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Using Ms Excel Function to Solve Economic Problems

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Annotation. The paper discusses the main and frequently used formulas in Excel for use in the field of economics: IF, SUMIF, VLOOKUP, SUMPRODUCT, COUNT, AVERAGE, MAX, MIN.

Keywords. MS EXCEL, Spreadsheets, Economics, IF, SUMIF, VLOOKUP, SUMPRODUCT, COUNT, AVERAGE, MAX, MIN.

Excel spreadsheets are one of the components of the Microsoft Office application package that runs in the Windows environment. It is intended for processing numerical data, carrying out mathematical modeling of various processes, manufacturing various documents and forms. Excel offers a wide range of tabular data processing functionality:

- creating and editing spreadsheets using a rich set of built-in functions;
- design and printing of spreadsheets;
- construction of charts and graphs of varying degrees of clarity and detail;
- work with spreadsheets as with databases: filtering, sorting, creating summary and summary tables, consolidating data from different tables, etc.;
- solution of economic problems by selection of parameters;
- solution of optimization problems;
- numerical solution of various mathematical problems;
- statistical data processing;

Spreadsheet editors, in particular MS Excel today, are one of the most common software products used throughout the world. Without special skills, they allow you to create fairly complex applications that satisfy up to 90 requests of average users. In the program, you can create complex formulas in Excel and solve economic problems without much effort and without requiring extensive knowledge in the field of economics [3].

Modeling - the study of any phenomena, processes or systems of objects by building and studying their models; the use of models to determine or refine the characteristics and rationalize the ways of constructing newly constructed objects. Any method of scientific research is based on the idea of modeling, both theoretical (which uses various kinds of symbolic, abstract models) and experimental (using subject models).

In the process of modeling in the Microsoft Excel programming language, several stages can be distinguished: problem statement; formalization; drawing up an algorithm; programming; testing; debugging; registration; forecasting. Depending on the complexity of the task, some stages of modeling can change the order, be combined or excluded, due to the absence of a need for them or the obviousness of the solution [4].

RESULTS and DISCUSSIONS

Functions in Excel are used to perform standard calculations in workbooks. The values that are used to evaluate functions are called arguments. The values returned by functions as a response are called results. In addition to built-in functions, you can use user-defined functions in calculations that are created using Excel tools. To use a function, you must enter it as part of a formula in a worksheet cell. The sequence in which the symbols used in the formula must be located is called the syntax of the function. All functions use the same basic syntax rules. If you violate the syntax rules, Excel will display a message stating that there is an

error in the formula. If a function appears at the very beginning of a formula, it must be preceded by an equal sign, as in any other formula. Function arguments are written in parentheses immediately after the function name and are separated from each other by a semicolon. The parentheses allow Excel to determine where the argument list starts and ends. Arguments must be placed inside parentheses. Remember that when writing a function, open and close brackets must be present, and no spaces should be inserted between the function name and the brackets. Arguments can be numbers, text, booleans, arrays, error values, or references. Arguments can be either constants or formulas. In turn, these formulas can contain other functions. Functions that are an argument to another function are called nested functions. You can use up to seven levels of function nesting in Excel formulas. The given input parameters must have valid values for the given argument [3].

Some functions may have optional arguments that may not be present when the function's value is evaluated. For ease of use, the functions in Excel are categorized into database and list management functions, date and time functions, DDE external functions, engineering functions, financial, informational, logical, view and link functions. In addition, the following categories of functions are statistical, textual and mathematical. Mathematical functions are widely represented in Excel.

For example, you can perform various operations with matrices, multiply, find the inverse, transpose. View and link functions allow you to view information stored in a list or table, as well as process links [4].

Below are the main and commonly used formulas in Excel for use in the field of economics: IF, SUMIF, VLOOKUP, SUMPRODUCT, COUNT, AVERAGE and MAX/MIN.

The IF function for comparing data is considered the most popular logical function that is useful to economists, accountants. With its help, you can compare numeric and text values according to certain criteria. For example, calculate depreciation, discounts, markups, or remove errors from calculations. Sometimes the built-in IF function is used in statistical, textual and mathematical formulas, which gives them the ability to "make decisions". The IF function helps you accurately compare values and get the result, depending on whether the comparison is true or not. This is how the formula [3] looks like:

=IF(logical_expression, [value_if_true], [value_if_false])

- Boolean_expression is what you need to check or compare (numeric or text data in cells)
- Value_if_true is what will appear in the cell if the comparison is true.
- Value_if_false - what will appear in the cell if the comparison is incorrect.

For example, the store sells accessories for adults and children. This month all baby products are 20% off. You can sort stock items using the IF function for text values. Let's write the formula in the "Discount" column like this:

=IF(B2="childish",20%,0)

And apply to all lines. In cells where equality is true, we will see discounted products. This is how the IF function is used for text values with one condition

The SUMIF and SUMIFS functions are considered to be another useful function. SUMIF, which allows you to sum several numeric data according to a certain criterion. The formula consists of 2 parts:

- SUM is a mathematical function for adding numeric values. Written as =SUM(cell/range 1; cell/range 2; ...).
- and the IF function discussed above.

For example, you need to calculate the total amount of accrued wages for managers,

and the report contains data for all employees of the enterprise. In the formula, you need to write the following arguments:

- Select the range of all positions of employees — in our case B2:B10.
- Write the selection criterion through a semicolon - "manager".
- The summation range is wages. Specify C2:C10.

And we get the total amount of salaries of managers in one click.

With SUMIF, you can sum the cells that meet a certain criteria. The SUMIFS function will perform a selective summation of data selected by several criteria. Unlike SUMIF, you can use up to 127 data selection criteria. For example, using this formula, it is easy to calculate the total profit from the supply of different goods to several countries at once. In the SUMIFS function, you can work with wildcard characters, use operators for greater than, less than, and equal to calculations. For the convenience of working with the function, it is better to use absolute references in Excel - they do not change when copied and allow you to automatically recalculate the formula if the data in the cell has changed[3].

The VLOOKUP and HLOOKUP functions are used to search for data in a large range. Economists often have to process huge spreadsheets to get the data they need for analysis. Or to reduce two tables into one, which is also not uncommon. The VLOOKUP function or, as it is also called, vertical lookup (English version of VLOOKUP) allows you to quickly find and extract the necessary data in columns. Or transfer data from one table to the corresponding cells in another. The syntax of the simplest VLOOKUP function looks like this:

= VLOOKUP(lookup_value, table, column_number, [scan]).

For example, you need to quickly extract the product name by number in the list. The VLOOKUP function allows you to quickly find the necessary data and transfer it to the selected cell. In cell C1, we indicated the item number. Then we selected the range of cells where to look for it (A1:B10) and wrote the column number "2" in which to take the data. We pressed Enter and got the desired product in the selected cell.

There is a less popular HPR function. It works the same way as VLOOKUP, but searches for data in horizontal lists. One of the goals of this function is to simplify the preparation of source data for analytical and pivot tables [3].

The SUMPRODUCT function or the summation of products will help you quickly deal with any economic problem where there are arrays. Includes the capabilities of the previous IF, SUMIF, and SUMIFS formulas, and also allows you to perform calculations in 255 arrays. It is loved by accountants and often used in payroll and other expenses. To set the number of arrays, they need to be listed separated by a semicolon, then multiplied, and then summed up. At the same time, there is one condition - the arrays must be the same in type and length. For example, you have a monthly sales report for a store that you want to know how much T-shirts in size "M" were sold for. To do this, use the SUMPRODUCT function and specify 2 conditions. We take each of them in brackets, and between them we put an "asterisk", which in Excel is read as a union "and". Let's write the command like this:

=SUMPRODUCT((A5:A11=A13)*(B5:B11=B13)*C5:C11)

where

- the first condition A5:A11=A13— search range and name of the desired product
- second condition B5:B11=B13 — search range and size
- C5:C11 — array from which the final sum is taken

Using the SUMPRODUCT function, we learned in a short time that the store sold M-size T-shirts for a certain amount in a month. To find out sales for a different product and size, you just need to replace the data in cells A13 and B13[3].

The MIN and MAX functions help you find the smallest or largest data value. The MATCH function helps to find the number of the specified element in the selected range. And the VLOOKUP formula, recall, allows you to extract the necessary data from the columns to the specified cells. Let's consider a combination of these functions using the example of solving a problem in Excel for economists. Let's make a combined formula to find the company with the largest amount of debt. To begin with, we will compile a list of debtors, indicate the amount of their debt and set the end date of the loan agreement.

To solve the problem, you can apply the functions sequentially:

- The MAX function will help you find the largest debt ($=\text{MAX}(B2:B10)$), where B2:B10 is the debt column.
- To find the number of the debtor company in the list, you need to add a column with numbering to the table. Because the MATCH function looks for data only in the leftmost column of the selected range.

We compose a function according to the formula:

$\text{MATCH}(\text{lookup_value}; \text{lookup_array}; [\text{match_type}])$

In our case, this will be $=\text{MATCH}(14569; C2: C10; 0)$, where the required value is the maximum amount of debt. The match type will be "0" because we did not apply sorting to the column with debts.

- To find out the name of the debtor company, we use the familiar VLOOKUP function.

It will look like this $=\text{VLOOKUP}(D14; A2: B10; 2)$, where D4 is the desired one, A2: B10 is a table or selected range with company names and numbering, and "2" is the number of the column with debtors.

The same result could be obtained by collecting one formula from 3:

$=\text{VLOOKUP}(\text{MATCH}(\text{MAX}(C2:C10), C2:C10,0), A2:B10,2)[3]$.

In economic calculations, the VLOOKUP function helps you quickly extract the desired value from a huge range of data. Moreover, the value can be found according to different selection criteria. For example, the price of a product can be retrieved by ID, the tax rate by income level, and so on. In addition to the above functions, economists often use the AVERAGE formula, for example, to calculate the average wage. The COUNT function, when you need to calculate the number of shipments in the context of customers or the cost of goods for a certain period. By the way, on the example of shipments, the MIN / MAX formula will help track the range in which the cost of goods has changed. There are a hundred more mathematical and financial functions in Excel, with which you can solve economic problems of varying complexity. For example, process orders, plan production load, calculate taxes, keep personnel records and manage sales. But to solve such problems, hints in Excel will no longer be enough. Here you need to dive deeper into the program and learn how to work with its various tools: from functions and pivot tables to charts and macros[5].

In addition to the above functions, there are Excel tools for modeling and analyzing economic data. The constant development of the functionality of the Excel spreadsheet editor has led to the fact that many new tools have appeared that can help economists in solving their tasks. Among the most significant are the "Search for a solution" function, an advanced data analysis package and specialized add-ons. The solution search function is an additional add-on and allows you to find the most rational way to solve an economic problem using mathematical methods. It can automatically perform calculations for problems with multiple inputs, subject to the imposition of certain restrictions on the desired solution. Such economic tasks can be:

- Calculation of the optimal volume of output with limited raw materials;
- minimization of transportation costs for the delivery of products to customers;
- decision to optimize the wage fund.

CONCLUSIONS

The computational power of Excel and its editing and formatting capabilities add up to a wonderful program for creating any document that can contain textual and numeric data and allows you to perform calculations. Because the tables contain dynamic formulas, their totals will always be up to date. And this is very important in modern conditions.

The application of the MS Office MS Excel package significantly reduces the time for processing symbolic information. Knowledge of the methods of working with built-in functions, the scope and parameters of financial functions, the ability to correctly compose formulas using spreadsheet tools will greatly simplify the calculation steps associated with solving economic and other problems [4].

The paper considers the theoretical and practical foundations for the use of financial functions, their capabilities and methods of use. Various variants of tasks are considered, as well as ways to fill in the arguments of functions (mandatory and optional arguments).

To date, a large number of specialized software products have been developed for economic calculations, however, employees of financial and economic services most often use the Excel spreadsheet editor. The reason for the popularity of this tool is the extensive functionality of Excel and its constant development in almost every new version of the spreadsheet editor.

Within the framework of one article, it is impossible to consider all the advantages of Excel that economists can use in one job, so we stopped at the analysis of the best editor functions used to solve economic problems.

For ease of perception of the material, these functions were grouped into three blocks:

1. Functionality of calculation formulas in Excel.
2. Excel functionality for tabular data processing.
3. Excel tools for modeling and analyzing economic data.

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