

Hypothesis Tests Assignment

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Q1.

- ① null hypo (H_0): Assumes no effect
- ② Alternative hypo (H_1): Assumes an effect
- ③ Type I Error: Rejecting a True (H_0)
- ④ Type II Error: Failing to reject a False (H_0)
- ⑤ Level of significance: Probability of Type I error

Q2.

• $\bar{X} = 4.3, \sigma = 0.6, n = 36, \alpha = 0.05$

• Hypo: $H_0: \mu = 4, H_1: \mu > 4$

• Z-Test $\rightarrow Z = \frac{4.3 - 4}{0.6/\sqrt{36}} = 3$

• $Z_{\alpha} = 1.645$

• $3 > 1.645 \rightarrow \text{Reject } H_0$

* There is a significant evidence the drink increases alertness for more than 4 hours



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Q3. $\bar{x} = 4.85, s = 0.3, n = 25, \alpha = 0.01$

• Hypo. $H_0: \mu = 5, H_1: \mu \neq 5$

• Test: $t = \frac{4.85 - 5}{0.3/\sqrt{25}} = -2.5$

• $df = 24$
 $\alpha = 0.01 \rightarrow t_{\alpha/2} = \pm 2.797$

• -2.5 is not beyond -2.797
(fail to reject H_0)

∴ No significant evidence that bolt length differs from 5 cm

Q4. $M \geq 7, \bar{x} = 6.7, s = 0.8, n = 40, \alpha = 0.05$

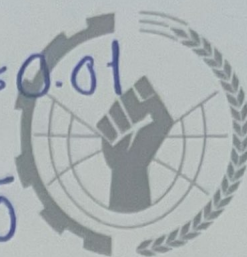
• Hypo. $H_0: \mu \geq 7, H_1: \mu < 7$

• Test: $Z = \frac{6.7 - 7}{0.8/\sqrt{40}} = \frac{-0.3}{0.1265} = -2.37$

• P-Value $= P(Z < -2.37) \approx 0.0089$

• $0.0089 < 0.05 \rightarrow \text{Reject } H_0$

∴ Evidence shows students sleep less than 7 hours on average



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Q5.

one-tailed: Tests direction ↑ or ↓

Two-tailed: tests any difference ≠



Ex.

one-tailed: testing if a new drug increases recovery speed.

two-tailed: checking if a machine's output deviates from target.

Problem: battery > 12 hours

$$\bar{X} = 13, S = 1.5, n = 10, \alpha = 0.1$$

• Hypo: $H_0: \mu = 12, H_1: \mu > 12$

• Test: $t = \frac{13 - 12}{1.5 / \sqrt{10}} = 2.11$

• $df = 9$

$\alpha = 0.1 \rightarrow t_{\alpha} = 1.383$

• $2.11 > 1.383 \rightarrow \text{Reject } H_0$

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✱ The battery life is significantly greater than 12 hours