

## Creating A Grade Sheet With Microsoft Excel

Microsoft Excel serves as an excellent tool for tracking grades in your course. But its power is not limited to its ability to organize information in rows and columns. Using formulas and functions in Excel, you can simplify the grading process. With Excel you can sort students by names, grades or whatever characteristics you choose. You can also setup a grade curve in advance and have Excel automatically assign letter grades (not just percentages) to each of your students. When you change the curve, the grades will change automatically. This tutorial will show you how to setup a grading sheet in Excel that makes use of all these functions plus some other helpful features that will be explained in detail later.

This tutorial assumes the reader has a basic understanding of how to navigate a spreadsheet and enter data in cells. A reader who is experienced with Excel and is familiar with entering formulas and the difference between absolute and relative cell references can begin in section three.

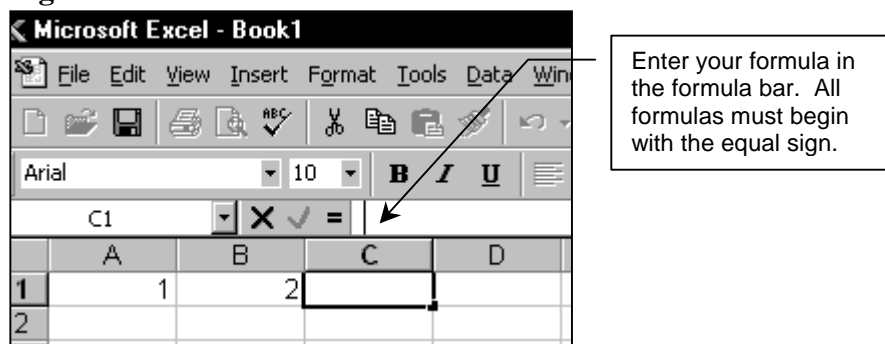
Also, note that this tutorial is based on Excel 2000 for Windows. Everything in this tutorial with the exception of keyboard shortcuts will work in Excel for Mac.

### 1) Introductory Excel: *Entering Formulas*

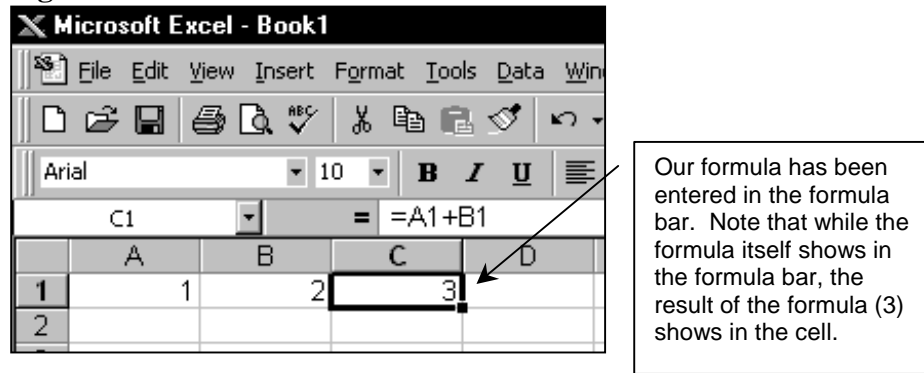
In Excel, formulas allow a user to make new calculations based on data entered into a spreadsheet. In simple terms a formula is made up of a combination of numbers, cell references and mathematical operators. To input a formula, click once on the cell in which you wish to enter a formula. Then click on the formula bar to begin entering your formula.

In **Figures 1.1** and **1.2** we have entered the number 1 in cell **A1** and the number 2 in cell **B2**. We will add a formula into cell **C3** to calculate the sum of cells **A1** and **B2**. Note that after clicking on cell **C3** we type the formula in the formula bar just above the worksheet. Once the formula is complete, hit enter. Cell **C3** now displays the result of your formula, the value 3. In other words  $A1+B1 = 3$  because  $1+2=3$ . Whenever you enter a formula into a cell, the cell will always display the result of the formula and not the formula itself. However, if there is a formula in the cell, it will be displayed in the formula bar.

**Figure 1.1**



**Figure 1.2**



When entering formulas for your grade sheet, most likely you will use the typical mathematical operators to calculate your grade formulas. They include the following:

Addition	+
Subtraction	-
Multiplication	*
Division	/

The order of calculation follows conventional mathematics. You can use parentheses to organize your formulas, but be aware that Excel calculates from the inside out where there are multiple sets of parentheses. For example, Excel calculates the formula `=(2+3)*5` in the following way:

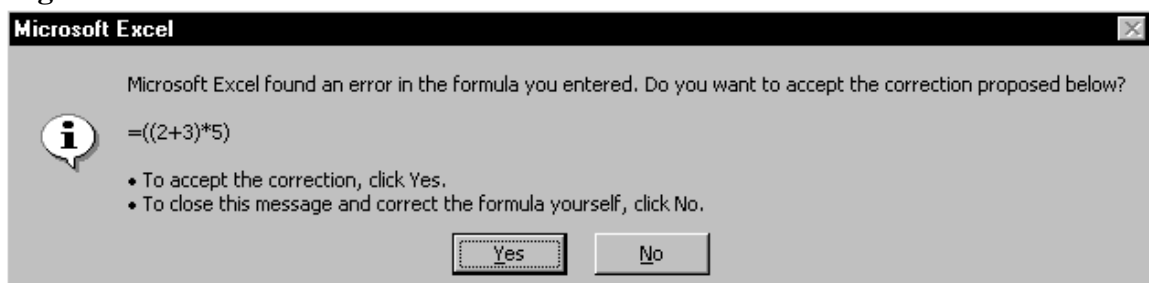
$$2+3 = 5$$

*then*

$$5 * 5 = 25$$

So the answer to the formula `=(2+3)*5` is 25. Note that you always must have matching pairs of parentheses. If Excel finds they do not match it will give you an error message like that in **Figure 1.3**. The error message in **Figure 1.3** appeared as the result of the formula `=(2+3)*5`. The correct version would be `=(2+3)*5`. Of course you could always mix cell references with numbers in your formulas. The formula `=(A2+3)*5` would also equal 25.

**Figure 1.3**



Finally, note that capital letters were used in the formula in **Figure 1.2**. It is not necessary to use capital letters. Excel doesn't care whether you use capitals or lower case letters when referencing cells. You may want to use lower case letters simply because it means less typing (less use of the shift key).

## 2 Introductory Excel: Absolute and Relative Cell References

One of the keys to building a working grade sheet is to understand the difference between absolute and relative cell references. With the ability to copy and paste cells (and thus formulas) in Excel spreadsheets, the difference between absolute and relative references is the difference between a right and wrong answer to your formula. This is critical when calculating student grades because a wrong formula may lead to you reporting the wrong grade for a student.

### 2.1 Relative Cell References

In a formula in which you use relative cell references, the cell references will change depending on where you copy the original in your spreadsheet. The best way to understand this is through an example.

In **Figure 2.1** data has been entered in three rows and two columns. Your goal is to add the values across columns so that you have a result in the third column. In **Figure 2.1**, cell **A1** will be added to cell **B1** and the result will be placed in **C1**. **A2** and **B2** will be added with the result in **C2**, and **A3** and **B3** will be added with the result showing in **C3**. To begin, enter your formula in **C1**. Once the formula has been entered you can simply copy it into cells **C2** and **C3**. This is displayed in **Figure 2.2**.

Figure 2.1

	A	B	C
1	5	10	15
2	10	20	30
3	100	200	300

Figure 2.2

	A	B	C
1	5	10	15
2	10	20	30
3	100	200	300

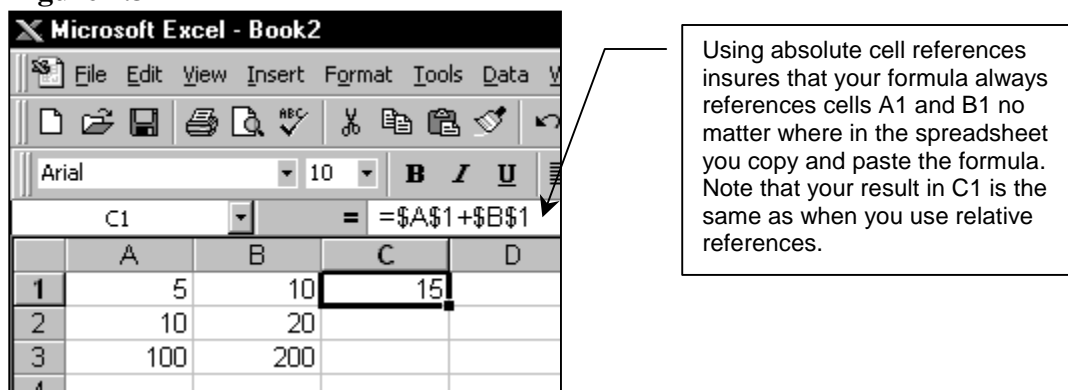
If you look over **Figure 2.2** carefully, you will notice that the formula entered in cell **C3** is different from that in cell **C1**. When you copied cell **C1** to **C2** and **C3** the cell references automatically changed. This is because the cell references are in relative reference form. What this means is that the formula in cell **C1** adds a cell two spaces to the left with a cell one space to the left. When you copy this formula to **C3**, two spaces to the left is **A3** and 1 space to the left is **B3**. Thus, where relative cell references are used, the cells that enter into the formula depend on the location in the spreadsheet of the formula itself. When you use an absolute cell reference, your formula will always reference exactly the same cell or cells no matter where you copy and paste your formula in your spreadsheet. We turn to absolute cell references next.

## 2.2 Absolute Cell References

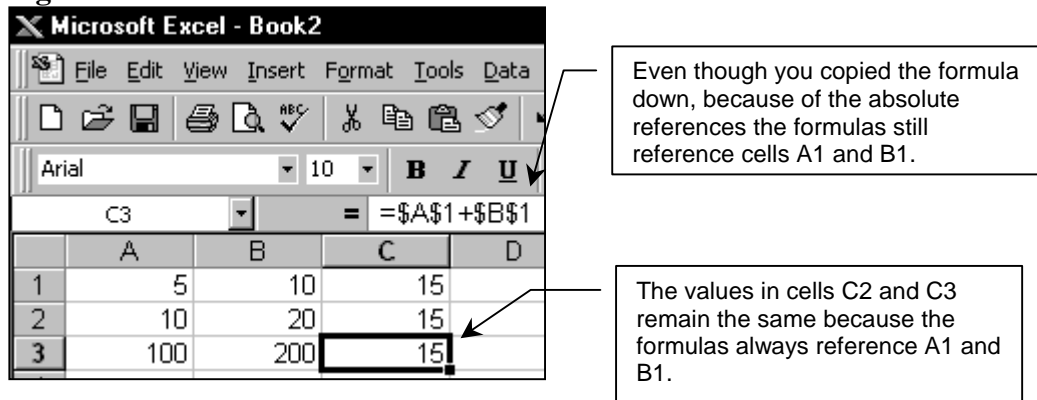
Again, when you use absolute cell references in your formula, your formula will always point to exactly the same cell or cells no matter where you copy and past your formula in your spreadsheet. An absolute cell reference looks a bit different from the relative cell references used above. They have the added feature of a dollar sign **\$** placed in front of the row and column references. Thus, if you wanted to add cells **A1** and **B1** using an absolute reference, your formula would be **=A\$1+B\$1**. This is shown in **Figure 2.3**.

When you copy this formula to cells **C2** and **C3** (as you did when using relative references) you will notice that the cell references in your formula do not change. They still reference **A1** and **B1**. Thus, **C2** and **C3** will still display the value 15 that is the result of adding together **A1** and **B1**. This is displayed in **Figure 2.4**.

Figure 2.3



**Figure 2.4**



With absolute references you can also restrict your formulas to columns only (but allow rows to change) or restrict your formulas to rows only and allow columns to change. This can be done by entering the \$ in front of only the row or only the column reference. Thus, if you enter the formula `= $A I` in a cell and then copy it to different cells in the spreadsheet, the row number may change, but the column letter will always be **A**. Likewise, if you enter `= A $ I` and then copy it to different cells, the column letter may change, but the row number will always remain the same.

Windows  
Only

To ease the entering of absolute references, Excel has a feature that will allow you to add the \$ without having to punch it in directly. Punch a cell reference into the formula bar and then click and hold to highlight the cell reference only. Press the **F4** key once. You will notice that it has added two dollar signs. If you press **F4** again, it will only add the \$ to the row reference. Press it again and it switches to only adding the \$ to the column reference. One more press of **F4** will remove all the dollar signs.

It is a good idea to practice a little with absolute and relative cell references before continuing on in this tutorial. You will make extensive use of absolute and relative references when you punch in your grading formula and you will likely get the most out of this tutorial if you are comfortable with absolute and relative cell references. Simply punch in the examples supplied in **Figures 2.1 -2.4** above. You may wish to enter more data or more complex formulas. Don't be afraid to experiment.

Windows  
Only

Typically Excel will only display one formula at a time in the formula bar. What is displayed depends upon what cell you have selected from the spreadsheet. This can be frustrating when you wish to experiment and learn through comparing differences among formulas. Fortunately, Excel has a feature that will allow you to display all formulas entered into a spreadsheet at the same time. This function is called the "reveal codes" function. To employ it, simply hold down the control key **Ctrl** and press the tilde key `~`. This will reveal all formulas within their cells on your spreadsheet. This is displayed in **Figure 2.5** on the next page. Note that in the case of **Figure 2.5**, the formulas use relative references. To return the spreadsheet to normal mode where the cells display the results of a formula, simply press **Ctrl** plus `~` again.

**Figure 2.5**



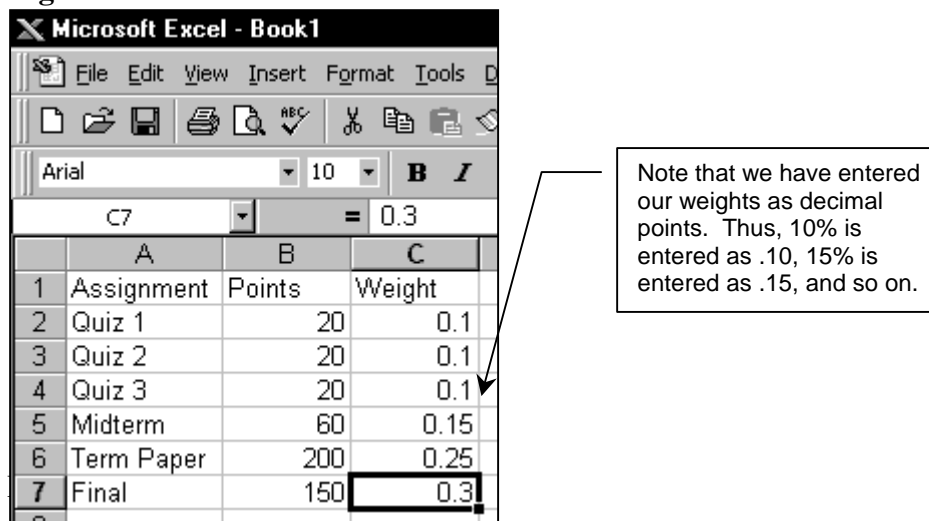
### 3 Setting Up Your Grade Sheet

Having reviewed formulas, absolute and relative cell references, you can now begin creating a grade sheet. Your grade sheet will have three major components. First, it will contain a table that lists all the assignments, tests, and activities that will receive a grade, their individual point values, and the overall weight in percentage terms of each item in the final grade for the course. Second, it will contain a table that outlines the initial grading curve for the course (don't worry too much about this now, you can change the curve later if you want). Third, it will contain a table that lists all the students in the course, their scores on individual assignments, and empty spaces for calculating final course percentages and grades.

#### 3.1 Input A Table Of Assignments

Your first step will be to enter the assignments, their points and overall weights (in decimal format) into your grade sheet. Start with a blank worksheet. **Figure 3.1** displays your assignment table. Note that your weights should be entered as decimal values. That is, 10% is entered as .10.

**Figure 3.1**



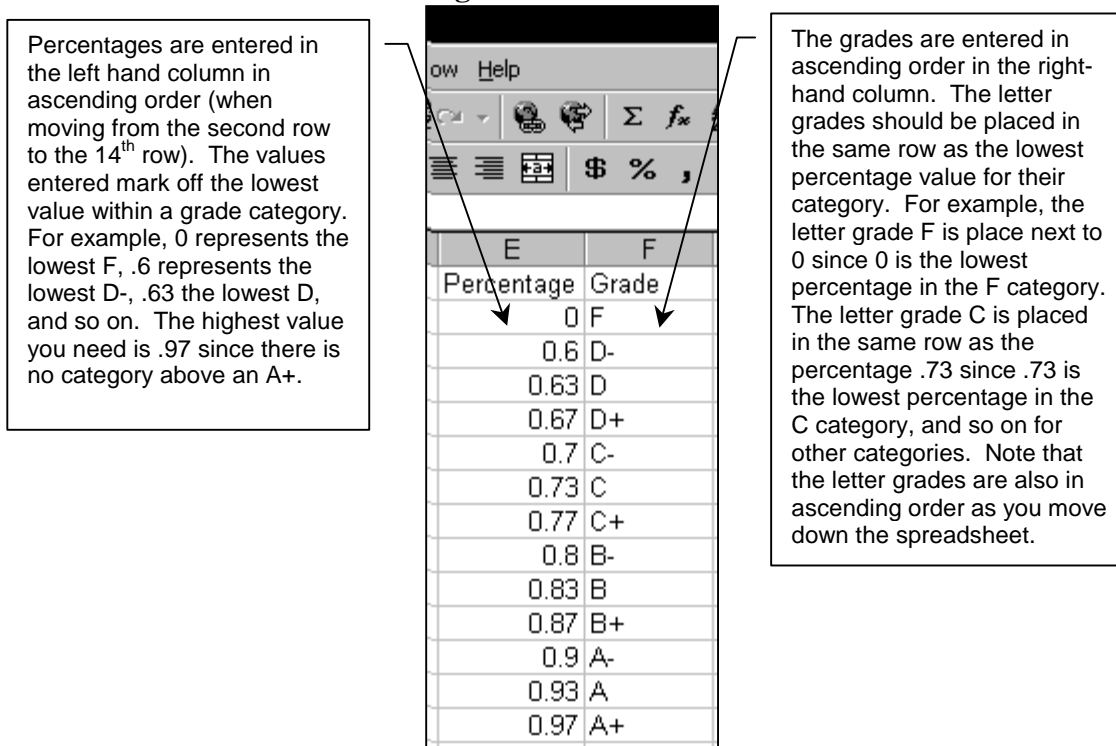
Also, note that even though we gave Quiz 1 a weight of 10% (or .10) we do not have to grade on a basis of 10 points. You can assign whatever point value we want to each assignment. Using a weighting scheme (to be explained later) will insure that the Quiz 1 score is properly incorporated in the final grade. Further, this means that you can set up your point schemes in a way that allows you to give appropriate feedback to students (you can distinguish good work from bad using either a very coarse or a fine grained point system). Finally, check and make sure your weights add up to 1.0.

### 3.2 Input Your Grade Curve

After you have your table of assignments entered, you can move on to enter the grade curve in the same worksheet as your assignments table. The grade curve will be used to calculate the final grades for the course. **Be careful here because you need to enter the grade curve in a very specific format if you want Excel to automatically assign letter grades at the end of the quarter or semester.** For now simply enter the grade curve on a standard ninety, eighty, seventy, sixty basis. You can change this later if you want.

Your grade curve table should be spread between two columns with percentages in the left column and letter grades in the right column. The grade curve table must be entered in the following way. Percentages must be entered in ascending order (when moving down rows) in the left column. Letter grade categories (entered in the right column) are marked off by the lowest percentage value within the category. This is displayed in **Figure 3.2** below.

**Figure 3.2**



Percentages are entered in the left hand column in ascending order (when moving from the second row to the 14<sup>th</sup> row). The values entered mark off the lowest value within a grade category. For example, 0 represents the lowest F, .6 represents the lowest D-, .63 the lowest D, and so on. The highest value you need is .97 since there is no category above an A+.

The grades are entered in ascending order in the right-hand column. The letter grades should be placed in the same row as the lowest percentage value for their category. For example, the letter grade F is placed next to 0 since 0 is the lowest percentage in the F category. The letter grade C is placed in the same row as the percentage .73 since .73 is the lowest percentage in the C category, and so on for other categories. Note that the letter grades are also in ascending order as you move down the spreadsheet.

### 3.3 Setup Your Reporting Table And Enter Students' Points

The third step is to set up a reporting table (still, in the same worksheet). You will use this table to enter students names and ID numbers, their point scores on different assignments, tests, and activities, and set aside space for calculating final percentages and letter grades. This is displayed in **Figure 3.3**.

**Figure 3.3**

	First	Last	ID#	Quiz 1	Quiz 2	Quiz 3	Midterm	Term Paper	Final	Percentage	Grade
19	Ben	Jerry	100100100	15	10	18	35	175	140		
20	koka	kola	200200200	18	14	19	47	190	147		
21	Pepci	Kola	300300300	19	17	19	55	195	148		

### 3.4 Enter The Formula For Overall Percentage Score

Entering the formula to calculate students' grades in percentage terms is perhaps the most difficult part of this project since it requires a lot of typing and an understanding of weights. Fortunately, if you enter the formula correctly using absolute and relative cell references, you will only need to type it in once. Then you can simply copy it down the spreadsheet for all students listed.

Your grading formula will use a weighting scheme that works in the following way. For each assignment, you will calculate the percentage score for the individual assignment. You will then multiply this result by the overall weight of the assignment in the final course grade. The results for all assignments will then be added together to produce the final percentage score for the overall course. For example, from **Figures 3.1** and **3.3** (our table of assignments and reporting table) you know that Quiz 1 is worth a total of 20 points, and the first student, Ben Jerry, received a 15. You also know that Quiz 1 is 10% (or .10) of the overall course grade. So, divide 15 by 20 and multiply the result by .10. Do this calculation for all the activities and assignments completed by Ben Jerry and add the results together. The full calculation for Ben Jerry is listed below. This equation tells us that Ben Jerry earned an 80.1% (or .801) for the course overall.

#### **Ben Jerry's Percentage Score:**

$$= \left( \frac{15}{20} \right) \cdot .10 + \left( \frac{10}{20} \right) \cdot .10 + \left( \frac{18}{20} \right) \cdot .10 + \left( \frac{35}{60} \right) \cdot .15 + \left( \frac{175}{200} \right) \cdot .25 + \left( \frac{140}{150} \right) \cdot .30$$

Quiz 1
Quiz 2
Quiz 3
Midterm
Term Paper
Final

Enter this formula into your spreadsheet in the Percentage column for Ben Jerry. However, when you enter the formula, instead of using the values as displayed in the equation above, use cell references. Further, use *relative cell references* when referencing those cells that contain a student's score on an activity. Use *absolute cell references* when you reference those cells that contain total possible points and the weights of different assignments. You should use *relative references* for students scores, because you will want to copy the formula down the Percentage column for each student and you will want the scores on the activities to change for each student as you paste the formula. You should use *absolute references* for total points and weights because you do



not want these values to change as you copy and past the formula. You will want these values to stay the same no matter where you copy and paste your grade calculation formula. The formula for Ben Jerry is listed below:

```
=((D19/$B$2)*$C$2)+((E19/$B$3)*$C$3)+((F19/$B$4)*$C$4)+((G19/$B$5)*$C$5)+((H19/$B$6)*$C$6)+  
((I19/$B$7)*$C$7)
```

Phew! That was a lot of careful typing! Check the formula over several times to make sure it is correct. You may even want to calculate the first student's score manually just to make sure the values are correct. Since it is the beginning of the term, you probably don't have scores for all assignments and students entered, so just make up some fictitious data to test your formulas. Once you know the formula works, you can simply copy it down the page for all students. Again, you might want to check the last student in the list manually to insure you have correctly entered the *absolute* and *relative* cell references.

[Remember, there are two ways you can look at formulas 1) one at a time by simply clicking on a cell and reading the formula in the formula bar 2) use Ctrl + ~ to reveal all formulas so you can compare them.]

### 3.5 Tell Excel How To Assign Letter Grades

Your last step in creating your grade sheet is to enter a formula that will make Excel look up students percentage score in the grade curve table and then assign a letter grade based on the percentage score. To do this you will use a built in function called vlookup. This function is entered in similar form to a formula. It will be entered in the cells labeled Grade. As with the formula for percentage score listed above, you only need to enter the vlookup formula once, then you can simply copy it down the spreadsheet for each student. For Ben Jerry, enter the formula listed below. Explanations of each component of the formula follows.

```
=VLOOKUP(I19,$E$2:$F$14,2,TRUE)
```

#### **=VLOOKUP**

This part of the formula tells Excel that you want it to use the VLOOKUP function in the spread sheet to look up a percentage value and return the associated letter grade. Excel needs four other pieces of information in the formula to accomplish this task. These pieces are outlined below. All four pieces must be contained within parentheses and separated by commas.

#### **I19**

This references the cell that contains the value you want Excel to lookup in the grade curve table. In this case **I19** references the cell that contains the Percentage score for Ben Jerry. This reference is in relative form because you will want it to change for each student.

#### **\$E\$2:\$F\$14**

This piece references the complete range of the grade curve table. Excel identifies the range by the upper left and lower right cells in the range (when referencing a range the two cell references are always separated by

a colon). In our case the upper left cell is **E2** and the lower right is **F14**. Note that the range does not include the labels, it only includes the values in the grade curve table. Also, since you are going to be copying the vlookup formula down the grade sheet, you want to make sure your vlookup formula always references the same cells in the grade curve table, so you should use absolute references.

## **2**

The third piece of your formula is the number two. The number **2** tells Excel from which column it should return values. Excel reads from left to right so the left column is **1** and the right column is **2**. You want Excel to return letter grades based on the percentage (lookup) values so input **2**.

## **TRUE**

When using the vlookup function you can have Excel match specific values or you have Excel look up approximations. If you enter the value **FALSE**, Excel will look for an exact match of the percentage in the grade table. If it doesn't find a match it will return #N/A. If you enter the value **TRUE**, Excel will look for an approximate match using the percentage values listed in the grade curve table as category boundaries. If the lookup value falls within a specific category, Excel will return the grade associated with that category. Use **TRUE**, because you do not want to look for exact matches, instead, you should look at categories.

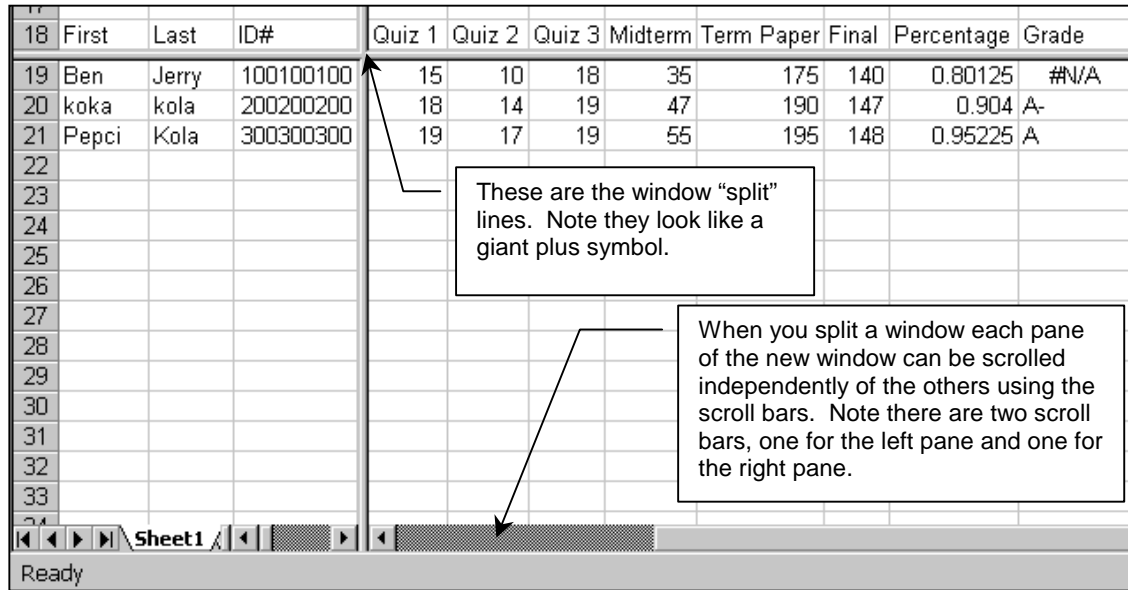
**[Remember, the percentage values in the grade curve table represent the lowest values for each of the grade categories.]**

With the =vlookup formula entered properly, you can simply copy it down the Grade column so that all students are automatically assigned a letter grade according to what you have laid out in the grade curve table. If you want to change your curve, you need only to change the values in the grade curve table, and all letter grades will be adjusted accordingly. Be aware that if you add another row to your grade curve table (to identify a finer division among grades) you will need to make the same adjustment in your =vlookup formula for all students, otherwise their grades will not be reported accurately.

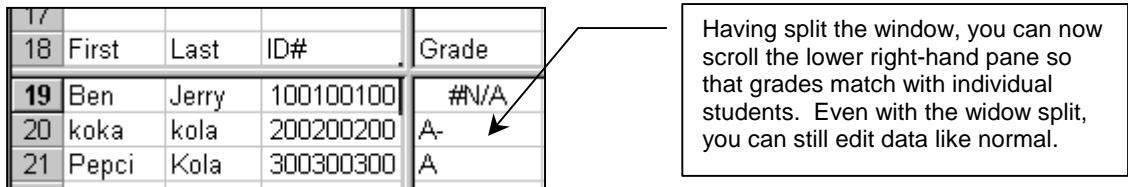
## **4 Entering Information For Students**

With your grade sheet laid out and formulas input, all you have to do now is enter the point values for each assignment for each individual student. If you have many assignments and exams for your course, it may become a bit difficult to match a particular cell with an individual student. The cell may be on the far right hand side of your screen while the student's name is on the far left. The next thing you know you have fingerprints all over your screen as you try to guide your eye across the row using your finger. Fortunately, Excel will allow you to split your screen so that the cell in which you are currently entering data rests right next to the name of your student. This is shown in **Figures 4.1** and **4.2** on the next page.

**Figure 4.1**



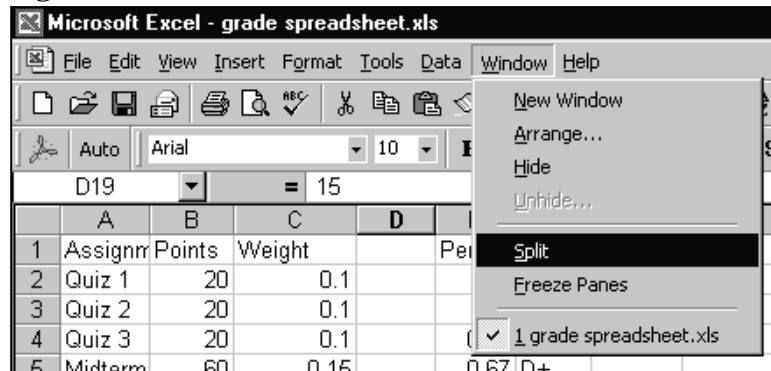
**Figure 4.2**



### 4.1 Splitting A Window To Ease Data Entry

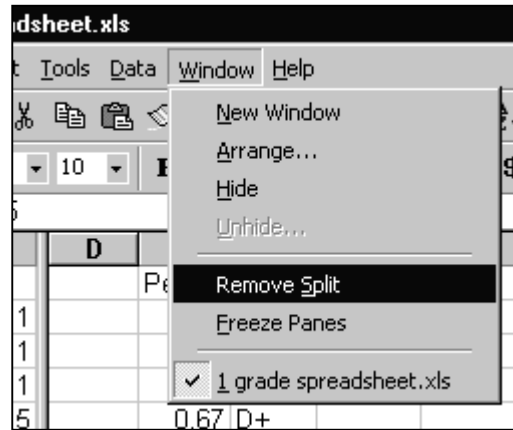
To split a window, first you need to figure out where you want the split to appear. Generally, when you apply the split, the cross point will appear in the upper-left hand corner of the cell you selected before you applied the split. So, select a cell where you want the split to appear. Click on that cell once with your cursor so the cell is highlighted. Select **Split** from the **Window** pull-down menu (see **Figure 4.3**).

**Figure 4.3**



To remove the split, simply return to the **Window** pull-down menu. You should see an option in the list for **Remove Split**. Your grade sheet will return to normal once you click **Remove Split** (see **Figure 4.4**).

**Figure 4.4**



#### 4.2 Sorting Student Scores and Grades

Once you have all your data entered you may wish to see who did well on the first quiz, or you might want to know how many students received A's for their final score or you might want to sort students by their last name so it is easier to record and send grades to the administration. To sort your students according to some category click and hold your left mouse button and highlight your entire reporting table including column headings (such as Quiz 1, Quiz 2, etc.). This is shown in **Figure 4.5**.

Be careful with sorting. Excel will only sort those columns you have highlighted. If you only highlight parts of student data, those parts will be sorted independently of other data. Thus, you will mix up all your student data. The result being you will have to remove it all and re-enter their scores from scratch.

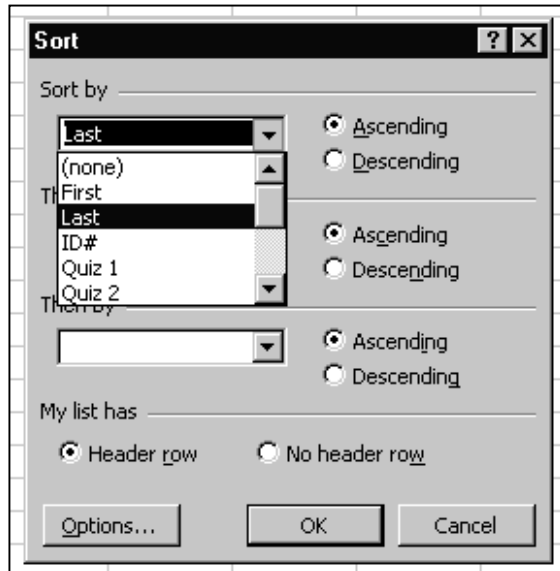
**Figure 4.5**

18	First	Last	ID#	Quiz 1	Quiz 2	Quiz 3	Midterm	Term Paper	Final	Percentage	Grade
19	Ben	Jerry	100100100	15	10	18	35	175	140	0.80125	B-
20	koka	kola	200200200	18	14	19	47	190	147	0.904	A-
21	Pepci	Kola	300300300	19	17	19	55	195	148	0.95225	A

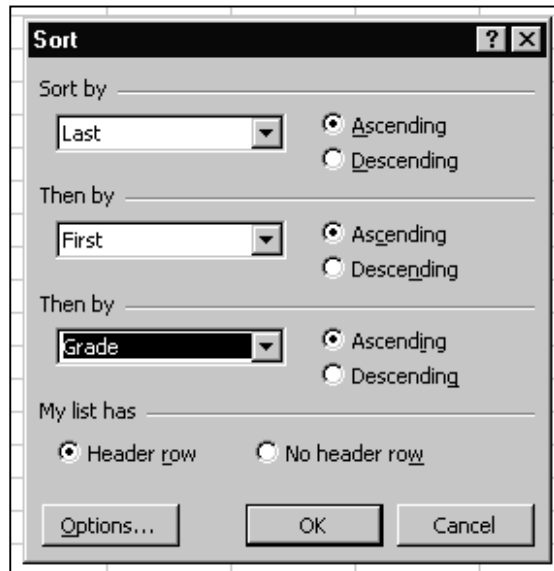
Once you have all the cells in your reporting table highlighted, select **Sort** from the **Data** drop-down menu. A dialogue window named **Sort** will pop up. From this window, you can select which column you want to sort by, the order in which you want to sort, and you can tell Excel whether there is a header row. The header row is simply that row which identifies the data in your columns. In the example, the header row is row 18 because it contains the column headings (such as First, Last, ID#, Quiz 1, and so on). If

you do not select the **Header** option, Excel will treat the columns by their reference numbers (such as Column A, Column B, and so on). The Sort dialogue box is displayed in **Figure 4.6a** and **Figure 4.6b**. Note from **Figure 4.6b** you can sort up to 3 columns together. In **Figure 4.6b** we have told Excel to sort first by *Last* (name) then by *First* (name), then by *Grade*. All sorts will be done in **ascending** order.

**Figure 4.6a**



**Figure 4.6b**



## 5 Auditing Your Spreadsheet: An Alternative Method For Identifying Errors

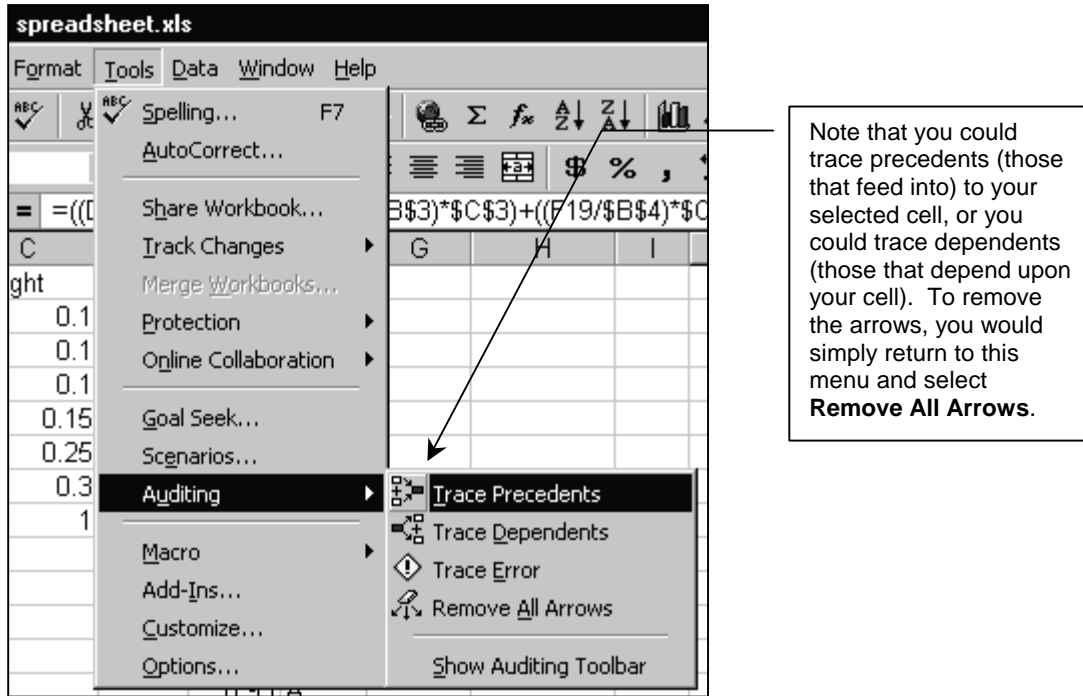
If you are not sure that you have entered your formulas correctly, Excel offers a feature that will allow you to check formulas visually rather than by having to read the text of the formula itself. This feature is called **Auditing**. When we audit a formula, Excel will use *Lines*, *Arrows* and *Dots* to show you what other cells (and their respective data) feed into a cell you select. Conversely, it can also show you what other cells depend upon the data entered into a cell you select.

To audit your formula, you first must select a cell we want to audit. For the purposes of this tutorial, you will audit the formula for Percentage in the first row of the reporting table. You will identify what other cells in the table feed into the Percentage for your first student in the list. To audit this cell, select the cell by clicking on it once, then select the **Tools** pull-down menu. From this menu select **Auditing** and then **Trace Precedents**. This is displayed in **Figure 4.7**.

With this option selected. You will find that a series of blue arrows and blue dots have appeared on your spreadsheet. The blue dots identify which cells feed into the cell (formula) that you selected initially. The arrows connect the blue dots and point at the cell you selected. If there was an error in your formula you would easily be able to see that there is a cell feeding into our formula that should not actually be a part of the

formula. **Figure 4.8** shows the arrows and dots feeding into your selected cell. **Figure 4.9** shows how you might identify an error in your formula.

**Figure 4.7**



**Figure 4.8**

	A	B	C	D	E	F	G	H	I	J	K
1	Assignm	Points	Weight		Percent	Grade					
2	Quiz 1	20	0.1		0.6	D-					
3	Quiz 2	20	0.1		0.63	D					
4	Quiz 3	20	0.1		0.67	D+					
5	Midterm	80	0.15		0.7	C-					
6	Term Pa	200	0.25		0.73	C					
7	Final	150	0.3		0.77	C+					
8					0.8	B-					
9					0.83	B					
10					0.87	B+					
11					0.9	A-					
12					0.93	A					
13					0.97	A+					
14											
15											
16											
17											
18	First	Last	ID#	Quiz 1	Quiz 2	Quiz 3	Midterm	Term Paper	Final	Percentage	Grade
19	Ben	Jerry	100100100	15	10	10	35	175	140	0.80125	B-
20	koka	kola	200200200	18	14	19	47	190	147	0.904	A-
21	Pepci	Kola	300300300	19	17	19	55	195	148	0.95225	A

Note that dots appear in the cells that feed into your selected cell. Arrows point to your selected cell. As we might expect all the cells from your table of assignments feed into the Percentage. Also all the students' scores from the reporting table feed into the final Percentage. This suggests that you got the formula right. You should still check the text of the formula to be sure.

**Figure 4.9**

	A	B	C	D	E	F	G	H	I	J	K
1	Assignm	Points	Weight		Percent	Grade					
2	Quiz 1	20	0.1		0	F					
3	Quiz 2	20	0.1		0.6	D-					
4	Quiz 3	20	0.1		0.63	D					
5	Midterm	80	0.15		0.67	D+					
6	Term Pa	200	0.25		0.7	C-					
7	Final	150	0.3		0.73	C					
8			1		0.77	C+					
9					0.8	B-					
10					0.83	B					
11					0.87	B+					
12					0.9	A-					
13					0.93	A					
14					0.97	A+					
15											
16											
17											
18	First	Last	ID#	Quiz 1	Quiz 2	Quiz 3	Midterm	Term Paper	Final	Percentage	Grade
19	Ben	Jerry	100100100	15	10	10	35	175	148	0.80625	B-
20	koka	kola	200200200	18	14	19	47	190	147	0.904	A-
21	Pepci	Kola	300300300	19	17	19	55	195	148	0.95225	A

There is an error in this formula. Can you figure out what it is?

Ans.: the formula for Quiz 3 is configured wrong. Koka Kola's score on Quiz 3 is being used for Ben Jerry's Percentage. We should correct the error in the Percentage formula so Ben Jerry is graded on his own work rather than Koka Kola's work.

Clearly, auditing will not tell you exactly what is wrong with your grade sheet, but it can help quite a lot with locating errors in formulas.

## 6 Conclusion

We have covered quite a bit of ground in this tutorial. It seems like a lot of work but once you have your grade sheet set up you will appreciate the power of using a spreadsheet. Of course, this tutorial says nothing about what sort of grading systems you should use in the first place. Should you grade on a curve? Should you use an absolute system where students' grades depend only on their individual work and not their rank in the class? What about gap grading? Should grades be the primary form of feedback you give to students? Should students receive a grade or points for every bit of work they do in a course? These are some tough questions, which are not easy to answer. To help, here are some references.

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