

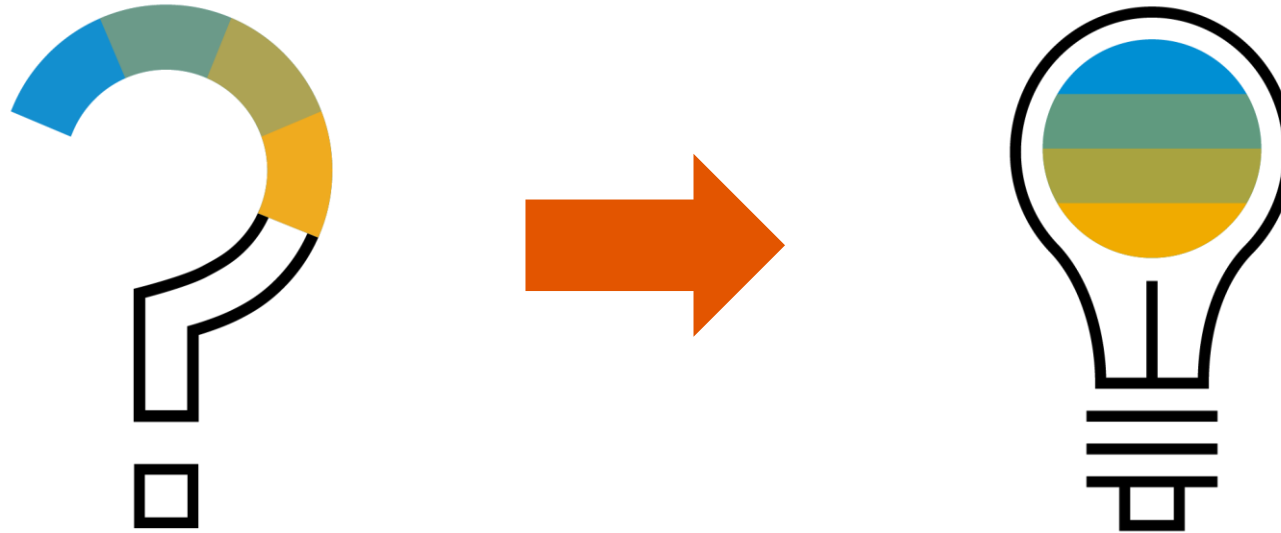


Week 5: Probability Distributions

Unit 5: Hypothesis Testing

Hypothesis Testing

Introduction



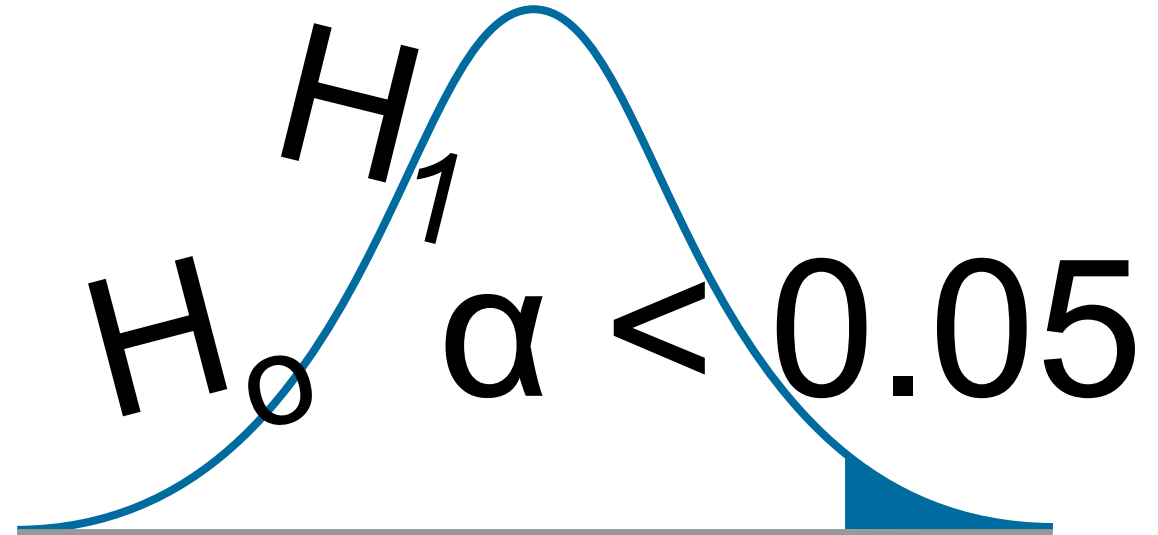
Null and alternative hypotheses

Determine whether a coin was fairly balanced:

- A null hypothesis H_0 might be that half the flips would result in Heads and half in Tails.
- The alternative hypothesis H_a might be that the number of Heads and Tails would be very different.

$$H_0: P = 0.5$$

$$H_1: P \neq 0.5$$



Hypothesis Testing



1. State the hypotheses

2. Formulate an analysis plan

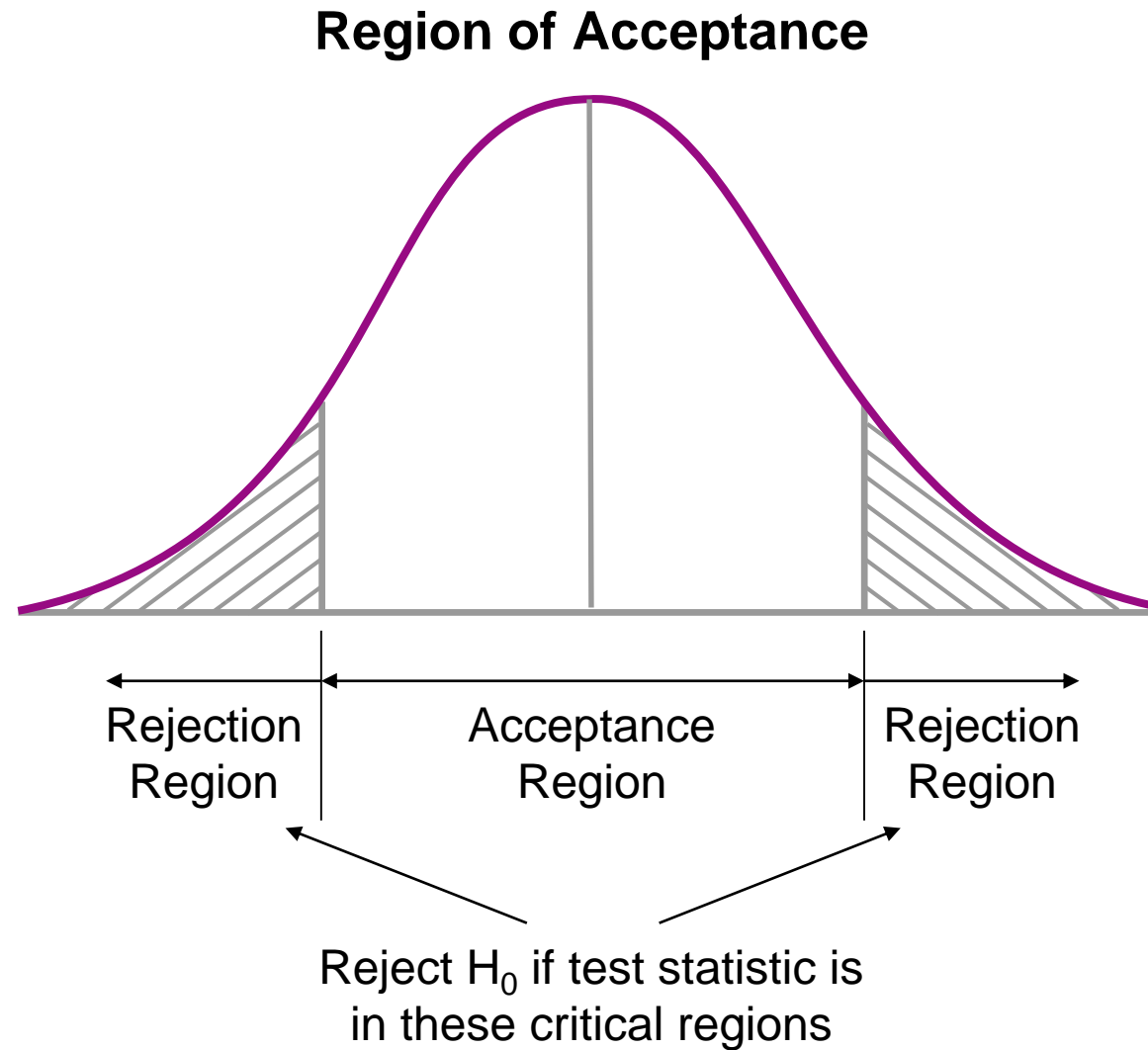
3. Analyze sample data

4. Interpret results



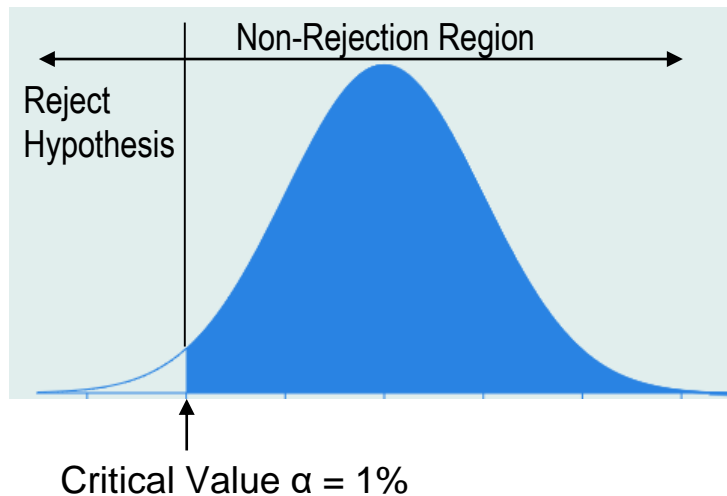
Hypothesis Testing

Decision rules

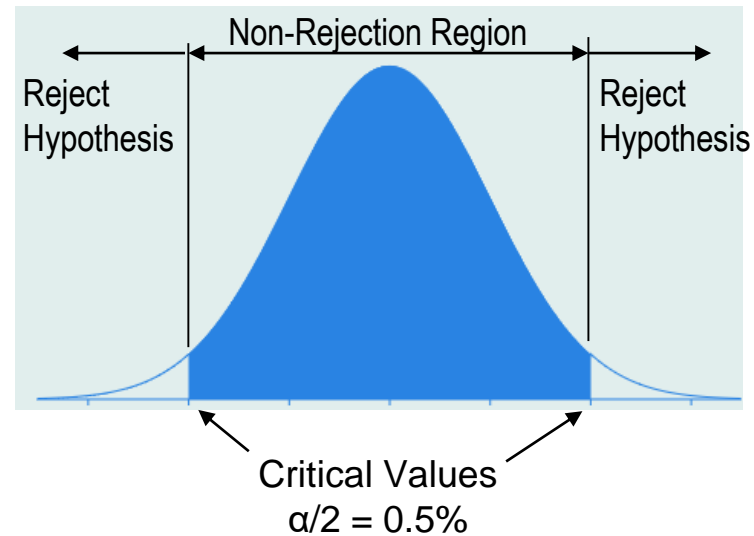


One-tailed and two-tailed tests

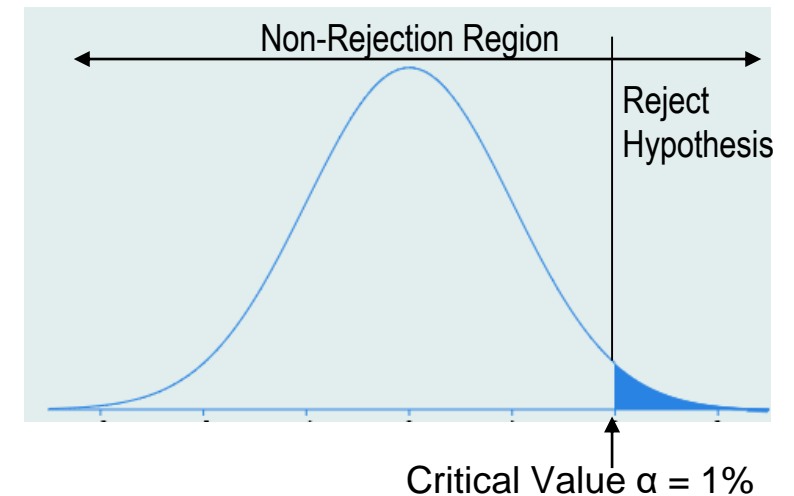
Left-Sided (One-Tailed) Test



Two-Tailed Test



Right-Sided (One-Tailed) Test



<http://www.stat.yale.edu/Courses/1997-98/101/sigtest.htm>

<https://blog.minitab.com/blog/adventures-in-statistics-2/understanding-hypothesis-tests-significance-levels-alpha-and-p-values-in-statistics>

Hypothesis Testing

Decision errors

		Truth	
		H_0 is True	H_0 is False
Statistician's opinion (based on the sample data and decision rule)	H_0 Not Rejected	Correct Decision	Type II Error β
	H_0 Rejected	Type I Error α	Correct Decision

[https://en.wikipedia.org/wiki/Power_\(statistics\)](https://en.wikipedia.org/wiki/Power_(statistics))

Hypothesis Testing

Summary

- **“Hypothesis testing”** refers to the formal procedures used by statisticians to accept or reject statistical hypotheses.
- There are two types of statistical hypotheses:
 1. **Null hypothesis** (H_0) is usually the hypothesis that the sample observations result purely from chance.
 2. **Alternative hypothesis** (H_1 or H_a) is the hypothesis that the sample observations are influenced by some non-random cause.
- An analysis plan includes decision rules for rejecting the null hypothesis. Statisticians describe these decision rules in two ways – with reference to a P-value or with reference to a region of acceptance.
- Two types of errors can result from a hypothesis test.
 - A Type I error occurs when the researcher rejects a null hypothesis when it is true.
 - A Type II error occurs when the researcher fails to reject a null hypothesis that is false.



Thank you.

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