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# MedCalc.net

Tutorial

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MedCalc.net tutorial. Version 1.001 - June 21, 2015

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## Introduction

MedCalc.net is an online service of MedCalc software that allows you to statistically analyze your data on any device that is connected to the internet and has a web browser. After you have uploaded your data to MedCalc.net through a secure web interface you can select one of the many statistical procedures. The statistical analyses are performed in the background by MedCalc, which is also available as a desktop program on [www.medcalc.org](http://www.medcalc.org).

The results and graphs are displayed in the browser. Graphs can be downloaded in PowerPoint format or as high resolution TIF files.

MedCalc.net operates "in the cloud". Your data are securely saved on Microsoft servers and the software runs on several servers in the Microsoft Azure environment. The servers are "load-balanced" which means that the workload is equally distributed across the different servers. Load balancing aims to optimize resource use, maximize throughput, minimize response time, and avoid overload of any single server.

The MedCalc.net interface is flexible and adapts to the device you are using. On a desktop or laptop computer with full screen, the menu and content is shown in a horizontal layout and uses the full screen. On tablets or phones, menus and content are reorganized to fit the screen. The menu changes to a drop down menu and content is arranged in a more vertical layout.

## Let's get started

### Subscribe to a MedCalc.net trial

To get started you visit the secure website <http://www.medcalc.net/>. At the bottom of the home page you are invited to register and get started with a 7-day free trial. You click that link.

To create an account, enter your full name, email address and a password of your choice. It is recommended to use a strong password. Your email address will be used as your primary sign in ID.

Full name:	<input type="text" value="John Smith"/>
Email:	<input type="text" value="john.smith@example.com"/>
Password:	<input type="password" value="••••••••"/>
	<input type="checkbox"/> Show characters
<input checked="" type="checkbox"/> I have read and agree with the <a href="#">Terms and Conditions</a>	
<input type="button" value="Create account"/>	

You must agree with the MedCalc.net terms and conditions. Click on the Terms and Conditions link to read them. When you have done, use the Back button of your browser to return to the create account page.

Next click **Create account**. This will take you to a new page that will inform you that a confirmation email has been mailed to your email address. Open your mailbox and you will find an email from [info@medcalc.net](mailto:info@medcalc.net) which will look like this:

<b>Subject:</b> MedCalc.net registration confirmation required
 <b>MedCalc.net</b>
 Thank you for your registration on the <b>MedCalc.net</b> site.
You must confirm your registration by clicking the following link: <a href="https://www.medcalc.net/account/confirm.php">https://www.medcalc.net/account/confirm.php</a>
Your confirmation code is <b>{DBB0F2E3-9A25-CED5-97A9-E04ECCD10766}</b>
Please do not hesitate to contact us if you need any assistance.
Sincerely, MedCalc Software
 Acacialaan 22 B-8400 Ostend Belgium email: <a href="mailto:info@medcalc.net">info@medcalc.net</a> <a href="http://www.medcalc.net">www.medcalc.net</a>

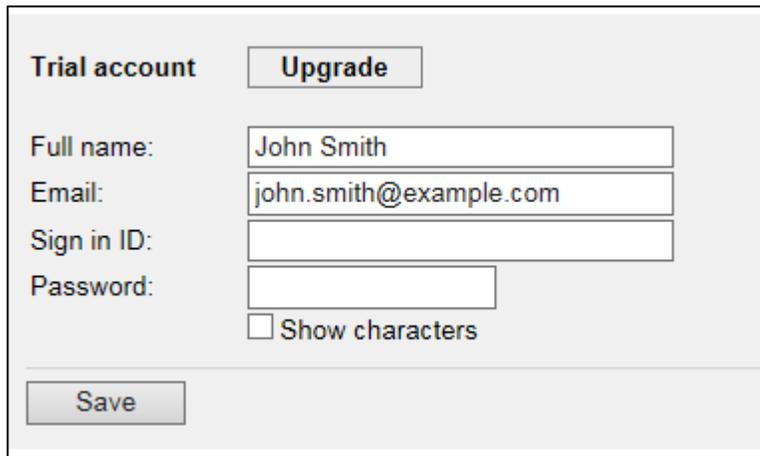
You click on the confirmation link in the email. This will bring you back to the MedCalc.net site with your account setup completed.

## User & login information

To review your login information, you click on your name in the top right corner of the screen. This will cause a drop-down menu to be displayed.



Click **User** and the following will be displayed:

A screenshot of a user profile editing form. At the top left, it says "Trial account" and next to it is a button labeled "Upgrade". Below this, there are four input fields: "Full name:" with the value "John Smith", "Email:" with the value "john.smith@example.com", "Sign in ID:" which is empty, and "Password:" which is empty. Below the password field is a checkbox labeled "Show characters" which is unchecked. At the bottom left of the form is a "Save" button.

Here you can edit your name if necessary, or change your email address if you desire to do so.

Your email address is your primary sign in ID. This means you can always sign in on MedCalc.net with your email address and your password. If you find it more convenient to login with your name (or any other alias), you can enter this in the dialog panel next to Sign in ID. For example, if you would like to sign in with John, you enter:

A screenshot of the "Sign in ID" input field. The label "Sign in ID:" is on the left, and the input field contains the text "John".

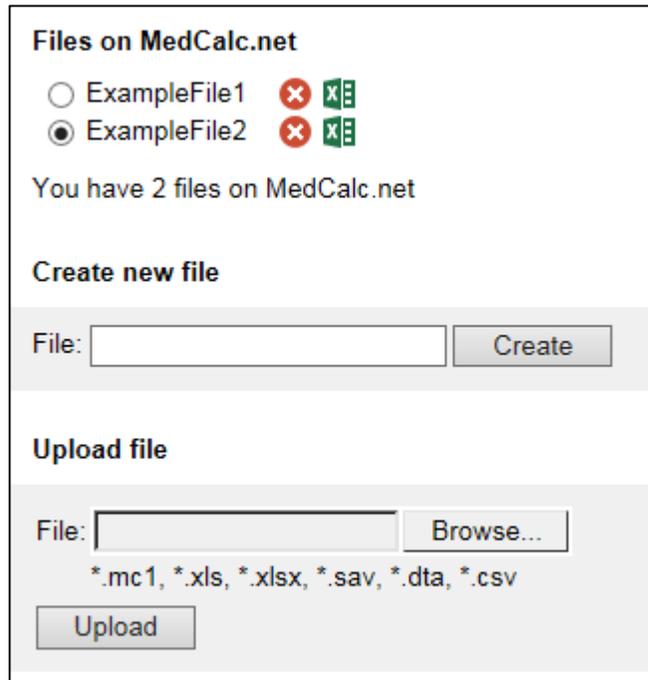
However every sign in ID on MedCalc.net must be unique, and your first name may already be reserved by another user.

Now we have completed our registration, we need some data to analyze.

## File management

There are two ways to have your data on MedCalc.net. You can upload a data file, or you can just create a new empty file and enter the data on the website, but uploading a file in Excel or MedCalc format is the most convenient.

Click **Files** in the MedCalc.net menu.



The screenshot shows the 'Files on MedCalc.net' interface. At the top, there are two file entries: 'ExampleFile1' and 'ExampleFile2'. Each entry has a radio button, a red 'x' icon, and a green 'x' icon with a grid pattern. Below these entries, it says 'You have 2 files on MedCalc.net'. Underneath, there is a section titled 'Create new file' with a text input field labeled 'File:' and a 'Create' button. Below that is a section titled 'Upload file' with a text input field labeled 'File:', a 'Browse...' button, and a list of supported file formats: \*.mc1, \*.xls, \*.xlsx, \*.sav, \*.dta, \*.csv. At the bottom of the upload section is an 'Upload' button.

If you do not want to upload or enter any data at this point, the system has already created some files on your account, and you can start playing with the data in these files.

### Upload file

To upload a file from your computer to MedCalc.net, click the Browse button and locate the file on your system. Next click the Upload button.

Whichever file format (Excel, CSV, etc.) you use, the data must be organized as follows:

- Each column contains the data of one variable.
- The top row contains the names of the variables. The top row should not contain numbers or other data.
- The data for every case are entered on one row.
- Do not code missing data with a number.

Note that the Upload file feature is not supported by all devices.

When you upload a file, the file is converted into a MedCalc.net specific format. Your file is not saved in its original format on MedCalc.net.

### Create new file

Alternatively, you can start and create a new file on MedCalc.net by entering a file name and click **Create**.

## Managing your files

If you do not longer need a file, you click the  button to delete the corresponding file.

To download the file in Excel format to your computer you click the  button.

## Data editing

Click **Data** in the MedCalc.net menu to bring up the table data editor which shows the data of the active file. You can easily select a different file in the file selector above the data table.

The data are arranged in columns and rows. A column represents a variable and a row represents a case, sample or subject. All data for one case are entered on one row of the table. The top row contains the names of the variables.

	A	B	C	D	E	
	Group	Outcome	Variable1	Variable2	Variable3	
1	0	0	126.7	154.3	260.6	
2	0	0	110.7	88.8	279.8	
3	0	0	114.8	106.9	263.8	
4	0	0	104.5	133	259.7	
5	0	0	124	142.5	235.5	
6	0	0	138	150.5	245.6	
7	0	1	131.1	117.5	270.8	
8	0	0	131	132	245.5	
9	0	1	102.5	100.5	245.6	
10	0	0	123	113	245.1	

If you are working on a desktop PC, you can navigate in the table using the arrow keys, Page Up and Page Down keys, etc. Alternatively you can use the different buttons in the right side and bottom navigation bars, and the arrow buttons in the top toolbar.

To enter new data to the cell you move the cellpointer to that cell and enter the data. To start editing a cell you press function key F2 (if available) or click the  button.

## Variables

Variables in MedCalc may be basic variables, which refer directly to columns in the data table or can be a combination of variables or a transformation of a variable.

### The basic variable: column heading

These variables refer directly to columns in the spreadsheet.

- The name of the variable is the heading you enter for the column in the spreadsheet.
- A variable name should not include any spaces, nor the following characters: - + / \* = < > ^ ( ) \$ " ' : , .
- The variable name should not start with a number and it must be different from reserved words such as TRUE, FALSE, ROW and COLUMN.
- The variable name should not be equal to the address of a spreadsheet cell such as A1, S1, AB35, IL6, etc.

### Combination of variables

A mathematical formula combining two or more variables.

For example:  $WEIGHT/(HEIGHT*HEIGHT)$

Any of the following operators can be used to combine variables (in order of precedence):

- ^ Exponentiation
- Negation
- \* / Multiplication, Division
- + - Addition, subtraction

As shown in the example, brackets can be used to change the operators' precedence.

To create a new variable which is a combination of variables, see below: How to create a derived variable.

### Transformation of a variable

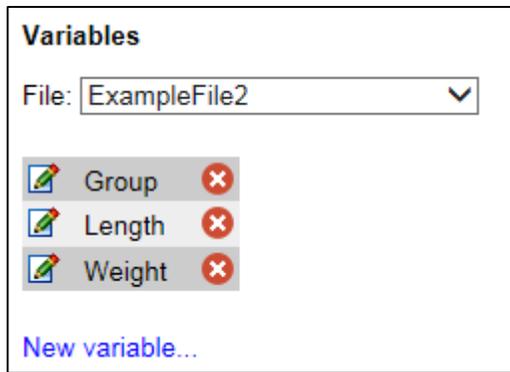
When a variable needs transformation, you can use one of the many MedCalc spreadsheet functions. For example, if a variable needs square root transformation you use the  $SQRT(variable)$  function as a new variable.

To create a new variable which is a transformation of an existing variable, see below: How to create a derived variable.

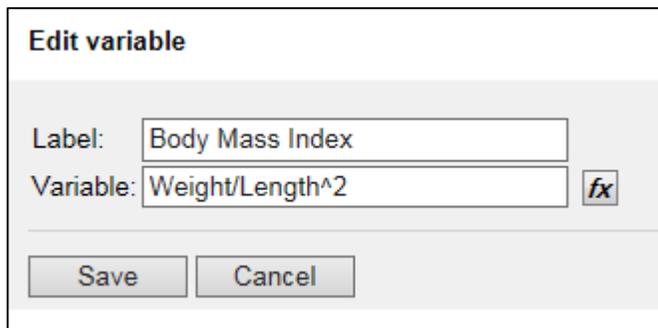
### How to create a derived variable

The example file ExampleFile2 contains data on body weight (in *kg*) and length (in *m*). You want to have a new variable Body Mass Index which is the weight divided by length squared.

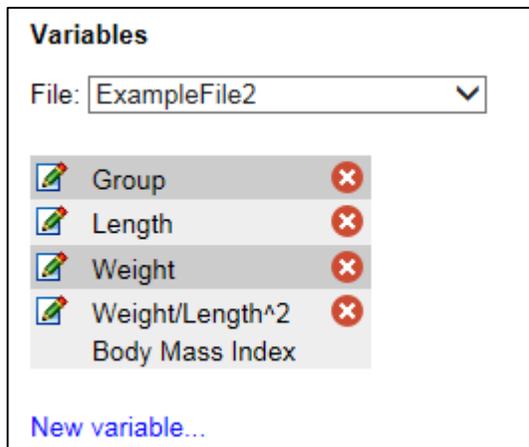
Click **Tools** in the MedCalc.net menu. Next click **Variables**. The browser displays the variables in the data table.



Click the **New variable** hyperlink. A new input panel is displayed which you complete as follows:



Click **Save** and the new variable is added to the variables list:



## Filters

A filter is a logical expression which evaluates to 1 (= TRUE) or 0 (=FALSE). For every case in the data table, the expression is evaluated and if the result is TRUE, the case is included in the analysis or graph but if the result is not TRUE, then the case is excluded from the procedure.

### Basic filter

A basic filter exist of a variable, a logical operator and a constant value. The relational operators, in order of precedence, are:

- = Equality
- <> Inequality
- < Less than
- > Greater than
- <= Less than or equal to
- >= Greater than or equal to

For example, if you have a variable AGE then the expression AGE>40 can be used as a filter.

Other examples of filters:

TREATMENT="A": Treatment must be equal to "A" - notice the use of quotation marks for text constant in formula.

AGE<=60: Age must be less than or equal to 60

ROW<21: Only the first 20 cases in the spreadsheet will be selected

### Combined filters

Different filters can be combined into one single filter using the logical functions AND, OR and NOT, e.g.

AND(AGE>40,AGE<60): only cases with age more than 40 and less than 60 will be selected.

AND(AGE>40,TREATMENT="A"): only cases with age more than 40 and treatment "A".

OR(AGE>40,TREATMENT="A"): cases with age more than 40 or treatment "A" will be selected.

AND(AGE>40,OR(TREATMENT="A",TREATMENT="B")): cases with age more than 40 and treatments "A" or "B" will be selected.

When you have used a filter, you should check the resulting sample size and verify that the cases you intended to be selected have indeed been selected, and that you did not make a logical error in composing the selection filter.

### How to create a filter

The example file ExampleFile2 contains data on body weight and length and included a variable **Group**. The Group variable contains the numbers 0 and 1 that identify two subgroups (controls and treated). You want to have a filter that select the cases belonging to group 0 and a filter that selects the cases belonging to group 1.

Click **Tools** in the MedCalc.net menu. Next click **Filters**. The browser displays the following (there are no filters defined yet for this data table):

**Filters**

File:

[New filter...](#)

Click the **New filter** hyperlink. A new input panel is displayed which you complete as follows:

**New filter**

Label:

Filter:

Click **Save** and the new filter is added to the filters list:

**Filters**

File:

group=0

Controls

[New filter...](#)

You proceed in a similar way for the second group, where group=1 for the treated cases.

## Statistical procedures and graphs

Click **Statistics** in the MedCalc.net menu. You are presented with a menu of the statistical procedures available in MedCalc.net.

Summary statistics	One-way ANOVA
Outlier detection	Two-way ANOVA
Histogram	Analysis of covariance
Cumulative distribution plot	Repeated measures ANOVA
Normal plot	Kruskal-Wallis test
Box-and-whisker plot	Friedman test
Correlation	Frequency table & Chi-squared test
Partial correlation	Fisher's exact test
Rank correlation	McNemar test
Regression	Cochran's Q test
Multiple regression	Kaplan-Meier survival analysis
Logistic regression	Cox proportional-hazards regression
One sample t-test	Bland-Altman plot
Independent samples t-test	Passing-Bablok regression
Paired samples t-test	Intraclass correlation coefficient
Signed rank sum test (one sample)	Concordance correlation coefficient
Mann-Whitney test (independent samples)	Inter-rater agreement (Kappa)
Wilcoxon test (paired samples)	Cronbach's Alpha
Variance ratio test (F-test)	ROC curve analysis
	Comparison of ROC curves

For example, click **Correlation**. This will bring up the following input panel:

**Correlation**  
File:    
  

<b>Variables</b>		<b>Options</b>
Variable X:	<input type="text" value="Variable1"/> 	<input type="checkbox"/> Logarithmic transformation X
Variable Y:	<input type="text" value="Variable2"/> 	<input type="checkbox"/> Logarithmic transformation Y
Filter:	<input type="text"/> 	<b>Graph options</b>
		<input checked="" type="checkbox"/> Scatter diagram
		<input type="checkbox"/> Draw line of equality

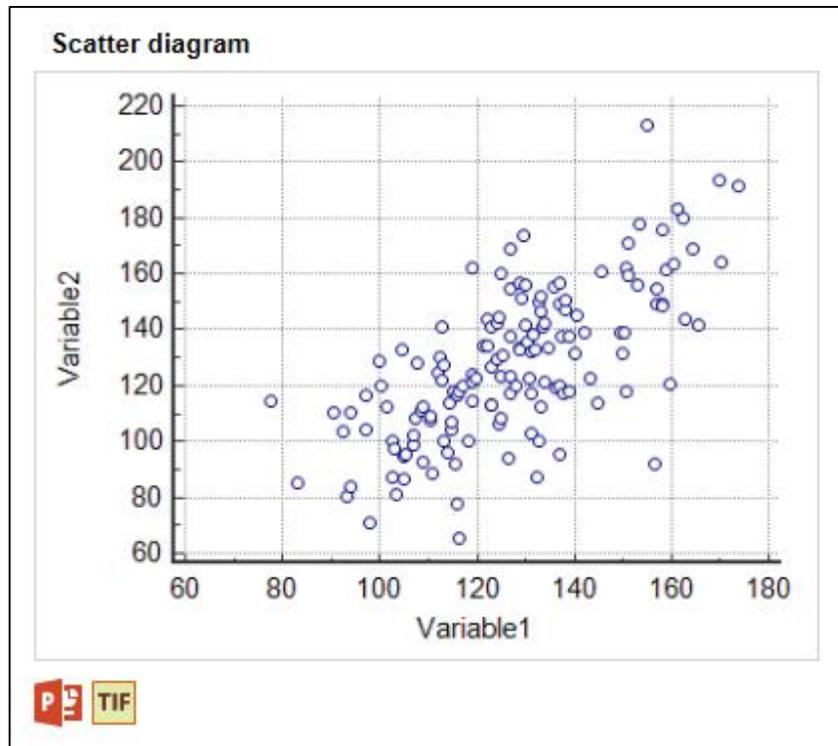
You can select the data to be analyzed: the variables X and Y and optionally a filter. If any of the variables needs logarithmic transformation, you select the corresponding option.

In the example, an optional Scatter diagram has also been selected. Click OK and after some processing, the following results are displayed in the browser:

**Results**

Variable Y	Variable2
Variable X	Variable1
Sample size	145
Correlation coefficient r	0.6812
Significance level	P<0.0001
95% Confidence interval for r	0.5830 to 0.7599

This result section is followed by the scatter diagram:



You can download the graph in PowerPoint format or as a high resolution TIF file by clicking the corresponding icon below the graph.

## Appendix A. Spreadsheet functions

This appendix lists only the most commonly used functions. For a full overview of all functions that are available in MedCalc, visit [https://www.medcalc.org/manual/spreadsheet\\_functions.php](https://www.medcalc.org/manual/spreadsheet_functions.php).

### Mathematical functions

**ABS(x)** returns the absolute value of the number  $x$ .

**EXP(x)** returns the natural exponential of  $x$ :  $2.718281828^x$ . EXP is the inverse function of the LN function.

**LN(x)** returns the natural logarithm of the positive number  $x$  to the base  $e$  ( $e=2.718281828$ ). The argument  $x$  must be greater than 0. LN is the inverse function of EXP.

**LOG(x)** returns the logarithm of the positive number  $x$  in the base 10. The argument  $x$  must be greater than 0.

**POWER(n,p)** returns  $n$  raised to the power  $p$ .

**RAND(x)** returns a computer-generated random number (a) when  $x \leq 1$  the result is a number between 0 and 1, or (b) when  $x > 1$  then the result is a number between 1 and  $x$ . The function will return a different value every time the spreadsheet is recalculated.

**RANDNORM(m,s)** returns a random number from a Normal distribution with mean  $m$  and standard deviation  $s$ .

**ROUND(x,n)** rounds the number  $x$  to the number of digits  $n$ . If  $n$  is negative, then  $x$  is rounded to the left of the decimal point.

**SIGN(x)** returns a number that indicates the sign  $x$ : -1 if  $x$  is negative; 0 if  $x$  equals 0; or 1 if  $x$  is positive.

**SQRT(x)** returns the square root of the positive number  $x$ .  $SQRT(x) = x^{(1/2)}$ . If the argument  $x$  of the function is negative, then the function returns an error (missing value).

### Trigonometric functions

**ACOS(x)** returns the arccosine of  $x$ . The arccosine function is the inverse function of the cosine function and calculates the angle for a given cosine.  $X$  must be in the  $[-1..1]$  range. The result is an angle expressed in radians. To convert from radians to degrees, use the DEGREES() function.

**ASIN(x)** returns the arcsine of  $x$ . The arcsine function is the inverse function of the sine function and calculates the angle for a given sine.  $X$  must be in the range  $[-1..1]$ . The result is an angle expressed in radians. To convert from radians to degrees, use the DEGREES() function.

**ATAN(x)** returns the arctangent of  $x$ . The arctangent function is the inverse function of the tangent function and calculates the angle for a given tangent. The result is an angle expressed in radians. To convert from radians to degrees, use the DEGREES() function.

**ATAN2(y,x)** returns the arc tangent of the two numbers  $x$  and  $y$ . It is similar to calculating the arc tangent of  $y / x$ , except that the signs of both arguments are used to determine the quadrant of the result. The result is an angle expressed in radians. To convert from radians to degrees, use the DEGREES() function.

**COS(x)** returns the cosine of an angle  $x$ . The result range is  $[-1..1]$ . The angle  $x$  must be expressed in radians. To convert an angle expressed in degrees to radians, use the RADIANS() function.

**DEGREES(x)** converts an angle  $x$  expressed in radians to degrees. The relation between the 2 units is as follows:  $2 \times \text{Pi radians} = 360 \text{ degrees}$ .

**RADIANS(x)** converts an angle  $x$  expressed in degrees to radians.

**SIN(x)** returns the sine of the angle x. The result range is [-1..1]. The angle x must be expressed in radians. To convert an angle expressed in degrees to radians, use the RADIANS() function.

**TAN(x)** returns the tangent of the angle x. The angle x must be expressed in radians. To convert an angle expressed in degrees to radians, use the RADIANS() function.

## Date and time functions

**DATE(dnr)** returns the date corresponding with the serial date number dnr expressed as a string. DATE(DATEVALUE(A1)+7) returns "6.9.96" when cell A1 contains the date string 30.8.96 or "30/8/96" (date format DD.MM.YY)

**DATEFRAC(date)** converts date into a fractional year-number. The integer part of this number is the year, and the decimal fraction ranges from 0.0 to 0.99..., representing the dates 01 Jan to 31 Dec. DATEFRAC("01.07.2000") returns 2000.5

**DATEVALUE(str)** returns the serial date number for the date expressed in the string str. DATEVALUE("10.12.88") returns 68645 if the date format is DD.MM.YY.

**DAY(date)** returns the day of the month of date. Date can either be a serial date number or a date string. DAY("23.08.88") returns 23 (date format DD.MM.YY)

**MONTH(date)** returns the month of the year of date. Date can either be a serial date number or a date string. MONTH("23.08.88") returns 8 (date format DD.MM.YY)

**TIMEFRAC(time)** converts time into fractional time-number. The integer part of this number is the hour, and the decimal fraction ranges from 0.0 to 0.99, representing the minutes 0:00 to 0:59. TIMEFRAC("12:30") returns 12.5.

**TIMEVALUE(str)** converts a time string (in "hh:mm" format) to a serial time number. A serial time number is a number ranging from 0.00 to 1.00 representing the time 0:00 to 24:00. TIMEVALUE("06:30") returns 0.27084.

**WEEKDAY(date)** returns the weekday number of date. Days are numbered from Monday (=1) to Sunday (=7). WEEKDAY("05.07.56") returns 4, this is the 4th day of the week (=Thursday).

**WEEKNUM(date)** returns the number of the week of the year of date. Date can either be a serial date number or a date string. WEEKNUM("25.12.98") returns 52.

**YEAR(date)** returns the year of date. Date can either be a serial date number or a date string. YEAR("23.08.88") returns 88 (date format DD.MM.YY)

## Logical functions

**AND(condition1,condition2,...)** returns 1 (=TRUE) if all of its arguments are TRUE. If one of the arguments, either condition1, condition2, etc. is FALSE (or 0), the function returns 0 (=FALSE). If one of the conditions cannot be evaluated (for example because of missing data), the function returns an error.

**IF(condition,x,y)** returns x if the condition is TRUE (=1), but returns y if the condition is FALSE (=0).

**NOT(x)** reverses the value of its argument x. If x is 0 or FALSE then NOT(x) returns 1 (= TRUE). If x is 1 or TRUE then NOT(x) returns 0 (= FALSE).

**OR(condition1,condition2,...)** returns 1 (=TRUE) if at least one of its arguments is TRUE (or 1). If one of the conditions cannot be evaluated (for example because of missing data), the function returns an error.

## **Miscellaneous functions**

**COLUMN**(cell) returns the zero-based column number of a cell in the spreadsheet. The cell argument is optional and **COLUMN**() returns the column number of the cell in which the formula is used. **COLUMN**() can be shortened to **COLUMN**.

**ROW**(cell) returns the row number (indicating cases) of a cell in the spreadsheet. The cell argument is optional and **ROW**() returns the row number of the cell or row in which the formula is used. **ROW**() can be shortened to **ROW**.