CHAPTER 2: FORMULAS

"A formula for success? It's quite simple, really. Double your rate of failure. You are thinking of failure as the enemy of success. But it isn't at all. You can be discouraged by failure—or you can learn from it. So go ahead and make mistakes. Make all you can. Because, remember that's where you will find success."

– Thomas J. Watson, IBM Chairman

A spreadsheet's *raison d'être* is its ability to define relationships among cells. A formula begins with an equal sign, and may contain one or more numbers, strings, cell address, or functions, related by mathematical or logical operators to produce a *value* that *appears* in the cell containing the formula.

ENTERING FORMULÆ

To add the numbers in cells B1 and B2, divide that amount by the number in cell C6, and display the result in cell E4, you would move the cell pointer to E4 and type:

```
=(B1+B2)/C6
```

Lock in a formula exactly as you would with numbers or labels: press ←Enter or an arrow key.

From now on, whenever the contents of B1, B2, or C6 are changed, the formula in E4 will recalculate and display the new value.

To illustrate this, let's use an example. Ann scored 92.2 on the last exam, Bob scored 83.1, and Cindy, 92.2. What was their average score?

Enter the data shown below. Note that the text is automatically left-aligned, and the numbers are automatically right-aligned. See how the long-label feature spills the heading into cell B1.

	A	B	C
1	Average Scores		
2	Bob	92.2	
3	Cindy	83.1	
4	Cindy	95	
5	Average		

Then, in B5, enter:

```
=(B1+B2+B3)/3
```

and press ←Enter. Cell B5 now ***contains*** the formula. Remember: the ***contents*** of the active cell appears in the Input Line. Its ***value*** appears in the spreadsheet.

	A	B	C
1	Average Scores		
2	Ann	92.2	
3	Bob	83.1	
4	Cindy	95	
5	Average	90.1	

FORMULA BASICS

Before we get too involved in creating complex formulæ, here are some basic concepts worth remembering.

In Excel, formulas always begin with an equal sign, =.

Don't place spaces anywhere in the formula. Excel is very tolerant of spaces, but sometimes an extra space causes problems. In any event, an extra keystroke here and there cuts into productivity.

As mentioned earlier, the contents of a cell appear in the input line—*not necessarily in the cell itself.* For example, in Figure 88, on page 29, the number 3.14 appears in cell B5—but we can see its true contents (displayed in the Formula Bar) is a formula. The cell *contains* a formula and *displays* a value.

ORDER OF PRECEDENCE

Excel calculates formulæ using an algebraic order of precedence. That means that values are not calculated sequentially, but in the same order you learned in 8th grade math:

1. Values inside parentheses, nested values first
2. Exponentials
3. Multiplication and division
4. Addition and subtraction

Example 2B: Without using the PC, evaluate this expression:

=3+(4+6)²/5

Solution:

a) First combine the values in parentheses:
=3+(4+6)²/5 becomes =3+10²/5

b) Next, perform the exponential:
=3+10²/5 becomes =3+100/5

c) Perform the multiplication and/or division:
=3+100/5 becomes =3+20

d) Perform the addition and/or subtraction:
=3+20 becomes =23

Here's another, slightly more complicated example:

Example 2C: Without using the PC, evaluate this expression:

=2+(3*2-4)³/(2*(4-2+6/2-1))

Solution:

a) First examine the values in parentheses. Because we do the multiplication and/or division before addition and/or subtraction, the first set:
(3*2-4) becomes (6-4) or 2

b) Following the same logic, the second set:
(2*(4-2+6/2-1)) becomes (2*(4-2+3-1)) or (2*(4)) or 8

c) Substituting, this turns:
=2+(3*2-4)³/(2*(4-2+6/2-1)) into =2+2³/8

d) The exponential precedes other arithmetic operations:
=2+2³/8 becomes =2+8/8

e) Because division precedes addition:
=2+8/8 becomes =2+1 or 3

Now, before your eyes glaze over, understand you will rarely, if ever, encounter expressions like these. It is the principle that's important, not the complexity.

An entry beginning with an alphabetical character or a single quote, ', is ***always*** understood to be text. Be sure not to use the lower case "L," when you mean to type the numeral "1."

Any entry beginning with +, =, or @ is assumed to be a formula, unless it is preceded by a '.

Formulas may contain relationships among numbers:

Example 2D: Entering this formula in a cell:

=5+6+7-3

adds 5, 6, and 7, subtracts 3, and places the answer (in this case, 15) in the active cell. The relationship is solely among numbers.

among cells:

Example 2E: Entering this formula in a cell:

=C1+C2+C3-D2

adds the values of cells C1, C2, and C3, subtracts the value in cell D2, and places the answer in the active cell. In this case, the relationship is solely among cells; as the values in C1, C2, C3, or D2 change, the value of the cell containing this formula will also change.

or both:

Example 2F: Entering this formula in a cell:

=(C1+C2)/2

adds the values in cells C1 and C2 and divides the result by 2. This relationship is among cell addresses and numbers.

CREATING A FORMULA

To create a formula, go to the cell where you want the results displayed. Start the formula with an equal sign, =.

There are three general methods for entering cell addresses[1]:

- ***Point Method***:

  1. Move cell pointer to the cell containing the desired value.

2. "Lock in" that value to the formula with an arithmetic function or a parenthesis

- ***Direct Address:*** Type the cell address directly.
- ***Point & Click Method:*** Click the cell with the mouse.

Of these, the Point Method is, by far, the most important, because, once you master it, it is faster, and it is always more accurate.

RECALC

As you change worksheet data, all of the formulas that refer to that cell directly or indirectly recalculate automatically, by default. As your spreadsheet grows very large, this automatic recalculation may slow noticeably. To turn off automatic recalculation:

Step 1: From the pull-down menu, select Tools, Options.

Step 2: On the Calculation tab, under Calculation, select the Manual option and the Recalculate before save check box.

Step 3: Click OK to save changes and exit the dialog.

Now, as you enter data in a cell, cells that refer to that cell do not recalculate until you press the Recalc key, F9. This change will apply to all workbooks, until you return to Automatic recalculation.

FUNCTION KEYS

Function keys, the so-called "F-keys" along the top of the keyboard, were important back in the PC's Jurassic period, when MS-DOS® programs roamed the Earth. Although often overlooked in Windows® programs, they are still useful. Excel adopted the same basic commands pioneered by Lotus® 1-2-3.

FREQUENTLY USED FUNCTIONS KEYS		
F1	Help	Context sensitive help
F2	Edit	Enter Edit mode. Press ←Enter to replace the former value.
F3	Name	In Point mode, shows list of range names
F4	Abs	Locks that cell as absolute cell address
F5	Go to	Go to cell address; F5 CR moves cursor to cell CR
F6	Window	Toggle between split screens
F9	Calc	Recalculates spreadsheet

NOTES

1. This is not limited to formulæ. Any time a cell address is called for, it may be supplied by either the point-and-click or direct address methods.

LAB 2: BUILDING FORMULAS

Learning how to work with formulas is one of those things that takes a lots and lots of practice, because your fingers have more to learn than your brain.

MILEAGE EXAMPLE

I would like to enter the amount of fuel that I buy, along with the odometer reading, every time I fill my car. I would like Excel to calculate my gas mileage.

SETTING UP THE WORKSHEET

When you are setting up formulas, it helps to put in some dummy values to test your work. Duplicate the following worksheet, which assumes that the initial odometer reading was zero, and, after driving 200 miles, you bought 10 gallons of gas.

	D	E	F	G
3	**Initial Mileage**	**Ending Mileage**	**Gas (in gallons)**	**MPG**
4	0	200	10	
5				

What formula should we place in cell G4 to calculate the miles per gallon?

STATING THE PROBLEM

This is an important point: whenever you work with formulas, make sure that you can state the solution in plain English. If you didn't have a spreadsheet, how would *you* figure out the answer?

I would subtract the initial mileage from the ending mileage to see how many miles I had driven, and then divide that amount by the number of gallons. Symbolically:

(Ending Mileage - Initial Mileage) / Gas

In this case:

(200 - 0)/10

or 20 miles per gallon. Now, let's translate this into a formula for cell G4:

Step 1: Move to cell G4.

Step 2: Type the equal sign, [=], because formulas always start with an equal sign.

Step 3: Type a left parenthesis, [(].

Step 4: Press [←] twice, to point to cell E4, the ending mileage.

Step 5: To subtract the initial mileage, type a minus sign, [-], and press [←] three times, to point to cell D4.

Step 6: Type a right parenthesis, [)], to end the group.

Step 7: To divide by the number of gallons, type the division operator, [/], and press [←] once to point to cell F4.

Step 8: Press [↵Enter] to lock the formula into the cell.

The results are just as we expected:

	D	E	F	G
3	**Initial Mileage**	**Ending Mileage**	**Gas (in gallons)**	**MPG**
4	0	200	10	20
5				

=(E4-D4)/F4

A LITTLE FORMATTING

A little formatting will make our example more useable. The numbers in columns D through G will normally be expressed with a comma separator and one decimal place.

Step 1: Select these four columns.

- Click the D column header and drag to G.

Step 2: Apply the comma format to the selected columns; either:

- click [,] on the Formatting toolbar, or,
- press [Ctrl] [Shift] [!]

Step 3: Because the comma format automatically displays two decimal places, we want to reduce the number of decimal places that are displayed:

- Click  on the Formatting toolbar.

Let's replace the dummy values in cells D4, E4, and F4 with real values, as shown below:

	D	E	F	G
3	**Initial Mileage**	**Ending Mileage**	**Gas (in gallons)**	**MPG**
4	50,021.1	50,325.0	11.2	27.1
5				

As soon as you enter the values, the answer appears automatically. This is what spreadsheets are all about!

EXTENDING THE MILEAGE

Now, what happens when I take another trip? I should not have to type the initial mileage in cell D5, because it is the same as the previous ending mileage, which I have already entered in cell E4:

Step 1: Move to cell D5.

Step 2: Type the equal sign, [=], to indicate that this will be a formula.

Step 3: Press [→] and then [↑] to point to cell E4.

Step 4: Press [←Enter] to lock the formula in the cell.

	D	E	F	G
3	**Initial Mileage**	**Ending Mileage**	**Gas (in gallons)**	**MPG**
4	50,021.1	50,325.0	11.2	27.1
5	50,325.0			

=E4

Indeed, we can make this really easy for future trips by copying the formula in cell D5 down ten rows:

Step 1: Move to cell D5.

Step 2: Click and drag D5's fill handle straight down.

	D	E	F	G
3	**Initial Mileage**	**Ending Mileage**	**Gas (in gallons)**	**MPG**
4	50,021.1	50,325.0	11.2	27.1
5	50,325.0			
6	-			
7	-			

Step 3: To show you what this has done, move to cell E5, type:

50,625.3

and press [←Enter].

- Do you see how it fills in the next trip's initial mileage automatically?

	D	E	F	G
3	**Initial Mileage**	**Ending Mileage**	**Gas (in gallons)**	**MPG**
4	50,021.1	50,325.0	11.2	27.1
5	50,325.0	50,625.3		
6	50,625.3			
7	-			

COPY THE MPG FORMULA

Copying the last formula worked so well that we should try the same approach to the formula in cell G4:

Step 1: Move to cell G4.

Step 2: Click cell G4's fill handle, and drag it straight down.

This time the results are not so pretty . . .

	D	E	F	G
3	**Initial Mileage**	**Ending Mileage**	**Gas (in gallons)**	**MPG**
4	50,021.1	50,325.0	11.2	27.1
5	50,325.0	50,625.3		**#DIV/0!**
6	50,625.3			**#DIV/0!**
7	-			**#DIV/0!**

. . . but they work, as you will see if you type 12.2 in cell F5 and press ←Enter:

	D	E	F	G
3	**Initial Mileage**	**Ending Mileage**	**Gas (in gallons)**	**MPG**
4	50,021.1	50,325.0	11.2	27.1
5	50,325.0	50,625.3	12.2	24.6
6	50,625.3			**#DIV/0!**
7	-			**#DIV/0!**
8	-			**#DIV/0!**

The error message that you generated, **#DIV/0!**, is a warning that the formula you created is trying to divide by zero. As soon as you enter a number for the Gas (other than zero, of course), Excel performs the calculation and puts the answer in the MPG column.

THINGS TO COME

We can prevent this error message from messing up our worksheet, but we can't quite do it yet. Instead, we will learn how fix it in Lab 5.

Still, we can improve the way your gas mileage calculator looks, by reviewing some formatting techniques.

	D	E	F	G
2	***Gas Mileage Calculator***			
3	**Initial Mileage**	**Ending Mileage**	**Gas (in gallons)**	**MPG**
4	50,021.1	50,325.0	11.2	27.1
5	50,325.0	50,625.3	12.2	24.6
6	50,625.3			**#DIV/0!**
7	-			**#DIV/0!**

NOTES

CHAPTER 3: INTRO TO FUNCTIONS

"Cats are intended to teach us that not everything in nature has a function."

– Not unknown, but unwilling to be identified

Functions are pre-defined features of the general form: =*fNAME*(*a, b, . . . n*) where *fNAME* is the function's name, and *a, b, . . . n* are that function's complement.

FUNCTION RULES

The rules for working with functions are pretty easy:

- The complement must be entered in precise order.
- Elements of the complement are separated by commas.
- Although Excel is very forgiving about extraneous spaces, it is recommended that no spaces appear in a function, unless they are within a string.
- Function names are ***not*** case sensitive.

USING SUM()

The most common function is the SUM() function. The general form is:

=SUM(*Range*)

where *Range* is any range.

To illustrate the SUM() function, consider the following table:

	A	B	C	D	E
1		1			
2		2			
3		3			
4					

To place the sum of the cells B1, B2, and B3 in cell B4:

Step 1: Move to cell B4.

- This is where you want the sum to appear.

Step 2: Type:

=sum(

Step 3: Press ↑ once, to move to one corner of the range.

Step 4: To select the range, hold down Shift, and tap ↑ twice.

- Each tap will expand the range.

Step 5: When you have selected the range you want to total, B1:B3, type a right parenthesis,), to close the group.

- At this point, the worksheet should look like this:

	A	B	C	D	E
1		1			
2		2			
3		3			
4		=sum(B1:B3)			

Step 6: Press ←Enter to lock the formula into the cell.

Now, move the cursor back to cell B4. What does cell B4 contain? (It will appear in the Formula bar.)

=SUM(B1:B3)

What does cell B4 display?

6

To see the wonder of spreadsheets, go to cell B1, type a new number, and press ←Enter. What this do to cell B4?

OTHER RANGE FUNCTIONS

Three other common functions work very much like the SUM() function:

- =MAX(*Range*) returns the largest number in a range.
- =MIN(*Range*) returns the smallest number in a range.
- =AVERAGE(*Range*) returns the arithmetic mean of all the numbers in a range.

DISPLAY FORMULAS

If a cell's contents are hard to read from the Formula bar, try pressing F2. This places you in Edit mode, and displays the formula in the body of the worksheet until you press ←Enter.

To display all the formulas in a worksheet, press Ctrl ~. (The tilde (~) is in the upper-left of the keyboard, just below Esc.) This will widen cells to accommodate the length of formulas. To return to the normal view, where the results are displayed, press Ctrl ~ again.

AUTOSUM

Excel's AutoSum feature can make the SUM() function even easier:

Step 1: Duplicate this spreadsheet:

	A	B	C	D
2	Food	1,000.00		
3	Insurance	486.44		
4	Food	3,000.00		
5	Gas	227.88		
6	Total			

Step 2: Now, move to cell B6.

Step 3: To invoke the AutoSum, either:

- click the AutoSum icon, Σ, and press ←Enter, or,
- press Alt = and press ←Enter.

LIMITATIONS

Instead of typing the SUM() function, beginners are beguiled into thinking that using AutoSum is easier. I strongly discourage you from using this tool.

Let's try this experiment.

Step 1: Duplicate the following spreadsheet:

	A	B	C	D
1		**1999**	**2000**	**2001**
2	Food	1,000.00	1,200.00	1,300.00
3	Insurance	486.44		
4	Food	3,000.00	3,300.00	
5	Gas	227.88	200.00	
6	**Total**			

Step 2: Now, move to cell B6.

Step 3: Click the AutoSum icon, Σ, and press ←Enter.

Step 4: Move to cell C6, click the AutoSum icon, Σ, and press ←Enter.

Step 5: Move to cell D6, click the AutoSum icon, Σ, and press ←Enter.

Do you see how fast you get answers? They are wrong, of course, but it was really, really fast! (I know, you don't need the sarcasm, but my point is that you cannot be fast enough to compensate for inaccuracy. Fast is important, but it is always second to accuracy.)

In cell B6, AutoSum included the year in the calculation. In C6, AutoSum returned 3,500.00; it included the numbers in the column above it—up to the first empty cell, that is.

Now, the people at Microsoft are intelligent, and they would not have given you the AutoSum feature if there was not an easy way—several ways, in fact—to solve these problems. Still, the easiest, and most accurate way is to avoid it altogether in favor of the keyboard method. In addition, if that's the right word, typing the SUM() function prepares you for functions yet to come.

AUTOCALC

Excel has a feature called AutoCalc, which displays the sum of a range without typing. To see this, select a range of numbers. Their sum will appear in a box in the status bar, at the bottom of the screen.

You can have AutoCalc perform other operations by doing the following:

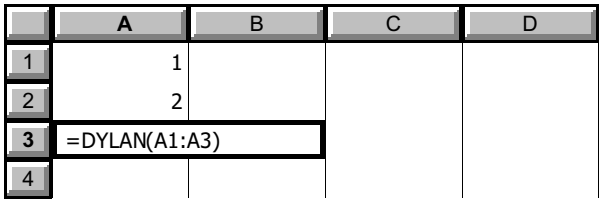
Step 1: Right-click the status bar.

Step 2: On the resulting shortcut menu, select the desired operation.

- AutoCalc calculates accordingly until you change the operation again.

#NAME?

Let's examine a new function, DYLAN():



Unfortunately, there is no DYLAN() function. If you a function that Excel doesn't recognize, Excel will display:

#NAME?

in the cell. Usually, of course, this results from a spelling misadventure.

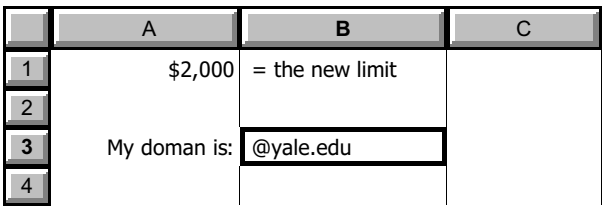
TEXT REVISITED

As you recall, a cell can contain:

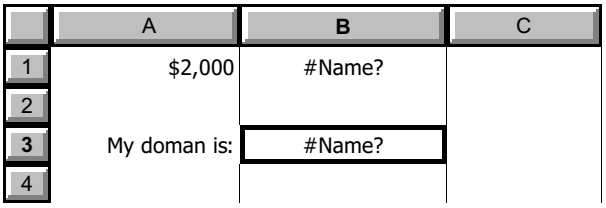
- text;
- a number; or,
- a formula.

You enter text and numbers simply by typing them. To enter a formula, though, you must tell the machine, by first typing an equal sign, [=]. Excel also allows you to start a formula with [+], [@], or [-], to accommodate refugees from Lotus® 1-2-3.

But what if you want this:

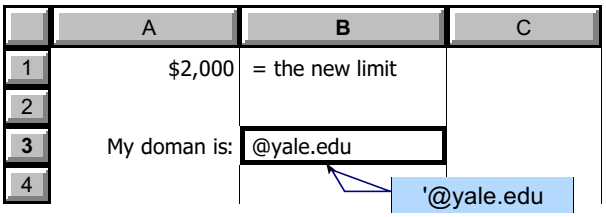


If you enter the data as it appears, the results will be:



Excel displays: **#Name?**, because it thinks you are trying to start a formula or function that it doesn't understand.

To start a string of text with one of these characters, precede it with the apostrophe, [']. The single quote says, in effect, "What follows is text." The apostrophe itself will not appear:



NESTED FUNCTIONS

Excel allows you to nest functions. A nested function is one that uses another function as part of its argument. There are only two restrictions:

- You may nest up to seven levels of functions.
- The nested function must return the same value type as the argument.

We will deal with nested functions in the next few chapters.

CIRCULAR REFERENCES

Consider the following spreadsheet. What is the result of the formula in cell A3?

	A	B	C	D	E
1	1				
2	2				
3	=SUM(A1:A3)				
4					

This is known as a circular reference. A circular reference is one that uses the results to calculate the results to calculate the results to calcu . . . *ad infinitum*. A formula or function that contains a circular reference is a bad thing.

If you create a circular reference, Excel will open the Circular Reference toolbar and mark the cell with a ◆, as shown in Figure 169.

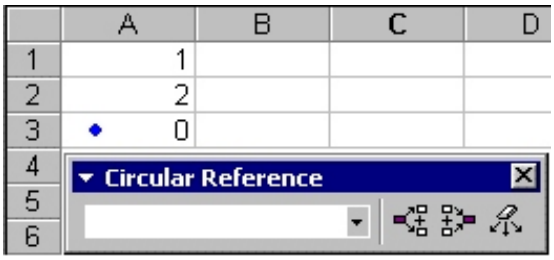


Figure 10

In addition:

`Circular:A3`

will appear in the Status Bar.

HANDLING CIRCULAR REFERENCES

It is important to deal with circular references immediately:

Step 1: Move the cursor back to the cell that contains the circular reference.

- It will be noted in the status bar; and,
- it will be marked with a ◆; and,
- if it's ***still*** not clear to you which of the cells contains the circular reference, it will be listed in the drop-down box of the Circular Reference toolbar.

Step 2: Click the Trace Precedents icon, on the Circular References toolbar.

- Excel will display the cells that are used to calculate the results in the formula, as shown in Figure 171.
- It should be clear which cell is causing the problem.

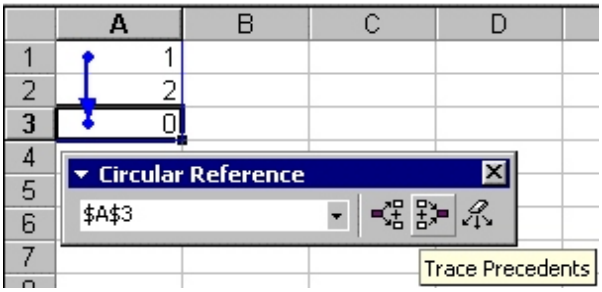


Figure 12

Step 3: Press F2 to go into Edit mode.

Step 4: Correct the formula and press ↵Enter.

After successfully eliminating the circular reference, the Circular Reference toolbar will go away, and the status bar will clear.

TROUBLESHOOT CIRCULAR REFERENCES

It's important to deal with a circular reference immediately, because if you close the Circular Reference toolbar, the only reminder that you have a problem is the message in the Status Bar—and Murphy's Law says you will overlook that.

If you accidentally close the Circular Reference toolbar:

- From the pull-down menu, select View, Toolbars, Circular Reference.

Then, fix the circular reference as you normally would.

Circular references usually occur, as in this example, by selecting an incorrect range. They can also result when one cell refers to another that refers to another that . . . eventually refers back to the first, as shown in ?.

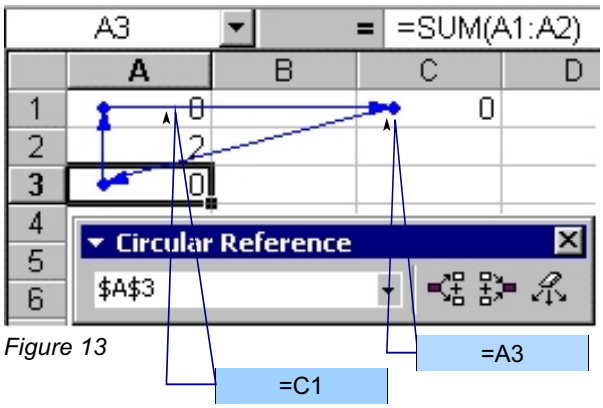


Figure 13

NOTES

LAB 3: FUN WITH FUNCTIONS

This is one of those labs where we are training your finger as much as we are training your brain.

SIMPLE EXAMPLE

Adding things up is one of the most common problems in spreadsheets. In fact, by some estimates the Sum function is used more than all the other functions combined! Let's do a simple example.

Step 1: Recreate this spreadsheet:

	A	B	C	D	E
1		1			
2		2			
3		3			
4	Total				

Step 2: Move to cell B4, where you want the total to appear.

Step 3: Type:

=sum(

Step 4: To go to one corner of the range, press ↑.

Step 5: To select the range, hold down Shift, and tap ↑ twice.

Step 6: When you have selected the range you want to total, B1:B3, type the right parenthesis,).

- At this point, the worksheet should look like this:

	A	B	C	D	E
1		1			
2		2			
3		3			
4	Total	=sum(B1:B3)			

Step 7: Press ←Enter to lock the formula into the cell.

GRADE BOOK EXAMPLE

Here's a similar problem. Your teacher has seven students and gives three exams this semester. She wants to know:

- the top score on each test;
- the lowest score on each test;
- the average score on each test; and,
- each student's average score.

Set up the spreadsheet so it looks like this.

	A	B	C	D	E
1	Student	Test 1	Test 2	Test 3	Average
2	Alan	90	80	70	
3	Bill	65	65	65	
4	Cindy	92	81	65	
5	David	86	77	81	
6	Earl	75	60	79	
7	Fred	100	92	93	
8	George	66	58	36	
9	Hillary	90	59	83	
10	Average				
11	Best score				
12	Worst score				

CALCULATE AVERAGE FOR EACH TEST

Step 1: Move to cell B10, where you want the average of the scores from Test 1 to appear.

Step 2: Type:

=average(

Step 3: To move to one corner of the range, press ↑.

Step 4: To select the range, hold down Shift, and tap ↑ seven times.

Step 5: When you have selected the range you want to total, B2:B9, type right parenthesis,).

- Your worksheet should look like this.

	A	B	C	D	E
1	Student	Test 1	Test 2	Test 3	Average
2	Alan	90	80	70	
3	Bill	65	65	65	
4	Cindy	92	81	65	
5	David	86	77	81	
6	Earl	75	60	79	
7	Fred	100	92	93	
8	George	66	58	36	
9	Hillary	90	59	83	
10	Average	=average(B2:B9)			
11	Best score				
12	Worst score				

- If it doesn't, press Esc, and start again.

Step 6: If it looks like it should, press ←Enter to lock the formula into the cell.

Now, simply repeat these steps for cells C10 and D10. There is, of course, an easier way to do this, but our focus here is making we have trained your fingers.

CALCULATE THE BEST SCORE FOR EACH TEST

Step 7: Move to cell B11, where you want the largest score from Test 1 to appear.

Step 8: Type:

```
=max(
```

Step 9: To move to one corner of the range, press ↑ ***twice***.

Step 10: To select the range, hold down Shift, and tap ↑ seven times.

Step 11: When you have selected the range, B2:B9, type a right parenthesis,).

- Your worksheet should look like this:

	A	B	C	D	E
1	Student	Test 1	Test 2	Test 3	Average
2	Alan	90	80	70	
3	Bill	65	65	65	
4	Cindy	92	81	65	
5	David	86	77	81	
6	Earl	75	60	79	
7	Fred	100	92	93	
8	George	66	58	36	
9	Hillary	90	59	83	
10	Average	83.0	71.5	71.5	
11	Best score	=max(B2:B9)			
12	Worst score				

- If it does not, press Esc, and start again.
- Now, take a look at the numbers. What should the answer be?

Step 12: If it looks like it should, press ←Enter to lock the formula into the cell.

- The answer, of course, is 100—the highest number in the range.

FINE THE WORST SCORE

Step 13: Move to cell B12, where you want the lowest score from Test 1 to appear.

Step 14: Type:

```
=min(
```

Step 15: To move to one corner of therange, press ↑ three times.

Step 16: To select the range, hold down Shift, and tap ↑ seven times.

Step 17: When you have selected the range you want to total, B2:B9, type a right parenthesis,).

- At this point, the worksheet should look like this:

	A	B	C	D	E
1	Student	Test 1	Test 2	Test 3	Average
2	Alan	90	80	70	
3	Bill	65	65	65	
4	Cindy	92	81	65	
5	David	86	77	81	
6	Earl	75	60	79	
7	Fred	100	92	93	
8	George	66	58	36	
9	Hillary	90	59	83	
10	Average	83.0	71.5	71.5	
11	Best score	100	92	93	
12	Worst score	=min(B2:B9)			

- if it does not, press Esc, and start again.
- Again, before you do the next step, take a look at the numbers. What should the answer be?

Step 18: If it looks like it should, press ↵Enter to lock the formula into the cell.

- The answer, of course, is 65—the smallest score in the range.

Step 19: repeat these steps for cells C11 and D11.

- There is an easier way to do this, but your fingers can use the exercise.

Calculate Student Averages

Before we calculate Alan's average, let's take a look at it. Without worrying about the spreadsheet, what should the answer be? The average of 90, 80, and 70 is 80. Let's see if Excel agrees:

Step 20: Move to cell E2, where you want Alan's average to appear.

Step 21: Type:

```
=average(
```

Step 22: To move to a corner of the range, tap ← once.

Step 23: To select the range, hold down Shift, and tap ← two more times.

Step 24: When you have selected the range, B2:D2, type the right parenthesis,).

Step 25: Press ↵Enter to lock the formula into the cell.

- The answer, of course, is 80.

Step 26: Repeat these steps for cells E3 through E9.

We only want the answers to the nearest tenth:

Step 27: Select column E, and click  to increase the number of decimal places that appear, or  to decrease the number of decimal places.

- The results should look like this:

	A	B	C	D	E
1	Student	Test 1	Test 2	Test 3	Average
2	Alan	90	80	70	80.0
3	Bill	65	65	65	65.0
4	Cindy	92	81	65	79.3
5	David	86	77	81	81.3
6	Earl	75	60	79	71.3
7	Fred	100	92	93	95.0
8	George	66	58	36	53.3
9	Hillary	90	59	83	77.3
10	Average	83.0	71.5	71.5	
11	Best score	100	92	93	
12	Worst score	65	58	36	

Notes