

Calculating Confidence Intervals with a TI-84 Calculator: A Step-by-Step Guide

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A **confidence interval (C.I.)** is a core construct in inferential statistics, providing a calculated range of values that is highly likely to contain the true value of an unknown population parameter, based on a specified level of certainty. Since researchers rarely have access to the entire population, we rely on samples to estimate crucial parameters, such as the **population mean** or the **population proportion**. The confidence interval offers a statistically robust measure of the precision and reliability of these estimates, moving beyond a simple point estimate to define a plausible range for the underlying population characteristic.

This comprehensive tutorial is designed as an essential resource for students and professionals seeking to master the computation of confidence intervals using the **TI-84 calculator**. The TI-84 streamlines these complex computations, allowing users to efficiently generate results and dedicate their focus to the crucial task of statistical interpretation rather than manual formula application. Understanding which specific function to use is the most critical step, as the correct choice depends entirely on the nature of the data and the known characteristics of the population.

To ensure a thorough grasp of the topic, we will provide detailed, step-by-step instructions for calculating the three most prevalent types of confidence intervals encountered in introductory and intermediate statistics courses:

Confidence interval for a population mean (Z-Interval): When the population variability is known.

Confidence interval for a population mean (T-Interval): When the population variability must be estimated from the sample.

Confidence interval for a population proportion (1-PropZInt): When dealing with categorical or binary data.

Example 1: Confidence Interval for a Population Mean (Z-Interval)

The Z-Interval is the appropriate tool when the **population standard deviation** (σ) is known, or when the sample size (n) is sufficiently large (typically defined as $n \geq 30$), allowing the use of the standard normal distribution, or **Z-distribution**. This scenario often arises when reliable historical data or census information provides a precise measure of population variability. The methodology relies heavily on the Central Limit Theorem, which ensures that the distribution of sample means approximates a normal distribution, thereby justifying the use of the Z-score to calculate the margin of error.

We are tasked with determining a 95% confidence interval for a population mean based on the following summary statistics. The critical distinction here is the explicit availability of the population standard deviation, which permits a more precise statistical estimation than when this parameter must be estimated from the sample data alone. This knowledge directs us immediately to the Z-Interval function on the calculator.

Sample mean (\bar{x}) = 14

Sample size (n) = 35

Population standard deviation (σ) = 4

Step 1: Selecting the Z-Interval Function.

Initiate the calculation process by pressing the Stat key on your TI-84. Navigate horizontally to the **TESTS** menu. From the list of available statistical tests and intervals, scroll down and select option **7:ZInterval**. This function is specifically engineered for computing confidence intervals for means when the population standard deviation (σ) is known and available. Press Enter to proceed to the crucial input screen where the parameters will be defined.

```
EDIT CALC TESTS
1:Z-Test...
2:T-Test...
3:2-SampZTest...
4:2-SampTTest...
5:1-PropZTest...
6:2-PropZTest...
7:ZInterval...
8:TInterval...
```

Step 2: Inputting the Required Parameters.

The TI-84 interface requires specific data points corresponding to the problem. First, specify the input type, followed by the known population variability, the sample statistics, and finally, the desired confidence level. Ensure careful entry of the following summary statistics:

Inpt: Since we are using pre-calculated values rather than raw data stored in a list, highlight **Stats** and press ENTER.

σ : Enter the known population standard deviation. Type 4 and press ENTER.

x: Input the calculated sample mean. Type 14 and press ENTER.

n: Enter the sample size. Type 35 and press ENTER.

C-level: Define the desired confidence level as a decimal. For 95%, type 0.95 and press ENTER.

Once all fields are accurately populated, scroll down to highlight **Calculate** and press ENTER. The calculator will then apply the Z-distribution formula to determine the margin of error and the final interval boundaries.

```

ZInterval
Inpt:Data Stats
σ:4
 $\bar{x}$ :14
n:35
C-Level:0.95
Calculate

```

Step 3: Interpreting the Calculated Interval.

Upon execution, the TI-84 displays the resulting [confidence interval](#), presented as a lower bound and an upper bound. This specific range represents the estimated location of the true [population mean](#) (μ) based on the input sample data and the chosen confidence level.

```

ZInterval
(12.675,15.325)
 $\bar{x}$ =14
n=35

```

The displayed interval, approximately (12.684, 15.316), signifies that we are 95% confident that the true average of the population falls within this range. In practical terms, if this sampling procedure were repeated many times, 95% of the resulting intervals would successfully capture the true, but unknown, population parameter.

Example 2: Confidence Interval for a Population Mean (T-Interval)

In the vast majority of real-world statistical research, the true [population standard deviation](#) (σ) is an unknown quantity. When this is the case, especially when working with small sample sizes ($n < 30$), we must use the sample standard deviation (s or S_x) as an estimate for σ . This process of estimation introduces additional uncertainty into the calculation, necessitating a shift from the Z-distribution to the [Student's T-distribution](#). The T-distribution is characterized by its degrees of freedom ($df = n - 1$), which dynamically adjusts the shape of the distribution to account for the increased variability inherent in estimating σ from the sample data.

For this example, we will construct a 95% confidence interval for the population mean using the following data. Note the critical difference from Example 1: we are provided with the sample standard deviation (S_x) rather than the population standard deviation (σ). Furthermore, the

relatively small sample size ($n=19$) reinforces the decision to utilize the T-distribution method for robust estimation.

Sample mean (\bar{x}) = 12

Sample size (n) = 19

Sample standard deviation (S_x) = 6.3

Step 1: Choosing the T-Interval Function.

Navigate to the statistical functions by pressing Stat and selecting the **TESTS** menu. Since we are operating under the crucial assumption that the population standard deviation is unknown, we must select the T-interval option. Highlight option **8:TInterval** and press Enter. Selecting the correct interval type--Z versus T--based on the known information is the most foundational decision in conducting accurate statistical inference.

```
EDIT CALC TESTS
1:Z-Test...
2:T-Test...
3:2-SampZTest...
4:2-SampTTest...
5:1-PropZTest...
6:2-PropZTest...
7:ZInterval...
8:TInterval...
```

Step 2: Entering the Sample Statistics.

The T-Interval input screen is structured similarly to the Z-Interval, but it requires the sample standard deviation (S_x) in place of σ . Ensure that the input method is set to 'Stats' and meticulously enter the summary data provided in the problem statement, corresponding to the characteristics of the sample:

Inpt: Confirm that **Stats** is highlighted, indicating the use of summary data, and press ENTER.

x: Input the sample mean. Type 12 and press ENTER.

Sx: Input the sample standard deviation. Type 6.3 and press ENTER.

n: Enter the sample size. Type 19 and press ENTER.

C-level: Specify the desired confidence level (95%). Type 0.95 and press ENTER.

After all data is entered and verified, scroll down, highlight **Calculate**, and press ENTER. The calculator will then use the T-distribution with 18 degrees of freedom ($19 - 1$) to correctly calculate the margin of error.

```
TInterval
Inpt:Data Stats
x̄:12
Sx:6.3
n:19
C-Level:0.95
Calculate
```

Step 3: Analysis of the T-Interval Results.

The resulting output screen furnishes the calculated T-interval, along with essential summary statistics such as the sample mean, sample size, and the calculated degrees of freedom (df). The interval itself defines the estimated boundaries within which the true [population mean](#) is likely to reside with the chosen level of confidence.

```
TInterval
(8.9635, 15.037)
x̄=12
Sx=6.3
n=19
■
```

The computed 95% confidence interval for the population mean is **(8.9635, 15.037)**. This result is interpreted as follows: we are 95% confident that the average value of the entire population from which this sample was drawn falls between approximately 8.96 and 15.04.

Example 3: Confidence Interval for a Population Proportion (1-PropZInt)

Confidence intervals for a [population proportion](#) (p) are essential when analyzing categorical data, such as binary outcomes (e.g., success/failure, approve/disapprove). Unlike intervals for means, proportions are calculated based on the count of "successes" (x) observed out of a total number of trials (n). Because the sampling distribution of sample proportions ($p?$) can be approximated by a normal distribution for sufficiently large samples, we utilize a Z-distribution approximation for this calculation, which corresponds to the 1-PropZInt function on the [TI-84](#)

calculator.

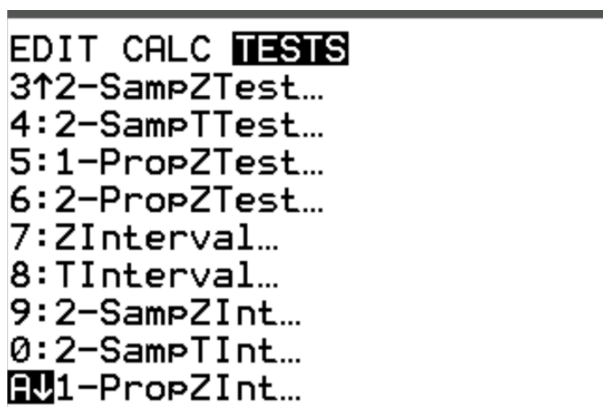
Imagine we conducted a poll or experiment yielding the results below, and we aim to establish a 95% confidence interval for the true proportion of successes within the entire population. The required inputs are streamlined: we only need the absolute count of the positive outcome and the total number of observations, which together define the sample proportion ($p = x/n$).

Number of "successes" (x) = 12

Number of trials (n) = 19

Step 1: Selecting the 1-PropZInt Function.

Press Stat and scroll over to the **TESTS** menu. Scroll down through the list until you locate and highlight option **A:1-PropZInt**. This function is uniquely designed to calculate the confidence interval for a single population proportion. Press Enter to proceed to the input screen. It is vital to remember that this method requires the raw count of successes (x) and the total sample size (n), not the calculated proportion itself.



Step 2: Defining the Proportion Parameters.

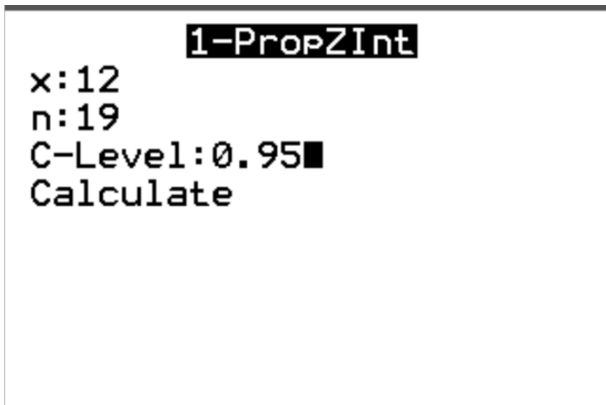
The input screen for the 1-PropZInt is straightforward, requiring only the two crucial count values and the desired confidence level. Carefully enter the sample results:

x: Input the count of successes observed in the sample. Type 12 and press ENTER.

n: Input the total number of trials or observations (the sample size). Type 19 and press ENTER.

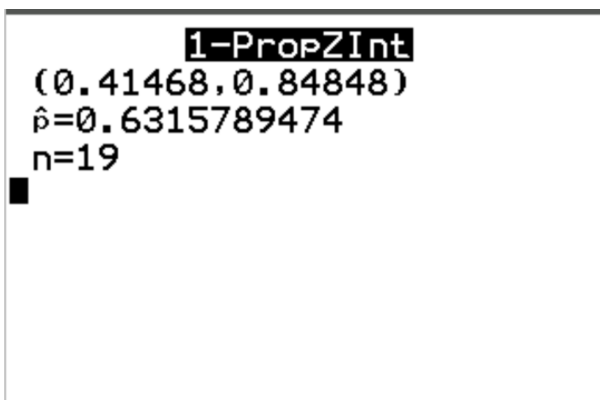
C-level: Enter the confidence level as a decimal. Type 0.95 and press ENTER.

After confirming the inputs, scroll down to highlight **Calculate** and press ENTER. The calculator will apply the appropriate Z-interval formula, specifically adapted for proportions, to generate the final range estimate.



Step 3: Interpreting the Proportion Interval.

The final output screen provides the calculated confidence interval, the calculated sample proportion (\hat{p} , which is $12/19 \approx 0.6316$), and the sample size (n). This interval defines the estimated range for the true [population proportion](#) (p).



The resulting 95% confidence interval for the population proportion is **(0.41468, 0.84848)**. This implies that based on the sample data gathered, we are 95% confident that the true proportion of successes in the entire population lies between approximately 41.47% and 84.85%.

Summary: Essential Guidelines for Confidence Interval Selection

Successful calculation of confidence intervals using the TI-84 calculator fundamentally relies on correctly identifying the underlying statistical scenario. The three methods detailed here--Z-Interval, T-Interval, and 1-PropZInt--form the cornerstone of introductory statistical inference regarding means and proportions. The primary rule for distinguishing between the mean intervals is whether the [population standard deviation](#) (σ) is known (use Z) or unknown (use T). The choice of the proportion interval (1-PropZInt) is reserved exclusively for categorical data.

Adhering to the appropriate conditions for each test ensures that the calculated margin of error accurately reflects the true sampling distribution. For instance, incorrectly using a Z-interval when the population standard deviation is unknown and the sample size is small will lead to an inaccurate calculation, typically underestimating the true variability and resulting in an artificially narrow and unreliable **confidence interval**. Consequently, always verify the assumptions concerning sample size and knowledge of the population parameters before making your selection from the **TESTS** menu.

While the TI-84 calculator effectively handles the complex computational requirements, the most crucial intellectual step remains the proper interpretation of the output. Statisticians must be able to translate the calculated range back into the real-world context of the population parameter being estimated, offering meaningful insights into the reliability and precision of their findings.