How to lift VBA User-Defined Functions over pairwise arrays

Owen Price – 2024-01-15 | @flexyourdata on YT

Suppose we have these two very simple input arrays

	A	B	C	D
1	x		y	
2	1		-1	
3	2		-2	
4	3		-3	
5	4		-4	
6	5		-5	
7	6		-6	
8	7		-7	
9	8		-8	
10	9		-9	
11	10		-10	
12				

And suppose we have some very simple User-Defined Functions with two parameters

```
Option Explicit

Public Function multiply(x As Double, y As Double)

multiply = x * y

End Function

Public Function add(x As Double, y As Double)

add = x + y

End Function
```

We can call the functions row by row with no problem

	A	B	C	D	E	F	G	H	I
1	x		y						
2	1		-1		-1	=multiply(A2,C2)		0	=add(A2,C2)
3	2		-2		-4	=multiply(A3,C3)		0	=add(A3,C3)
4	3		-3		-9	=multiply(A4,C4)		0	=add(A4,C4)
5	4		-4		-16	=multiply(A5,C5)		0	=add(A5,C5)
6	5		-5		-25	=multiply(A6,C6)		0	=add(A6,C6)
7	6		-6		-36	=multiply(A7,C7)		0	=add(A7,C7)
8	7		-7		-49	=multiply(A8,C8)		0	=add(A8,C8)
9	8		-8		-64	=multiply(A9,C9)		0	=add(A9,C9)
10	9		-9		-81	=multiply(A10,C10)		0	=add(A10,C10)
11	10		-10		-100	=multiply(A11,C11)		0	=add(A11,C11)

But what if we want to “lift” the function over the two ranges and spill the result?

This doesn’t work.

	A	B	C	D	E	F	G	H	I
1	x		y						
2	1		-1		#VALUE!	=multiply(A2:A11,C2:C11)		#VALUE!	=add(A2:A11,C2:C11)
3	2		-2						
4	3		-3						
5	4		-4						
6	5		-5						
7	6		-6						
8	7		-7						
9	8		-8						
10	9		-9						
11	10		-10						

For simple functions with a known count of parameters, we can construct a “lift” function to do the work

```
Public Function lift(func As String, ParamArray arrs() As Variant)
    Dim i As Long
    Dim leadingArray As Variant
    Dim result As Variant
    Dim resultLength As Long

    leadingArray = arrs(0)
    resultLength = UBound(leadingArray)

    ReDim result(1 To resultLength, 1 To 1)

    For i = 1 To resultLength
        result(i, 1) = Application.Run(func, arrs(0)(i, 1), arrs(1)(i, 1))
    Next i

    lift = result

End Function
```

This allows us to pass the name of the UDF we want to lift as an argument to the lift UDF, and the function spills

	A	B	C	D	E	F	G	H	I
1	x		y						
2	1		-1		-1	=lift("multiply",A2:A11,C2:C11)		0	=lift("add",A2:A11,C2:C11)
3	2		-2		-4			0	
4	3		-3		-9			0	
5	4		-4		-16			0	
6	5		-5		-25			0	
7	6		-6		-36			0	
8	7		-7		-49			0	
9	8		-8		-64			0	
10	9		-9		-81			0	
11	10		-10		-100			0	

But this is fraught with problems...

Relies on correctly spelled function name 💀

```
Public Function lift(func As String, ParamArray arrs() As Variant)
    Dim i As Long
    Dim leadingArray As Variant
    Dim result As Variant
    Dim resultLength As Long

    leadingArray = arrs(0)
    resultLength = UBound(leadingArray)

    ReDim result(1 To resultLength, 1 To 1)

    For i = 1 To resultLength
        result(i, 1) = Application.Run(func, arrs(0)(i, 1), arrs(1)(i, 1))
    Next i

    lift = result

End Function
```

Need to add code to check for same-sized arrays in arrs() 🤭

Can't pass ParamArray to Application.Run 😱, each argument must be passed individually

And anyway, we have MAP for lifting functions…

	A	B	C	D	E	F	G	H	I
1	x		y						
2	1		-1		-1	=MAP(A2:A11,C2:C11,LAMBDA(x,y,multiply(x,y)))		0	=MAP(A2:A11,C2:C11,LAMBDA(x,y,add(x,y)))
3	2		-2		-4			0	
4	3		-3		-9			0	
5	4		-4		-16			0	
6	5		-5		-25			0	
7	6		-6		-36			0	
8	7		-7		-49			0	
9	8		-8		-64			0	
10	9		-9		-81			0	
11	10		-10		-100			0	

Or if you think you'll be doing a lot of this kind of thing, curry the function so you can pass it to MAP more simply

	A	B	C	D	E	F	G	H	I	J
1	x		y							
2	1		-1		-1	=MAP(A2:A11,C2:C11,two_arg(multiply))		0	=MAP(A2:A11,C2:C11,two_arg(add))	
3	2		-2		-4			0		
4	3		-3		-9			0		
5	4		-4		-16			0		
6	5		-5		-25			0		
7	6		-6		-36			0		
8	7		-7		-49			0		
9	8		-8		-64			0		
10	9		-9		-81			0		
11	10		-10		-100			0		
12										
13										

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```
two_arg = LAMBDA(function,
    LAMBDA(x, y,
        function(x, y)
    )
);
```

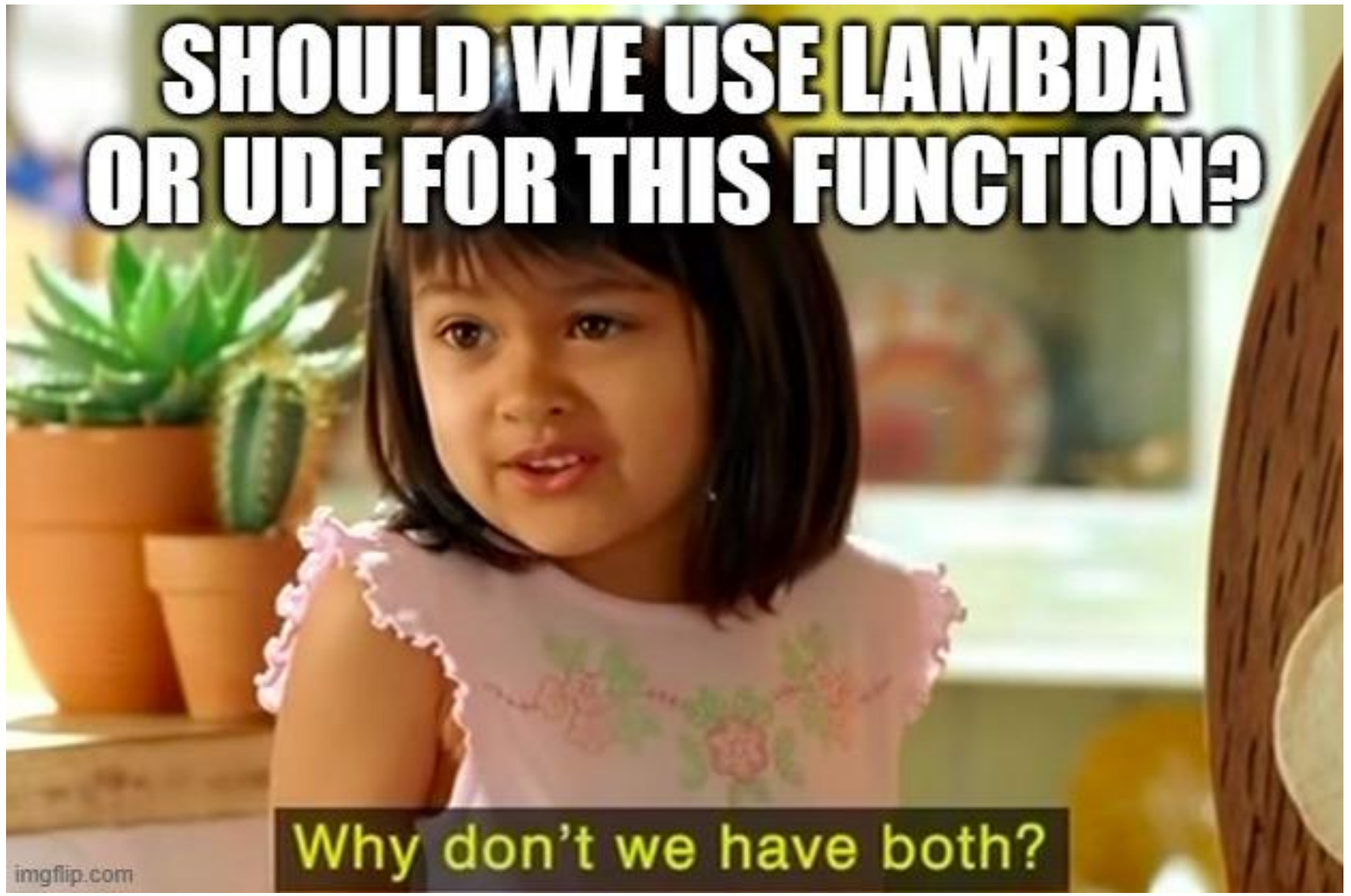
These are trivial examples. Nobody would create a “multiply” UDF.

But you might create something more complex as a UDF which is either very difficult or not possible with a formula.

So, what’s the point?

You're not limited to just one paradigm. Just because you wrote the scalar function in VBA, doesn't mean you have to lift it with VBA.

Combine the tools available to get the job done!



Interested? Grab the code!

http://gist.github.com/ncalm

Other links: https://linktr.ee/flexyourdata