

Using Excel's, Google Sheets', and Numbers' COUNTIFS Function to Make a Frequency Distribution Table for Continuous Data

Chelsea Andrews (modeled after Owlcation: Using Excel's COUNTIF function to make a Frequency Distribution by Blinkster. <https://owlcation.com/stem/Using-Excel-COUNTIF-Function-in-Frequency-Distribution>)

Let's say we've collected data on the number of hours college students sleep each night. These data are represented in Column A, in Figure 1 below, that has the Column Heading "Sleep (in hours)." Note that these data are continuous measurements (we can measure sleep in increasingly more precise ways).

Let's also say we want to know how many students get 1 to 3 hours of sleep every night, how many students get 4 to 6 hours of sleep, and how many get 7 to 9 hours of sleep. Therefore, we want to know the frequency of these three intervals: 1 to 3 hours of sleep, 4 to 6 hours of sleep, and 7 to 9 hours of sleep.

To make a Frequency Distribution Table for these intervals, we first create two new columns. We call them "Min" and "Max," as illustrated in Columns C and D of Figure 1 below. Because our first interval is 1 to 3 hours, in the first "Min" cell under the Column Heading we enter the minimum of our first interval, 1, and in the first "Max" cell under the Column Heading we enter the maximum of our first interval, 3. In the second "Min" cell we enter the minimum of our second interval, 4, and in the second "Max" cell we enter the maximum of our second interval, 6. In the third "Min" cell we enter the minimum of our third interval, 7, and in the third "Max" cell we enter the maximum of our third interval, 9, all of which is shown in Figure 1 below.

Next, we create another column, illustrated in Column E, that we call "Absolute Frequency," which is where we'll compute Absolute Frequency using the COUNTIFS function (note the S at the end!). The COUNTIFS function is like the COUNTIF function, which we used for making a Frequency Distribution Table for discrete data. However, the COUNTIF function counts values that match only one criteria, whereas the COUNTIFS function counts values based on two or more criteria.

	A	B	C	D	E	F
1	Sleep (in hours)		Min	Max	Absolute Frequency	
2	4		1	3	=COUNTIFS(A2:A19, ">="&C2,A2:A19, "<="&D2)	
3	7		4	6		
4	5		7	9		
5	8					
6	3					
7	9					
8	7					
9	6					
10	5					
11	8					
12	4					
13	6					
14	7					
15	8					
16	5					
17	9					
18	7					
19	6					

Figure 1 -
Excel & Google Sheets

	A	B	C	D	E
1	Sleep (in hours)		Min	Max	Absolute Frequency
2	4		1	3	...
3	7		4	6	
4	5		7	9	
5	8				
6	3				
7	9				
8	7				
9	6				
10	5				
11	8				
12	4				
13	6				
14	7				
15	8				
16	5				
17	9				
18	7				
19	6				

Figure 1 -
Apple Numbers

Remember, to use any function, we start by typing an equal sign = in the cell where we're building our formula. Immediately after typing the equal sign, we type the name of the function, in this case COUNTIFS, then we type an open parenthesis and begin building our formula, for example, =COUNTIFS(A2:A19,">="&C2, A2:A19,"<="&D2) as illustrated in Figure 1.

The COUNTIFS function requires two argument pairs enclosed in parentheses and separated by a comma. An argument pair is like an argument, but it has two members, rather than one, and the two members are connected by an ampersand &.

The first argument pair tells the function to search somewhere for values greater than or equal to our Min value. When we write the formula =COUNTIFS(A2:A19,">="&C2, A2:A19,"<="&D2) we are telling the first argument pair of the COUNTIFS function to look in cells A2 through A19, which is why we wrote A2:A19, for values that are both greater than or equal to cell C2 (our Min value for that interval), which is why we wrote ">="&C2 in our formula. The expression <= is an operator, and operators always require quotation marks around them. As mentioned before, the ampersand connects the argument pair.

The second argument pair tells the function to search somewhere for values less than or equal to our Max value. For example, when we write the formula =COUNTIFS(A2:A19,">="&C2, A2:A19,"<="&D2) we are telling the second argument pair to again look in cells A2 through A19, which is why we again wrote A2:A19, for values that are both less than or equal to cell D2 (our Max value for that interval), which is why we wrote "<="&D2 in our formula.

Now, we need to make a formula for each of the other two intervals. These two formula will be

=COUNTIFS(A2:A19,">="&C3, A2:A19,"<="&D3) for the second interval
and =COUNTIFS(A2:A19,">="&C4, A2:A19,"<="&D4) for the third interval.

	A	B	C	D	E
1	Sleep (in hours)		Min	Max	Absolute Frequency
2	4		1	3	1
3	7		4	6	8
4	5		7	9	9
5	8				
6	3			Total	=SUM(E2:E4)
7	9				
8	7				
9	6				
10	5				
11	8				
12	4				
13	6				
14	7				
15	8				
16	5				
17	9				
18	7				
19	6				

**Figure 2 -
Excel & Google Sheets**

	A	B	C	D	E
1	Sleep (in hours)		Min	Max	Absolute Frequency
2	4			1	3
3	7			4	6
4	5			7	9
5	8				
6	3			Total	...
7	9				
8	7				
9	6				
10	5				
11	8				
12	4				
13	6				
14	7				
15	8				
16	5				
17	9				
18	7				
19	6				

**Figure 2 -
Apple Numbers**

Finally, we want to create a Total, which will help us check our work to make sure we've counted everything -- and it will prepare us for making a Relative Frequency Table. We can use the SUM function to get our Total.

As shown in Figure 2 above, we type the word Total in one blank cell, and then in another blank cell, we first type an equal sign followed by the word SUM and an open parenthesis. Then, we can either select the cells we want to sum, or we can type the name of the cells separated by a colon, for example `=SUM(E2:E4)` and close our parentheses.

When we press return (or enter) we get the sum.

	A	B	C	D	E	F
1	Sleep (in hours)		Min	Max	Absolute Frequency	Relative Frequency
2	4		1	3	1	<code>=E2/E6</code>
3	7		4	6	8	
4	5		7	9	9	
5	8					
6	3			Total	18	
7	9					
8	7					
9	6					
10	5					
11	8					
12	4					
13	6					
14	7					
15	8					
16	5					
17	9					
18	7					
19	6					

**Figure 3 -
Excel &
Google Sheets**

	A	B	C	D	E	F
1	Sleep (in hours)		Min	Max	Absolute Frequency	Relative Frequency
2	4		1	3	1	...
3	7		4	6	8	
4	5		7	9	9	
5	8					
6	3			Total	18	
7	9					
8	7					
9	6					
10	5					
11	8					
12	4					
13	6					
14	7					
15	8					
16	5					
17	9					
18	7					
19	6					

NOTE: In Apple Numbers, when you type a division formula, for example, `=E2/E6`, the formula bar will show with the division symbol \div . That's ok!

**Figure 3 -
Apple Numbers**

Now we want to make a Relative Frequency Distribution Table.

First, we enter the column heading "Relative Frequency" as shown in Column F of Figure 3 above. Then, to compute each interval's relative frequency, we type an equal sign and then type the formula to divide each interval's Absolute Frequency by the Total.

For example, to find the Relative Frequency of the interval 1 to 3 hours of sleep, we type the formula `=E2/E6` because E2 is the Absolute Frequency of the number of students who get 1 to 3 hours of sleep, and E6 is the Total. Notice that we do not need to enclose the formula in parentheses. We only need to enclose in parentheses formula that are built with functions (e.g., SUM and COUNTIF).

Next, we need to compute the relative frequency for each of the other intervals. Again, we do that by dividing each interval's Absolute Frequency by the Total. When we're finished, we have a Relative Frequency Table for our continuous data.

To adhere to good scientific practice, we want to always use three decimal places for our Relative Frequencies (and for any other time we use decimals). We can use the tool provided by each of our data management systems. Those tools are highlighted in yellow in Figure 4 (on the next page).

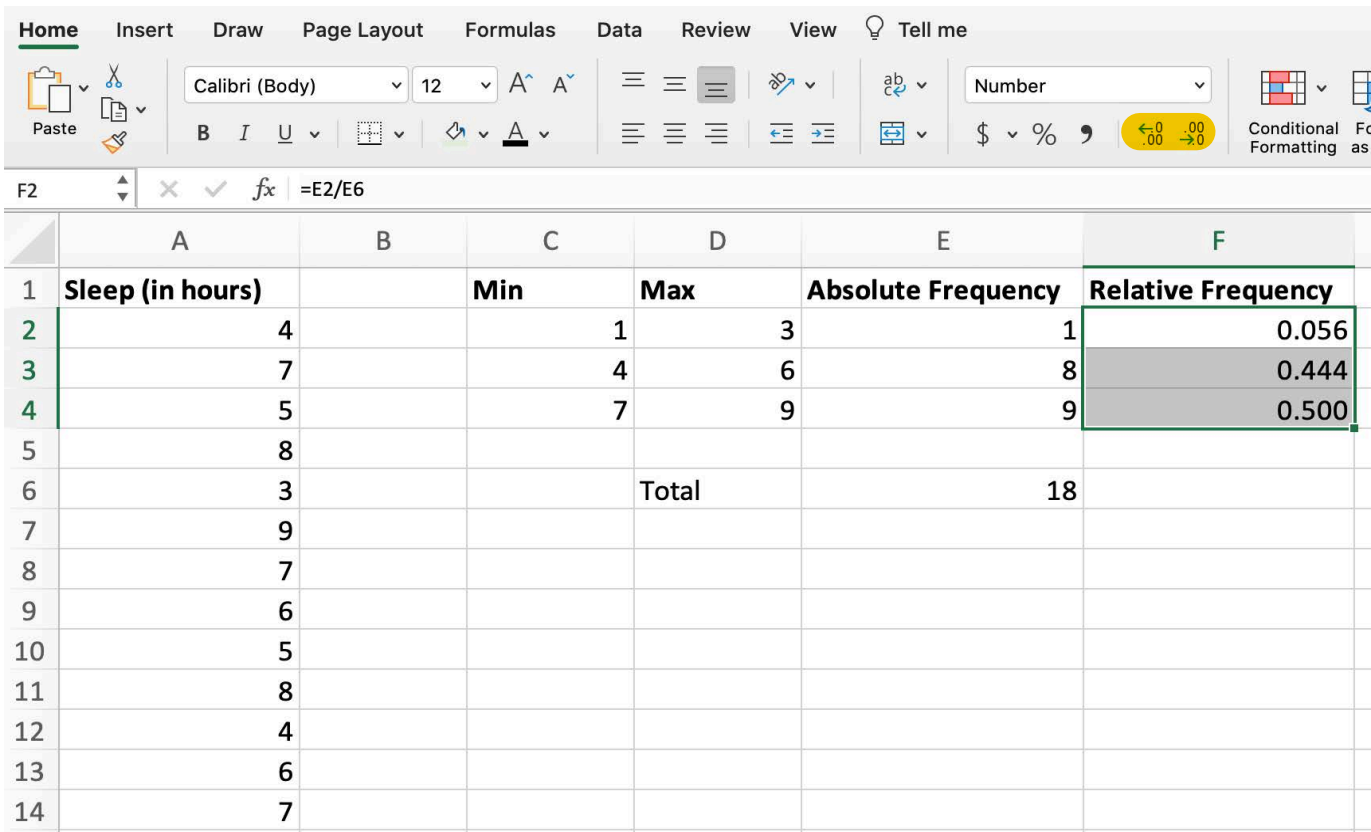


Figure 4 - Excel

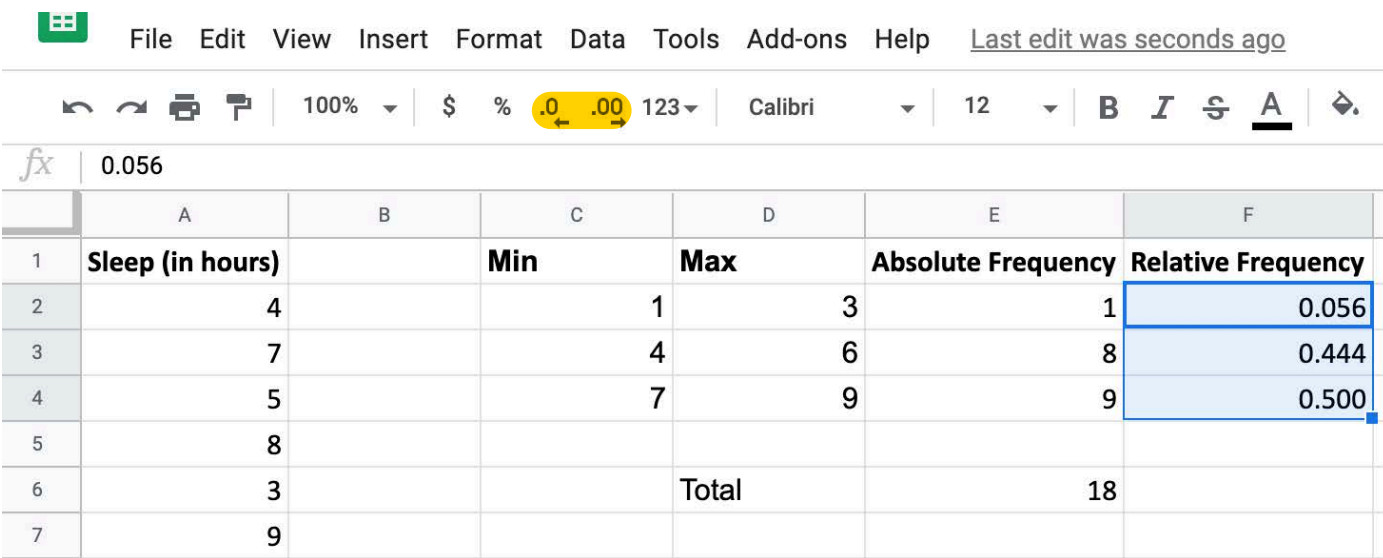


Figure 4 - Google Sheets

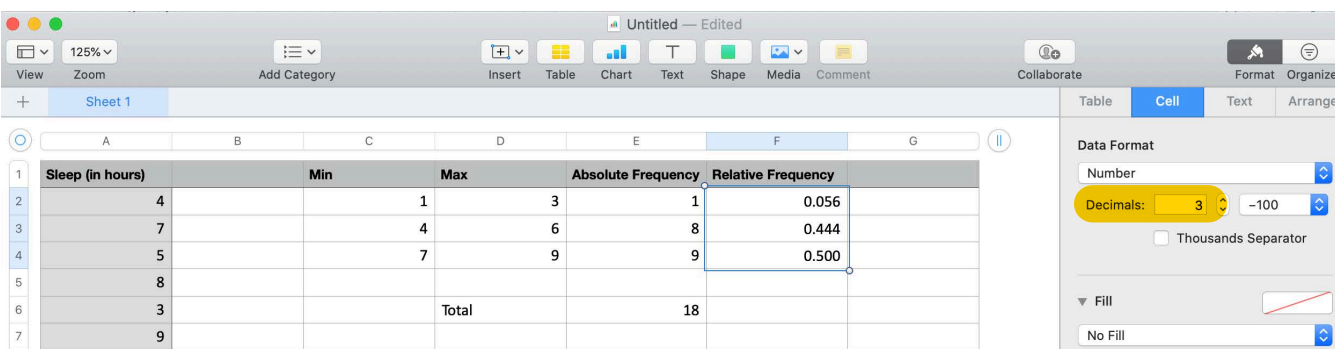


Figure 4 - Apple Numbers

Finally, we want to create a Total for our Relative Frequency Distribution that will help us check our work. We can again use the SUM function to sum our relative frequencies. If our relative frequencies are calculated correctly, they will add up to 1.000

In a blank cell, for example, F6, we first type an equal sign followed by the word SUM and an open parenthesis. Then, we can either select the cells we want to sum, or we can type the name of the cells in parentheses separated by a colon, for example `=SUM(F2:F4)` and close our parentheses. When we press return (or enter) we get the sum.

Notice that Figure 4 does not contain the Total for our Relative Frequency Distribution, but your Frequency Distribution Table should contain that Total. Remember we always want to use three decimal places when we use decimals (e.g., 1.000).

And we have now have now created a Frequency Distribution Table for Discrete Data!