

Lesson 13.3: Margin of Error

A point estimator is a statistic that provides an estimate of a population parameter. The value of that statistic from a sample is called a point estimate.

A C% confidence interval gives an interval of plausible values for a parameter. The interval is calculated from the data and has the form

$$\text{point estimate} \pm \text{margin of error}$$

Point Estimator

- ① Mean
- ② Proportion

The confidence level C gives the overall success rate of the method for calculating the confidence interval. That is, in C% of all possible samples, the method would yield an interval that captures the true parameter.

★ The size of the margin of error is inversely proportional to the sample size. In other words as the sample size increases the margin of error decreases and vice versa.

If the sample size is big,
then we have a smaller
margin of error

The report of a sample survey of 1,014 adults says, "With 95% confidence, between 9% and 15% of all Americans expect to spend more money on gifts this year than last year." What is the point estimator used? What is the point estimate? What is the margin of error?

Estimator: proportion

$$\text{Estimate: } \frac{(9+15)}{2} = \boxed{12\%}$$

$$\text{Margin: } 15\% - 12\% = \boxed{3\%}$$

An insect ecologist reports a 95% confidence interval for the mean length of full-grown aquatic larvae of the Phantom Midge *Chaoborus albatus* to be 6.9 to 8.5 mm, based on a sample of 9 individual larvae. What is the point estimator used? What is the point estimate? What is the margin of error?

Estimator: \bar{X} (Mean)

Estimate: $\frac{(6.9 + 8.5)}{2} = 7.7 \text{ mm}$

Margin: $8.5 - 7.7 = 0.8 \text{ mm}$

The 95% confidence interval for the mean score on the NAEP test is between 200 and 360. What is the point estimator used? What is the point estimate? What is the margin of error?

Estimator: Mean

$$\text{Estimate: } \frac{(200 + 360)}{2} = 280$$

$$\text{Margin: } 360 - 280 = 80$$

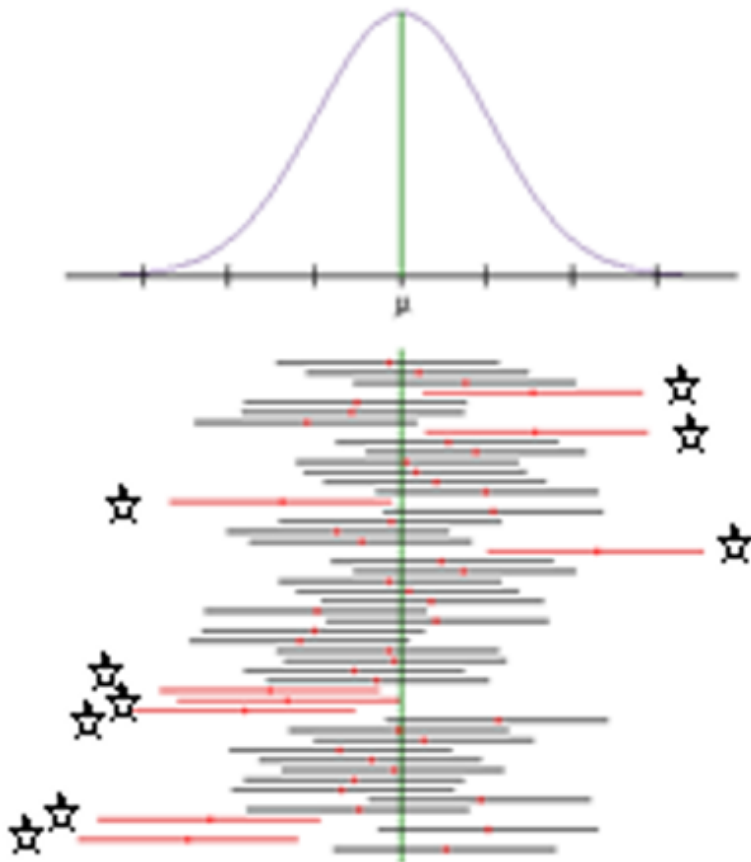
The figure to the right shows the results of taking 50 random samples from a Normal population and constructed a confidence interval for each sample. Which confidence interval—80%, 90%, 95%, or 99%—do you think was used?

9 - stars

$$\frac{41}{50} = 0.82$$

↓
82%

Answer: 80%



The margin of error for a 95% confidence interval is ± 15 . Give a confidence level that would increase the margin of error. \uparrow

Choices: 80%, 90%, ~~95%~~, 99%

\uparrow %

99%

A researcher is deciding between a 95% confidence level and 99% confidence level. Describe the margin of error & risk of being inaccurate of the 99% interval compared to the 95%.

- 99% has a bigger margin of error
- 95% is more accurate

A researcher is deciding between a sample of size 500 and size 1000. Compared to using a sample size of 500, describe the margin of error and risk of being inaccurate with sample size of 1000 at the same confidence level.

- 500 has the bigger margin of error
- Same accuracy for both