One and Two Tailed Tests

Data Science for Quality Management: Two Sample Hypothesis Testing

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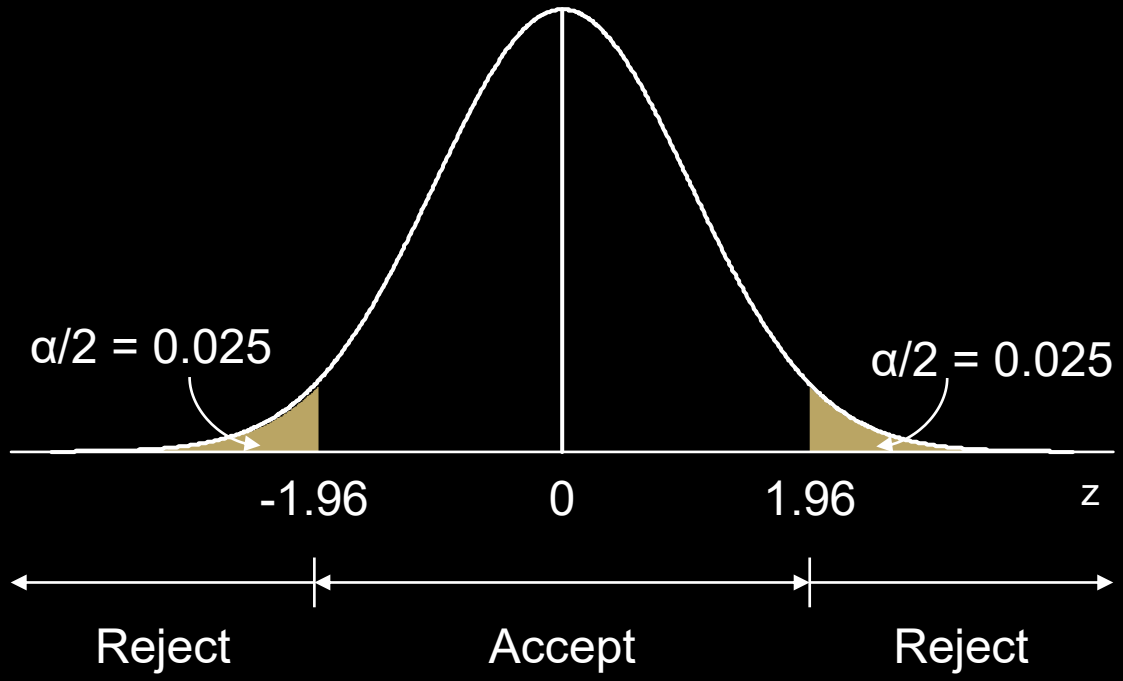
Learning objective:

Discriminate between one tail and two tailed tests

Two Tailed Tests

- In most instances, the researcher will not be able to make a prediction as to the direction of a possible change
- In this case, an alternative H structure is appropriate, and the test will have 2 rejection areas.

Rejection Regions
Two Tailed Tests



One Tailed Tests

- In some cases, an investigator will be able (or forced) to make a prediction based upon a theoretical rationale or prior research

One Tailed Tests

- In this case, a one-tailed test with a directional hypothesis may be appropriate.

- This choice would result in a single rejection region.

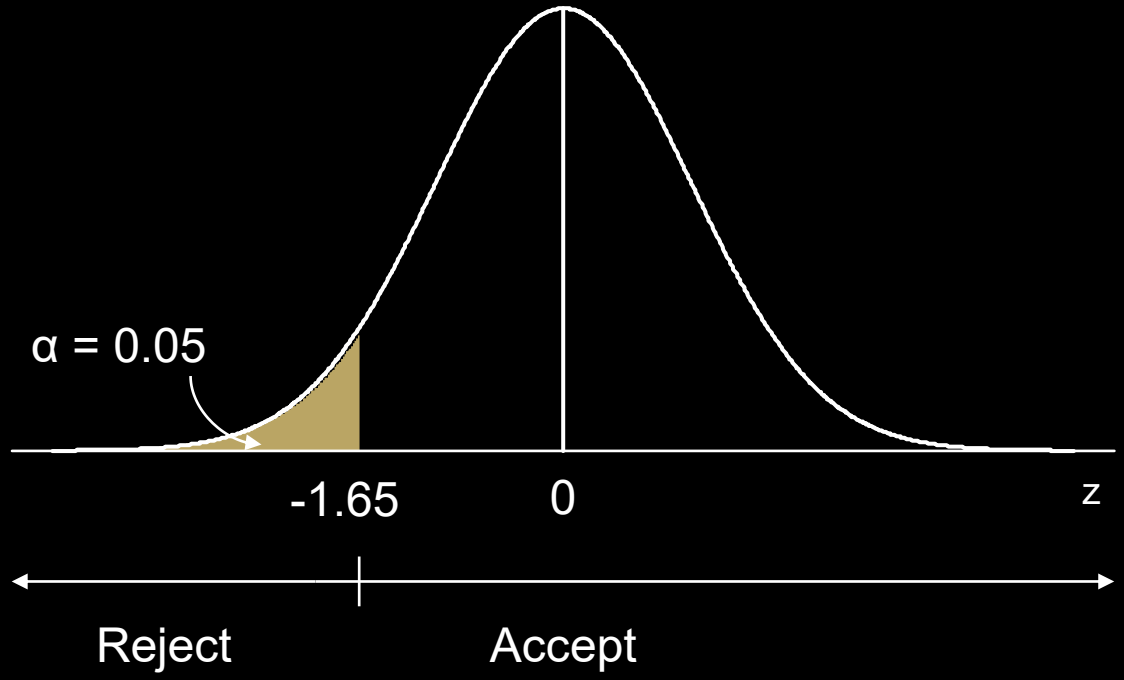
One Tailed Test Example

- Suppose that we do not wish to ship a production lot of washing machines unless, based upon a randomly drawn sample from the lot and spin tested, the mean (μ) of the lot may be reasonably assumed to be at least 2,000 rpm to failure

One Tailed Test Example

- The hypotheses to be tested are:
  - H_0: $\mu \geq 2{,}000$
  - H_1: $\mu < 2{,}000$

Rejection Region
One Tailed Test



Observations and Cautions

- The one-tailed test will cause the rejection of the H_0 more often than a two-tailed test if the direction predicted is the same as the direction of the difference or association

Observations and Cautions

- Note: there is no possibility of rejecting the null hypothesis if there is a difference in the opposite direction!

- A directional test should be employed only when thoroughly justified

Sources

- Luftig, J. An Introduction to Statistical Process Control & Capability. Luftig & Associates, Inc. Farmington Hills, MI, 1982