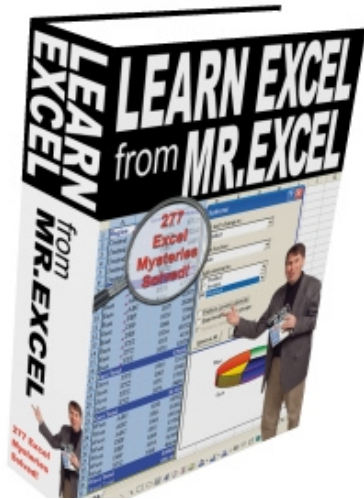




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First this week is an interesting question posed by a student in one of my classes. She worked in Human Resources and wanted to keep a running formula to count the number of employees.

Topics 2 & 4 deal with =RANK and how to deal with ties in a Rank.

Topic 3 shows how to take the results of a RANK function and how to virtually sort a list using formulas.

## AUTOMATICALLY NUMBER A LIST OF EMPLOYEES

**Problem:** You work in Human Resources. You have a list of employees separated by department. As shown in Fig. 369, you have a numerical sequence in column A and the employees' names in column B. Every time that you hire or fire an employee, you have to manually renumber all of the employees.

|    | A                           | B                      | C | D |
|----|-----------------------------|------------------------|---|---|
| 1  | <b>Marketing Department</b> |                        |   |   |
| 2  | 1                           | George Washington      |   |   |
| 3  | 2                           | John Adams             |   |   |
| 4  | 3                           | Thomas Jefferson       |   |   |
| 5  | 4                           | James Madison          |   |   |
| 6  | 5                           | James Monroe           |   |   |
| 7  |                             |                        |   |   |
| 8  | <b>Human Resources</b>      |                        |   |   |
| 9  | 6                           | John Quincy Adams      |   |   |
| 10 | 7                           | Andrew Jackson         |   |   |
| 11 | 8                           | Martin Van Buren       |   |   |
| 12 | 9                           | William Henry Harrison |   |   |
| 13 |                             |                        |   |   |
| 14 | <b>Manufacturing</b>        |                        |   |   |
| 15 | 10                          | John Tyler             |   |   |
| 16 | 11                          | James K. Polk          |   |   |
| 17 | 12                          | Zachary Taylor         |   |   |
| 18 | 13                          | Millard Fillmore       |   |   |
| 19 | 14                          | Franklin Pierce        |   |   |
| 20 | 15                          | James Buchanan         |   |   |
| 21 | 16                          | Abraham Lincoln        |   |   |
| 22 | 17                          | Andrew Johnson         |   |   |
| 23 | 18                          | Ulysses S. Grant       |   |   |
| 24 | 19                          | Rutherford B. Hayes    |   |   |

*Fig. 369*

**Strategy:** Replace the numbers in column A with a formula that will count the entries in column B. The formula should count from the current row all the way up to row 1.

The COUNT function will not work, because it only counts numeric entries. You need to use the COUNTA function.

- The range that should be counted should extend from B1 to the current row.
  - The notation to always use B1 is B\$1.
- 1) As shown in Fig. 370, enter this formula in cell A2: =COUNTA(B\$1:B2).

|    |                      |                     |   |   |   |   |
|----|----------------------|---------------------|---|---|---|---|
| A2 |                      | fx =COUNTA(B\$1:B2) |   |   |   |   |
|    | A                    | B                   | C | D | E | F |
| 1  | Marketing Department |                     |   |   |   |   |
| 2  | 1                    | George Washington   |   |   |   |   |
| 3  |                      | John Adams          |   |   |   |   |
| 4  |                      | Thomas Jefferson    |   |   |   |   |
| 5  |                      | James Madison       |   |   |   |   |
| 6  |                      | James Monroe        |   |   |   |   |

Fig. 370

When you copy this formula down a row, the range that is counted will extend from B1 to B3, as shown in Fig. 371. This is because the B2 portion of the above formula is a relative reference that is allowed to change as the formula is copied. The dollar sign in the B\$1 reference tells Excel that no matter where you copy the formula, it should always refer to cell 1.

|    |                      |                     |   |   |   |   |
|----|----------------------|---------------------|---|---|---|---|
| A3 |                      | fx =COUNTA(B\$1:B3) |   |   |   |   |
|    | A                    | B                   | C | D | E | F |
| 1  | Marketing Department |                     |   |   |   |   |
| 2  | 1                    | George Washington   |   |   |   |   |
| 3  | 2                    | John Adams          |   |   |   |   |
| 4  |                      | Thomas Jefferson    |   |   |   |   |
| 5  |                      | James Madison       |   |   |   |   |
| 6  |                      | James Monroe        |   |   |   |   |

Fig. 371

- 2) Copy the formula down to all of the names in your list. They will be numbered 1 through 19, just as when you typed the names in manually.

When an employee leaves the company, you can simply delete the row, All of the other numbers will change to indicate that you now have a total of 18 employees, as shown in Fig. 372.

| A23 |                             | fx =COUNTA(B\$1:B23)   |   |   |   |   |
|-----|-----------------------------|------------------------|---|---|---|---|
|     | A                           | B                      | C | D | E | F |
| 1   | <b>Marketing Department</b> |                        |   |   |   |   |
| 2   | 1                           | George Washington      |   |   |   |   |
| 3   | 2                           | Thomas Jefferson       |   |   |   |   |
| 4   | 3                           | James Madison          |   |   |   |   |
| 5   | 4                           | James Monroe           |   |   |   |   |
| 6   |                             |                        |   |   |   |   |
| 7   | <b>Human Resources</b>      |                        |   |   |   |   |
| 8   | 5                           | John Quincy Adams      |   |   |   |   |
| 9   | 6                           | Andrew Jackson         |   |   |   |   |
| 10  | 7                           | Martin Van Buren       |   |   |   |   |
| 11  | 8                           | William Henry Harrison |   |   |   |   |
| 12  |                             |                        |   |   |   |   |
| 13  | <b>Manufacturing</b>        |                        |   |   |   |   |
| 14  | 9                           | John Tyler             |   |   |   |   |
| 15  | 10                          | James K. Polk          |   |   |   |   |
| 16  | 11                          | Zachary Taylor         |   |   |   |   |
| 17  | 12                          | Millard Fillmore       |   |   |   |   |
| 18  | 13                          | Franklin Pierce        |   |   |   |   |
| 19  | 14                          | James Buchanan         |   |   |   |   |
| 20  | 15                          | Abraham Lincoln        |   |   |   |   |
| 21  | 16                          | Andrew Johnson         |   |   |   |   |
| 22  | 17                          | Ulysses S. Grant       |   |   |   |   |
| 23  | 18                          | Rutherford B. Hayes    |   |   |   |   |

Fig. 372



**Strategy:** If you are not concerned about ties, then use the RANK function. The function requires two arguments. In plain language, you are asking the function to assign a rank to the value in H23 amongst all values in H23:H26.

As shown in Fig. 375, in cell F23, use `=RANK(H23,$H$23:$H$26)`. Note that the H23:H26 range in the second parameter is in absolute reference style due to the dollar signs. This allows the formula to be easily copied to each name in the list.

| fx =RANK(H23,H\$23:H\$26) |        |          |
|---------------------------|--------|----------|
| F                         | G      | H        |
| Rank                      |        | Pages    |
| 2                         | Tessa  | 145.6137 |
| 1                         | Josh   | 247.9678 |
| 4                         | Ashley | 86.63641 |
| 3                         | Lee    | 96.58829 |

Fig. 375

**Additional Details:** The above version of the function will rank the values in high-to-low order. Sometimes you might need to rank in a low-to-high fashion. Golf is one such instance. You can specify an optional third parameter to specify the order. Using a third parameter of 1 will force the rank results to be reported in low-to-high order, as shown in Fig. 376.

| =RANK(H23,H\$23:H\$26,1) |        |          |
|--------------------------|--------|----------|
| F                        | G      | H        |
| Rank                     |        | Pages    |
| 3                        | Tessa  | 145.6137 |
| 4                        | Josh   | 247.9678 |
| 1                        | Ashley | 86.63641 |
| 2                        | Lee    | 96.58829 |

Fig. 376

**Summary:** The RANK function is useful for producing a ranking by using formulas.

**Functions Discussed:** =RANK()

**Cross Reference:** Rank a List Without Ties; Sorting with a Formula

## SORTING WITH A FORMULA

**Problem:** In the previous example, you used the RANK function to find the relative rank order of four writers, as shown in Fig. 377. Now you want to use a formula to produce a sorted list of the writers in high-to-low sequence.

Part  
II

|    | F    | G      | H        |
|----|------|--------|----------|
| 22 | Rank |        | Pages    |
| 23 | 2    | Tessa  | 145.6137 |
| 24 | 1    | Josh   | 247.9678 |
| 25 | 4    | Ashley | 86.63641 |
| 26 | 3    | Lee    | 96.58829 |
| 27 |      |        |          |
| 28 | 1    |        |          |
| 29 | 2    |        |          |
| 30 | 3    |        |          |
| 31 | 4    |        |          |

Fig. 377

**Strategy:** In cells F28 through F31, enter the numbers 1 through 4. Use the VLOOKUP function to return the name in column G and the pages in column H. Here is how this function works.

VLOOKUP stands for vertical lookup. There are four parameters to the VLOOKUP function. In plain language, you are asking Excel to look for the value in F28 in the first column of F23:H26. When Excel finds an exact matching value, it returns the name in the second column of the lookup range.

The first parameter is the value that you are trying to match. In the case of cell G28, you would be looking for the value in F28. Write this as

\$F28 so that you can copy the formula to column H without rewriting that parameter.

The second parameter is the database range containing rows and columns of data. The key value that you are looking up must be in the first column of the range. In this case, it would be \$F\$23:\$H\$26. Note that you use dollar signs before both the column letters and row numbers in order to keep the database range absolute as you copy the formula.

The third parameter tells Excel the column from which you want to return the answer. For the name in column G, it is column 2 of the range F23:H26. For the page count in column H, it is column 3 of the range F23:H26.

The fourth parameter tells Excel if you will allow a close match. If your original data is not sorted, you are required to specify an exact match. For the fourth parameter, use TRUE for a close match and FALSE for an exact match.

Follow these steps:

- 1) As shown in Fig. 378, enter the following formula in G28: =VLOOKUP(\$F28,\$F\$23:\$H\$26,2,FALSE).

|    | D | E | F    | G      | H        | I | J | K | L |
|----|---|---|------|--------|----------|---|---|---|---|
| 22 |   |   | Rank |        | Pages    |   |   |   |   |
| 23 |   |   | 2    | Tessa  | 145.6137 |   |   |   |   |
| 24 |   |   | 1    | Josh   | 247.9678 |   |   |   |   |
| 25 |   |   | 4    | Ashley | 86.63641 |   |   |   |   |
| 26 |   |   | 3    | Lee    | 96.58829 |   |   |   |   |
| 27 |   |   |      |        |          |   |   |   |   |
| 28 |   |   | 1    | Josh   |          |   |   |   |   |
| 29 |   |   | 2    |        |          |   |   |   |   |
| 30 |   |   | 3    |        |          |   |   |   |   |
| 31 |   |   | 4    |        |          |   |   |   |   |
| 32 |   |   |      |        |          |   |   |   |   |

Fig. 378



- 2) Copy cell G28 to H28. The result in H28 will also be Josh, as shown in Fig. 379.

| H28 |   | ▼    |        | fx =VLOOKUP(\$F28,\$F\$23:\$H\$26,2,FALSE) |   |   |   |   |
|-----|---|------|--------|--------------------------------------------|---|---|---|---|
| D   | E | F    | G      | H                                          | I | J | K | L |
| 22  |   | Rank |        | Pages                                      |   |   |   |   |
| 23  |   | 2    | Tessa  | 145.6137                                   |   |   |   |   |
| 24  |   | 1    | Josh   | 247.9678                                   |   |   |   |   |
| 25  |   | 4    | Ashley | 86.63641                                   |   |   |   |   |
| 26  |   | 3    | Lee    | 96.58829                                   |   |   |   |   |
| 27  |   |      |        |                                            |   |   |   |   |
| 28  |   | 1    | Josh   | Josh                                       |   |   |   |   |
| 29  |   | 2    |        |                                            |   |   |   |   |
| 30  |   | 3    |        |                                            |   |   |   |   |
| 31  |   | 4    |        |                                            |   |   |   |   |

Fig. 379

- 3) Edit the formula in the formula bar to change the third parameter from column 2 to column 3, as shown in Fig. 380.

|                                                                   |  |
|-------------------------------------------------------------------|--|
| =VLOOKUP(\$F28,\$F\$23:\$H\$26,3,FALSE)                           |  |
| VLOOKUP(lookup_value, table_array, col_index_num, [range_lookup]) |  |

Fig. 380

The result in H28 will now contain the number of pages written by Josh, as shown in Fig. 381.

| H28 |   |   | ▼    | fx     | =VLOOKUP(\$F28,\$F\$23:\$H\$26,3,FALSE) |   |   |   |   |
|-----|---|---|------|--------|-----------------------------------------|---|---|---|---|
|     | D | E | F    | G      | H                                       | I | J | K | L |
| 22  |   |   | Rank |        | Pages                                   |   |   |   |   |
| 23  |   |   | 2    | Tessa  | 145.6137                                |   |   |   |   |
| 24  |   |   | 1    | Josh   | 247.9678                                |   |   |   |   |
| 25  |   |   | 4    | Ashley | 86.63641                                |   |   |   |   |
| 26  |   |   | 3    | Lee    | 96.58829                                |   |   |   |   |
| 27  |   |   |      |        |                                         |   |   |   |   |
| 28  |   |   | 1    | Josh   | 247.9678                                |   |   |   |   |
| 29  |   |   | 2    |        |                                         |   |   |   |   |

Fig. 381

- 4) Copy G28:H28 down to the next three rows. You will now have a sorted list of the data, as shown in Fig. 382.

| F | G      | H        |
|---|--------|----------|
| 1 | Josh   | 247.9678 |
| 2 | Tessa  | 145.6137 |
| 3 | Lee    | 96.58829 |
| 4 | Ashley | 86.63641 |

*Fig. 382*

**Additional Details:** Your goal is to always enter one formula that you can copy to the entire data range. In this case, your formula in G28 could be copied to anywhere in column G, but when you copied it to column H, the third parameter had to be manually edited. You needed to plan ahead to use the proper combination of dollar signs in the references in order to ensure that three of the four parameters were correct when you copied the formula to column H.

If you find that you have only a few columns of data in an example like this, you can edit the third parameter manually. If you have many columns of data, this could get tedious. The =INFO("Col",G28) function would return a column number of cell G28. This would return a 7 for column G and an 8 for column H. You could have used the following formula in G28:

=VLOOKUP(\$F28,\$F\$23:\$H\$26,CELL("Col",G28)-5,FALSE)

If you enter this formula in G28, you can copy it to all rows and columns of your results table.

**Summary:** After using a RANK function to assign rank values to a list, use a second table with the numbers 1 through n and a series of VLOOKUP formulas in order to return a sorted list of the data.

**Functions Discussed:** =VLOOKUP(); =CELL(); =RANK()

**Cross Reference:** Rank Scores

## RANK A LIST WITHOUT TIES

**Problem:** The RANK function behaves strangely when there are ties. It is possible to have a list where two people are ranked second and no one is ranked third. In Fig. 383, Dora and Jerry are ranked second with 90 units produced. Next is Harry with 86 units. Harry will receive a rank of 4.

This behavior is by design. However, if you are later going to use VLOOK-UPS to sort the employees by productivity, having two people ranked as #2 and no one ranked as #3 is not a good situation.

|    |                   |       |      |                             |   |   |  |
|----|-------------------|-------|------|-----------------------------|---|---|--|
|    | C4                |       |      | fx =RANK(B4,\$B\$4:\$B\$13) |   |   |  |
|    | A                 | B     | C    | D                           | E | F |  |
| 1  | Widget Production |       |      |                             |   |   |  |
| 2  |                   |       |      |                             |   |   |  |
| 3  | Name              | Total | Rank |                             |   |   |  |
| 4  | Ashley            | 80    | 6    |                             |   |   |  |
| 5  | Bill              | 80    | 6    |                             |   |   |  |
| 6  | Carl              | 92    | 1    |                             |   |   |  |
| 7  | Dora              | 90    | 2    |                             |   |   |  |
| 8  | Ed                | 79    | 8    |                             |   |   |  |
| 9  | Fred              | 78    | 9    |                             |   |   |  |
| 10 | Gary              | 84    | 5    |                             |   |   |  |
| 11 | Harry             | 86    | 4    |                             |   |   |  |
| 12 | Inez              | 70    | 10   |                             |   |   |  |
| 13 | Jerry             | 90    | 2    |                             |   |   |  |

Part II

Fig. 383

In the formulas in columns F and G, the spreadsheet designer counted on there being one employee at each rank from 1 to 10. Since Excel did not assign anyone to a rank of #3 or #7, Jerry and Bill do not show up in the list, as shown in Fig. 384.

| F4 |                   | fx =INDEX(\$A\$4:\$A\$13,MATCH(\$E4,\$C\$4:\$C\$13,FALSE),1) |      |   |                   |        |       |   |   |   |
|----|-------------------|--------------------------------------------------------------|------|---|-------------------|--------|-------|---|---|---|
|    | A                 | B                                                            | C    | D | E                 | F      | G     | H | I | J |
| 1  | Widget Production |                                                              |      |   | Widget Production |        |       |   |   |   |
| 2  |                   |                                                              |      |   |                   |        |       |   |   |   |
| 3  | Name              | Total                                                        | Rank |   | Rank              | Name   | Total |   |   |   |
| 4  | Ashley            | 80                                                           | 6    |   | 1                 | Carl   | 92    |   |   |   |
| 5  | Bill              | 80                                                           | 6    |   | 2                 | Dora   | 90    |   |   |   |
| 6  | Carl              | 92                                                           | 1    |   | 3                 | #N/A   | #N/A  |   |   |   |
| 7  | Dora              | 90                                                           | 2    |   | 4                 | Harry  | 86    |   |   |   |
| 8  | Ed                | 79                                                           | 8    |   | 5                 | Gary   | 84    |   |   |   |
| 9  | Fred              | 78                                                           | 9    |   | 6                 | Ashley | 80    |   |   |   |
| 10 | Gary              | 84                                                           | 5    |   | 7                 | #N/A   | #N/A  |   |   |   |
| 11 | Harry             | 86                                                           | 4    |   | 8                 | Ed     | 79    |   |   |   |
| 12 | Inez              | 70                                                           | 10   |   | 9                 | Fred   | 78    |   |   |   |
| 13 | Jerry             | 90                                                           | 2    |   | 10                | Inez   | 70    |   |   |   |

Fig. 384

**Strategy:** In this case, you absolutely want the list in A4:A13 to be ranked without ties. The generally accepted solution may seem rather convoluted, but it works. In plain language, the formula in column C will say, “Give me the RANK of this value, plus 1 for every row above me that has an identical score.” As shown in Fig. 385, this can be accomplished with the following formula:

=RANK(B4,\$B\$4:\$B\$13)+COUNTIF(B\$3:B3,B4)

|    |                   |       |                                                 |   |                   |        |       |   |   |
|----|-------------------|-------|-------------------------------------------------|---|-------------------|--------|-------|---|---|
|    | C4                |       | fx =RANK(B4,\$B\$4:\$B\$13)+COUNTIF(B\$3:B3,B4) |   |                   |        |       |   |   |
|    | A                 | B     | C                                               | D | E                 | F      | G     | H | I |
| 1  | Widget Production |       |                                                 |   | Widget Production |        |       |   |   |
| 2  |                   |       |                                                 |   |                   |        |       |   |   |
| 3  | Name              | Total | Rank                                            |   | Rank              | Name   | Total |   |   |
| 4  | Ashley            | 80    | 6                                               |   | 1                 | Carl   | 92    |   |   |
| 5  | Bill              | 80    | 7                                               |   | 2                 | Dora   | 90    |   |   |
| 6  | Carl              | 92    | 1                                               |   | 3                 | Jerry  | 90    |   |   |
| 7  | Dora              | 90    | 2                                               |   | 4                 | Harry  | 86    |   |   |
| 8  | Ed                | 79    | 8                                               |   | 5                 | Gary   | 84    |   |   |
| 9  | Fred              | 78    | 9                                               |   | 6                 | Ashley | 80    |   |   |
| 10 | Gary              | 84    | 5                                               |   | 7                 | Bill   | 80    |   |   |
| 11 | Harry             | 86    | 4                                               |   | 8                 | Ed     | 79    |   |   |
| 12 | Inez              | 70    | 10                                              |   | 9                 | Fred   | 78    |   |   |
| 13 | Jerry             | 90    | 3                                               |   | 10                | Inez   | 70    |   |   |

Fig. 385

As you copy this formula down, the first parameter of COUNTIF will expand to include B3 down to the row above the current row. Thus, in cell C13, the formula will be as follows:

=RANK(B13,\$B\$4:\$B\$13)+COUNTIF(B\$4:B12,B13)

The COUNTIF portion of the formula counts how many rows above the current row have an identical score. For each row above that is a tie, 1 gets added to the current row. This causes Bill to be ranked seventh instead of sixth. It may not be fair that Ashley appears before Bill, but in the summary report, anyone can notice that they have a tie.

**Summary:** Add a COUNTIF function to the RANK function in order to prevent ties.

**Functions Discussed:** =RANK(); =COUNTIF()