Math 1700: Elementary Statistics

7^{th} and 8^{th} Weeks Summary (10/16/25)

- Inference about the value of the population mean, μ.
- Estimating the value of a population parameter (μ).

  Point estimate for a parameter ($\bar{x}$)

  Interval estimate ($\bar{x} - E$, $\bar{x} + E$)
- Level of confidence $(1 - \alpha)$: The portion of all interval estimates that include the parameter being estimated.
- Confidence interval for μ: An interval estimate with a specified level (1–α) of confidence:

  $$(\bar{x} - z(\alpha/2)\frac{\sigma}{\sqrt{n}}, \bar{x} + z(\alpha/2)\frac{\sigma}{\sqrt{n}})$$

  Maximum error of Estimate: $E = z(\alpha/2)\left(\frac{\sigma}{\sqrt{n}}\right)$

  Confidence Interval Applet
- Required Sample size for a specific level of confidence, $(1 - \alpha)$:

  $$n = \left(\frac{z(\alpha/2)\sigma}{E}\right)^2$$
- Testing a hypothesis..........................

  Null Hypothesis:

  $H_0 : \mu = \mu_0$

  Alternative (Research) Hypotheses:

  $H_a : \mu < \mu_0$, or

  $H_a : \mu > \mu_0$, or

  $H_a : \mu \neq \mu_0$
- Type of Errors:

  Type I Error or Level of Significance (α):

  Falsely Rejecting H_0

  Type II Error (β):

  Falsely Fail to Reject H_0
- Test Statistic:

  $$z^* = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}}$$
- Hypothesis Test Approaches

  Classical Approach

  P-value Approach
- P-value Approach HT: A 5-step Procedure

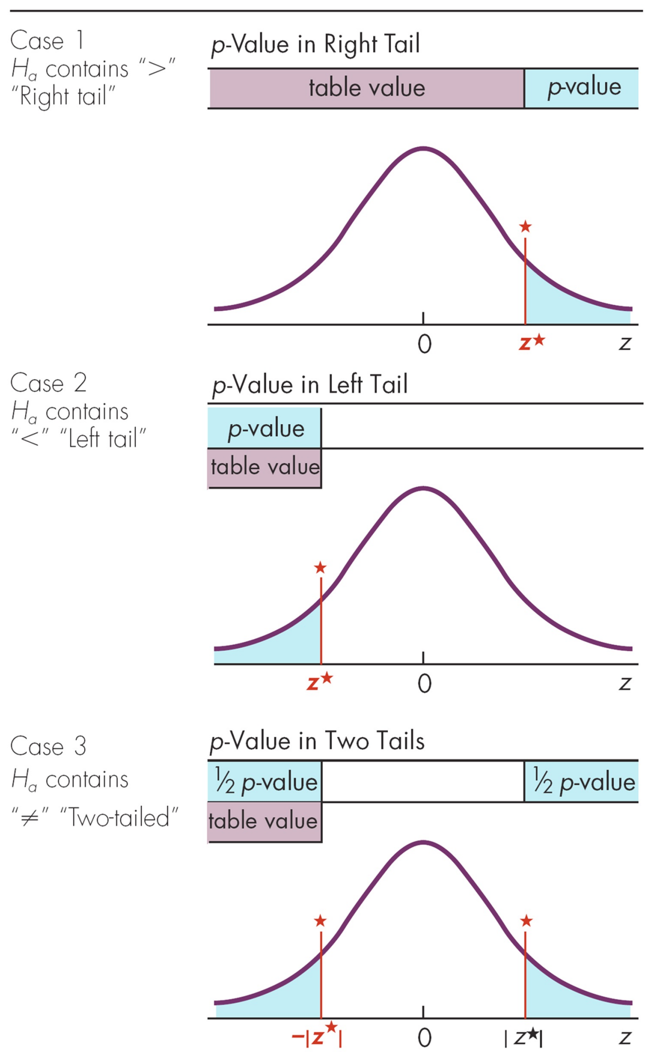
  Step 1 The Set-Up

  Step 2 The Hypothesis Test Criteria

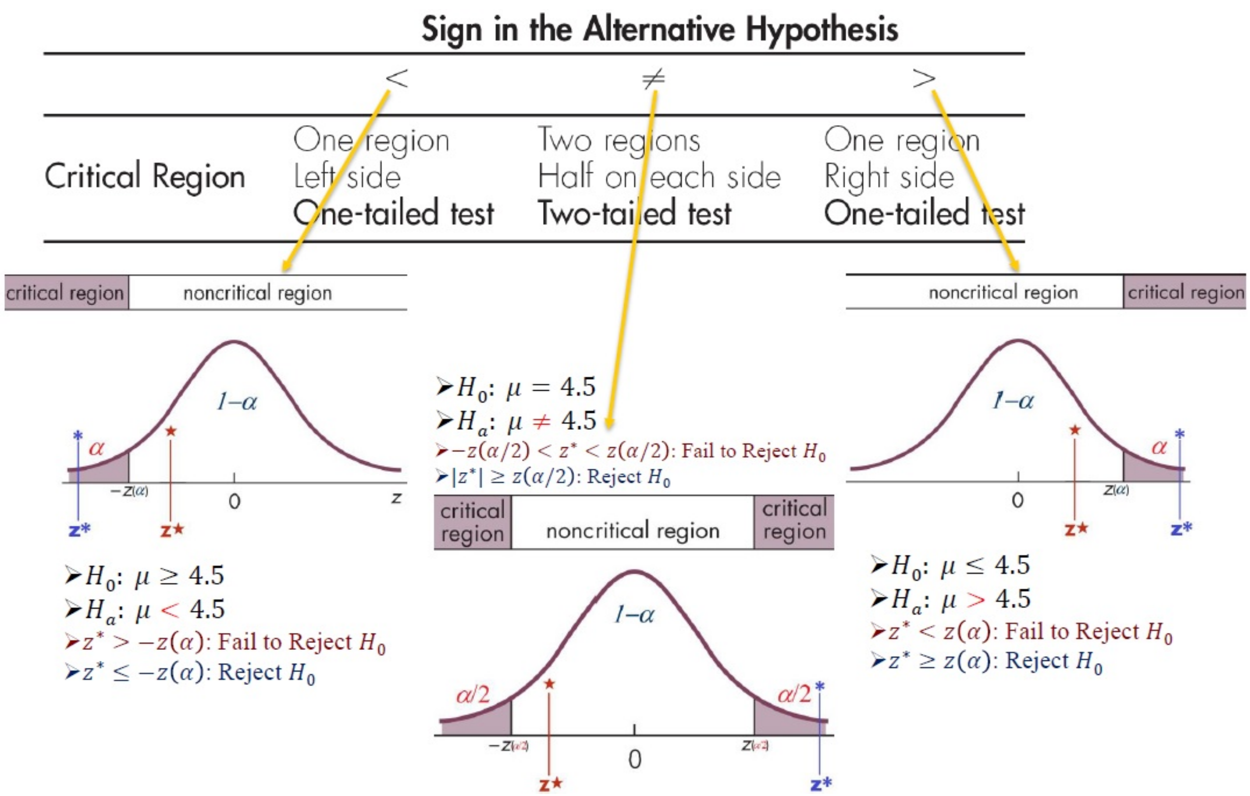
  Step 3 The Sample Evidence

  Step 4 The Probability Distribution

  Step 5 The Results



- Classical approach of Hypothesis Testing . . . .



<u>Case 1: One Variable (Population)</u>

Assumptions	σ is known	σ is unknown
Parameter of interest:	Mean, μ	Mean, μ
Confidence Interval Formula:	$\bar{x} \pm z(\alpha/2)\dfrac{\sigma}{\sqrt{n}}$	$\bar{x} \pm t(df, \alpha/2)\dfrac{s}{\sqrt{n}}$ with $df = n - 1$
Name of Hypothesis Test, H_0	One sample z-test, $H_0: \mu = \mu_0$	One sample t-test, $H_0: \mu = \mu_0$
Test Statistic Formula:	$z^* = \dfrac{\bar{x} - \mu_0}{\sigma/\sqrt{n}}$	$t^* = \dfrac{\bar{x} - \mu_0}{s/\sqrt{n}}$ with $df = n - 1$
p-value:	$H_a: \mu > \mu_0$, p-value=$P(z \geq z^*)$ $H_a: \mu < \mu_0$, p-value=$P(z \leq z^*)$ $H_a: \mu \neq \mu_0$, p-value=$2 \times P(z \geq \lvert z^* \rvert)$	$H_a: \mu > \mu_0$, p-value=$P(t(df) \geq t^*)$ $H_a: \mu < \mu_0$, p-value=$P(t(df) \leq t^*)$ $H_a: \mu \neq \mu_0$, p-value=$2 \times P(t(df) \geq \lvert t^* \rvert)$