MATH 1342

Section 7.1

Margins of Error and Estimates

What is estimation?

An educated guess based on available data. We can say, based on the data available, the some estimates are better than others.

A **point estimate** is a single value that has been calculated from sample data to estimate the unknown population parameter.

This is typically going to be a mean, a proportion, a difference of means, or a difference of proportions.
This forms the center value of our confidence interval.

Commonly Used Symbols

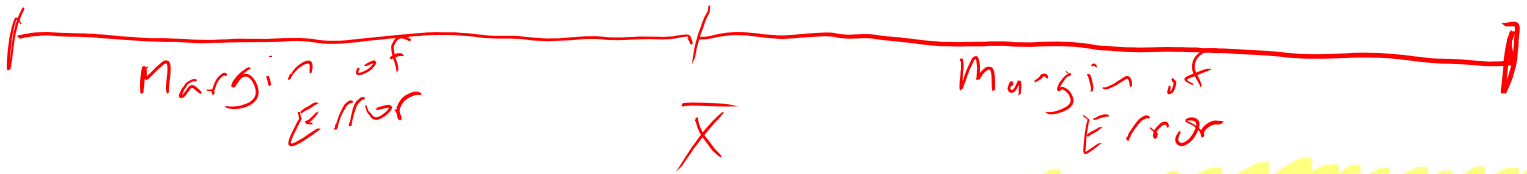
Population Parameter	Sample Statistic
p - Population Proportion	$\hat{p}$ - Sample Proportion
μ - Population Mean	$\overline{x}$ - Sample Mean
σ - Population Standard Deviation	s – Sample Standard Deviation

The goal of chapter 7 is to create an estimate for the population parameter based on the observed sample parameter.

Confidence

Suppose we would like to make an estimate of a population parameter based on a sample statistic. A **confidence interval** is a range of possible values that is likely to contain the unknown population parameter that we are seeking.

First, we must have a **level of confidence**. Then, based on this level, we will compute a **margin of error** (we will discuss how to compute this in the next sections). Last, we can say that we are --% confident that the true population parameter falls within our confidence interval.



Formula for a confidence interval is: sample statistic ± margin of error

Example: Problem 11 from the text

Suppose the heights of the population of basketball players at a certain college are in question. A sample of size 16 is randomly selected from this population of basketball players and their heights are measured. The average height is found to be 6.2 feet and the margin of error is found to be ± 0.4 feet.

If this margin of error was determined with a 95% confidence level, find and interpret the confidence interval.

$\bar{x} \pm ME$

6.2 ± 0.4

$6.2 + 0.4 = 6.6$

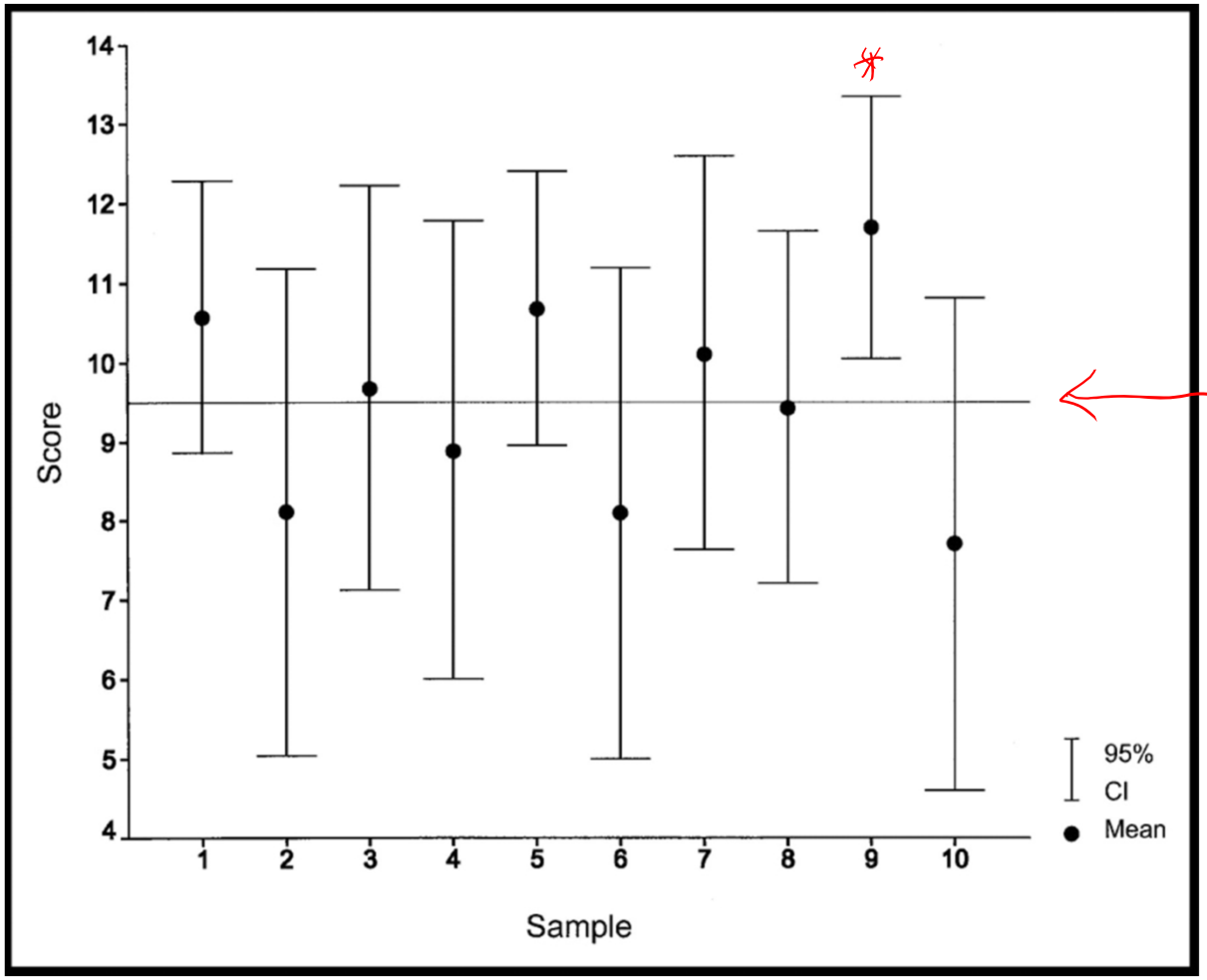
$6.2 - 0.4 = 5.8$

$[5.8, 6.6]$

Interpretation: We are 95% confident that the population mean falls between 5.8 feet and 6.6 feet.

Second Interpretation: If we were to repeat this process several times, 95% of confidence intervals calculated would contain the population mean.

So, what does this interpretation really mean?



Popper 22

A study is conducted to determine the number of times a week a college student purchases coffee. A sample of 200 college students were surveyed, and it was determined that, on average, 12 cups of coffee per week were purchased, with a possible error of 2 cups. There was a 90% confidence level in this study.

1. Based on this study, what is mean number cups of coffee purchased by a college student in our sample? → Given in question

   a. 200 b. 2 c. 12 d. 14

2. In this study, what is the confidence interval? [12-2, 12+2]

   a. [2,12] b. [10,14] c. [12,14] d.[188,212] [10, 14]

3. What is the population mean?

   a. 12 b. 10 c. 14 d. Cannot be determined

   Population mean can never be determined with 100% certainty. We can only create an estimate based on this process.

Popper 22…continued:

A study is conducted to determine the number of times a week a college student purchases coffee. A sample of 200 college students were surveyed, and it was determined that, on average, 12 cups of coffee per week were purchased, with a possible error of 2 cups. There was a 90% confidence level in this study.

4. What does the confidence level mean?

a. 90% of people surveyed responded.

b.90% of the people surveyed purchased 12 cups of coffee

c. There is a 90% certainty that a college student will purchase at least 1 cup of coffee.

d. There is a 90% certainty that the population mean will fall within the confidence interval.

e. 90% of people surveyed had drank so much coffee that their response was 90% inarticulate because their blood stream contained over 90% caffeine.