Calculating Power of a Test

The power of a test is the probability of avoiding a Type 2 error; that is, the probability of correctly rejecting H_0 if the null hypothesis is, in fact, false.

Calculating Power

In the following, μ_0 is the value of μ specified by null hypothesis; σ is the standard deviation of the population; n is the sample size.

1 Find the critical value

- One-tailed test: Z_α Two-tailed test: $Z_{\alpha/2}$

2 Find value of $\bar{x}$ whose z-score is the critical value.

We'll call this $\bar{x}^*$.

- Left-tailed (H_1: $\mu < \mu_0$) $\bar{x}^* = \mu_0 - Z_\alpha \frac{\sigma}{\sqrt{n}}$
- Right-tailed (H_1: $\mu > \mu_0$) $\bar{x}^* = \mu_0 + Z_\alpha \frac{\sigma}{\sqrt{n}}$
- Two-tailed (H_1: $\mu \neq \mu_0$)

  Two values: $\bar{x}^*_{left} = \mu_0 - Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$

  $\bar{x}^*_{right} = \mu_0 - Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$

3 Select a specific value, μ_1, that satisfies H_1. Sketch a normal curve with mean μ_1.

4 Power is the area under the curve relative to $\bar{x}^*$. (i.e., find the p-value of $\bar{x}^*$ with mean μ_1 and standard deviation σ.)

- Left-tailed   Area to left of $\bar{x}^*$.
- Right-tailed   Area to right of $\bar{x}^*$.
- Two tailed   Sum of area to left of $\bar{x}^*_{left}$ and to the right of $\bar{x}^*_{right}$.