STATISTICS FOR DATA SCIENCE

HYPOTHESIS and INFERENCE

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UNIT-4 HYPOTHESIS and INFERENCE

Session-3

Large-Sample Tests for a Population Mean

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Large-Sample Tests for a Population Mean

- Let $X_1, X_2 \ldots, X_n$ be a *large* (e.g., $n > 30$) sample from a population with mean μ and standard deviation σ.
- To test a null hypothesis of the form
- $H_0: \mu \leq \mu_0, H_0: \mu \geq \mu_0,$ or $H_0: \mu = \mu_0$

Source: Text Book Chapter6

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Large-Sample Tests for a Population Mean

- **Compute the z-score:**

$$z = \frac{\bar{X} - \mu 0}{\sigma / \sqrt{n}}$$

If σ is unknown it may be approximated with s.

Source: Text Book Chapter6

- **Compute the *P*-value.**

- **The P-value is an area under the normal curve, which depends on the alternate hypothesis as in the table:**

Source: Text Book Chapter6

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Large-Sample Tests for a Population Mean

Alternate Hypothesis	P-value
$H_1 : \mu > \mu_0$	Area to the right of z
$H_1 : \mu < \mu_0$	Area to the left of z
$H_1 : \mu = \mu_0$	Sum of the areas in the tails cut off by $z \; and \; -z$

Source: Text Book Chapter6

Example:

- The mean lifetime of a sample of 100 fluorescent light bulbs produced by a company is computed to be 1570 hours with a standard deviation of 120 hours.

- If μ is the life time of all the bulbs produced by the company test the hypothesis $\mu = 1600\ hours$ against the alternate hypothesis $\mu \neq 1600\ hours$.

Source: Text Book Chapter6

Solution:

H_0: $\mu = 1600$ hours

H_1: $\mu \neq 1600$ hours

$\bar{X} = 1570, \sigma = s = 120, n = 100$

$$z = \frac{X - \mu 0}{\sigma / \sqrt{n}} = \frac{1570 - 1600}{120 / \sqrt{100}} = -2.51$$

P- Value is 0.012.

Which is very low . So we reject H_0

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Large-Sample Tests for a Population Mean

Example:

- A trucking firm is suspicious of the claim that the average lifetime of certain tires is at least 28,000 miles.

- To check the claim, the firm puts 40 of these tires on its trucks and gets a mean lifetime of 27,463 with a standard deviation 1,348 miles.

Find the P value for testing H_0: $\mu \geq 28,000\ miles H_1$: $\mu < 28,000\ miles$?

Solution:

$$H_0: \mu \geq 28,000\ miles$$

$$H_1: \mu < 28,000\ miles$$

$$z = \frac{\bar{X} - \mu}{s/\sqrt{n}} = \frac{27,463 - 28,000}{1,348/\sqrt{40}} = -2.52 < -2.33$$

P – Value is 0.0059

Since P- Value is a very small probability we need to reject H_0

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