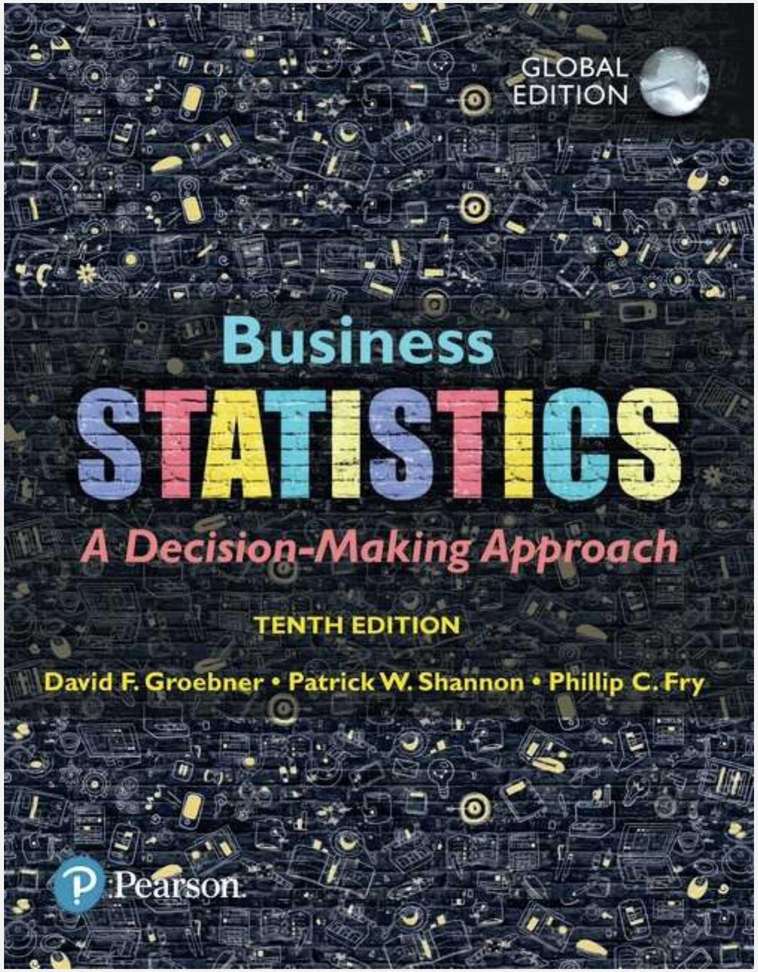
Chapter 8

Estimating Single Population Parameters



Learning Outcomes

Outcome 1. Distinguish between a point estimate and a confidence interval estimate.

Outcome 2. Construct and interpret a confidence interval estimate for a single population mean using both the standard normal and *t* distributions.

Outcome 3. Determine the required sample size for estimating a single population mean.

Outcome 4. Establish and interpret a confidence interval estimate for a single population proportion.

Outcome 5. Determine the required sample size for estimating a single population proportion.

8.1 Point and Confidence Interval Estimates for a Population Mean

- Point Estimate
  - A single statistic, determined from a sample, that is used to estimate the corresponding population parameter

Parameter Point Estimate

	Population	Sample
Mean	μ	$\bar{x}$
Proportion	p	$\bar{p}$

Point estimates are subject to sampling error

Point Estimates

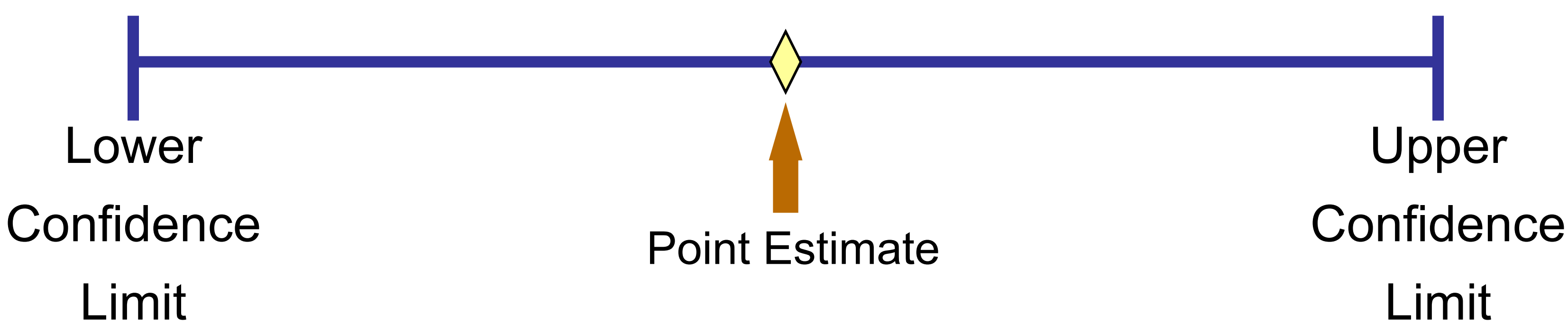
- Population parameter can be estimated with sample statistic (point estimate)

	Population	Sample
Mean		
Proportion		

The Problem With Point Estimates – They are almost always wrong!

Confidence Interval Estimate

- An interval developed from a statistical sample such that if all possible intervals of a given width were constructed, a percentage of these intervals, known as the confidence level, would include the true population parameter



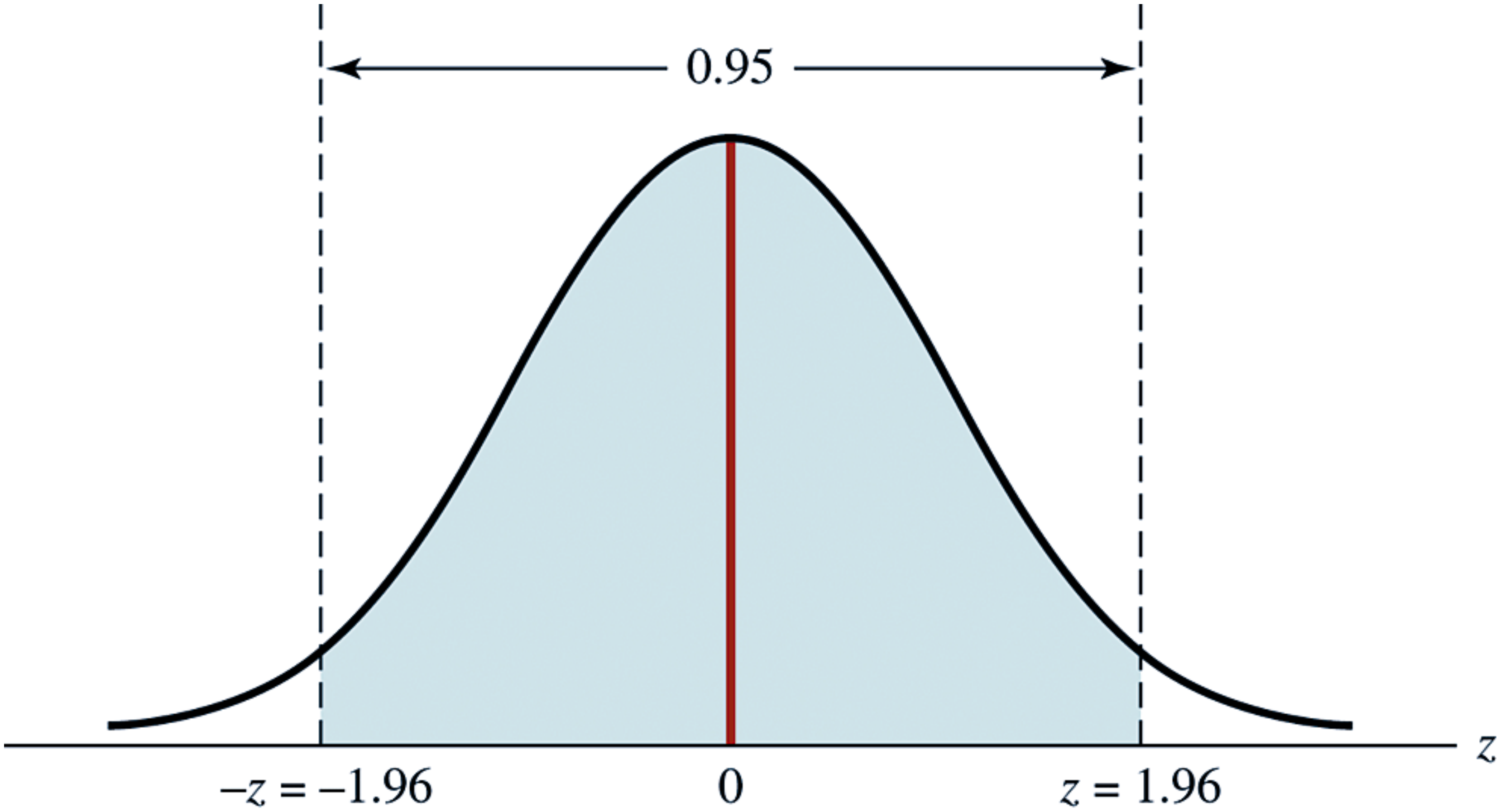
Confidence Interval Estimate – General Format

Confidence Interval Estimate

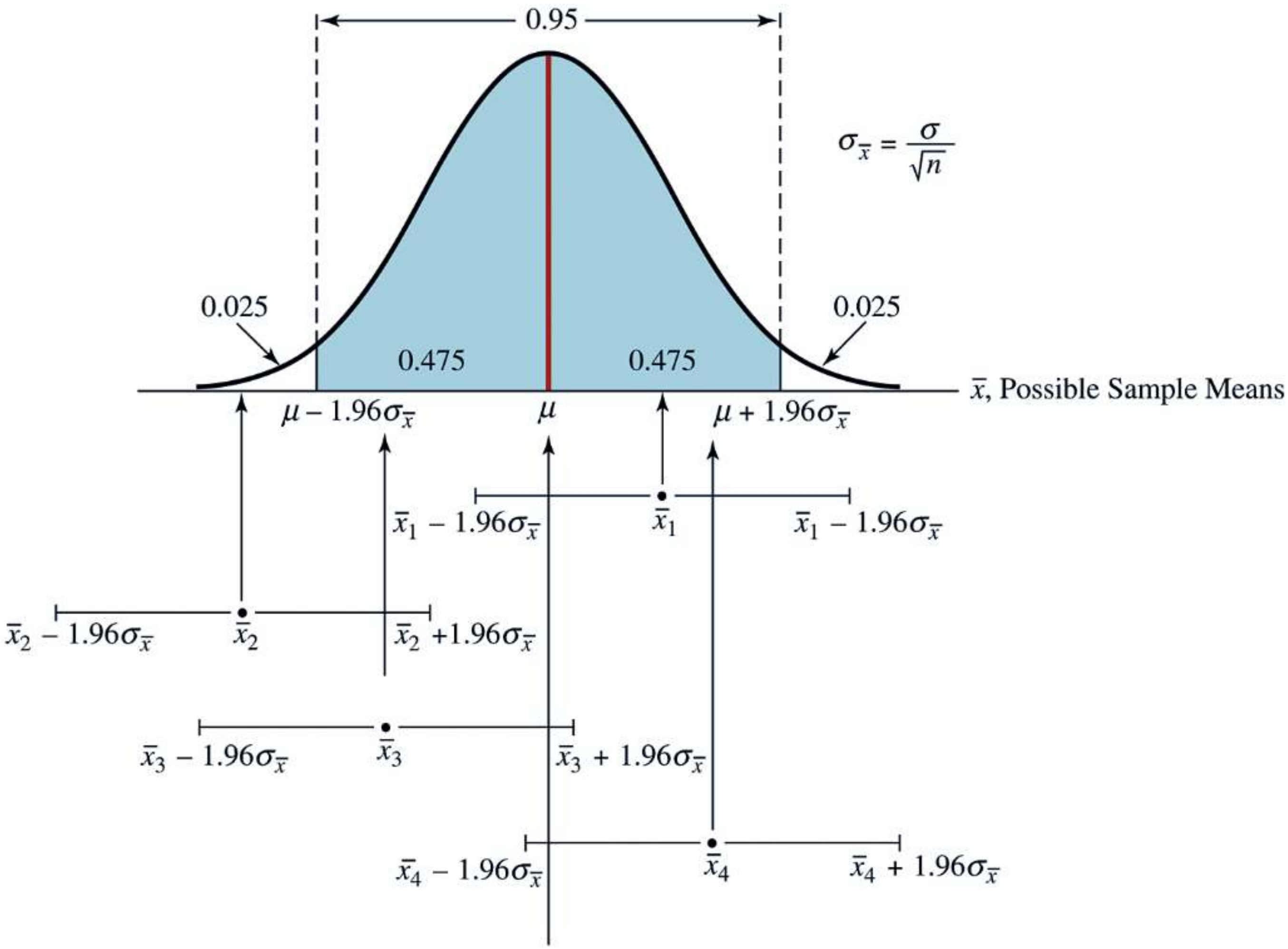
Confidence Level	Critical Value
80%	$Z = 1.28$
90%	$Z = 1.645$
95%	$Z = 1.96$
99%	$Z = 2.575$

Critical values can be found using the standard normal table, or using Excel's **NORM.S.INV** function

Critical Value – 95% Confidence



95% Confidence Interval



Confidence Interval Estimate - Example

Assuming that the population distribution for credit card balances is normal with a population standard deviation equal to \$400, construct and interpret a 95% confidence interval estimate for the population mean balance if a random sample of n = 100 accounts have a sample mean equal to \$2,000.

Confidence Interval Estimate - Example

Confidence Interval Estimate - Example

Based on the sample data, with 95% confidence, we conclude that the population mean is somewhere between $1,921.60 and $2,078.40

Margin of Error- Example

The margin of error indicates that the sample mean of \$2,000 is within \$78.40 of the true population mean.

Confidence Interval Estimate - Example

The distribution of hours worked by students at a university is normally distributed. If the population standard deviation is known to be 5 hours, construct and interpret a 90% confidence interval estimate for the mean hours worked by all students at the university if a random sample of 64 students has a mean equal to 23 hours.

Confidence Interval Estimate - Example

Margin of Error- Example

The margin of error indicates that the sample mean of 23 hours is within 1.03 hours of the true population mean.

Confidence Level Impact – University Student Work Example

90% Confidence Interval

95% Confidence Interval

99% Confidence Interval

Sample Size Impact – Credit Card Example

n = 100

n = 200

n = 400

Confidence Interval Objectives

1. Small margin of error
2. High Confidence
3. Small sample size

Conflicting objectives

Conclusions So Far

- Point estimates are subject to sampling error
- For a given sample size, the percentage of possible confidence interval estimates that contain the true parameter is equal to the confidence level
- The margin of error is half the width of the confidence interval estimate
- Increasing the confidence level, increases the margin of error
- Increasing the sample size decreases the margin of error.