

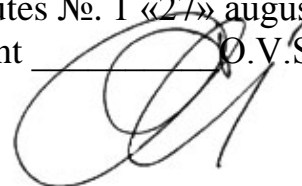
Ministry of Public Health of Ukraine
“Ukrainian Medical Stomatological Academy”

“APPROVED”

at the meeting of the Department
of Medical Informatics, Medical Biophysics
«27» august 2020

Minutes №. 1 «27» august 2020

Head of department _____ O.V. Silkova



METHODICAL GUIDANCE

IRUVW&HQVPHOLed work when preparing and during the practical session

Academic Subject	Medical Information Science
Module No 1	Fundamentals of Information Technology in the Health Care System. Treatment and analysis of medical and biological data
Topic	Use of spreadsheets for the analysis of medical and biological data
Year of study	2
6SHFLDOLW\	Foreign Student Training (Medicine/Stomatology)
Number of academic hours	2

1. Relevance of the topic:

Medical researches are impossible without gathering, ordering and statistical analysis of large volumes of various information about healthy peoples living in different condition and following the different life modes, about sick persons, and reactions of bodies on different therapeutical influences. Spreadsheets give an opportunity to accumulate and prepare data in tabular form, to produce preliminary calculation by easy way. Corresponding knowledges are necessary for future doctors for comprehension of their professional tasks and possibilities.

2. The specific aims:

- To have general knowledge of the topic studied;
- To understand, to remember and to use the knowledge received;
- To form the professional experience by reviewing, training and authorizing it;
- To be able to carry out laboratory and experimental work.
- To be able to prepare data tables, and to carry out simplest calculations using MS Excel.

3. Basic knowledge and skills necessary to study the topic (inter-disciplinary integration).

<i>Previous (providing disciplines)</i>	<i>Obtainable skills</i>
Bases of computer sciences	To know assignment of computer programs.
Subsequent disciplines:	
Social medicine	To know assignment, basic features, using methods of spreadsheets.

4. The tasks for students' individual work

4.1. The list of basic term, parameters, characteristics, which student should master while preparin for the class.

Term	Definition
Wizard	It is a program that generates program elements with specified properties; wizards are design for simplification, acceleration, partial automatization of typical user actions. Double-click a function name to display the function and its arguments in the Function Arguments wizard, which helps you add correct arguments.
t-Test	With help of t-test it is possible to determine whether two sample means are equal
F-test	F-test returns the probability that the variances in sample 1 and sample 2 are not significantly different
NORMDIST	This function returns the normal cumulative distribution for the specified mean and standard deviation.

4.2 Theoretical questions for the class (to the topic):

1. What name as *the formula* and *an operand* in Excel?
2. How to use functions in Excel?
3. For what the wizard of functions is intended? How to work with it?
4. How to work with the function wizard?
5. Basic statistical functions of Excel. List them, describe.
6. How to proceed statistical calculations in Excel?
7. t-Test in Excel.

4.3 Practical tasks pertaining to the topic and to be completed during the class:

To execute work corresponding to task list, issued by teacher: prepaer the table with data, format the data, make calculation usinf functions.

Test

1. WHAT IS THE NAME OF CELLS WHICH ADDRESS DOES NOT CHANGE WHEN COPYING FORMULAS?
 - a) standard
 - b) relative
 - c) absolute
 - d) final
 - e) are open
2. WHAT IS THE STANDARD NAME EXTENSIONS FILE CREATED BY EXCEL?
 - a) “.xls”
 - b) “.txt”
 - c) “.xlc”
 - d) “.doc”
 - e) “.docx”
3. WHAT IS THE RANGE LISTED IS CALLED?
 - a) all other cell line
 - b) All cell one column
 - c) set of allowable values
 - d) one cell
 - e) a set of cells that form a rectangular table area
4. WHICH OF THE OPTIONS INCLUDES THE CORRECT ADDRESS OF THE CELL?
 - a) 123S
 - b) SS12
 - c) V1A
 - d) D2A55
 - e) A12S
5. AS INDICATED BY THE OPERATOR ASSOCIATION THAT BRINGS TOGETHER MULTIPLE LINKS IN ONE?
 - a) ":" (Colon)
 - b) "\$" (Dollar sign)
 - c) ";" (semicolon)
 - d) gap
 - e) "=" (Equals)

Practical work:

Index	The formula	The formula in Excel
Median (M_e)	value that divides the distribution into two equal parts, central or median of a series of observations ordered by an increase or decrease	=MEDIAN()
Mean values or Average (M)	$M = \frac{\sum_{i=1}^n x_i}{n}, n - \text{total}$	=AVERAGE()

Standard deviation (σ)	$\sigma = \sqrt{\frac{\sum_{i=1}^n (X_i - M)^2}{n - 1}}$	=STDEVA()
The coefficient of variation (C_v)	$C_v = \frac{\sigma}{M} \cdot 100\%$ <p>$C_v < 10\%$ - poor variety of signs $10\% \leq C_v \leq 20\%$ - average variety of signs $C_v > 20\%$ - strong variety of signs</p>	=STDEVA()/AVERAGE() Submit a percentage format
Error mean arithmetic (m)	$m = \pm \frac{\sigma}{\sqrt{n - 1}}$	=STDEVA()/SQRT(total-1)

Contents of the topic.

Functions.

Functions are predefined formulas that perform calculations by using specific values, called arguments, in a particular order, or structure. Functions can be used to perform simple or complex calculations.

Using functions and nested functions in formulas

Functions are predefined formulas that perform calculations by using specific values, called arguments, in a particular order, or structure. Functions can be used to perform simple or complex calculations.

The syntax of functions

The following example of the ROUND function rounding off a number in cell A10 illustrates the syntax of a function.

Structure of a function

Structure. The structure of a function begins with an equal sign (=), followed by the function name, an opening parenthesis, the arguments for the function separated by commas, and a closing parenthesis.

Function name. For a list of available functions, click a cell and press SHIFT+F3.

Arguments. Arguments can be numbers, text, logical values such as TRUE or FALSE, **arrays**, error values such as #N/A, or cell references. The argument you designate must produce a valid value for that argument. Arguments can also be constants, formulas, or other functions.

Array: Used to build single formulas that produce multiple results or that operate on a group of arguments that are arranged in rows and columns. An array range shares a common formula; an array constant is a group of constants used as an argument.

Constant: A value that is not calculated and, therefore, does not change. For example, the number 210, and the text "Quarterly Earnings" are constants. An expression, or a value resulting from an expression, is not a constant.

Argument tooltip. A tooltip with the syntax and arguments appears as you type the function. For example, type =ROUND(and the tooltip appears. Tooltips only appear for built-in functions.

Entering functions

When you create a formula that contains a function, the **Insert Function** dialog box helps you enter worksheet functions. As you enter a function into the formula, the **Insert Function** dialog box displays the name of the function, each of its arguments, a description of the function and each argument, the current result of the function, and the current result of the entire formula.

To make it easier to create and edit formulas and minimize typing and syntax errors, use formula autocomplete. After you type an = (equal sign) and beginning letters or a display trigger, Microsoft Office Excel displays below the cell a dynamic drop down list of valid functions, arguments, and names that

match the letters or trigger. You can then insert an item in the drop-down list into the formula.

Nesting functions

In certain cases, you may need to use a function as one of the arguments of another function.

Argument: The values that a function uses to perform operations or calculations. The type of argument a function uses is specific to the function. Common arguments that are used within functions include numbers, text, cell references, and names.

For example, the following formula uses a nested AVERAGE function and compares the result with the value 50.

The AVERAGE and SUM functions are nested within the IF function.

Valid returns. When a nested function is used as an argument, it must return the same type of value that the argument uses. For example, if the argument returns a TRUE or FALSE value, then the nested function must return a TRUE or FALSE. If it doesn't, Microsoft Excel displays a #VALUE! error value.

Using array formulas and array constants

An array formula can perform multiple calculations and then return either a single result or multiple results. Array formulas act on two or more sets of values known as array arguments. Each array argument must have the same number of rows and columns. You create array formulas in the same way that you create other formulas, except you press CTRL+SHIFT+ENTER to enter the formula. Some of the built-in functions are array formulas, and must be entered as arrays to get the correct results.

Array constants can be used in place of references when you don't want to enter each constant value in a separate cell on the worksheet.

Using an array formula to calculate single and multiple results

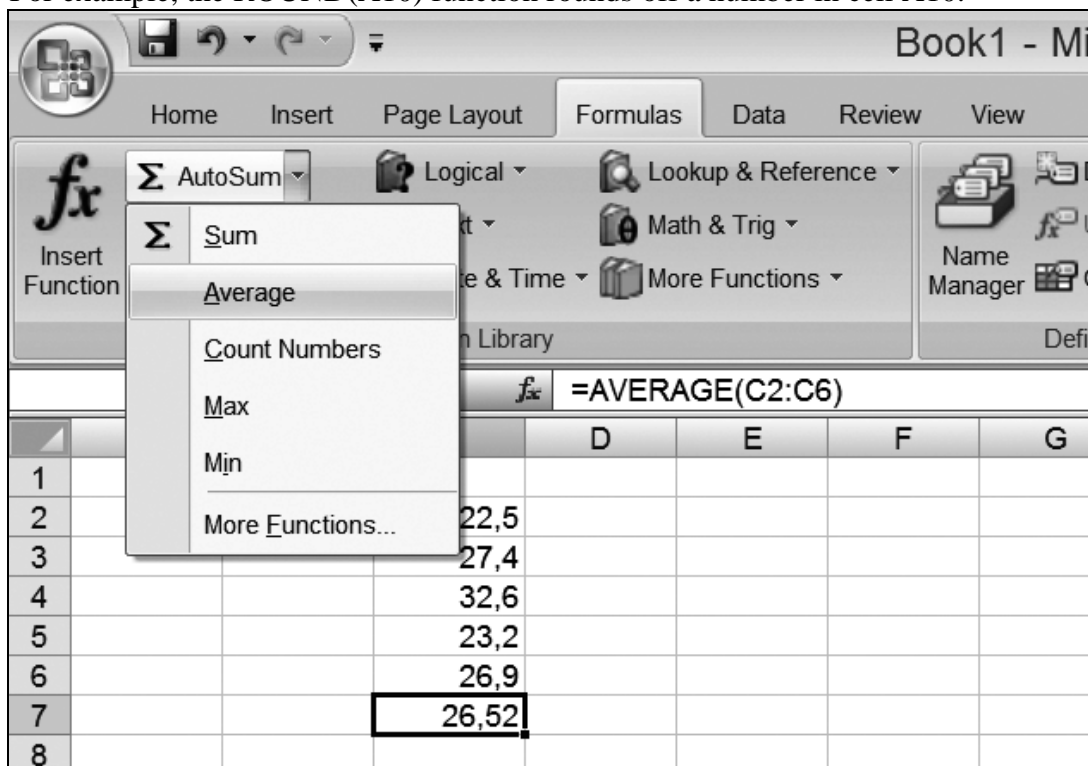
When you enter an array formula, Microsoft Excel automatically inserts the formula between { } (braces).

Array formula: A formula that performs multiple calculations on one or more sets of values, and then returns either a single result or multiple results. Array formulas are enclosed between braces { } and are entered by pressing CTRL+SHIFT+ENTER.

To calculate a single result. This type of array formula can simplify a worksheet model by replacing several different formulas with a single array formula.

For example, the following calculates the total value of an array of stock prices and shares, without using a row of cells to calculate and display the individual values for each stock.

For example, the ROUND(A10) function rounds off a number in cell A10.



On figure above drop-down list has appeared after pressing the down arrow button close Σ **AutoSum** button.

Search for a function

Type a brief description of what you want a function to do, and then click **Go**. A list of functions likely to fit your needs and based on your description will display in the **Select a function** box.

Select a category

From the drop-down list, do one of the following:

Select **Most Recently Used**. Functions you have inserted in the recent past will display in alphabetical order in the **Select a function** box.

Select a function category. Functions in that category will display in alphabetical order in the **Select a function** box.

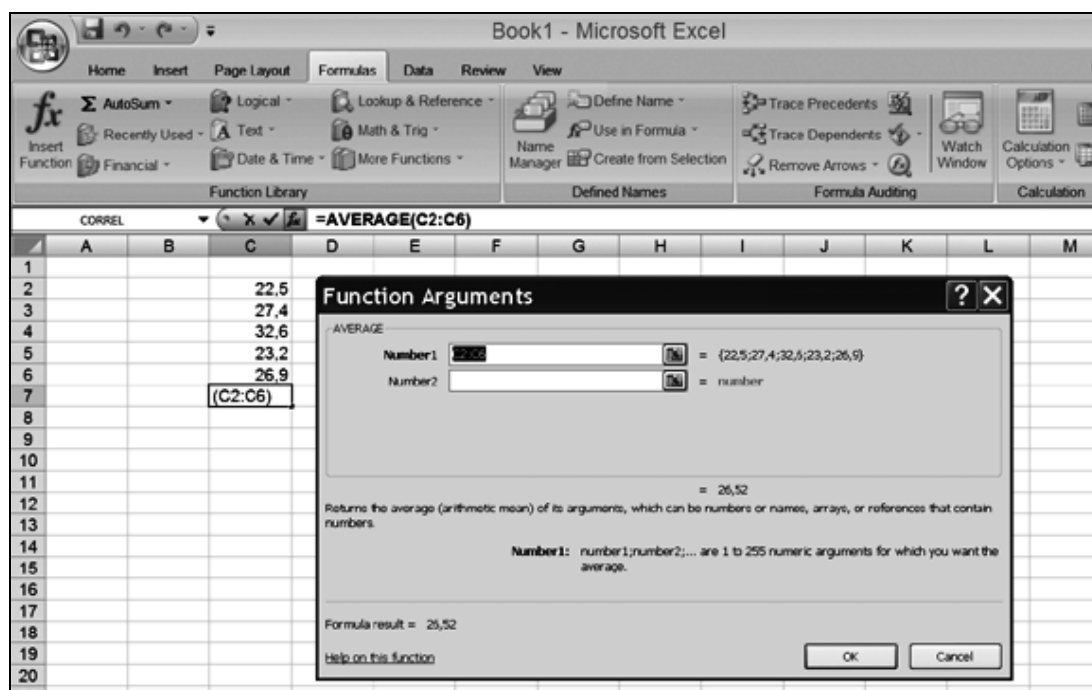
Select **All**. Every function will display in alphabetical order in the **Select a function** box.

Select a function

Do one of the following:

Click a function name to see the function syntax and a brief description immediately below the **Select a function** box.

Double-click a function name to display the function and its arguments in the **Function Arguments** wizard (figure below), which helps you add correct arguments.



Wizard is the software supervising the user at the decision of a problem, asking him or giving variants for a choice. For example, the wizard can help to begin to the user work above the text document, to install the software or to create a database.

In certain cases, you may need to use a function as one of the arguments of another function.

Move or copy a formula. When you move a formula, the cell references within the formula do not change. When you copy a formula, the cell references may change based on the type of reference used.

1. Select the cell that contains the formula.
 2. Verify that the cell references used in the formula will produce the result you want. Switch to the type of reference you need. To move a formula, use an absolute reference.
 3. Select the cell that contains the formula.
 4. In the formula bar select the reference you want to change.
1. Press F4 to toggle through the combinations. The "Changes To" column reflects how a reference type updates if a formula containing the reference is copied two cells down and two cells to the right.

B6						
	A	B	C	D	E	F
1		22,5				
2		27,4				
3		32,6				
4		23,2				
5		26,9				
6		26,52				
7						
8						
9						
10						
11						
12						

C9				
	A	B	C	D
1		22,5		
2		27,4		
3		32,6		
4		23,2		
5		26,9		
6				
7				
8				
9			26,52	
10				

Statistical functions in MS Excel

In MS Excel program there is a group of the built-in statistical functions.

The set of disposable functions not completely satisfies needs of the researcher-physician, but if necessary to carry out the composite statistical calculations it is possible to use the specialized program or if the circle of tasks is rather narrow – to write the program in built-in language Visual Basic for Applications for Excel.

If you use the specialized program for a solution of statistical problems, the count of the restrictions superimposed by a size of the explored data set, is executed automatically since the universal forms of algorithms are used. Calculations of reliabilities and errors will be carried out automatically or semi-automatically. Outcomes of calculations are produced in a reference window of outcomes in which all group of the necessary data is represented or there are buttons for access to dilated lists of outcomes. Working with MS Excel, you should to use the relevant formula, function for each necessary resulting value, or to build the necessary formula with use of one or several functions. Precisely to know, whether there corresponds available function to your problems, check before use the calculated formula (algorithm of calculation), given in MS Excel reference system, comparing it with the formula required to you.

Statistical functions in MS Excel are applied by the same rules, as others mathematical functions. Statistical functions also are with one, two or more arguments.

Analyzing statistics

Microsoft Excel provides a set of data analysis tools – called the Analysis ToolPak – that you can use to save steps when developing complex statistical or engineering analyses. When you use one of these tools, you provide the data and parameters for each analysis; the tool uses the appropriate statistical or engineering macro functions and then displays the results in an output table. Some tools generate charts in addition to output tables.

To view a list of the analysis tools that are available, click Data Analysis on the Tools menu. If the Data Analysis command is not on the Tools menu, run the Setup program to install the Analysis ToolPak. After you install the Analysis ToolPak, you must select and enable it in the Add-In Manager.

To use these tools, you need to be familiar with the specific area of statistics or engineering that you want to develop analyses for.

Microsoft Excel provides many other statistical, financial, and engineering worksheet functions.

To see a list of available worksheet functions, click  (*Insert Function*) on the Standard toolbar.

t-Test: Two-Sample Assuming Unequal Variances analysis tool

Performs a two-sample student's t-test. This t-test form assumes that the variances of both ranges of data are unequal; it is referred to as a heteroscedastic t-test. You can use a t-test to determine whether two sample means are equal. Use this test when the groups under study are distinct. Use a paired test when there is one group before and after a treatment.

The formula used to determine the test statistic value t is:

$$t' = \frac{\bar{x} - \bar{y} - \Delta_0}{\sqrt{\frac{S_1^2}{m} + \frac{S_2^2}{n}}}$$

The following formula is used to approximate the degrees of freedom. Because the result of the calculation is usually not an integer, use the nearest integer to obtain a critical value from the t table.

$$df = \frac{\left(\frac{S_1^2}{m} + \frac{S_2^2}{n}\right)^2}{\frac{\left(\frac{S_1^2}{m}\right)^2}{m-1} + \frac{\left(\frac{S_2^2}{n}\right)^2}{n-1}}$$

FTEST

Returns the result of an F-test. An F-test returns the one-tailed probability that the variances in array1 and array2 are not significantly different. Use this function to determine if two samples have different variances. For example, given test scores from public and private schools, you can test if these schools have different levels of diversity.

Syntax:

FTEST(array1, array2)

Array1 is the first array or range of data.

Array2 is the second array or range of data.

Remarks

The arguments should be numbers, or names, arrays, or references that contain numbers.

If an array or reference argument contains text, logical values, or empty cells, those values are ignored; however, cells with the value zero are included.

If the number of data points in array1 or array2 is less than 2, or if the variance of array1 or array2 is zero, FTEST returns the #DIV/0! error value.

Example

FTEST({6,7,9,15,21},{20,28,31,38,40}) equals 0.648318

NORMDIST

Returns the normal cumulative distribution for the specified mean and standard deviation. This function has a very wide range of applications in statistics, including hypothesis testing.

Syntax: NORMDIST(x, mean, standard_dev, cumulative)

X is the value for which you want the distribution.

Mean is the arithmetic mean of the distribution.

Standard_dev is the standard deviation of the distribution.

Cumulative is a logical value that determines the form of the function. If cumulative is TRUE, NORMDIST returns the cumulative distribution function; if FALSE, it returns the probability mass function.

Remarks

If mean or standard_dev is non-numeric, NORMDIST returns the #VALUE! error value.

If standard_dev <= 0, NORMDIST returns the #NUM! error value.

If mean = 0 and standard_dev = 1, NORMDIST returns the standard normal distribution, NORMSDIST.

The equation for the normal density function is:

Example

NORMDIST(42,40,1.5,TRUE) equals 0.908789

Note

The data analysis functions can be used on only one worksheet at a time. When you perform data analysis on grouped worksheets, results will appear on the first worksheet and empty formatted tables will

appear on the remaining worksheets. To perform data analysis on the remainder of the worksheets, recalculate the analysis tool for each worksheet.

Tasks for self-check:

Task 1:

1. WHEN YOU ENTER DATA INTO A CELL AND PRESS THE ENTER KEY ON THE KEYBOARD, THE CURSOR WILL MOVE TO ____.

- a) the cell to the right of where you entered the data
- b) the cell to the left of where you entered the data
- c) the cell below the cell where you entered the data
- d) the cell above the cell where you entered the data
- e) it will not move

2. THE MEASURE OF THE RELATION BETWEEN TWO OR MORE VARIABLES

- a) correlation
- b) set
- c) mode
- d) method
- e) statistics

3. THESE VARIABLES ALLOW US NOT ONLY TO RANK ORDER THE ITEMS THAT ARE MEASURED, BUT ALSO TO QUANTIFY BUT ALSO TO QUANTIFY AND COMPARE THE SIZES OF DIFFERENCES BETWEEN THEM

- a) ordinal
- b) alternative
- c) interval
- d) ratio
- e) nominal

4. WHAT IS THE NAME OF NUMERICAL CHARACTERISTIC WHICH QUANTITIES OF UNIFORM QUALITY THAT CHARACTERIZES A NUMBER OF STATISTICAL AGGREGATE OF ALL SET?

- a) mode
- b) median
- c) standard deviation
- d) correlation coefficient
- e) the average

5. THIS VALUE OCCURS MOST OFTEN IN A SERIES OF OBSERVATIONS

- a) mode
- b) the average
- c) median
- d) standard deviation
- e) correlation coefficient

Task 2.

For numeric rows of random samples of fixed volume, find: ~ Average value ~ Average square deviation 2 14 35 25 17 b) Find the correlation coefficient between the investigated features X and Y

according to the table. Where X muscle length, Y muscle contraction force X 1,2 1,4 1,6 1,8 2,0 Y 0,42 0,63 0,81 1,1 1,42 c) Determine the median number Distribution of protein concentration in solution. 1.0 1.4 1.8 2.2 2.6 3.0 3.4 2.4 3.2 3.0 2.5 1.2 1.4 1.4 d) Determine the mode, the mathematical expectation for row of protein concentration in solution (table from example 3)

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Additional.

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The methodical guidance has been completed by **S.Y. Olenets**