

[Home](#)

- I. [Introduction](#)
- II. [Graphing Distributions](#)
- III. [Summarizing Distributions](#)
- IV. [Describing Bivariate Data](#)
- V. [Probability](#)
- VI. [Research Design](#)
- VII. [Normal Distribution](#)
- VIII. [Advanced Graphs](#)
- IX. [Sampling Distributions](#)

X. Estimation

- 1. Contents
[Standard](#)
 - 2. Introduction
[Standard](#) [Video](#)
 - 3. Degrees of Freedom
[Standard](#) [Video](#)
 - 4. Characteristics of Estimators
[Standard](#) [Video](#)
 - 5. Bias and Variability Simulation
[Standard](#)
 - 6. Confidence Intervals
[Standard](#) [Video](#)
 - 7. Confidence Intervals Intro
[Standard](#) [Video](#)
 - 8. Confidence Interval for Mean
[Standard](#) [Video](#)
 - 9. t distribution
[Standard](#) [Video](#)
 - 10. Confidence Interval Simulation
[Standard](#)
 - 11. Difference between Means
[Standard](#) [Video](#)
 - 12. Correlation
[Standard](#) [Video](#)
 - 13. **Proportion**
[Standard](#)
 - 14. Statistical Literacy
[Standard](#)
 - 15. Exercises
[Standard](#)
- XI. [Logic of Hypothesis Testing](#)
 - XII. [Tests of Means](#)
 - XIII. [Power](#)
 - XIV. [Regression](#)
 - XV. [Analysis of Variance](#)
 - XVI. [Transformations](#)
 - XVII. [Chi Square](#)
 - XVIII. [Distribution Free Tests](#)
 - XIX. [Effect Size](#)
 - XX. [Case Studies](#)
 - XXI. [Calculators](#)
 - XXII. [Glossary](#)

Chapter: 10. Estimation

Section: Proportion

[Home](#) | [Previous Section](#) | [Next Section](#)[Video](#)**Proportion**

Author(s)

David M. Lane

Prerequisites

[Introduction to the Normal Distribution](#), [Normal Approximation to the Binomial Sampling Distribution of the Mean](#), [Sampling Distribution of a Proportion](#), [Confidence Intervals](#), [Confidence Interval on the Mean](#)

Learning Objectives

1. Estimate the population proportion from sample proportions
2. Apply the correction for continuity
3. Compute a confidence interval

A candidate in a two-person election commissions a poll to determine who is ahead. The pollster randomly chooses 500 registered voters and determines that 260 out of the 500 favor the candidate. In other words, 0.52 of the sample favor the candidate. Although this point estimate of the proportion is informative, it is also important to compute a [confidence interval](#). The confidence interval is computed based on the mean and standard deviation of the [sampling distribution](#) of a proportion. The formulas for these two parameters are shown below:

$$\mu_p = \pi$$

$$\sigma_p = \sqrt{\frac{\pi(1-\pi)}{N}}$$

Since we do not know the population [parameter](#) π , we use the sample proportion p as an estimate. The estimated [standard error](#) of p is therefore

$$s_p = \sqrt{\frac{p(1-p)}{N}}$$

We start by taking our statistic (p) and creating an interval that ranges $\pm z_{.95}$ in both directions, where $z_{.95}$ is the number of standard deviations extending from the mean of a [normal distribution](#) required to contain 0.95 of the area under the curve (see the section on the [confidence interval for the mean](#)). The value of $z_{.95}$ is computed with the normal calculator and is equal to 1.96. We then make a continuity adjustment to correct for the fact that the distribution is discrete rather than continuous.

[Normal Distribution Calculator](#)

s_p is calculated as shown below:

$$s_p = \sqrt{\frac{.52(1-.52)}{500}} = 0.0223$$

To correct for the fact that we are approximating a [discrete distribution](#) with a [continuous](#) distribution (the normal distribution), we subtract $0.5/N$ from the lower limit and add $0.5/N$ to the upper limit of the interval. Therefore the confidence interval is

$$p \pm z_{.95} \sqrt{\frac{p(1-p)}{N}} \pm \frac{0.5}{N}$$

$$\text{Lower limit: } 0.52 - (1.96)(0.0223) - 0.001 = 0.475$$

$$\text{Upper limit: } 0.52 + (1.96)(0.0223) + 0.001 = 0.565$$

$$0.475 \leq \pi \leq 0.565$$

Since the interval extends 0.045 in both directions, the [margin of error](#) is 0.045. In terms of percent, between 47.5% and 56.5% of the voters favor the candidate, and the margin of error is 4.5%. Keep in mind that the margin of error of

the margin of error for the percent favoring the candidate and not the margin of error for the difference between the percent favoring the candidate and the percent favoring the opponent. The margin of error for the difference is 9 times the margin of error for the individual percent. Keep this in mind when you see reports in the media; the media often get this wrong.

Question 1 out of 3.

Why do we subtract $0.5/N$ from the lower limit and add $0.5/N$ to the upper limit when computing a confidence interval for the population proportion?

- ☐ We need to correct for the fact that we are approximating a discrete distribution (the sampling distribution of p) with a continuous distribution (the normal distribution).
- ☐ The estimate of the population proportion is slightly biased, and we need to correct for it.
- ☐ The estimate of the standard error is slightly biased, and we need to correct for it.

[Check Answer](#)[Previous Question](#)[Next Question](#)[Previous Section](#) | [Next Section](#)