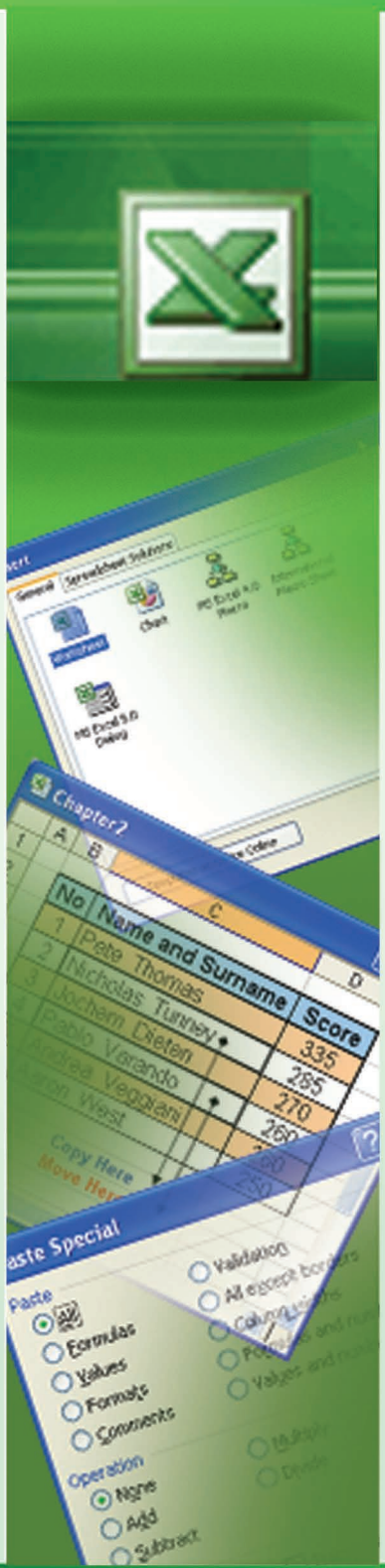


CHAPTER 5

FUNCTIONS AND FORMULAS

- ✓ Understanding Functions and Formulas
- ✓ Simple Formulas
- ✓ Using Predefined Functions and Formulas

Nothing is terminated until you give up. Therefore, if you don't give up your dreams, they are not terminated.

Christian von Koenigsegg

Microsoft Office
Excel 2003

FUNCTIONS AND FORMULAS

5.1 UNDERSTANDING FUNCTIONS AND FORMULAS

Using formulas is the essential part of Excel. Microsoft Excel is best when you have lots of numbers and different calculations with these numbers. Each box (cell) is like a different address and can be used with its referring address or name.

TO REFER TO	USE
The cell in column A and row 10	A10
The range of cells in row 15 and columns B through E	B15:E15
All cells in row 5	5:5
All cells in rows 5 through 10	5:10
All cells in column H	H:H
All cells in columns H through J	H:J
The range of cells in columns A through E and rows 10 through 20	A10:E20

FIGURE 5.1 Reference style

The A1 reference style

By default, Excel uses A1 reference style. This refers to columns with letters (A, B, C... IU, IV a total of 256 columns) and to rows with numbers (1 through 65536). These letters and numbers are called row and column headings. To refer to a cell, enter the column letter followed by the row number.

For example, B2 refers to the cell at the intersection of column B and row 2.

Referring to another worksheet

When referring to a cell in another worksheet. The worksheet name is followed by an exclamation mark and then the cell name is written.

=10C!A2 (refers to cell A2 in sheet 10C)

5.1.1 WRITING YOUR FIRST FORMULA

To write a formula, you must start with an equal sign "=". Then, using references, numeric values and arithmetic operators, you can write your own formulas. (You can see the cell reference name in **Name Box** on the left of Formula Bar).

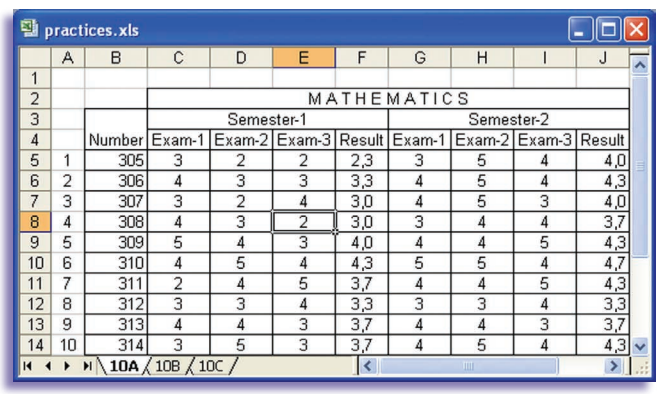


FIGURE 5.2 Writing Formula

Example 5.1:

You have a worksheet that lists all lessons, semesters and exams for each student. In order to calculate a student's average first semester average, you need to calculate the sum of Exam1, Exam2 and Exam3 and then divide the result by 3.

Solution:

You can not write Exam1 in your formula. You have to write referring address. According to Figure 5.2 the cell containing Exam1 is C4 for the first student. First, you select the cell where the result will appear (F4) and then write the formula.

= (C4+D4+E4)/3

After you press the ENTER key, it will display the average of the first student. Now, you can copy this formula for the other students. If you did not define the cells as an absolute address reference, Excel will automatically make the necessary changes to the formulas. (For absolute and relative addresses refer to Section 5.1.3). For the second student the Exams are stored in the 5th row and the formula has to be = (C5+D5+E5)/3. Since you used relative reference here, Excel automatically makes the necessary changes to the formula for every row and column.

5.1.2 OPERATORS IN EXCEL FORMULAS

Example 5.2:

Your math teacher needs some help. He wants to write all students' marks in the computer, but, he doesn't know how to do it. He wants you to prepare an Excel sheet in which he will write the students' marks. He has two written exams and a final exam. When calculating the semester average, written exams weigh 25% each, and the final exam 50%. Help him prepare an Excel sheet like the following one.

Analyses and Solution:

Since you want to calculate the final as 50% of the grade, you will multiply Final Exam (F2) by 50 and the other exams by 25. Then the sum of all will be divided by 100 to get the student's average. In cell G2 write the formula = (F2*50+E2*25+D2*25)/100 to get the average of the first student. Copy the formula for the other students in the list.

	A	B	C	D	E	F	G
1	Id	Name	Surname	Exam-1	Exam-2	Final Exam	Average
2	1	Stephen	Milligan	70	70	80	75
3	2	Samuel	Neff	100	100	80	90
4	3	Brendan	Hara	10	10	100	55
5	4	Jeremy	Petersen	100	100	10	55
6	5	Todd	Rafferty				
7	6	Kevin	Schmidt				
8							

FIGURE 5.3 Finding Average

OPERATOR	MEANING	EXAMPLE	RESULT
+	Addition	=3+2	5
-	Subtraction	=3-2	1
/	Division	=3/2	1.5
*	Multiplication	=3*2	6
%	Percentage (Divides number by 100)	=50%	0.5
^	To the power	=3^2	9

FIGURE 5.4.a Arithmetic Operators

OPERATOR	MEANING	EXAMPLE	RESULT
=	Equal sign	=3=2	FALSE
>	Greater than	=3>2	TRUE
<	Less than	=3<2	FALSE
>=	Greater than or equal to	=3>=2	TRUE
<=	Less than or equal to	=3<2	FALSE
<>	Is not equal to	=3<>2	TRUE

FIGURE 5.4.b Logical Operators

OPERATOR	MEANING	EXAMPLE	RESULT
:	Range	A2:C7	All the cells from A2 to C7
,	Union (to define more than one reference)	A1,B1:B6	The cells from B1 to B6 and A1
space	Intersection	=B7:D7 C6:C8	produces reference to common cells to the two references

FIGURE 5.4.c Other Operators

FIGURE 5.4 Operators in Excel

5.1.3 ABSOLUTE AND RELATIVE REFERENCE

A1 ➔ Relative column, Relative row.
$A1 ➔ Absolute column, Relative row.
A$1 ➔ Relative column, Absolute row.
$A$1 ➔ Absolute column, Absolute row.

A relative reference is an address that keeps the relative difference of the source from destination cells. When you copy this formula to another location. Microsoft Excel automatically adjusts the new addresses relatively, according to the new location.

Sometimes, you may not want an address to change when you copy it to another location. In such conditions, you add '**$**' sign to the front of the cell reference. You place a '**$**' sign at the front of row or column separately. This provides flexibility.

Example 5.3:

In an Excel worksheet, you have exchange rates and your expenses. Because you are a foreign company in this country, you pay in Euro but all your budget is built on USD. So, for every payment you convert from Euro to USD. You place exchange rates at the top of the page and you write your formula to convert the payment into USD.

	A	B	C	D	E
1	TOTAL EXPENSES				
2	Type	Euro			
3	CAD	1.61			
4	CHF	1.53			
5	GBP	0.66			
6	JPY	134.64			
7	MXN	14.02			
8	USD	1.22			
9					
10	Id	Date	Explanation	Euro Payment	USD
11	1	21-Apr	Michael Young - Seminar in Boston	2,500	$3,050
12	2	19-Apr	Michael Young - Seminar Participation fee	380	$463.6
13	3	17-Apr	Computer for Secretary	1,280	$1,561.6
14	4	15-Apr	Staff Salary	7,380	$9,003.6

FIGURE 5.5 Absolute and Relative Reference

Solution:

You will study more complicated conversions later. For now we will only explain converting Euro to USD. In this case the USD conversion cell has to be absolute reference and will not change from one payment to another: $B$8

Since, every conversion will take the left cell as payment, the payment cell has to be relative address. It's D11 for the first payment, D12 for the second payment, and D13 for the third one.

Then the formula for the first payment in column E becomes

=D11 * $B$8

Now your formula is ready.

When you copy this formula to other payments, USD conversion cell will be absolute reference but the payment cell will be relative and change automatically for every copy.

The formula for the second payment =D12 * $B$8
The formula for the third payment =D13 * $B$8
The formula for the fourth payment =D14 * $B$8

5.2 SIMPLE FUNCTIONS: SUM, AVERAGE, COUNT, MAX, MIN

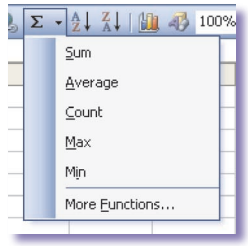


FIGURE 5.6 Insert Function button on Standard Toolbar

Excel provides a wide range of predefined functions.

You will study in this section some basic functions and their uses, and the way to access these functions.

If you click on the small arrow next to the **AutoSum** button on the Standard toolbar and then select **More functions** (or if you select **Function** from the **Insert** menu), you will see the **Insert Function** window.

There are three main parts in this window. If you remember the function name write it in the **Search for a function** box. If you know the function name and category for sure, you can first select the category 1 and then select the function from the Select a function list box 2. Below the list box 3 , a brief usage and explanation is shown. There is also a link for help 4 for the current function at the bottom left corner of the dialog box.

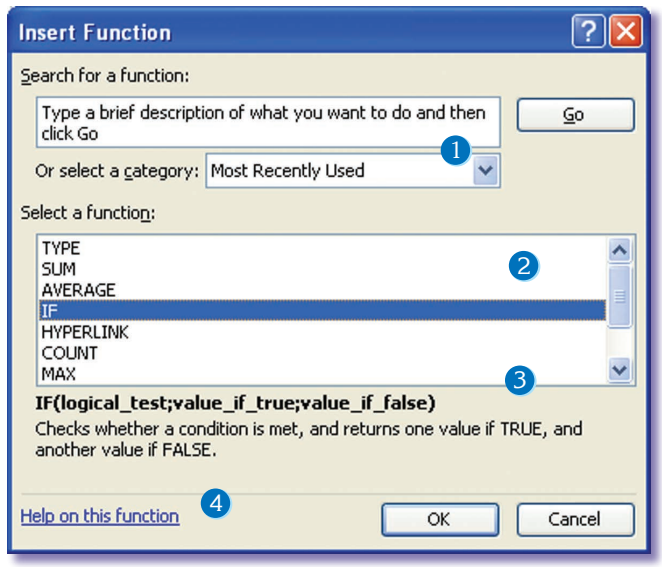


FIGURE 5.7 Insert Function window

Sum Function

This function calculates the sum of the numbers within the range. Any cell that is not a number format will be ignored. For the Sum function you can write single cell addresses with commas or you can also use a colon(:) to define a range.

Example 5.4:

If your Excel worksheet contains the data shown in Figure 5.8, the the following formulas give the results described in the table above.

FORMULA	DESCRIPTION	RESULT
=SUM(3, 12)	Adds 3 and 12 (Using direct numeric values)	15
=SUM(A5,A6, 2)	Adds the values in the last two rows above, and 2. Since text values in references are not translated, the values in the column above are ignored	2
=SUM("5", 15, TRUE)	Adds 5, 15 and 1, because the text values in parameters are translated into numbers, and the logical value TRUE is translated into the number	21
=SUM(A2:A4)	Adds the first three numbers in column A	40
=SUM(A2:A4, 15)	Adds the first three numbers in column A, and 15	55

	A	B
1	DATA	
2	-5	
3	15	
4	30	
5	'5	
6	TRUE	

FIGURE 5.8
Formulas and Descriptions

Average Function

The **Average** function returns the average of selected cells containing numbers.

If your Excel worksheet contains the data shown in Figure 5.9, the following formulas give the results described in the table.

FORMULA	DESCRIPTION	RESULT
=AVERAGE(A2:A4)	Average of the numbers 7,7,10	8
=AVERAGE(A2:A6; 5)	Average of the numbers in A2:A6 and 5	10

	A
1	DATA
2	7
3	7
4	10
5	27
6	4

FIGURE 5.9
Average Function

Example 5.5:

You start working in the sales department of the SURAT Company which sells computer peripherals and devices. Your boss wants you to prepare reports for every quarter. In this report you will have a list of products. Your task is to prepare the sum of each quarter and average. You also need to prepare the sum and average of each product. The list will be similar to the following:

	A	B	C	D	E	F	G	H
1	Id	Reseller	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Reseller	
2							Annual Total	Company Average
3	1	Sony Computer	500	500	600	700	2300	575
4	2	Compaq Computer	300	350	300	300	1250	312,5
5	3	Dell Computer	600	600	500	620	2320	580
6	4	Toshiba Computer	600	650	680	700	2630	657,5
7	5	Acer Computer	1200	1100	1100	1150	4550	1137.5
8	TOTAL		3200	3200	3180	3470	13050	652,5
9	AVERAGE		640	640	639	694		

FIGURE 5.10 Using Average Function

Analyses and Solution:

You have four formulas; Total and average formulas for every product and Total and Average formulas for every quarter. The first product Total formula will be in cell G3, it will find the sum of C3…F3. You can use the Sum function here and your formula will be =Sum(C3:F3). The average formula for products is also similar and will be placed in cell H3 =Average(C3:F3). Having written these formulas, you may copy them to other resellers.

The Total for the first quarter will be in cell C8. You can use the Sum function again here. =Sum(C3:C7). Average function for the first quarter will be in C9 =Average(C3:C7). Finally, your table is ready as in Figure 5.10.

Max Function

Returns the largest value within the range of cells.

Min Function

Returns the smallest value within the range of cells.

Example 5.6:

According to the following Figure 5.11, write the necessary formulas into cells D9 and D10 to find the highest and the lowest averages.

Solution:
Write "=max(H3:H9)" into cell D9 and "=min(H3:H9)" into cell D10 to find the maximum and minimum averages.

	A	B	C	D	E	F	G
1	Id	Name	Surname	Maths	Physics	Phy. Edu.	Average
2	1	Laurence	Lebihan	9	7	8	8.0
3	2	Elizabeth	Lincoln	7	5	6	6.0
4	3	Victoria	Ashworth	6	9		7.5
5	4	Patricio	Simpson	10	9	9	9.3
6	5	Francisco	Chang	6	10	8	8.0
7	6	Yang	Wang	6	10	9	8.3
8	7	Pedro	Afonso	4	9	10	7.7
9		The highest average		9.3			
10		The lowest average		6			

Write a formula to find the Max average

Write a formula to find the Min average

FIGURE 5.11 Using Max and Min Functions

Count Function

Counts the number of cells that contain numeric values. You can use this function to avoid #DIV/0! errors. (division by zero)

Formula	Description	Result
=Count (A2:A8)	Counts the number of cells that contain numbers in the list above	3
=Count (A5:A8)	Counts the number of cells that contain numbers in the last 4 rows of the list	2
=Count (A5:A8,2)	Counts the number of cells that contain numbers in the list, and the number 2	3

FIGURE 5.12 Count Function

	A
1	DATA
2	Sales
3	12.08.2008
4	
5	19
6	22,24
7	TRUE
8	#DIV/0!

Example 5.7:

Your teacher wants to keep track of class attendance in an Excel workbook. The table will contain names and dates. If a student is absent from school for a day, he writes the number of lessons the student missed. He wants you to write a formula to count the number of days that the students have not attended. In another formula you write the total missed hours missed.

	A	B	C	D	E	F	G	H	Y	Z
1	1st Semester Attendance Form									
2	Id	Name and surname	15.09.2003	16.09.2003	17.09.2003	18.09.2003	19.09.2003	.....	Total Days	Total Hours
3	1	Rob Brooks		2	7			.....	2	9
4	2	Raymond Camden						.....	0	0
5	3	Michael Dinowitz	1				1	.....	2	2
6	4	Adam Churvis	7	7	7			.....	3	21
7	5	Shlomy Gantz						.....	0	0
8	6	Paul Hastings				5		.....	1	5

FIGURE 5.13 Using Count Function

Analyses and Solution:

Your first formula will count the days that had at least one or more hours missed. Use the Count function to count the number of days the student skipped lessons. In the other column you will count the total number of lessons that the student skipped. For days, use the Count function, and for lessons, use the Sum function. For the first student, in cell Y2, write the formula =Count(C2:X2) and for the total hours skipped, in cell Z2, write =Sum(C2:X2)

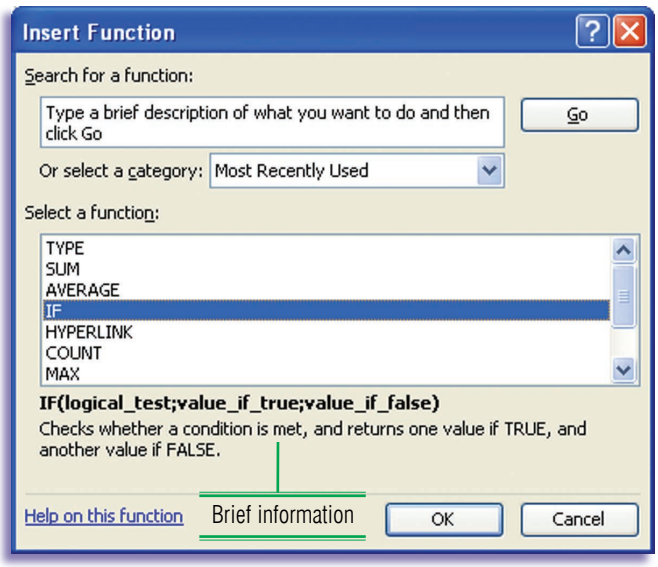


FIGURE 5.14 Insert Function

5.3 USING FUNCTIONS AND FORMULAS

In the previous section you studied how to define your own formulas and use some common functions. In this section you will study the usage of other predefined formulas and to use the help about them.

You already know how to open the **Insert Function** Window. When you select a function in this window, it will show the usage and brief information for the selected item. There is another link to get more help on the function at the bottom of the window.

After you press Enter, it will show another window that will guide you with the function arguments.

In the **Function Arguments window**, you are asked to fill in all the required parameters in separate boxes. If you can't remember a cell name, click the **Cell Name** button; it will minimize the function arguments window, letting you select a cell or a range. After you click the same button or press ENTER , it'll return the address to the Function arguments window.

So far you have studied some of the common predefined functions.

There are 9 main function groups with around 235 predefined functions. These groups are

- Financial
- Date & Time
- Math & Trig
- Statistical
- Lookup & Reference
- Database
- Text
- Logical
- Information

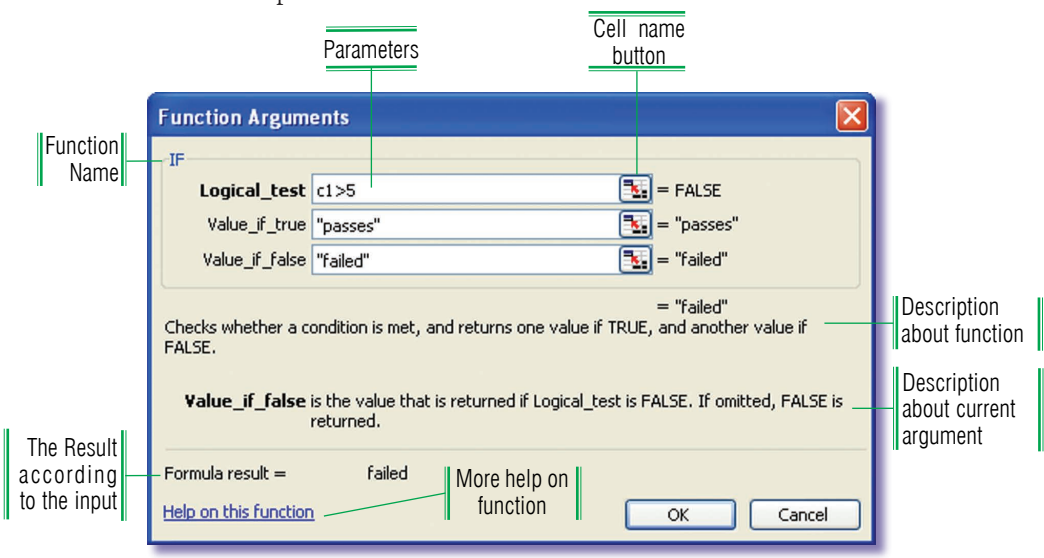


FIGURE 5.15 Function Arguments

5.3.1 DATE AND TIME FUNCTIONS

Now:

Shows current date and time. If the cell format was General before the function was entered, the result is formatted as a date.

Example 5.8: =Now () 01/15/2005 15:00

Today:

Shows current date. If the cell format was General before the function was entered, the result is formatted as a date.

Example 5.9: =Today () 01/15/2005

The output or input formats of the functions may vary from one computer to another, according to the Regional settings in Control Panel in Windows.

5.3.2 MATH AND TRIGONOMETRIC FUNCTIONS

Abs:

Calculates the absolute value of a number.

Example 5.10

=ABS(2) returns 2
=ABS(-2) returns 2
=ABS(-2.345) returns 2.345

Pi:

Gives the value of Pi with an accuracy of 15 digits.

Example 5.11: =Pi() returns 3.14159265358979

Radians:

Converts degrees into radians

$\pi/6$=.0.523598776

Example 5.12: =Radians(30) returns 0.523598776

Degrees:

Converts radians into degrees

Example 5.13: =Degrees(Pi()) returns 180
=Degrees(Pi()/3) returns 60

Sin:

Returns the sine of a given angle. If your argument is in degrees, multiply it by PI()/180 or use the radians function to convert it to radians. You can also use the cosine function in the same way.

Example 5.14: =Sin(Radians(30)) returns 0.5
=Sin(30*Pi()/180) returns 0.5
=Cos(Radians(60)) returns 0.5
=Cos(60*Pi()/180) returns 0.5

Fact:

*n factorial is the product of the numbers 1 through n. n! = 1*2*3*...*n.*

Returns the factorial of a number. n factorial is the product of the numbers 1 through n. n! = 1*2*3*...*n.

Example 5.15: =Fact(5) returns 120
=1*2*3*4*5 returns 120

Int:

Rounds the given real number down to the nearest integer

Example 5.16:

=Int(2.768) returns 2
=Int(-2.768) returns -3

Mod:

Returns the remainder after the number is divided by divisor. The result has the same sign as the divisor.

Example 5.17:

=Mod(23,5) returns 3

Power:

Returns the result of a number raised to a power

Example 5.18: =Power(2,10) returns 1024

Product:

Multiplies the numbers within the range of cells.

Example 5.19:

According to Figure 5.16, the following formulas give the results shown below

=Product(A1:A4) returns 16
=Product(B1:B4) returns 12
=Product(A1:B4) returns 192

	A	B
1	2	2
2	1	3
3	4	1
4	2	2

FIGURE 5.16

Round:

Rounds a number to the specified number of digits.

=Round (number, num_digits)

- Number: is the number you want to round.
- Num_digits: specifies the number of digits to which you want to round a number.

If Num_digits is greater than 0 (zero), then Number is rounded to the specified number of decimal places.

If Num_digits is 0, then Number is rounded to the nearest integer.

If Num_digits is less than 0, then Number is rounded to the left of the decimal point.

Example 5.20: =Round (3.785645,3) returns 3.786
=Round (3.785645,5) returns 3.78565

Trunc:

Removes the fractional part of the number.

=Trunc (number, num_digits)

- Number: is the number you want to truncate.
- Num_digits: is a number specifying the precision of the truncation. The default value for Num_digits is 0 (zero).

Example 5.21:

=Trunc(253.268569,3) returns 253.268
=Trunc(253.268569,5) returns 253.26856

SumIf:

Calculates the sum of the numbers within the range according to the given criteria.

=Sumif (range,criteria,sum_range)

- Range: Is the range of cells you want to be manipulated.
- Criteria:Is the criteria in the form of a number, expression, or text that defines which cells to be added.
- Sum_Range:are the actual cells to sum.

Criterion can be	
a direct number	7
a text	"Book"
an expression	">=5"

FIGURE 5.17 SumIf Criteria

	A	B
1	2	23
2	4	54
3	1	76
4	8	45
5	4	98
6	5	34
7	3	27
8	RESULT	126

FIGURE 5.18 Sumif Function

Example 5.22: Write a formula to calculate the sum of the numbers in the range of cells B1:B7. The corresponding number in the range of cells A1:A7 is less than 4.

Solution:

Write this formula in cell C10 =SumIf(B2:B8,"<4",C2:C8)

Sqrt:

Returns the square root of a number.

Example 5.23: = Sqrt(4) returns 2
= Sqrt(25634) returns 160.1062147

Rand:

Returns an evenly distributed random number greater than or equal to 0 and less than 1. A new random number is returned every time the worksheet is calculated.

5.3.3 STATISTICAL FUNCTIONS

Count:

Counts the number of cells that contain number.

=Count(value1, value2, value3,....)

Example 5.24: According to Figure 5.11 in Example 5.6 to find the number of students who take Phy Edu write this formula in cell F9

=Count(F2:F8) .

CountBlank:

Counts the number of empty cells in the selected range.

CountBlank(range)

Counta:

Counts the number of cells that are not empty within the selected range.

=Counta(value1,value2,...)

CountIf:

Counts the number of cells within the selected range that comply with the given criteria.

=CountIf(range, criteria)

Example 5.25:

According to Figure 5.11, in Example 5.6, write the necessary formula in cell F10 to calculate the number of students whose average is greater than or equal to 9.

Solution:

Write the formula in cell F10 = CountIf (F1:F8; ">= 9")

5.3.4 TEXT FUNCTIONS

Mid:

Returns Num_Chars characters from the text starting from the start_num character

=Mid(text, start_num, num_chars)

- **Text:** is the text string containing the characters you want to extract.
- **Start_num:** is the position of the first character you want to extract from the text.
- **Num_chars:** specifies the number of characters you want Mid to return from the text.

Find:

Finds one text string (find_text) within another text string (within_text), and returns the starting position of find_text, from the first character of within_text. You can also use Search to find one text string within another, but unlike Search, Find is case sensitive and doesn't allow wildcard characters.

=Find(find_text, within_text, start_num)

- **Find_text:** is the text you want to find.
- **Within_text:** is the text containing the text you want to find.
- **Start_num:** specifies the character at which to start the search.

Len:

Returns the number of characters in a text string.

=Len(text)

Left:

returns the first character or characters in a text string, based on the number of characters you specify from the left.

=Left(text, num_chars)

Right:

returns the last character or characters in a text string, based on the number of characters you specify from the right.

=Right(text, num_chars)

- **Text:** is the text string containing the characters you want to extract.
- **Num_chars:** specifies the number of characters you want to extract.

Example 5.26:

According to the **Figure 5.19**, write these formulas into suitable cells, and examine the results.

	A	B	C	D	
1	Id	Name and surname	Phone	City	
2	1	Simon Horwith	546532	New York	
3					
4	Find	6			=FIND(" ",B2)
5	Len	13			=LEN(B2)
6	Left	Simon			=LEFT(B2,B4)
7	Right	Horwith			=RIGHT(B2,B5-B4)
8	Mid	Horwith			=MID(B2,B4+1,B5-B4)

FIGURE 5.19 Text Functions

=Find(" ",B2)	returns 6
=Len(B2)	returns 13
=Left(B2,B4)	returns Simon
=Right(B2, B5-B4)	returns Horwith
=Mid(B2,B4+1, B5-B4)	returns Horwith

5.3.5 LOOKUP & REFERENCE

VLookUp:

Searches for a value in the leftmost column of a table, and then returns a value in the same row from a column you specify in the table.

=VLookUp (lookup_value, table_array,col_index_num, range_lookup)

- **Lookup_value:** is the value to be found in the first column of the array. Lookup_value can be a value, a reference, or a text string.
- **Table_array:** is the table of information in which data is searched. Use a reference to a range or a range name, such as Database or List.
- **Col_index_num:** is the column number in table_array from which the matching value must be returned.
- **Range_lookup:** is a logical value that specifies whether you want VLookUp to find an exact match or an approximate match.

HLookUp:

Searches for a value in the top row of a table or an array of values, and then returns a value in the same column from a row you specify in the table or array.

=HLookUp(lookup_value,table_array,row_index_num,range_lookup)

- **Lookup_value:** is the value to be matched in the first row of the table. Lookup_value can be a value, a reference, or a text string.
- **Table_array:** is a table of information in which data is looked up. Use a reference to a range or a range name.
  The values in the first row of table_array can be text, numbers, or logical values.
- **Row_index_num:** is the row number in table array from which the matching value will be returned.
- **Range_lookup:** is a logical value that specifies whether you want HLookUp to find an exact match or an approximate match.

Example 5.27 :

In order to improve the Excel document that you have given to your math teacher, now you can prepare another formula, which defines the letter grades for each student. If the average of a student is lower than 60 it will write 'F' and so on.

Analyses and Solution:

According to your worksheet design you can use both; HLookUp or VLookUp. If you design the worksheet as in Figure 5.18, you need to use VLookUp.

Now you can design a complete worksheet for your math teacher. When looking up the letter grade of the first student, write the formula in F4 referring to the average in E4. The table is in J4: K9 and you want the VLookUp function to return the value in the second column as the result. The formula for the first student becomes

=VLookUp(E4, J4:K9,2,TRUE)

This is an absolute address formula, because you do not change the address of **Letter Grade Table** (J4:K9) for every student. As you know from Section 5.13, you place a '$' sign front of an absolute address; $J$4:$K$9.

The Lookup value cell is relative address because it changes for every student. Finally the formula becomes

=VLookUp(E5, $J$4:$K$9, 2, TRUE)

The formula is ready and can be copied to other students.

	J	K
	Grade	Letter
4	0	F
5	60	D
6	70	C
7	80	B
8	90	A
9	101	Undefined

FIGURE 5.20
Letter Grade Table

	A	B	C	D	E	F
2	11A Mathematics Lesson The Results of First Semester					
3	Id	Name and Surname	Exam-1	Exam-2	Average	Grade Letter
4	1	Kevin Schmidt	100	60	80	B
5	2	Todd Rafferty	91	100	95.5	A
6	3	David Shadowitz	80	40	60	D
7	4	Pele Thomas	86	70	78	C
	5	Pablo Varando	55	45	50	F
	Class Average		82	63	72.5	C
	Class Success Percentage		72 %			
					Teacher	
					John Walker	

FIGURE 21. VLookup Project

5.3.6 DATABASE FUNCTIONS

There are two important things:

- to get information as much as and as fast as possible
- to process and decide as fast as possible

For a good analysis of data, you need to have a well organized data list. This is called as database. Microsoft Excel provides a flexible environment for you to prepare well organized lists and powerful functions to process and decide fast. For this purpose, it includes many functions that analyze data stored in lists or databases. Each of these functions, referred to collectively as the Dfunctions, uses three arguments: **database, field,** and **criteria**. These arguments refer to the worksheet ranges that are used by the function. When placing criteria:

- Take care that your criteria field does not overlap with your database.
- Do not place your criteria field beneath your database, because when you use Data form it may cause conflicts with your criteria field.

	A	B	C	D	E	F
1	CRITERIA					
2	Class	Name and Surname	Date	Subject	Hours	Motivates
3		Todd Rafferty				FALSE
4		RESULT	4			
6	DATABASE					
7	Class	Name and Surname	Date	Subject	Hours	Motivates
8	11A	David Shadovitz	14-Feb-04	Maths	2	TRUE
9	11A	Todd Rafferty	17-Feb-04	Maths	2	FALSE
10	11A	Pablo Varando	18-Feb-04	Chemistry	2	TRUE
11	11A	Brendan Hara	19-Feb-04	Informatics	2	TRUE
12	11A	Pete Thomas	20-Feb-04	Informatics	2	FALSE
13	11A	Todd Rafferty	21-Feb-04	Physics	1	TRUE
14	11A	Todd Rafferty	24-Feb-04	Physics	2	FALSE
15	11A	Simon Horwith	25-Feb-04	Physics	1	TRUE
16	11A	David Shadovitz	26-Feb-04	Physics	2	TRUE
17	11A	David Shadovitz	27-Feb-04	Chemistry	2	FALSE
18	11A	David Shadovitz	28-Feb-04	Informatics	1	TRUE

FIGURE 5.21 Atlanta High Scool Attendance Form

Example 5.28:

The Assistant director of Atlanta High School is using an Excel worksheet to keep track of student attendance. In his form he has 6 columns of information; Class, Name, Date, Subject, Hours, and Motivation. But, because it's quite difficult to count or to filter and then process all the data, he wants a formula that counts automatically all the data with the given criteria. In the example below, he wants to search all data for Todd Rafferty's unmotivated absences. (Design all the data in a worksheet and write your formula using the DSum function)

Analyses and Solution:

As it is explained in the question, we need six fields: Class, Name and Surname, Date of absence, Subject, Number of hours, and if the absence is Motivated or not.

The criteria field should not be beneath the database. So, we can place it at the top of the sheet starting from B3 till the end of F3. Every time we add another absence, our database will grow. We'll use the **DSum** function which adds the numbers in the field column of records in the database that match the criteria.

DSum (Database, Field, Criteria)

We want the result to appear in the 4th row, so we will write the formula into the cell C4.

The **Database** range is A7:F20, where A7 is the start address of **Database** and F20 is the **Criteria.** The range is A2:F3 and we want the **Hours** field to be added according to the **Criteria**. Then the formula becomes;

=DSum(A7:F20, "Hours", A2:F3)

It will calculate the sum of the numbers in **Hours** column with the records complying with the criteria described in the **Criteria** field. When you enter a name in the criteria name part, all the absences with that name will be processed. If you want to see the total unmotivated attendance of this student, in the motivation field, write **FALSE**. Or, if you want absences from a specific subject then write the subject name. The function will return the sum of the **Hours** column with the records satisfying your criteria.

CHAPTER 5
in BRIEF

SUMMARY

Microsoft Excel is best when you have lots of numbers, calculations, and complex formulas. The first thing you studied is how to implement your own formulas. For this reason, the range term is very important in Excel. Below is an example of range. (Letters refer to the column indexes where numbers refer to the row indexes)

A1:A10	All cells A1 through A10
A1, A10	Only A1 and A10 are included in the formula (pay attention to the difference)
A:A	All the values of column A

A formula starts with an equal sign (=). When you type the formula, you see it on the formula bar; on the other hand, by default, the cells show the result only. For example, Assuming A1 has 3 and A10 has 7 in them, the formula =A1+A10 can be seen on the formula bar where the result 10 will be seen in the cell.

Excel changes the range relatively when you copy the formula onto another location. To prevent this, you must add $ symbol before column and/or row reference. For example, let us suppose you have a simple formula on A4 as =A3+5. When you copy this formula onto B4, it will turn to =B3+5. If you type your formula in A4 as =$A$3+5, and copy it onto B4, the formula will remain the same.

Seperators in formulas differ from country to country according to the Regional Settings. For example the separator and floating point digit operator in the following IF statements changes according to regional settings.

Country	Formula
England	=IF (A2>=3.5,10,15)
France	=IF(A2>=3,5;10;15)
Germany	=IF(A2>=3,5;10;15)
Romania	=IF(A2>=3,5;10;15)
Russia	=IF(A2>=3,5;10;15)
Turkey	=IF (A2>=3,5;10;15)
USA	=IF (A2>=3.5,10,15)

The examples in this book use USA Regional settings. If you have difficulty in having results from the examples in this book check your regional settings.

From the **Insert-Function** menu, you can select the formula you want. The formulas are categorized for easy selection:

- Financial
- Date&time
- Math&trig
- Statistical
- Lookup&reference
- Database
- Text
- Logical
- Information

Now let us have a look at some formulas and results for confirmation.

	A	B	C
1	1	2	3
2	4	5	6
3	7	8	9
4	10	11	12
5	13	14	15

For the table above, if you type the following formulas you will get the results.

The Formula	Result	Explanation
=SUM(A1:C1)	6	
=SUM(A1,C1)	4	
=AVERAGE(A1:C1)	2	
=AVERAGE(B1,C1)	2.5	
=AVERAGE(C2,A1:C1)	3	
=MAX(A1:C5)	15	
=MAX(A1:C5)-MIN(A1:C5)	14	15 - 1
=MIN(A1:C5)	1	
=SUM(A1:C5)/COUNT(A1:C5)	8	120 / 15
=AVERAGE(A1:C5)	8	
=IF(A3>B4,"TRUE","NOT TRUE")	NOT TRUE	
=NOW()	05.01.2005 12:48	Returns current date of your computer
=ABS(-3.425)	3.425	
=ABS(3.425)	3.425	
=RADIANS(45)	0.7853	$\pi / 4$
=RADIANS(360)	6.2831	2π
=DEGREES(PI()/4)	45	
=DEGREES(2*PI())	360	
=SIN(30)	-.098803	
=SIN(30*PI()/180)	0.5	
=COS(PI())	-1	

SUMMARY

QUESTIONS

1. If cell A5 contains a formula which produces 10, what can be the formula in A5?

   A.=Sum (A1 : A4)
   B.=Min (A1 : A4)
   C.=Average (A1 : A4)
   D.=Count (A1 : A4)

	A
1	10
2	20
3	30
4	40
5	?

2. According to the figure in question 1, if value of A5 is 40, what can be the formula in A5?

   A. =Count (A1 : A4)
   B. =Sum (A1 : A4)
   C. =Average (A1 : A4)
   D. =Max (A1 : A4)

3. If you want to type a formula in a cell, you must start your formula with a ….. sign.

   A.= B.! C.$ D.?

4. Which of the followings is **not** a Microsoft Excel function?

   A. If B.List
   C. Max D.Count

5. Look at the next figure. What can be the reason for the error message #VALUE!?

   A. The column is too narrow
   B. A3 contains text
   C. One of the columns is deleted
   D. Formula is misspelled

	A
1	10
2	20
3	January
4	
5	#VALUE!
6	

This cell contains the formula =A1+A2+A3

6. What is the result of the function =Max(B1:D4)

	A	B	C	D
1	100	12	128	20
2	200	22	601	60
3	400	68	288	80
4	800	21	204	97

   A. 800 B. 68 C. 601 D. 288

7. Which function returns the result of the mathematical expession Sin (30)?

   A. =Sin(30)
   B. =Sin(30*P/180)
   C. =Sin(30*180/Pi())
   D. =Sin(30*Pi()/180)

8. What is the result of the function in A4?

	A	B	C
1	5	2	
2	5	3	
3	1	7	
4	=AVERAGE(A2:B3)+SUM(A2:B3)		

   A. 26.8 B. 3.8 C. 16 D. 20

9. The result of =Int(-1.5) is less than the result of =Trunc(-1.5)

   TRUE ☐ FALSE ☐

QUESTIONS

10. According to the formulas in C1 and C2, which one is true?

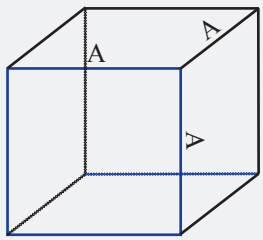
	A	B	C
1	John	3	=If(B1<=2,"Very bad",If(B1<4,"Bad","Perfect"))
2	Smith	4	=If(B2<=2,"Very bad",If(B2<4,"Bad","Perfect"))

A. John : Very bad Smith : Bad
B. John : Bad Smith : Bad
C. John : Very bad Smith : Very bad
D. John : Bad Smith : Perfect

11. Which formula must be written into cell B2 to calculate the volume of the cube in the figure?

A. = A1*A1*A1
B. = B2*B2*B2
C. = B1*B1*B1
D. = Cube(B1)

	A	B
1	A:	4
2	Volume	64



12. Find the result of the formula =VLookUp(2,A2:D4,3)

	A	B	C	D
1	Id	Name	Surname	1st Term
2	1	Andrew	Jackson	3
3	2	Thomas	Ericsson	4
4	3	Laura	Callahan	5

A.2 B.Andrew C.Ericsson D.4

13. What is the result of the formula =Int(3.141596)+Round(36.9245,2)

A. 40.1 B. 40 C.39.92 D.39

14. Match the following functions with the definitions?

Functions	Definitions
Min	Calculates the average value of a list of numbers
Max	Adds a list of numbers.
Average	Finds the smallest value in a list of numbers.
Sum	Finds the largest value in a list of numbers.

15. In cells B1 through G1 these values are entered arbitrarily.

	A	B	C	D	E	F	G
1	Excel	1	2	7	5.5	Word	-12

What is the result of the formula =CountIf(B1:G1, ">5")

A.0 B.7 C.1 D.2

16. The LookUp functions allow you to

A. Retrieve the names of workbooks and worksheets.
B. Dynamically change information in different workbooks and worksheets.
C. Retrieve information according to given criteria.
D. Retrieve information stored in different workbooks and worksheets.

QUESTIONS

PRACTICE

1. According to the figure below write the necessary formulas to
   - calculate the average salary of all employees
   - find the maximum salary
   - find the minimum salary
   - find the total salary

	A	B	C
1	Tree Star Trade Company		
2	Employee	City	Salary
3	Selena Bainum	Berlin	$ 1520
4	Raymond Camden	Mexico	$ 2500
5	Paul Hastings	Moscow	$ 1800
6	Kevin Schmidt	London	$ 3200
7	Pete Thomas	Istanbul	$ 5210
8	Nicholas Tunney	Madrit	$ 850
9			
10	The Average salary of all employees :		?
11	Maximum salary :		?
12	Minimum salary :		?
13	Total salary :		?

2. Use the following functions on the table below.

	A	B	C	D	E	F
1	Id	Students	Grades	Int	Round	Trunc
4	1	Raymond Camden	2.460	?	?	?
5	2	Paul Hastings	3.689			
6	3	Kevin Schmidt	4.840			
7	4	Pete Thomas	4.118			
8	5	Nicholas Tunney	2.060			

3. In the following Figure, write a formula
   - in A3 to calculate the multiplication of the numbers in range A1:F1.
   - in B6 to calculate the absolute value of a given number.
   - in D6 to calculate the square-root of the given number.
   - in F7 to calculate x^y

	A	B	C	D	E	F
1	6	7	8	9	10	11
2	Write the multiplication of the numbers above using "product" function.					
3	Formula					
4						
5	x	ABS	Y	SQRT	Enter base (X)	2
6	-8	Formula	256	Formula	Enter power(Y)	3
7					Power(X^Y)	Formula

4. In an apartment building, you have 5 floors and 5 different entrances. On each floor, there are three apartments. Write a formula that will take an apartment number from cell A2 and show the floor and entrance numbers in cells B2 and C2.

	A	B	C
1	Apartment #	Entrance #	Floor #
2	43	?	?

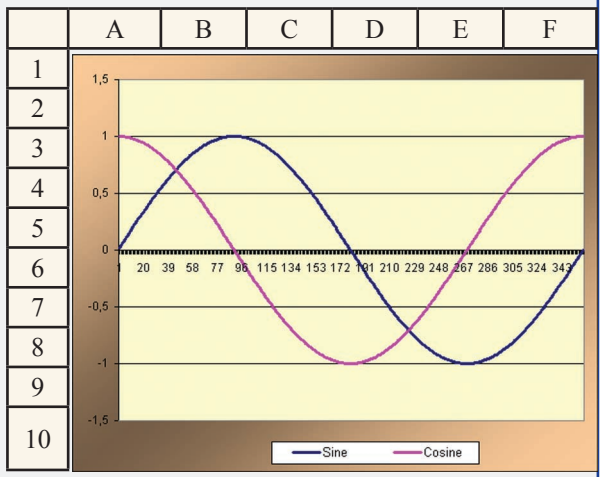
5. Create a mini trigonometric table below.

	A	B	C	D	E
1	Mini Trigonometric Table				
2	Degree	Radian	Sinus	Cosine	Tangent
3	0				
4	10				
5	20				
6	30				
7	40				
8	50				
9	60				
10	70				
11	80				
12	90				

6. Write a formula which can calculate the Average salary of the employees in the city given by cell C2.

	A	B	C	D
1	Id	Employee	City	Salary
2			London	
3	Total salary of employees live in given city?			
4	1	Samuel Neff	New York	400
5	2	Brendan Hara	London	400
6	3	Jeremy Peterson	London	400
7	4	Todd Rafferty	New York	350
8	5	Kevin Schmidt	London	400
9	6	David Shadovitz	New York	615
10	7	Pete Thomas	London	540
11	8	Nicholas Tunney	London	1000

7. Draw the following chart using **Sin** and **Cos** functions.



8. Write the necessary formula,
   - in column B to show the lengths of adjacent names in column A.
   - to separate the texts in column A to the columns C and D as shown in the figure.

	A	B	C	D
1	Name and surname	Length of the text	Name	Surname
2	Samuel Neff	12	Samuel	Neff
3	Brendan Hara	13	Brendan	Hara
4	Jeremy Peterson	16	Jeremy	Peterson
5	Todd Rafferty	14	Todd	Rafferty
6	Kevin Schmidt	14	Kevin	Schmidt
7	David Shadovitz	16	David	Shadovitz
8	Pete Thomas	12	Pete	Thomas
9	Nicholas Tunney	16	Nicholas	Tunney

PRACTICE

9. Write the necessary formulas into the cells between B11 and G11 that will accept C9 as student id using the "Vlookup" function.

	A	B	C	D	E	F	G
1	EXAMINATION RESULTS						
2	Id	Name	Surname	Maths	Physics	Chemistry	AVERAGE
3	1	Samuel	Neff	5	5	5	5
4	2	Brendan	Hara	3	2	4	3
5	3	Jeremy	Peterson	2	4	3	3
6	4	Todd	Rafferty	4	5	3	4
7	5	Kevin	Schmidt	3	4	5	4
8							
9		Enter Id :	4				
10		Name	Surname	Maths	Physics	Chemistry	AVERAGE
11		Todd	Rafferty	4	5	3	4

10. Write the necessary formulas into range B9:C12 that will read class name from C7 and show the requested class list in the cells.

	A	B	C	D	E
1	Index	11A	11B	11C	11D
2		Name and surname	Name and surname	Name and surname	Name and surname
3	1	Simon Horwith	Pete Thomas	Selene Bainum	Hanna Moos
4	2	Stephen Milligan	Nicholas Tunney	Geoff Bowers	Bob Hanks
5	3	Samuel Neff	Jochem Dieten	Rob Brooks	Martin Sommer
6	4	David Shadovitz	Pablo Varando	Raymond Camden	Victoria Ashworth
7		Enter Class :	11C		
8		Index	Name and surname		
9		1	Selene Bainum		
10		2	Geoff Bowers		
11		3	Rob Brooks		
12		4	Raymond Camden		

11. Everyday in exchange offices, everyday, money from many different currencies are exchanged. Because they are afraid of making mistakes, they decided to have an exchange program. In this document, the first part will have a table of conversion from all other currencies into a base one. (In this figure, the base currency is TL.) They want to write exchange currencies into cells A12 and B12. When they write the amount of the first currency into A13, they want to see the converted value in B13.

	A	B
1	EXCHANGE RATES	
2	Currencies	TL
3	Dollar	1.38
4	Euro	1.82
5	TL	1
6	Pound	2.57
7	Ruble	0.47
8	Yen	1.5
9	Dinar	1.3
10		
11	From	To
12	Dollar	Euro
13	10	7.58

PRACTICE

12. There is an international Informatics Olympiad in your country. They prepared a table after the exam. For some statistical purposes, they want to get some information from the table. Write a formulas

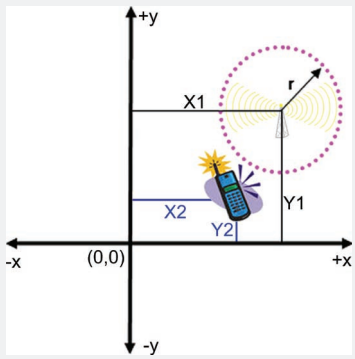
- In cell F18 to show the number of students who did not participate on the first day;
- to show each student's total points
- How many students from each country? (in cell F20)

	A	B	C	D	E	F
1	The Results of Informatics Olympiad					
2	Rank	Name and Surname	Country	1st Day	2nd Day	TOTAL
3	4	Selena Bainum	England	140	120	260
4	8	Geoff Bowers	France	150	80	230
5	3	Rob Brooks	England	120	150	270
6	9	Raymond Camden	Switzerland		210	210
7	6	Adam Churvis	Germany	150	100	250
8	12	Michael Dinowitz	USA		180	180
9	1	Shlomy Gantz	Germany	180	155	335
10	14	Paul Hastings	USA		100	100
11	11	Alexandra Kim	Korea	52	150	202
12	9	Viktoria Shay	Korea		210	210
13	2	Olga Nam	Korea	85	200	285
14	7	Brendan Hara	Spain		240	240
15	13	Jeremy Peterson	England	50	120	170
16	14	Todd Rafferty	Switzerland		100	100
17	4	Kevin Schmidt	England	80	180	260
18	How many contestants are absent on the 1st Day ?					6
19	How many contestants are there at 2nd Day ?					15
20	Country	Korea	Number of the contestants			3

13. A cellular base-station is located at the coordinates (x1,y1) and it has a transmit range of "r" . A person using a mobile phone is located at the coordinates (x2,y2) .

Write a function that asks for (x1,y1), (x2,y2) coordinates and the radius of the transmitter and then decides if the mobile phone is in use or not . If the phone works, the message will be "The phone is working in this location", otherwise, "The phone is out of range"

	A	B	C	D
1	x1 :	100	x2 :	60
2	y1 :	100	y2 :	40
3	r "	50	The phone is out of range	



14. In the following sheet, if the correct user name and password are entered, the message of A3 will be "Welcome to the Matrix" otherwise "Incorrect user name or password".

	A	B
1	User Name :	admin
2	Password :	x-man
3	Welcome to The Matrix	

WORD SEARCH PUZZLE

1. Match

Write the following functions under their categories in the table on the right.

abs	and	count
pi	if	int
left	len	lower
max	mid	not
now	or	hlookup
right	rank	round
today	upper	vlookup
weekday		

CATEGORIES					
Date & Time	Logical	Lookup & Reference	Math & Trig	Statistical	Text

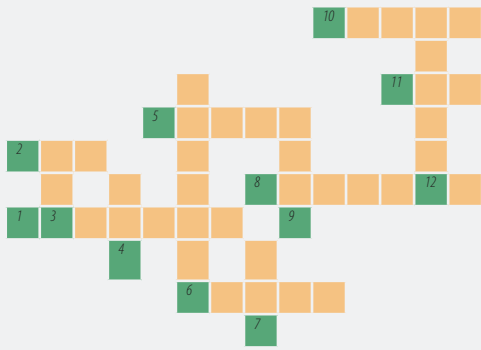
2. Puzzle

Across

1. Searches for a value in the leftmost column of a table, and then returns a value in the same row from a column you specify in the table.
2. Rounds a number down to the nearest integer.
5. Returns the last character or characters in a text string, based on the number of characters you specify.
6. Counts the number of cells that contain numbers, and also numbers within the list of arguments.
8. Returns the day of the week corresponding to a date. The day is given as an integer, ranging from 1 (Sunday) to 7 (Saturday), by default.
10. Converts all uppercase letters in a text string to lowercase.
11. Returns the largest value in a set of values.

Down

3. Returns the number of characters in a text string.
4. Returns the serial number of the current date and time.
6. Counts the number of cells within a range that meet the given criteria.
7. Adds all the numbers in a range of cells.
9. Returns the first character or characters in a text string, based on the number of characters you specify.
12. Returns the average (arithmetic mean) of the arguments.



HOMEWORK

1. Cell B4 has a formula which is used by cells B1, B2 and B3. But nobody knows the formula in cell C5. Find out the value in the cell C2 when the result is 10.

   (Hint: Use "Goal seek")

	A	B
1	A:	4
2	B:	7
3	C:	1
4	Result	28

2. You have the following data on your Excel sheet. How can you divide each word into seperate cells as shown in the table below?

	A	B	C	D	E	F	G	H
1	Name Surname Exam1 Exam2 Exam3 Average		Name	Surname	Exam1	Exam2	Exam3	Average
2	Kevin Schmidt 100 60 94 85	==>	Kevin	Schmidt	100	60	94	85
3	Todd Rafferty 91 100 100 97		Todd	Rafferty	91	100	100	97
4	David Shadovitz 80 40 72 64		David	Shadovitz	80	40	72	64

3. In a document, write and explain the usage of 25 different Excel functions from five different groups.

4. Visit an accountant (or your school Assistant Director) and ask they what kind of documents they uses. Try to prepare the same document in Excel using formulas.

HOMEWORK