Single Sample t Test

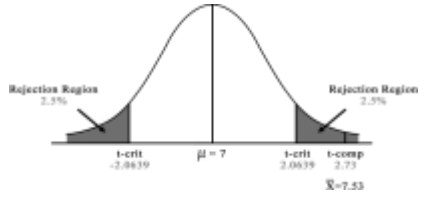
Assessment of differences between groups

t_{comp} & t_{crit}

- t_{crit} values come from back of text
  - t_{crit} = "REQUIRED" t
- t_{comp} values come from your brain
  - t_{comp} = "ACTUAL" t

Alternative Decision Rule

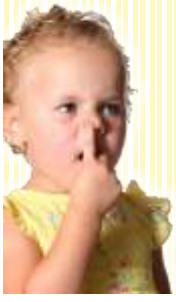
- Rejection Region—typically 5%
  - p-value ≤ 0.05 = statistical significance



Alternative Decision Rule

- Reject Null if $|t_{comp}| \geq t_{crit}$
  - If critical t = 2.0639, then sample & pop means are *required* to be at least 2.0639 standard error units apart in order to reject

What does rejection really mean?



Pick your favorite!

1. "There is a less than 5 in 100 chance that the sample came from the population."
2. "There is less than a 5% probability that the difference between the sample and population averages is due to coincidence."
3. "There is a 95% or better probability that the difference between the sample and population is due to something real."

Treating mean differences like Z scores

- Z score deviance
- Problem: Group distributions contain error and are not normally distributed.
- Solution: t distribution
  - deviance of mean difference

$$t_{\bar{X}} = \frac{\bar{X} - \mu}{s_{\bar{X}}}$$

One-Sample t Walkthrough

- A researcher is interested in the effect of amphetamine on short-term memory. To test this, she has 25 adult volunteers swallow a small dose of amphetamine, wait 30 minutes, and take a digit-span test. The researcher finds that the mean digit-span for the subjects is 7.53, with a standard deviation of .97. She knows from many previous studies that the average adult digit span is 7. *If we assume that μ=7, what is the probability of selecting a sample of size N = 25, M = 7.53, if only chance is involved?* In other words, how likely is it that the amphetamine had a real (non-chance) effect on digit span?

Type I and Type II Errors

Cross your fingers… mistakes are always possible

Correct & Incorrect Decisions

In reality, H_0 is…

We decide to…	True	False
Accept	Correct	Type II False Negative
Reject	Type I False Positive	Correct

Type I Error

- Type I error: **Null rejected when it is true**
  - **Like saying "I found something" …when really nothing there (over-reacting)**
  - **Also called *alpha* (α) *error or a "false positive"***

$H_0: \bar{x} = \mu$

Type II Error

- Type II error: **Null not rejected (accepted) when it is false**
  - **Like saying "II bad. Nothing there," …when really was something (under-reacting)**
  - **Also called *beta error* (β) or a "miss"**

$H_0: \bar{x} = \mu$

Choosing an Alpha Level

Consequences of our decisions

Minimize chance of Type I error...

- … with smaller α
  - Common values are α = 0.01 and 0.05
    - "How small" depends on seriousness of Type I error
    - Decision is practical not statistical
- When might we be more or less cautious about making Type I errors? In different types of criminal trials? Certain medications?

The mechanic inspects the brake pads for the minimum allowable thickness.

Ho: Vehicles breaks meet the standard for the minimum allowable thickness.

H1: Vehicles brakes do not meet the standard for the minimum allowable thickness.

Situation: The breaks are fine, but the check indicates you need to replace the brake pads; therefore any possible problems with breaks are avoided even though the breaks were not worn. Type 1 or Type 2?

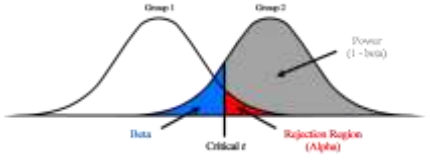
Situation: The pads are too thin but the mechanic does not find anything wrong with them and does not replace them. Consequently the driver of the vehicle gets into an accident because she was unable to break effectively and gets into a fatal accident. Type 1 or Type 2?

POWER!

A critical factor for researcher and reviewer

What is Power?

- Power: **probability concluding difference when really IS a difference**
  - **Power related to alpha, beta (Types I and II error), sample size, treatment effect**



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