Statistics and Data Analysis

Unit 03 – Lecture 02: Hypothesis Testing (t-test): Concepts and Setup

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https://github.com/tali7c/Statistics-and-Data-Analysis

Quick Links

Overview t-test Basics p-values Exercises Demo Summary

Agenda

Learning Outcomes

- Define null and alternative hypotheses clearly

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- Compute a one-sample t statistic (given summary)

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- Compute a one-sample t statistic (given summary)
- Explain p-value and significance level alpha
- Distinguish one-tailed vs two-tailed tests
- State key assumptions behind the t-test

t-test Basics: Key Points

- H0/H1 setup

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- H0/H1 setup
- Test statistic measures how far the sample is from H0
- Assumptions: independence, outliers, normality/CLT

t-test Basics: Key Formula

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}, \quad \mathrm{df} = n - 1$$

p-values: Key Points

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- Small p-value -¿ evidence against H0
- p-value is not effect size

Exercise 1: Write hypotheses

Claim: mean score is 60. Write H0 and H1 for a two-sided test.

Solution 1

- H0: mu = 60
- H1: mu != 60

Exercise 2: Compute t

Given n=25, xbar=53, s=10, test H0: mu=50. Compute t.

Solution 2

- SE = 10/sqrt(25) = 2
- t = (53-50)/2 = 1.5
- df = 24

Exercise 3: Tail choice

You want to show a new method increases mean score. One-tailed or two-tailed?

Solution 3

- One-tailed (right): H1: mu ¿ mu0

Mini Demo (Python)

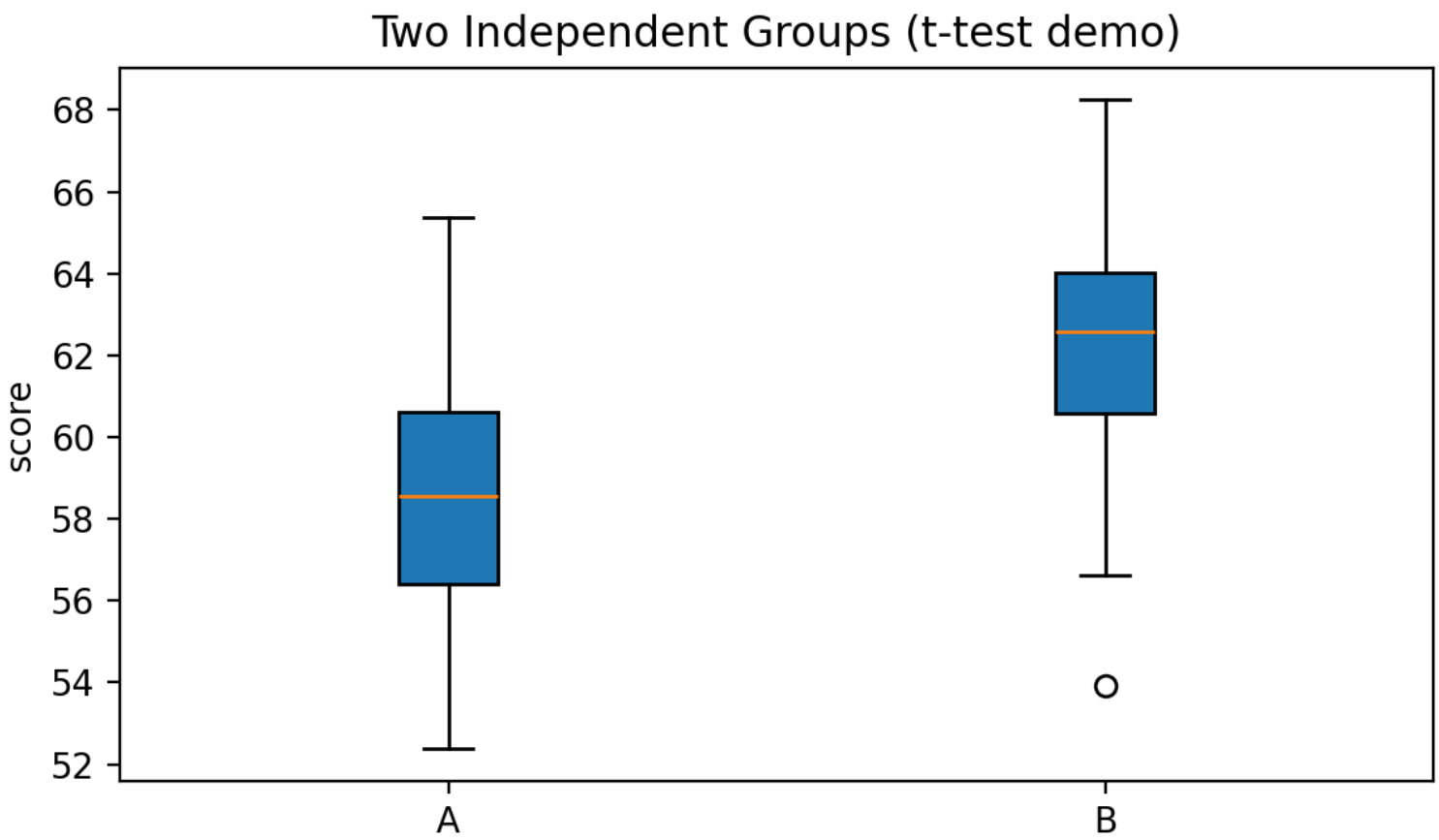
Run from the lecture folder:

```
python demo/demo.py
```

Outputs:

- `images/demo.png`
- `data/results.txt`

Demo Output (Example)



Summary

- Key definitions and the main formula.

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- How to interpret results in context.

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- Key definitions and the main formula.
- How to interpret results in context.
- How the demo connects to the theory.

Exit Question

Why can a very small p-value still be unimportant in practice?