

Lecture 4: Stats Week!

Sampling Distributions, 1 Sample Tests, and 1 Sample CIs for Means

Sampling Distribution for Means

Sampling Distribution of Means

Mean	Standard Deviation
$\mu_{\bar{x}} = \mu$	$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

Note: The SD formula requires that we know the population standard deviation. If we are trying to make predictions about the population mean, it's incredibly unlikely we'll know the population standard deviation.

Sampling Distribution of Means

So... we have to estimate the standard deviation. When we estimate the standard deviation, it's called the standard error rather than the standard deviation.

Mean	Standard Error
$\mu_{\bar{x}} = \mu$	$\sigma_{\bar{x}} = \frac{s}{\sqrt{n}}$

In other words, the standard error is usually the standard deviation of the sampling distribution of means.

Checking Conditions for Sampling Dist of Means

As long as we meet the...

- **Randomization Condition** (random sample)
- **10% Condition**, which says that the sample size, n , must be no larger than 10% of the population,
- **Nearly Normal Condition** - satisfiable by (1) population is normal, (2) dataset appears normal, or (3) Large Enough by CLT.

...then the sampling distribution for means can be described as:

Known σ	Unknown σ
$\sim N(\mu, \frac{\sigma}{\sqrt{n}})$	$\sim N(\mu, \frac{s}{\sqrt{n}})$

Example #1

Consider the approximately normal population of heights of male college students with mean of 70 inches and standard deviation of 5 inches.

- a. What is the probability that a single randomly selected male college student has a height greater than 73 inches? *Note that we know orig pop is normal.*
- b. A random floor of the men's dormitory is selected and the 25 male students on the floor are sampled. What is the mean and standard deviation of the average heights for sample sizes of 25?
- c. Find the probability that the sample mean of the 25 college males will be greater than 73 inches.

Group Work #1

In groups of 2-3, answer the two questions on the in-class activity sheet.

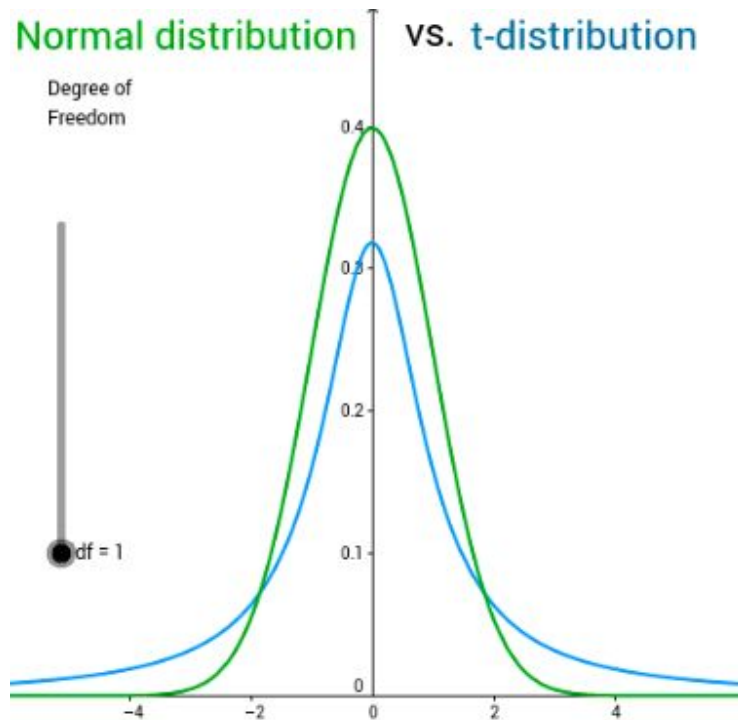
1 Sample T Test for Means

1 Sample T Test for Means

- You may use either a T test statistic or a Z test statistic for inference tests on means, depending on the scenario.
 - If we know the population standard deviation (σ), then we use Z
 - If the sample size is large, we can use Z (or T, too) - the Z and T curves converge to a similar curve at large values of n
 - T distributions are especially good for small sample sizes
 - So, most professors will ask you to use the T test statistic. This is true in 400A and 400B

What is a T Distribution?

- Gosset's T or Student's T
- Has addition df parameter
- Similar to the normal model, but t distributions with small degrees of freedom (small sample sizes) have fatter tails - basically meaning the test statistic would need to be more extreme to be rejected.
- At large sample sizes/large degrees of freedom, the t distribution resembles the normal distribution. ([LINK](#))



T Scores

- You solve for t-scores just like you solve for z-scores. Keep in mind, though, that we are now using the standard error as the standard deviation of the sampling distribution of means.
- You'll look t-scores up on a t table - *not* a z-score table (remember the shape of the distribution is different).

$$t = \frac{\bar{X} - \mu_{\bar{x}}}{\frac{S}{\sqrt{n}}}$$

1 Sample T Test for Means

Notes and Example 2 on handout

Group Work #2

In groups of 2-3, answer the two questions on the in-class activity sheet.

1 Sample T Interval for Means

What is a Confidence Interval?

- A confidence interval provides us a range of values that the true population mean could take for a given confidence level. For example, we can construct a 95% confidence interval. We then can say that we are 95% confident the true mean falls in our interval.
- To make a confidence interval for a mean (a one-sample t-interval), we use the following equation:

$$\bar{x} \pm t_{n-1}^* \times SE(\bar{x})$$

1 Sample T Interval for Means

See handout for Notes and Example 3.

Group Work #3

In groups of 2-3, answer the two questions on the in-class activity sheet.