Excel Functions

- Excel is equipped with over 300 built-in functions.
  - They are divided into 10 groups: mathematical and trigonometric, logical, statistical, date and time, database, financial, text, informational, lookup and reference, engineering (Toolpack)
    - A function computes "something" and returns a value.
  - Syntax: =name(argument)
    - "name" is the name of the function

      "argument" is a list of cells, ranges, other functions or formulae
      - the number of arguments can vary, e.g.

        zero arguments: =PI() → 3.1415926535898....

        one argument: =SQRT(B5) ≡ √B5 → 2 for B5=4

        two arguments: =ROUND(PI(),3) → 3.142

        variable number: =SUM(C1:C10,B12,B5) → sums up the values of the cells C1,C2,...,C10,B12,B5

25

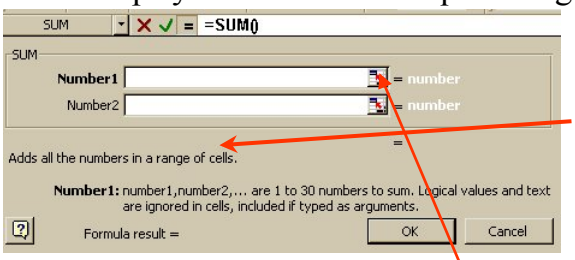
- When the number is variable, the maximum number of allowed arguments is 30 and the maximum number of characters is 1024. A range counts as one argument.

- You can either type the entire syntax or use:

  Insert → Function → (or LC)

  → gives a list of functions organized into the mentioned groups

  → selecting a particular function opens a dialog window which helps you to fill in the required arguments, e.g.



You also get the information about what the function does.

→ either type in the data or LC on , which allows you to select cells by pointing (see above).

26

- There are some special functions called array functions which need to be entered in a particular way (see below).
- There are various ways to make errors when using functions.

Excel will give the following error messages:

#DIV/0! ≡ division by zero

#NAME? ≡ a formula contains an undefined variable or function name, or the function syntax is not valid

#N/A ≡ value is not available, that is when formulae refer to cells which do not contain the appropriate data

#NULL! ≡ a result has no value

#NUM! ≡ numerical overflow, e.g. SQRT(A1) for A1 is -5

#VALUE! ≡ invalid argument type, e.g. SQRT(A1) for A1 containing text

#REF! ≡ invalid cell reference

circular error ≡ a formula contains a reference to its own location

27

- Examples for functions:
  - Mathematical &Trigonometric Functions
    - These are standard functions you also find on a calculator, e.g.

    =SIN(x) x is an angle in radians, e.g. SIN(PI()/2) → 1

    =COS(), =TAN(), =ACOS(), =EXP(), LN(), =COSH(), =ABS(), =PRODUCT(x,y,z,..) , =FACT(x) (x!), ...
  - Statistical Functions
    - These are functions from statistics & probability, e.g.

    =AVERAGE(A1:B7) ≡ computes the arithmetic mean

    =MAX(A1:B7) ≡ returns the largest number in A1:B7

    VAR, POISSON,SLOPE,TREND,HYPGEODIST,.....
  - Date & Time Functions
    - These are functions which deal with time, e.g.

    =TODAY() ≡ returns todays date

    =NOW() ≡ returns todays date and the current time

28

- Text Functions
  - These are functions which manipulate text strings and data, e.g.
    =EXACT(text1,text2) ≡ returns "TRUE" if text1=text2 and "FALSE" if text1≠text2 (case sensitive)
    =UPPER(text) ≡ converts all characters of text to upper case
- Financial Functions
  - These are functions with some financial applications, e.g.
    =FV(rate,np,pmt,pv,type) ≡ future value of an investment
    rate ≡ interest rate per period
    np ≡ total number of payment per year
    pmt ≡ is the payment made each period
    pv ≡ initial lump-sum, (optional, default is 0)
    type ≡ indicates when payments are due, 1 at the beginning of the period and 0 at the end of the period (optional, default is 0)

29

Expl.: You deposit £1,500 into a savings account at a monthly interest rate of 0.6%. You plan to deposit £150 at the beginning of every month for the next 2 years.
How much money will be in the account after 2 years?
FV(0.6%, 24, -150, -1500, 1) → £5,614.42

- Information Functions
  - These are functions which return informations about the cell data, format etc, e.g.
    =TYPE(A1) ≡ returns a number which stands for the data type contained in cell A1: 1 = number, 2 = text, 4 = logical value, 16 = error value, 64 = array
- Logical Functions
  - These functions handle boolean values, i.e. TRUE or FALSE. There are 6 functions of this type, IF, NOT, AND, OR, FALSE() and TRUE().

30

· The IF-function is used when you want the function to return a different result depending on the value of a certain condition.
Syntax: =IF(*condition*, value for true, value for false)

condition = expression1 *comparison operator* expression2

comparison operators: = ≡ equal to
<> ≡ not equal to
> ≡ greater than
>= ≡ greater than or equal to
< ≡ less than
<= ≡ less than or equal to

Expl.: - =IF(B3>0, "positive", "negative")
returns the text value "positive" if the value in the cell B3 is positive and otherwise the text "negative" .
- =IF((A1-B2)>=0, SQRT(A1-B2), "complex value")
- =IF(SUM(A1:A9)>0, 1, 0)
- =IF(D6, "true", "false")

31

· IF-functions can be nested up to seven times, which means that inside the argument of an IF-function (as condition or returned value) you can have further IF-functions.
Expl.: - =IF(A1>-5, IF(A1<=5,1,0) , 0) produces the function:

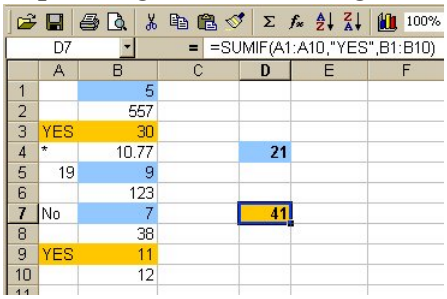
$$f(A1) = \begin{cases} 0 & \text{for } A1 \le -5 \\ 1 & \text{for } -5 < A1 \le 5 \\ 0 & \text{for } A1 > 5 \end{cases}$$

· Several Excel functions contain implicit IF- statements,e.g.
=SUMIF(range,condition,sum_range)
range ≡ The range to be evaluated.
condition ≡ A criterium which select out certain values.
sum_range ≡ The range which will actually be evaluated
It is optional. When omitted it corresponds to range.

32

· Expl.: - =SUMIF(B1:B10,"<10") sums up all values in the cells B1:B10 which are smaller than 10.

- =SUMIF(A1:A10,"YES",B1:B10) sums up all the values in the cells B1:B10 when YES is written in the corresponding cell of the range A1:A10.

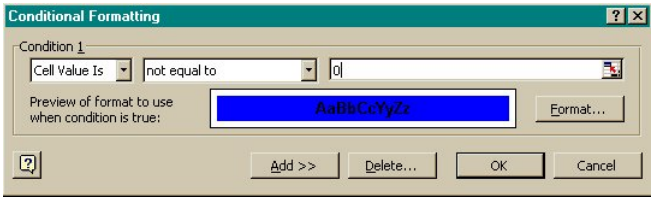


	A	B	C	D	E	F
1		5				
2		557				
3	YES	30				
4	*	10.77		21		
5	19	9				
6		123				
7	No	7		41		
8		38				
9	YES	11				
10		12				

· Also Formats can contain an implicit IF-statement. This is called conditional Formatting. It is for instance useful when some cells only contain data under certain circumstances.

33

You invoke it by: Format → Conditional Formatting →



In the example only when the content of the conditionally formatted cell(s) is not equal to zero the cell will be coloured in blue and the text will be displayed in bold. (see Lab-Session 2)

· The AND-function can be used to produce more complex tests. It returns the logical value TRUE if **all** conditions in its argument are true.

Syntax: =AND(condition1,condition2,condition3,...)

Expl.: - =AND(A1>5,A2>5) returns TRUE for A1>5 and A2>5

- =IF(AND(A1>-5, A1<=5) ,1 , 0) produces the same function as the example for the nested IF-function

34