

Statistics How To

Statistics for the rest of us!



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Confidence Interval: How to Find a Confidence Interval: The Easy Way!

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If you're just beginning statistics, you'll probably be finding confidence intervals using the normal distribution (see #3 below). But in reality, most confidence intervals are found using the t-distribution (especially if you are working with small samples). If you aren't sure which technique you should be looking at, start with #1 below (how to find a confidence interval for a sample).

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What is a Confidence Interval (Definition)?

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A confidence interval is how much uncertainty there is with any particular [statistic](#). Confidence intervals are often used with a [margin of error](#). It tells you how confident you can be that the results from a poll or survey reflect what you would expect to find if it were possible to [survey the entire population](#). Confidence intervals are intrinsically connected to [confidence levels](#).

Confidence Intervals vs. Confidence Levels

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Confidence levels are expressed as a percentage (for example, a 95% confidence level). It means that should you repeat an experiment or survey over and over again, 95 percent of the time your results will match the results you get from a population (in other words, your statistics would be sound!). Confidence intervals are your results... usually numbers. For example, you survey a group of pet owners to see how many cans of dog food they purchase a year. You test your statistics at the 99 percent confidence level and get a confidence interval of (200,300). That means you think they buy between 200 and 300 cans a year. You're super confident (99% is a very high level!) that your results are sound, statistically.

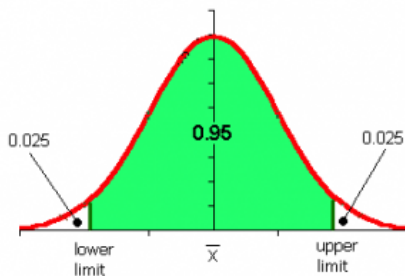


Image: WUSTL.EDU

Real Life Examples of Confidence Intervals

A 2008 Gallup survey found that TV ownership may be good for wellbeing. The results from the poll stated that the confidence level was 95% +/-3, which means that if Gallup repeated the poll over and over, using the same techniques, 95% of the time the results would fall within the published results. The 95% is the [confidence level](#) and the +/-3 is called a margin of error. At the beginning of the article you'll see statistics (and [bar graphs](#)). At the bottom of the article you'll see the [confidence intervals](#). For example, "For the European data, one can say with 95% confidence that the true population for wellbeing among those without TVs is between 4.88 and 5.26." The confidence interval here is "between 4.88 and 5.26".

The U.S. Census Bureau routinely uses [confidence levels](#) of 90% in their surveys. One survey of the number of people in poverty in 1995 stated a confidence level of 90% for the statistics "The number of people in poverty in the United States is 35,534,124 to 37,315,094." That means if the Census Bureau repeated the survey using the same techniques, 90 percent of the time the results would fall between 35,534,124 and 37,315,094 people in poverty. The stated figure (35,534,124 to 37,315,094) is the confidence interval.

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Confidence Interval For a Sample: Overview

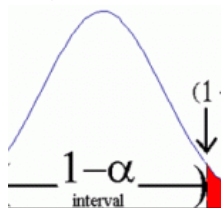
Watch the video or read on below:

Confidence interval for a sample



When you don't know anything about a population's behavior (i.e. you're just looking at data for a sample), you need to use the **t-distribution** to find the **confidence interval**. That's the vast majority of cases: you usually don't know population **parameters**, otherwise you wouldn't be looking at statistics!

The confidence interval tells you how confident you are in your results. With any survey or experiment, you're never 100% sure that your results could be repeated. If you're 95% sure, or 98% sure, that's usually considered "good enough" in statistics. That percentage of sureness is the confidence interval.



Confidence Interval For a Sample: Steps

Question:

A group of 10 foot surgery patients had a **mean** weight of 240 pounds. The sample **standard deviation** was 25 pounds. Find a confidence interval for a sample for the true mean weight of all foot surgery patients. Find a 95% CI.

Step 1: Subtract 1 from your **sample size**. $10 - 1 = 9$. This gives you **degrees of freedom**, which you'll need in step 3.

Step 2: Subtract the confidence level from 1, then divide by two.

$$(1 - .95) / 2 = .025$$

Step 3: Look up your answers to step 1 and 2 in the **t-distribution table**. For 9 degrees of freedom (**df**) and $\alpha = 0.025$, my result is 2.262.

df	$\alpha = 0.1$	0.05	0.025	0.01	0.005	0.001	0.0005
∞	$t_{\alpha} = 1.282$	1.645	1.960	2.326	2.576	3.091	3.291
1	3.078	6.314	12.706	31.821	63.656	318.289	636.578
2	1.886	2.920	4.303	6.965	9.925	22.328	31.600
3	1.638	2.353	3.182	4.541	5.841	10.214	12.924
4	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	1.476	2.015	2.571	3.365	4.032	5.894	6.869
6	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262				

Step 4: Divide your sample [standard deviation](#) by the square root of your sample size.

$$25 / \sqrt{10} = 7.90569415$$

Step 5: Multiply step 3 by step 4.

$$2.262 \times 7.90569415 = 17.8826802$$

Step 6: For the lower end of the range, subtract step 5 from the [sample mean](#).

$$240 - 17.8826802 = 222.117$$

Step 7: For the upper end of the range, add step 5 to the sample mean.

$$240 + 17.8826802 = 257.883$$

That's how to find the confidence interval for a sample!

Like the explanation on how to find a confidence interval? Check out our [statistics how-to book](#), with a how-to for every elementary statistics problem type.

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How to Find a Confidence Interval Example 2 (small sample)

Watch the video or read the steps below:

How to find a confidence interval with a t distribution



If you have one small set of data (under 30 items), you'll want to use the [t-distribution](#) instead of the [normal distribution](#) to construct your confidence interval.

$$\bar{X} \pm t \frac{s}{\sqrt{n}}$$

The formula for constructing a CI with the t-distribution.

Sample problem: Construct a 98% Confidence Interval based on the following data: 45, 55, 67, 45, 68, 79, 98, 87, 84, 82.

Step 1: Find the [mean](#), μ and [standard deviation](#), σ for the data.

$$\sigma: 18.172.$$

$$\mu: 71$$

Set these numbers aside for a moment.

Step 2: Subtract 1 from your [sample size](#) to find the [degrees of freedom](#) (df). We have 10 numbers listed, so our [sample size](#) is 10, so our **$df = 9$** . Set this number aside for a moment.

Step 3: Subtract the [confidence level](#) from 1, then divide by two. This is your [alpha level](#).

$$(1 - .98) / 2 = .01$$

Step 4: Look up **df** (Step 2) and **α** (Step 3) in the **t-distribution table**. For **df** = 9 and **α** = .01, the table gives us **2.821**.

T-Distribution Table

df	$\alpha = 0.1$	0.05	0.025	0.01	0.005
∞	$t_{\alpha} = 1.282$	1.645	1.960	2.326	2.576
1	3.078	6.314	12.706	31.821	63.656
2	1.886	2.920	4.303	6.965	9.925
3	1.638	2.353	3.182	4.541	5.841
4	1.533	2.132	2.776	3.747	4.604
5	1.476	2.015	2.571	3.365	4.032
6	1.440	1.943	2.447	3.143	3.707
7	1.415	1.895	2.365	2.998	3.499
8	1.397	1.860	2.306	2.896	3.355
9	1.383	1.833	2.262	2.821	3.250
10	1.372	1.812	2.228	2.764	3.169

Step 5: Divide your std dev (step 1) by the square root of your sample size.

$$18.172 / \sqrt{(10)} = 5.75$$

Step 6: Multiply step 4 by step 5.

$$2.821 \times 5.75 = 16.22075$$

Step 7: For the lower end of the range, subtract step 6 from the mean (Step 1).

$$71 - 16.22075 = 54.77925$$

Step 8: For the upper end of the range, add step 6 to the mean (Step 1).

$$71 + 16.22075 = 87.22075$$

That's how to find a confidence interval using the t-distribution!

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Confidence Interval with the Normal Distribution / Z-Distribution

Watch the video or read the article below:

How to find a confidence interval with ...



If you don't know your population mean (μ) but you do know the standard deviation (σ), you can find a confidence interval for the population mean, with the formula:

$$\bar{x} \pm z^* \sigma / (\sqrt{n}),$$

Sample problem: Construct a 95 % confidence interval an experiment that found the sample mean temperature for a certain city in August was 101.82, with a population standard deviation of 1.2. There were 6 samples in this experiment.

Step 1: Subtract the confidence level (Given as 95 percent in the question) from 1 and then divide the result by two.

This is your **alpha level**, which represents the area in one tail.

$$(1 - .95) / 2 = .025$$

Step 2: Subtract your result from Step 1 from 1 and then look that area up in the middle of the **z-table** to get the **z-score**:

$$1. 1 - 0.25 = 0.975$$

$$2. z \text{ score} = 1.96.$$

Step 3: Plug the numbers into the second part of the formula and solve:

$$z * \sigma / (\sqrt{n})$$

$$= 1.96 * 1.2 / \sqrt{(6)}$$

$$= 1.96 * 0.49$$

$$= 0.96$$

Step 4: For the lower end of the range, subtract step 3 from the mean.

$$101.82 - 0.96 = 100.86$$

Step 5: For the upper end of the range, add step 3 to the mean.

$$101.82 + 0.96 = 102.78.$$

The CI is (100.86,102.78)

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How to Find a Confidence Interval for a Proportion: Overview

When we talk about a confidence interval (CI), we're dealing with data. For example, let's say the manager for that job you applied for told you he would get back with you in a "couple of days." A couple of days could mean two. Or three. Or there might be a paperwork backlog and it could be a week. It definitely doesn't mean in an hour. So your CI would probably be between **2 and 4 days**.

Perhaps the trickiest part of CIs is recognizing the various parts needed for the formula, like $z \cdot \sigma / \sqrt{n}$. This section breaks everything down into simple steps and shows you how to find a confidence interval for population proportions.

How to Find a Confidence Interval for a Proportion: Steps

How to find a confidence interval for a proportion



Question: 510 people applied to the Bachelor's in Elementary Education program at Florida State College. Of those applicants, 57 were men. Find the 90% CI of the true proportion of men who applied to the program.

Step 1: Read the question carefully and figure out the following **variables**:

- α : subtract the given CI from 1.
 $1 - .9 = .10$

- $z_{\alpha/2}$: divide α by 2, then look up that area in the z-table. Not sure how to read a z table? See this article, [area to the right of a z-score](#) for an explanation on how to read the z-table.
 $.1/2 = .0500$. The closest z-value to an area of .0500 is 0.13
- \hat{p} : Divide the proportion given (i.e. the smaller number) by the sample size.
 $57/510 = 0.112$
- \hat{q} : Subtract \hat{p} from 1.
 $1 - 0.112 = 0.888$

Step 2: Multiply \hat{p} by \hat{q} .

$$0.112 \times 0.888 = 0.099456$$

Step 3: Divide step 2 by the sample size.

$$0.099456 / 510 = 0.000195011765$$

Step 4: Take the square root of step 3:

$$\text{sqrt}(0.000195011765) = 0.0139646613$$

Step 5: Multiply step 4 by $z_{\alpha/2}$:

$$0.0139646613 \times 0.13 = 0.0182$$

Step 6: For the lower percentage, subtract step 5 from \hat{p} .

$$0.112 - 0.0182 = 0.0938 = 9.38\%$$

Step 7: For the upper percentage, add step 5 to \hat{p} .

$$0.112 + 0.0182 = 0.1302 = 13.02\%$$

This next method involves plugging in numbers into the actual formula. You'll get the same results if you use the "formula free" method above or if you use the steps below.

Confidence intervals for a proportion are calculated using the following formula:

$$\hat{p} \pm Z \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

The formula might look daunting, but all you really need are two pieces of information: the [z-score](#) and the P-hat. You should be familiar with looking up z-scores from previous sections on the normal distribution (if you need a refresher, be sure to watch the above video) and P-hat is just dividing the number of events by the number of trials. Once you've figured those two items out, the rest is basic math.

Confidence Interval for a Proportion Example 2: Steps

Sample question: Calculate a 95% confidence interval for the true [population proportion](#) using the following data:

Number of trials(n) = 160

Number of events (x) = 24

Step 1: Divide your confidence level by 2: $.95/2 = 0.475$.

Step 2: Look up the value you calculated in Step 1 in the [z-table](#) and find the corresponding z-value. The z-value that has an area of .475 is 1.96.

1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817

Step 3: Divide the number of events by the number of trials to get the "P-hat" value: $24/160 = 0.15$.

Step 4: Plug your numbers into the formula and solve:

1. $0.15 \pm (1.96) \sqrt{((0.15(1-0.15))/160))} =$
2. $0.15 \pm (1.96) \sqrt{((0.15(0.85))/160))} =$
3. $0.15 \pm (1.96) \sqrt{((0.1275)/160))} =$
4. $0.15 \pm (1.96) \sqrt{(0.000796875)} =$
5. $0.15 \pm (1.96) 0.0282289744765905 =$
6. $0.15 \pm 0.0553 =$
7. $0.15 - 0.0553 = 0.0947$ <--this is your lower confidence interval for a proportion
8. $0.15 + 0.0553 = 0.2053$ <--this is your upper confidence interval for a proportion

Your answer can be expressed as: **(0.0947, 0.2053)**.

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How to Find a Confidence Interval for Two Populations (Proportions)

Finding confidence intervals for two populations can look daunting, especially when you take a look at the ugly equation below.

$$(\hat{p}_1 - \hat{p}_2) - z_{\alpha/2} \sqrt{\frac{\hat{p}_1 \hat{q}_1}{n_1} + \frac{\hat{p}_2 \hat{q}_2}{n_2}} < p_1 - p_2 < (\hat{p}_1 - \hat{p}_2) + z_{\alpha/2} \sqrt{\frac{\hat{p}_1 \hat{q}_1}{n_1} + \frac{\hat{p}_2 \hat{q}_2}{n_2}}$$

It looks a lot worse than it is, because the right side of the equation is actually a repeat of the left! Finding confidence intervals for two populations can be broken down to an easy three steps.

Example question: A study revealed that 65% of men surveyed supported the war in Afghanistan and 33% of women supported the war. If 100 men and 75 women were surveyed, find the 90% **confidence interval** for the data's true difference in proportions.

Step 1: Find the following *variables* from the information given in the question:

n_1 (population 1)=100

Phat1 (population 1, positive response): 65% or 0.65

Qhat1 (population 1, negative response): 35% or 0.35

n_2 (population 2)=75

Phat2 (population 2, positive response): 33% or 0.33

Qhat2 (population 2, negative response): 67% or 0.67

Step 2: Find $z_{\alpha/2}$

(If you've forgotten how to find $\alpha/2$, see the directions in: *How to Find a Confidence Interval for a Proportion* above)

$z_{\alpha/2}$ =0.13

Step 3: Enter your data into the following formula and solve:

$$(\hat{p}_1 - \hat{p}_2) - z_{\alpha/2} \sqrt{\frac{\hat{p}_1 \hat{q}_1}{n_1} + \frac{\hat{p}_2 \hat{q}_2}{n_2}} < p_1 - p_2 < (\hat{p}_1 - \hat{p}_2) + z_{\alpha/2} \sqrt{\frac{\hat{p}_1 \hat{q}_1}{n_1} + \frac{\hat{p}_2 \hat{q}_2}{n_2}}$$

If formulas scare you, here's the step-by-step to solve the equation (refer back to step 1 for the variables):

1. multiply phat1 and qhat1 together (.65 x .35 = .2275)
2. divide your answer to (1) by n_1 . Set this number aside. (.2275 x 100=.00275)
3. multiply phat2 and qhat2 together (.33 x .67=.2211).
4. divide your answer to (3) by n_2 (.2211/75=.002948).
5. Add (3) and (4) together (.00275 + .002948=.005698)
6. Take the square root of (5): (sqrt.005698=.075485)
7. Multiply (6) by $z_{\alpha/2}$ found in Step 2. (.075485 x 0.13=.0098). Set this number aside.
8. Subtract phat2 from phat1 (.65-.33=.32).
9. Subtract (8) from (7) to get the left limit (.32-.0098 = 31.9902)
10. Add (7) to (8) to get the right limit (.32+.0098=32.0098)

That's it!

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Confidence Interval for the Mean in Excel

Watch the video or read the article below:

Confidence interval for the mean in Ex...



How to Find a Confidence Interval for the Mean in Excel: Overview

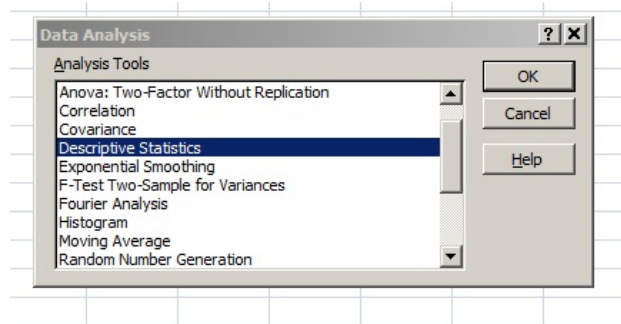
A confidence interval for the mean is a way of estimating the true population mean. Instead of a single number for the mean, a confidence interval gives you a lower estimate and an upper estimate. For example, instead of "6" as the mean you might get {5,7}, where 5 is the lower estimate and 7 is the upper. The narrower the estimate, the more precise your estimate is. The equations involved in statistics often involve a lot of minor calculations (such as summation), plus you would also need to calculate the margin of error and the mean of the sample. It's very easy for errors to slip in if you calculate the confidence interval by hand. However, [Excel](#) can calculate the [mean](#) of the sample, the margin or error and confidence interval for the mean for you. All you have to do is provide the data – which for this technique must be a sample greater than about 30 to give an accurate confidence interval for the mean.

How to Find a Confidence Interval for the Mean in Excel: Steps

Sample problem: Calculate the 95 percent confidence interval for the mean in Excel using the following sample:
2,5,78,45,69,100,34,486,34,36,85,37,37,84,94,100,567,436,374,373,664,45,68,35,56,67,87,101,356,56,31.

Step 1: Type your data into a single column in Excel. For this example, type the data into cells A1:A31.

Step 2: Click the "Data" tab, then click "Data Analysis," then click "Descriptive Statistics" and "OK." *If you don't see Data Analysis, [load the Excel data analysis toolpak](#).*



Step 3: Enter your input range into the Input Range box. For this example, your input range is "A1:A31".

Step 4: Type an output range into the Output Range box. This is where you want your answer to appear. For example, type "B1."

Step 5: Click the "Summary Statistics" check box and then place your chosen confidence level into the 'Confidence Level for Mean' check box. For this example, type "95".

Step 5: Click "OK." Microsoft Excel will return the confidence interval for the mean and the margin of error for your data. For this sample, the mean (\bar{X}) is 149.742 and the margin of error is 66.9367. So the mean has a lower limit of $149.742 - 66.936$ and an upper limit of $149.742 + 66.936$.

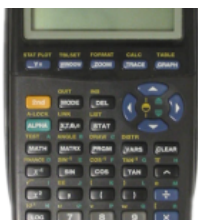
2	Column1
5	
78	Mean 149.7419
45	Standard Error 32.77501
69	Median 69
00	Mode 45
34	Standard Deviation 182.4869
86	Sample Variance 33301.46
34	Kurtosis 1.424554
36	Skewness 1.624941
85	Range 662
37	Minimum 2
37	Maximum 664
84	Sum 4642
94	Count 31
00	Confidence Level 66.93673
67	
36	

That's it!

Warning: A 99 percent confidence interval doesn't mean that there's a 99 percent probability that the calculated interval has the actual mean. Your sample is either going to contain the actual mean, or it isn't. Over the long-term, if you ran tests on many, many samples, there is a 99 percent probability that the calculated intervals would contain the true mean.

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TI 83 Confidence Interval: Two Populations



Statistics about two populations is incredibly important for a variety of research areas. For example, if there's a new drug being tested for diabetes, researchers might be interested in comparing the mean blood glucose level of the new drug takers versus the mean blood glucose level of a [control group](#). The confidence interval (CI) for the difference between the two population means is used to assist researchers in questions such as these.

The **TI 83** allows you to find a CI for the difference between two means in a matter of a few keystrokes.

Sample problem: Find a 98% CI for the [difference in means](#) for two normally distributed populations with the following characteristics:

$$x_1 = 88.5$$

$$\sigma_1 = 15.8$$

$$n_1 = 38$$

$$x_2 = 74.5$$

$$\sigma_2 = 12.3$$

$$n_2 = 48$$

Step 1: Press STAT, then use the right arrow key to highlight **TESTS**.

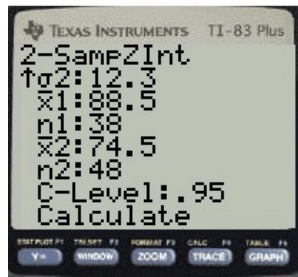


Step 2: Press 9 to select **2-SampZInt...**

Step 3: Right arrow to Stats and then press ENTER. Enter the values from the problem into the appropriate rows, using the down arrow to switch between rows as you complete them.



Step 4: Use the down arrow to select **Calculate** then press ENTER.



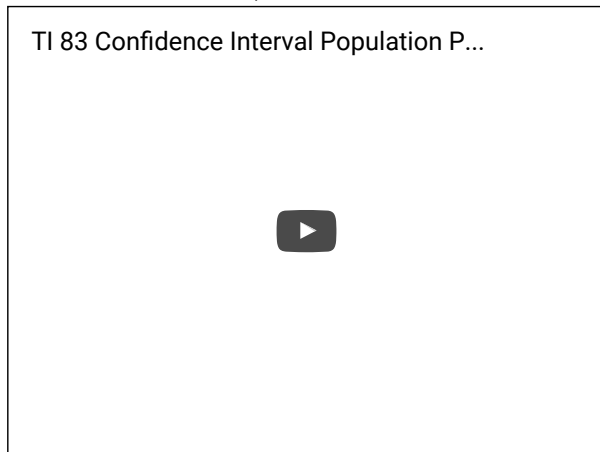
The answer displayed is **(6.7467, 21.253)**. We're 98% sure that the difference between the two means is between 6.7467 and 21.253.

That's it!

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How to Find a Confidence Interval for Population Proportion, p on the TI 83

Watch the video or read the steps below:



Sample problem: A recent poll shows that 879 of 1412 Americans have had at least one caffeinated beverage in the last week. Construct a 90% confidence interval for p , the true population proportion.

Note:

- “ x ” is the number of successes and must be a whole number. Successes in this question is how many Americans have had at least one caffeinated beverage (879). If you are given \hat{p} instead (the sample proportion), multiply \hat{p} by n to get x (because $x = n \cdot \hat{p}$).
- “ n ” is the number of trials.

Step 1: Press STAT.

Step 2: Right arrow over to “TESTS.”

Step 3: Arrow down to “A:1–PropZInt...” and then press ENTER.

Step 4: Enter your x -value: 879.

Step 5: Arrow down and then enter your n value: 1412.

Step 6: Arrow down to “C-Level” and enter .90. This is your confidence level and must be entered as a decimal.

Step 7: Arrow down to calculate and press ENTER. The calculator will return the range **(.6013, .64374)**

That means the 98 percent CI for the population proportion is between 0.6013 and .64374.

Tip: Instead of arrowing down to select A:1–PropZInt..., press Alpha and MATH instead.

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How to Find a Confidence Interval on the TI 83 for the Population Mean

If you don't know how to enter data into a list, you can find the information in [this article on cumulative frequency tables](#).

Watch the video or read the steps below:



Sample problem: 40 items are sampled from a normally distributed population with a sample mean \bar{x} of 22.1 and a population [standard deviation](#)(σ) of 12.8. Construct a 98% confidence interval for the true population mean.

Step 1: Press STAT, then right arrow over to "TESTS."

Step 2: Press 7 for "Z Interval."

Step 3: Arrow over to "Stats" on the "Inpt" line and press ENTER to highlight and move to the next line, σ .

Step 4: Enter 12.8, then arrow down to \bar{x} .

Step 5: Enter 22.1, then arrow down to "n."

Step 6: Enter 40, then arrow down to "C-Level"

Step 7: Enter .98. Arrow down to "calculate" and then press ENTER. The calculator will give you the result of (17.392, 26.808) meaning that your 98% confidence interval is **17.392 to 26.808**. This is the same as:

$$17.392 > \mu > 26.808$$

That's how to find a Confidence Interval on the TI 83 for the Population Mean!

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How to Find a Confidence Interval for the Mean on the TI 89

Sample problem #1 (known standard deviation): Fifty students at a Florida college have the following grade point averages: 94.8, 84.1, 83.2, 74.0, 75.1, 76.2, 79.1, 80.1, 92.1, 74.2, 64.2, 41.8, 57.2, 59.1, 65.0, 75.1, 79.2, 95.0, 99.8, 89.1, 59.2, 64.0, 75.1, 78.2, 95.0, 97.8, 89.1, 65.2, 41.9, 55.2. Find the 95% confidence interval for the population mean, given that $\sigma = 2.27$.

Step 1: Press APPS and scroll to **Stats/List Editor**. ENTER.

Step 2: Press F1 then 8. This clears the list editor.

Step 3: Press ALPHA) 9 2 to name the list "CI2."

Step 4: Enter your data in a list. Follow each number with the ENTER key: 94.8, 84.1, 83.2, 74.0, 75.1, 76.2, 79.1, 80.1, 92.1, 74.2, 64.2, 41.8, 57.2, 59.1, 65.0, 75.1, 79.2, 95.0, 99.8, 89.1, 59.2, 64.0, 75.1, 78.2, 95.0, 97.8, 89.1, 65.2, 41.9, 55.2.

Step 5: Press F4 then 1.

Step 6: Enter "ci" in the "List" box: ALPHA key then) 9 2.

Step 7: Enter 1 in the **frequency** box. Press ENTER. This should give you the mean (\bar{x} , the first in the list) = **75.033**.

Step 8: Press ENTER. Press 2nd F7 1 ENTER. This brings up the z-distribution menu.

Step 9: Press the right arrow key then the down arrow to select a "Data Input Method" of "Stats." Press ENTER.

Step 10: Enter your σ from the question (in our case, 2.27), \bar{x} from Step 7 (75.033), $n = 30$ and the Confidence Interval from the question (in our example, it's .95).

Step 11: Press ENTER and read the results. The "C Int" is **{74.49,76.123}**. This means we are 95% confident that the population mean falls between 74.49 and 76.123.

That's it!

Sample problem #2 (unknown standard deviation): A random sample of 30 students at a Florida college has the following grade point averages: 59.1, 65.0, 75.1, 79.2, 95.0, 99.8, 89.1, 65.2, 41.9, 55.2, 94.8, 84.1, 83.2, 74.0, 75.1, 76.2, 79.1, 80.1, 92.1, 74.2, 59.2, 64.0, 75.1, 78.2, 95.0, 97.8, 89.1, 64.2, 41.8, 57.2. What is the 90% confidence interval for the population mean?

Step 1: Press APPS. Scroll to the **Stats/List Editor** and press ENTER.

Step 2: Press F1 8 to clear the editor.

Step 3: Press ALPHA) 9 to name the list "CI."

Step 4: Enter your data in a list. Follow each number with the ENTER key: 59.1, 65.0, 75.1, 79.2, 95.0, 99.8, 89.1, 65.2, 41.9, 55.2, 94.8, 84.1, 83.2, 74.0, 75.1, 76.2, 79.1, 80.1, 92.1, 74.2, 59.2, 64.0, 75.1, 78.2, 95.0, 97.8, 89.1, 64.2,

41.8, 57.2.

Step 5: Press F4 1.

Step 6: Enter "ci" in the **List** box: Press ALPHA) 9.

Step 7: Enter 1 in the **frequency** box. Press ENTER. This should give you the sample standard deviation, $s_x = 15.6259$, $n = 30$, and \bar{x} (the **sample mean**) = 75.033.

Step 8: Press ENTER. Press 2nd F2 2.

Step 9: Press the right arrow key then the down arrow to select a "Data Input Method" of "Stats." Press ENTER.

Step 10: Enter your \bar{x} , s_x and n from Step 7. In our example, $s_x = 15.6259$, $n = 30$ and $\bar{x} = 75.033$.

Enter the Confidence Interval from the question (in our example, it's .9).

Step 11: Press ENTER and read the results. The **C Int** is **{70.19,79.88}** which means that we are 90% confident that the population mean falls between 70.19 and 79.88.

That's it!

Tip: If you know σ , use ZInterval instead of TInterval.

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How to find a Confidence Interval for a Proportion on the TI 89

Sample problem #1: In a simple **random sample** of 295 students, 59.4% of students agreed to a tuition increase to fund increased professor salaries. What is the 95% CI for the proportion in the entire student body who would agree?

Step 1: Press APPS and scroll down to **Stats/List Editor**. Press ENTER.

If you don't see the Stats/List editor, download it [HERE](#) from the TI-website. You'll need the graphlink cable that came with your calculator to transfer the software.

Step 2: Press 2nd F2 5 for the **1-PropZInt** menu.

Step 3: Figure out your "successes." Out of 295 people, 59.4% said yes, so $.694 \times 295 = 175$ people.

Step 4: Enter your answer from Step 3 into the **Successes,x** box: 175.

Step 5: Scroll down to **n**. Enter 295, the number in the sample.

Step 6: Scroll down to **C Level**. Enter the given confidence level. In our example, that's .95. Press ENTER twice.

Step 7: Read the result. The calculator returns the result **C Int { .5372, .6493}**. This means that you are 95% confident that between 54% and 65% of the student body agree with your decision.

Tip: If you are asked for a folder when entering the Stats Editor, just press Enter. It doesn't matter which folder you use.

Warning: Make sure you round your "success" entries to the nearest integer to avoid a domain error.

Sample problem #2: A recent poll in a simple random sample of 986 women college students found that 699 agreed that textbooks were too expensive. Out of 921 men surveyed by the same manner, 750 thought that textbooks were too expensive. What is the 95% confidence interval for the difference in proportions between the two populations?

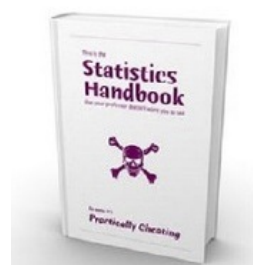
Step 1: Press APPS, scroll to the Stats/List Editor, and press ENTER.

Step 2: Press 2nd F2 6 to reach **2-PropZInt**.

Step 3: Enter your values into the following boxes (Use "women" for population 1 (x_1 and n_1) and "men" for population 2 (x_2 and n_2)):

- Successes, x_1 : 590*
- n_1 : 796
- Successes, x_2 : 548
- n_2 : 800
- C Level: 0.95

Step 4: Press ENTER.



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Step 5: Read the result. The confidence interval is displayed at the top as **C Int { .0119,.10053}**. This means that your confidence interval is **between 1.19% and 10.05%**.

That's how to find a Confidence Interval on the TI 89!

Tip: As long as you keep track of which population is x_1/n_1 and x_2/n_2 , it doesn't matter which is entered in which box.

*You must enter a whole number here, or you'll get ERR:DOMAIN.

You'll come across this common type of problem in elementary stats: find a confidence interval given a large random sample and the number of "successes" in that sample.

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The 95% Confidence Interval Explained

The terms confidence **level** and confidence **interval** are often confused.

A **95% confidence level** means is that if the survey or experiment were repeated, 95 percent of the time the data would match the results from the entire **population**. Sometimes you just can't survey everyone because of time or cost (think about how much it would cost to do a telephone survey of over 300 million Americans!). Therefore, you take a **sample** of the population. Having a 95% confidence level means that you're almost certain your results are the same as if you *had* surveyed everyone.

A **95% confidence interval** gives you a very specific set of numbers for your confidence level. For example, let's suppose you were surveying a local school to see what the student's state test scores are. You set a 95% confidence level and find that the 95% confidence interval is (780,900). That means if you repeated this over and over, 95 percent of the time the scores would fall somewhere between 780 and 900.

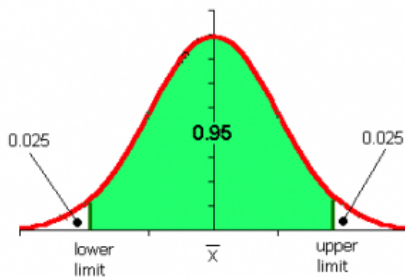
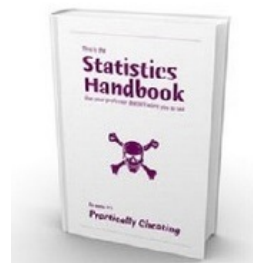


Image: WUSTL.EDU



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The above image shows a 95% confidence interval on a **normal distribution** graph. The red "tails" are the remaining 5 percent of the interval. Each tail has 2.5 percent (that's .025 as a decimal). You don't *have* to draw a graph when you're working with confidence intervals, but it can help you visualize exactly what you are doing — especially in **hypothesis testing**. If your results fall into the red region, then that's outside of the 95% confidence level that you, as a researcher, set.

If you have a small sample or if you don't know the population **standard deviation** which in most real-life cases is true), then you'll find the 95% Confidence Interval with a **t-distribution**.

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Asymmetric Confidence Interval

An asymmetric confidence interval just means that the **point estimate** doesn't lie in the exact center of the CI. You can end up with asymmetric CIs for many reasons, including:

- You transform your data (for example, using log transformations).
- You incorporate random error.
- You incorporate systematic bias into the interval:
 - A positive systematic bias will increase the right side of the interval.
 - A negative systematic bias will increase the left side of the interval.

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Confidence Interval: How to Find a Confidence Interval: The Easy Way! was last modified: November 12th, 2016 by Stephanie

Tagged on: confidence interval, Confidence Interval Population, population

By Stephanie | October 5, 2009 | Confidence Intervals | 24 Comments |

[← Binomial Formula: How to Solve a Binomial Distribution Problem](#)

[How to State the Null Hypothesis in Statistics →](#)

24 thoughts on “Confidence Interval: How to Find a Confidence Interval: The Easy Way!”

Stacey Bell

October 7, 2009 at 4:08 pm

This step by step was a tremendous help to me!

Angie Widdows

October 8, 2009 at 8:24 am

Wow. I didn't realize there were so many steps involved. This example helped alot because it broke everything up, step by step. Was helpful to have the link to the Z-table.

Lisa Barcomb

October 18, 2009 at 10:40 am

Yeah these problems have a lot of steps to them but once you get them down they are really easy because you have the Z table. And in order for you to do your problems you have to know how to use the tables. Which in a way I thought they were fun.

Mary Johnson

October 20, 2009 at 5:48 pm

I can't believe how much this helped me. I need the step by step explanation and this was great.

Jennifer Foster

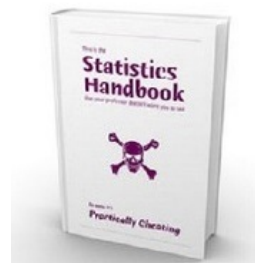
October 22, 2009 at 11:12 am

$z_{\alpha/2}$: divide the given confidence interval by 2, then look up that area in the z-table.
.9/2=.4500. The closest z-value to an area of .4500 is 1.65

I don't understand this....can someone please explain?
What am I not getting?

Stephanie

October 22, 2009 at 11:55 am



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Hi Jennifer,

Why don't you send me your working out, and I'll tell you where you are going wrong (or at least, point out which specific part you don't understand...is it how to look up a number in the z-table? Or something else?)

Stephanie

Jennifer Foster

October 22, 2009 at 6:23 pm

The closest z-value to an area of .4500 is 1.65 ...

This is where I am really stuck. How did you get that? I can look up .45 on the table and it does not come out to be 1.65

Stephanie

October 23, 2009 at 4:47 am

Jennifer,

What do you get when you look up .4500 in the center of the table? Let me know and I should be able to see where you are going wrong.

Sometimes it helps to work backwards...look up 1.65 in the table (i.e. 1.6 in the left hand column and .05 in the top row). Do you see the .4505 where it intersects?

Stephanie

Donna Allen

October 24, 2009 at 5:26 pm

Once again, I found this explanation very helpful. It was easier to follow your step by step instructions than the guided solution in mathzone.

Jennifer Thomas

October 25, 2009 at 8:05 pm

The step by step instructions are very helpful. Thank you!

April Fulton

October 25, 2009 at 8:46 pm

I have had the same question how do you get 1.65. But from this step by step and the teacher explaining to another student the same question, I see I am not the only one with these questions. This site is a big help!

Myrlande Blanc

August 7, 2011 at 4:06 am

I was wondering how to get confidence interval with standard deviation 0.3, confidence level of 90%, and satisfaction score of 4.5

Stephanie

September 27, 2011 at 4:54 pm

Hi, Myrlande,

Can you post your question on the forum? Unfortunately, I don't have the time to answer math questions here.



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Thanks,
Stephanie

Bill

April 15, 2012 at 6:42 am

I have two z-tables in my text , for 1.65 it's .9505 and for -1.65 it's .0495, how does your table have .4505?

Andale

April 15, 2012 at 9:47 am

Bill,

I suspect you're looking at a tenths and hundredths z-table, instead of the regular one. It's common in biostatistics and other subjects where tiny fractions are needed.

You can confirm .4505 is correct (for the regular table) by going here, where they give some z-table examples:
<http://www.mhhe.com/socscience/crimjustice/stat-methods/book1/chap8.mhtml> (question 2c).

Regards,
Stephanie

Sevira Marie

August 20, 2015 at 3:47 am

How do you get this?

The closest z-value to an area of .0500 is 0.13

Andale

August 20, 2015 at 8:07 am

Look up .0500 in the center of the z table. The closest you can get is at $z = .13$ (an area of .0517)

aqui El mejor precio seguro

December 22, 2015 at 4:02 am

buena respuesta, a mi me acabande traer la mia desde aqui

LaKyia Pettigrew

April 12, 2016 at 2:15 pm

Great explanations I have been struggling with this class for 2 weeks and this website has really helped me out a lot. Thanks

I do have one question though. My teacher is asking for the T Value and I have no idea what she is talking about or how to find it. Please help

Andale

April 13, 2016 at 8:49 am

It's the same thing as a t-score.
T Score Formula and Examples.



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M. Keshavarz

July 22, 2016 at 4:21 am

Hello,

I have 3 concentrations for a sample. for each concentration we measured a parameter let say 'X' for 10 samples. The mean value of parameter 'X' for each sample is plotted as a function of the concentration and are fitted with a linear fit and the slope gives another parameter 'Y'. I would like to see what is the statistical significance of our data and its effect on 'Y' since we have only 3 points (3 concentrations). Could you please help me?

Andale

July 22, 2016 at 7:23 am

Hi,M,

"I would like to see what is the statistical significance of our data and its effect on 'Y' "

Can you post the results from whatever significance test you are running? I'll take a look.

Regards,

Stephanie

Kingsley NJOKU

November 12, 2016 at 9:27 am

I just discovered this site today and I have stat exam next week. Thanks Stephanie.

I find it hard to really understand asymmetric and symmetric CI and when (and why) it would be appropriate to use exact Binomial Method for CI.

Many thanks

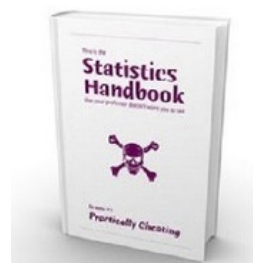
Andale

November 12, 2016 at 10:07 am

Glad the site helps, Kingsley.

I added a note to the bottom of the article on symmetric/asymmetric. I'm not sure if that will help...if not, let me know more about what you're getting stuck on.

As far as the binomial exact method, we have an article in the works. But basically you would use it for very small samples, as an alternative to the t-distribution.



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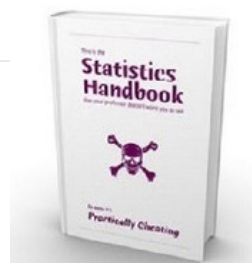
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