet View	West Virginia	168		
11	Banana	The Bamboo Mission	Alaska	120		

Dynamic Arrays and The # Sign

Typing a hash sign (#) within a formula that reference a dynamic array function will reference the entire spill range. In the example below:
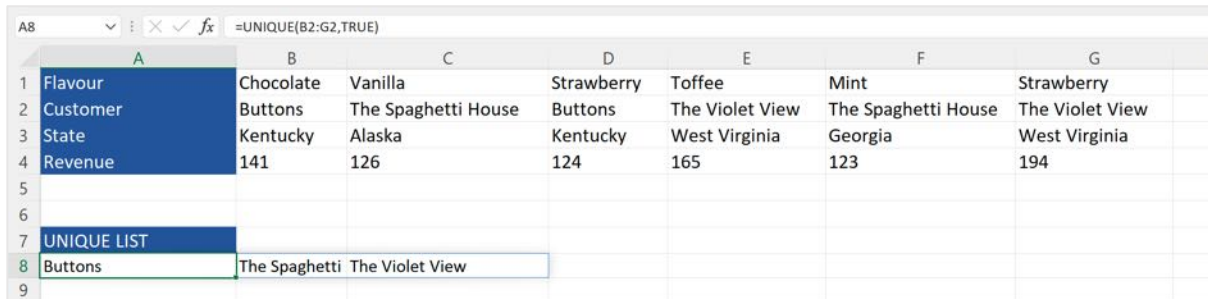
- The formula in I1 is =COUNTA(F2)
- The formula in I2 is =COUNTA(F2#)
- The formula in I3 is =COUNTA(F2:F10)

The difference between the formulas in I2 and I3 is that the formula in I2 refers to the spill range that starts in F2 (which may grow or shrink), whereas the formula in I3 refers to a fixed range F2:F10.

I2			fx	=COUNTA(F2#)				
	A	B	C	D	E	F	G	H	I
1	Flavour	Customer	State	Revenue		UNIQUE LIST		Count of Customers	1
2	Chocolate	Buttons	Kentucky	141		Buttons		Count of Customers	9
3	Vanilla	The Spaghetti House	Alaska	126		The Spaghetti House		Count of Customers	9
4	Strawberry	Buttons	Kentucky	124		The Violet View			
5	Toffee	The Violet View	West Virginia	165		The Baking Brewery			
6	Mint	The Baking Brewery	Georgia	123		The Cane			
7	Strawberry	The Violet View	West Virginia	194		The Italian Ranch			
8	Banana	The Cane	Delaware	139		The Bamboo Mission			
9	Strawberry	The Italian Ranch	New Jersey	170		The Caviar Oak			
10	Chocolate	The Violet View	West Virginia	168		Moonlight			
11	Banana	The Bamboo Mission	Alaska	120					

UNIQUE Function: By_Col Parameter

By default, the Unique function looks down a column and extracts unique values from the rows within that column. To force Excel to look across a row and extract unique values from the columns within that row, set the second (optional) parameter of the function to TRUE
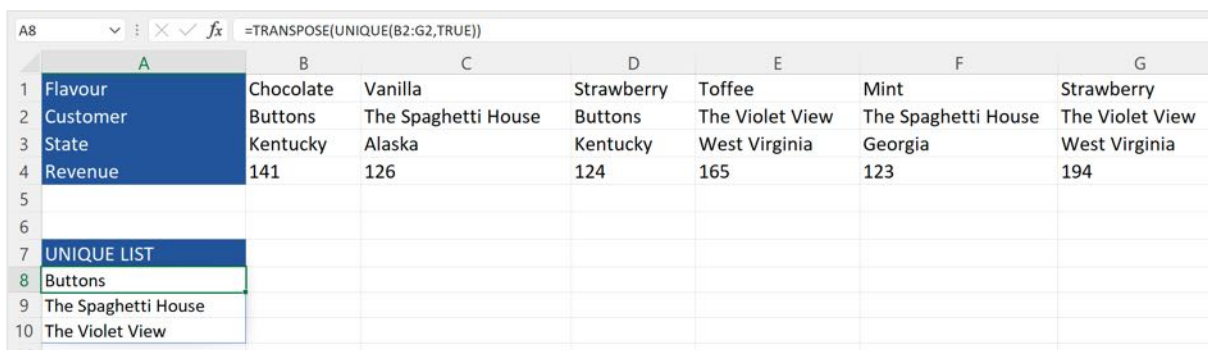
	A	B	C	D	E	F	G
A8	=UNIQUE(B2:G2,TRUE)						
1	Flavour	Chocolate	Vanilla	Strawberry	Toffee	Mint	Strawberry
2	Customer	Buttons	The Spaghetti House	Buttons	The Violet View	The Spaghetti House	The Violet View
3	State	Kentucky	Alaska	Kentucky	West Virginia	Georgia	West Virginia
4	Revenue	141	126	124	165	123	194
5							
6							
7	UNIQUE LIST						
8	Buttons	The Spaghetti	The Violet View				
9							

In the spreadsheet above, the formula in A8 is **=UNIQUE(B2:G2,TRUE)**

Notice that when using the TRUE parameter, the results spill across a row. To force the spill range to be a column, wrap the above formula in the TRANSPOSE function…

=TRANSPOSE(UNIQUE(B2:G2,TRUE))

	A	B	C	D	E	F	G
A8	=TRANSPOSE(UNIQUE(B2:G2,TRUE))						
1	Flavour	Chocolate	Vanilla	Strawberry	Toffee	Mint	Strawberry
2	Customer	Buttons	The Spaghetti House	Buttons	The Violet View	The Spaghetti House	The Violet View
3	State	Kentucky	Alaska	Kentucky	West Virginia	Georgia	West Virginia
4	Revenue	141	126	124	165	123	194
5							
6							
7	UNIQUE LIST						
8	Buttons						
9	The Spaghetti House						
10	The Violet View						

UNIQUE Function: Exactly_Once Parameter

By default, the Unique function displays a list of all unique values regardless of how many times they appear.

But what if what was needed was a list of customers who made a single purchase? To do that, set the 3rd (optional) parameter to TRUE.

The formula in the example below is: **=UNIQUE(B2:B19,FALSE,TRUE)**

Note that the second parameter has been set to FALSE to indicate that Excel needs to look down a column and extracts unique values from the rows within that column.

	A	B	C	D	E	F	G
							=UNIQUE(B2:B19,FALSE,TRUE)
1	Flavour	Customer	State	Revenue			**Customers Who Purchased Once**
2	Chocolate	Buttons	Kentucky	141			The Spaghetti House
3	Vanilla	The Spaghetti House	Alaska	126			The Cane
4	Strawberry	The Violet View	Kentucky	124			The Italian Ranch
5	Toffee	The Violet View	West Virginia	165			The Caviar Oak
6	Mint	The Baking Brewery	Georgia	123			Moonlight
7	Strawberry	The Violet View	West Virginia	194			The Comet Fox
8	Banana	The Cane	Delaware	139			

SORT

Sorts the value in a range into ascending or descending order.

The worksheet below contains a list or orders for a company that sells ice cream. The owner of the business needs an alphabetical list of customers.

One way to do this is to use the Sort command on the Ribbon to sort A2:A19 into ascending order. However, the owner wants to keep this list "as is". Another option is to copy the list to column D and use the Sort command on the Ribbon to sort that list. But that would increase the size of the file as well as making more work.

The Sort function offers a much simpler way to do the same thing.

Cell D2 contains the following: **=SORT(B2:B19)**

	D2	f_x =SORT(A2:A19)		
	A	B	C	D
1	Customer			Customer
2	Buttons			Buttons
3	The Spaghetti House			Buttons
4	Buttons			Buttons
5	The Violet View			Buttons
6	The Baking Brewery			Moonlight
7	The Violet View			The Baking Brewery
8	The Cane			The Baking Brewery
9	The Italian Ranch			The Bamboo Mission
10	The Violet View			The Bamboo Mission
11	The Bamboo Mission			The Bamboo Mission
12	The Caviar Oak			The Cane
13	Moonlight			The Caviar Oak
14	The Baking Brewery			The Comet Fox
15	The Bamboo Mission			The Italian Ranch
16	Buttons			The Spaghetti House
17	Buttons			The Violet View
18	The Comet Fox			The Violet View
19	The Bamboo Mission			The Violet View

SORT Function: Sort_Index Parameter

If the range to be sorted contains more than 1 column & needs to be sorted by a column other than the first one, use (optional) Sort_Index to indicate which column to sort by.

In the example below, the owner of the ice cream business needs, in columns F:I, a copy of the table in A2:D2 sorted by Revenue. The formula in F2 is: **=SORT(A2:D19,4)**

This tells Excel to sort the range A4:D19 by the 4th column (the one containing the revenue)

	A	B	C	D	E	F	G	H	I
	F2 ∨ : × ✓ fx =SORT(A2:D19,4)								
1	Flavour	Customer	State	Revenue		Flavour	Customer	State	Revenue
2	Chocolate	Buttons	Kentucky	141		Mint	Buttons	Kentucky	106
3	Vanilla	The Spaghetti House	Alaska	126		Toffee	The Baking Brewery	Georgia	108
4	Strawberry	The Violet View	Kentucky	124		Banana	The Bamboo Mission	Alaska	120
5	Toffee	The Violet View	West Virginia	165		Peach	The Caviar Oak	Indiana	121
6	Mint	The Baking Brewery	Georgia	123		Mint	The Baking Brewery	Georgia	123
7	Strawberry	The Violet View	West Virginia	194		Strawberry	The Violet View	Kentucky	124
8	Banana	The Cane	Delaware	139		Vanilla	The Spaghetti House	Alaska	126
9	Strawberry	The Italian Ranch	New Jersey	170		Banana	The Cane	Delaware	139
10	Chocolate	The Violet View	West Virginia	168		Chocolate	Buttons	Kentucky	141
11	Banana	The Bamboo Mission	Alaska	120		Toffee	The Violet View	West Virginia	165
12	Peach	The Caviar Oak	Indiana	121		Chocolate	The Violet View	West Virginia	168
13	Mint	Moonlight	Georgia	187		Strawberry	The Italian Ranch	New Jersey	170
14	Toffee	The Baking Brewery	Georgia	108		Chocolate	The Bamboo Mission	Alaska	184

SORT Function: Sort_Order Parameter

By default, the Sort function sorts in ascending order. To sort in descending order (highest to lowest, Z-A), set the 3rd (optional) parameter to **-1**.

For example: **=SORT(A2:D19,4,-1)** will produce a copy of the data in A2:D19, sorted by revenue with the highest revenue listed first:

	A	B	C	D	E	F	G	H	I
	F2 ∨ : × ✓ fx =SORT(A2:D19,4,-1)								
1	Flavour	Customer	State	Revenue		Flavour	Customer	State	Revenue
2	Chocolate	Buttons	Kentucky	141		Chocolate	The Bamboo Mission	Alaska	200
3	Vanilla	The Spaghetti House	Alaska	126		Banana	The Comet Fox	Massachusetts	197
4	Strawberry	The Violet View	Kentucky	124		Strawberry	The Violet View	West Virginia	194
5	Toffee	The Violet View	West Virginia	165		Peach	Buttons	Kentucky	188
6	Mint	The Baking Brewery	Georgia	123		Mint	Moonlight	Georgia	187
7	Strawberry	The Violet View	West Virginia	194		Chocolate	The Bamboo Mission	Alaska	184
8	Banana	The Cane	Delaware	139		Strawberry	The Italian Ranch	New Jersey	170
9	Strawberry	The Italian Ranch	New Jersey	170		Chocolate	The Violet View	West Virginia	168
10	Chocolate	The Violet View	West Virginia	168		Toffee	The Violet View	West Virginia	165
11	Banana	The Bamboo Mission	Alaska	120		Chocolate	Buttons	Kentucky	141
12	Peach	The Caviar Oak	Indiana	121		Banana	The Cane	Delaware	139
13	Mint	Moonlight	Georgia	187		Vanilla	The Spaghetti House	Alaska	126

SORT Function: By_Col Parameter

By default, the SORT function will sort data vertically by rows. To sort a range horizontally by columns, set the fourth (optional) argument, by_col, to TRUE.

SORTBY

Allows you to sort a range based on a column or row that doesn't appear in the results

In the previous example, the requirement was to sort the list in columns A:D based on the revenue (column D)

	A	B	C	D	E	F	G	H	I
1	Flavour	Customer	State	Revenue		Flavour	Customer	State	Revenue
2	Chocolate	Buttons	Kentucky	141		Mint	Buttons	Kentucky	106
3	Vanilla	The Spaghetti House	Alaska	126		Toffee	The Baking Brewery	Georgia	108
4	Strawberry	The Violet View	Kentucky	124		Banana	The Bamboo Mission	Alaska	120
5	Toffee	The Violet View	West Virginia	165		Peach	The Caviar Oak	Indiana	121
6	Mint	The Baking Brewery	Georgia	123		Mint	The Baking Brewery	Georgia	123
7	Strawberry	The Violet View	West Virginia	194		Strawberry	The Violet View	Kentucky	124
8	Banana	The Cane	Delaware	139		Vanilla	The Spaghetti House	Alaska	126
9	Strawberry	The Italian Ranch	New Jersey	170		Banana	The Cane	Delaware	139
10	Chocolate	The Violet View	West Virginia	168		Chocolate	Buttons	Kentucky	141
11	Banana	The Bamboo Mission	Alaska	120		Toffee	The Violet View	West Virginia	165
12	Peach	The Caviar Oak	Indiana	121		Chocolate	The Violet View	West Virginia	168
13	Mint	Moonlight	Georgia	187		Strawberry	The Italian Ranch	New Jersey	170
14	Toffee	The Baking Brewery	Georgia	108		Chocolate	The Bamboo Mission	Alaska	184

F2 = SORT(A2:D19,4)

Using a different scenario, here I have a list of the sales reps at the ice cream company together with the revenue that each has generated. The owner of the business wants a list of the sales reps based on their revenue but does not want the revenue to be displayed.

The formula in D2 is : **=SORTBY(A2:A6,B2:B6,-1).**

In other words, sort the range A2:A6 based on the corresponding values in B2:B6

D2 = SORTBY(A2:A6,B2:B6,-1)

	A	B	C	D
1	Sales Rep	Revenue		Sales Rep
2	Mike	100		Chris
3	Elaine	300		Elaine
4	Lola	250		Karen
5	Chris	400		Lola
6	Karen	290		Mike
7				

SORTBY Function: Sort_Order Parameter

The 3rd (optional) parameter defines the sort order. Use **1** (or do not specify) for ascending or **-1** for descending. In this example, -1 has been specified so the names are listed based on the revenue generated in highest-lowest order (Chris being the highest revenue generator)

Combining UNIQUE and SORT

Requirement: A unique list of customers sorted alphabetically by name. To do this, combine the UNIQUE and SORT functions.

In the example below, D2 contains: **=SORT(UNIQUE(A2:A18))**

D2	✓	fx	=SORT(UNIQUE(A2:A18))		
	A	**B**	**C**		**D**
1	Customer				Customer
2	Buttons				Buttons
3	The Spaghetti House				Moonlight
4	Buttons				The Baking Brewery
5	The Violet View				The Bamboo Mission
6	The Baking Brewery				The Cane
7	The Violet View				The Caviar Oak
8	The Cane				The Comet Fox
9	The Italian Ranch				The Italian Ranch
10	The Violet View				The Spaghetti House
11	The Bamboo Mission				The Violet View
12	The Caviar Oak				
13	Moonlight				
14	The Baking Brewery				

FILTER

Extracts a set of matching records from a dataset based on supplied criteria.

In the example below, starting at F4 are the records columns A:D that match the flavour shown in G1.

The formula in F4 is **=FILTER(A2:D19,A2:A19=G1)**

The 1st parameter is the range containing the data to be filtered

The 2nd parameter is the criteria. In this example this means "only display the records where whatever is displayed in G1 appears in A2:A19"

Filter Function: Is_Empty Parameter

If there are no records that match the criteria, the FILTER function returns a #CALC! error. To avoid this, add some text, inside double quotes, which will be displayed instead.

In the example below, B4 contains **=FILTER(A2:D19,A2:A19=G1,"No Matches Found")**

About Mike Thomas

Mike Thomas is a subject matter expert in a range of technologies, although his primary focus and passion is Excel and Power BI.

In a career spanning 30+ years, he has delivered thousands of training courses on a wide variety of technology-related topics.

In 2012 Mike founded theexceltrainer.co.uk where he has produced nearly 200 written and video-based Excel tutorials. He has an accompanying YouTube Channel and has also recorded several video-based training courses.

Mike is a Fellow of The Learning and Performance Institute and has worked with and for many global and UK-based companies and organizations across a diverse range of sectors.

In addition to training, he also designs and develops Microsoft Office-based solutions that automate key business tasks and processes.

Away from the Microsoft world, Mike is co-host of the [MacBites](#) podcast and a co-presenter of [MacBites After Hours](#), a live technology show hosted on YouTube.

Connect with Mike via the links below

- [YouTube Channel](#)
- [The Excel Trainer Website](#)
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