# dante

Digital Area for Networking
Teachers and Educators

Co-funded by
the European Union

# Data Analysis Using Formulas

## Array Formulas

WEEK 5

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# Array Formulas

Array formulas can be used where the result of a formula is an array (range of cells). Therefore, work on an array formula begins by selecting the output range of cells. Array formulas are confirmed after they entry using the key shortcut **CTRL+SHIFT+ENTER**. After confirmation, the array formula is visually wrapped in curly braces.

When using array formulas, it is not necessary to think about absolute or relative addressing. The formula is always the same in all cells of the array. Both cell addresses and defined names can be used in array formulas (see later). It is not possible to modify or delete part of the array, the array must always be completely consistent.

The latest versions of Excel (does not apply to Excel 2019 and older) already allow you to use dynamic array formulas, which must be entered in only one (upper left) cell and confirmed by pressing the **ENTER** key. Starting with the September 2018 update for Microsoft Office 365, any formula that returns multiple results automatically overflows into neighbouring cells. A dynamic array formula is not wrapped in braces, overflow values are displayed indistinctly in the formula bar. The dynamic array range can be referenced by the address of the upper left cell + '#', e.g.: =SUM(C2#).

# Practical Use of Array Formulas

Imagine the example again used in previous chapter. We should calculate again the payment for all months and markets when the payment is calculated as (SPACE * PRICE + TAX + TRANSPORT) * (1 - DISCOUNT) but this time as an array formula. You can find the tables in exercise workbook.

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Tax | | | | | | | | | | | Market 1 | Market 2 | Market 3 | | | |
| 2 | 200 | | | | | | | | | | Transport | 500 | 1200 | 400 | | | |
| 3 | | | | | | | | | | | | | | | | | |
| 4 | Space (m2) | Market 1 | Market 2 | Market 3 | | Price/m2 | Market 1 | Market 2 | Market 3 | | Payment | Market 1 | Market 2 | Market 3 | | Month | Discount |
| 5 | January | 16 | 20 | 52 | | January | 180 | 70 | 120 | | January | | | | | January | 0,2 |
| 6 | February | 23 | 30 | 70 | | February | 175 | 65 | 115 | | February | | | | | February | 0,15 |
| 7 | March | 31 | 43 | 87 | | March | 170 | 60 | 110 | | March | | | | | March | 0,1 |
| 8 | April | 38 | 58 | 103 | | April | 165 | 55 | 105 | | April | | | | | April | 0,05 |
| 9 | May | 45 | 72 | 114 | | May | 160 | 50 | 100 | | May | | | | | May | 0,05 |
| 10 | June | 50 | 85 | 120 | | June | 165 | 55 | 105 | | June | | | | | June | 0,03 |
| 11 | July | 50 | 90 | 130 | | July | 170 | 60 | 110 | | July | | | | | July | 0,03 |
| 12 | August | 50 | 85 | 120 | | August | 175 | 65 | 115 | | August | | | | | August | 0,03 |
| 13 | September | 31 | 43 | 87 | | Septembe | 180 | 70 | 120 | | September | | | | | Septembe | 0,03 |
| 14 | October | 23 | 30 | 70 | | October | 185 | 75 | 125 | | October | | | | | October | 0,1 |
| 15 | November | 16 | 20 | 52 | | Novembe | 190 | 80 | 130 | | November | | | | | Novembe | 0,2 |
| 16 | December | 16 | 20 | 52 | | Decembe | 195 | 85 | 135 | | December | | | | | Decembe | 0,25 |

*Figure 1 Example for using array formulas*

The older (and still valid) way how to calculate it is:

- Select output range of cells **L5:N16**.
- Write the formula: **=(B5:D16*G5:I16+A2+L2:N2)*(1-Q5:Q16)**. Ranges of cells select with mouse.
- Confirm the formula with **CTRL+SHIFT+ENTER** keys.

The way how to calculate it in the modern versions of Excel (365, 2021 and newer) is:

- Select cell **L5**.
- Write the formula: **=(B5:D16*G5:I16+A2+L2:N2)*(1-Q5:Q16)**. Ranges of cells select with mouse.
- Confirm the formula with **ENTER** key.

# Using Array Formulas to Replace Statistical Functions with Condition to Basic Statistical Functions

Statistical functions with a condition, i.e. a functions with an IF suffix, can be easily replaced by basic statistical functions without an IF suffix but with nested IF function all

confirmed as an array formula. It is mainly used for statistical functions that do not have an alternative with condition (an IF suffix), e.g. the MEDIAN function does not have an alternative in the form of the MEDIANIF function.

Imagine you have numbers in A1:A10 cells and want to calculate sum of all positive numbers:

- calculation using the SUMIF function: **=SUMIF(A1:A10,">0")**
- calculation using the SUM with nested IF function: **=SUM(IF(A1:A10>0,A1:A10))**

Compare the two formulas carefully.

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## Digital Area for Networking Teachers and Educators

Project Number: 2020-1-CZ01-KA226-HE-094368

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TECHNICAL UNIVERSITY OF KOŠICE

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