Lecture 33

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1 1 versus 2 Tailed Tests

In our example,

$$H_0 : \mu = \mu_0$$

$$H_1 : \mu \neq \mu_0$$

With $\mu_0 = 10$. We define the critical region to be $\overline{x} < 8, \overline{x} > 12$, where H_0 is rejected.
In a one-sided case,

$$H_0 : \mu = 0$$

$$H_1 : \mu > 0$$

with the critical region $\overline{x} > 2$.

2 Hypothesis Testing vs Confidence Interval

For a Type I error (false positive), we specify a critical region R, then find α. Recall

$$P(\overline{X} \in R) = 1 - \alpha$$

Now we can also specify α and find a critical region.

3 P Value

Definition 3.1. The p value is defined as

$$p = P(|Z| > |z|)$$

Then $p = 2P(Z \geq |z|)$. If p is close to 1, then the values of z are very close to zero, suggesting H_0 is likely true. If p is close to 0, then conversely, H_0 is likely false.

Example 3.1. $H_0 : \mu = 5, H_1 : \mu \neq 5$ with sample $n = 40, \overline{x} = 5.5, \sigma = 1$. Then

$$z = \frac{\overline{x} - \mu_0}{\sigma/\sqrt{n}} = \frac{5.5 - 5}{1/\sqrt{40}} = 3.16$$

Then the p value is

$$p = 2P(Z > 3.16) = 2(1 - \Phi(3.16)) = 0.0016$$

So we reject H_0 and take H_1.