

# StatLearning: A shiny app for practicing statistical hypothesis testing

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1. Goals of StatLearning

- **Individualized education:** Each student makes his own decisions on how to practice and learn the statistical tests.
- **Unlimited number of exercises:** Students can practice according to their needs.
- **Practice at home:** Use the workgroup time for theoretical questions and improve comprehension.

2. Learning preferences

- **Reading:** Prefer reading texts and examples given in papers and books.
- **Listening:** Prefer listening to podcasts or videos of explanations on specific topics.
- **Watching:** Prefer watching videos with explanations and examples on specific matters.
- **Doing:** Prefer doing computations either by hand or coding (using R).

3. Features

- Definitions statistical concepts
- Texts and videos on how to compute the statistics step by step by hand or using R.
- Integrated R box to compute the results.
- “Cheat” button to skip computations.
- Automatic answer check.
- Statistical conclusion written in a text format.

4. The app

Select the test

One sample t test

Independent samples t test

Paired samples t test

Chi squared test

Goodness of fit

Wilcoxon rank sum

Wilcoxon signed rank

Random

New exercise

We are studying the grades of two workgroups in an unknown scale. We have obtained a sample from each group. The first sample contains 8 subjects and the second sample contains 5 subjects.

We want to test whether the mean of the first group is different from the mean of the second group. Use a level of significance of = 0.05.

The measures in the samples are:

Sample 1

Id	1	2	3	4	5	6	7	8	Mean	Std. dev.
Measure	9	10	11	9	11	13	9	9	Cheat	Cheat

Sample 2

Id	1	2	3	4	5	Mean	Std. dev.
Measure	10	8	12	11	12	Cheat	Cheat

Standard error

t-value

Degrees of freedom

P-value

Statistical decision

Effect size

(a)

(b)

grades of two workgroups in an unknown scale. We have obtained a sample from each group. The first sample contains 8 subjects. The second sample contains 5 subjects.

Sample

A sample is a set of individuals selected from a population, usually intended to represent the population in a research study.

A population is the set of all the individuals of interest in a particular study.

Gravetter, F. J., & Wallnau, L. B. (2013). Statistics for the behavioral sciences.

Close

Id	1	2	3	4	5	Mean	Std. dev.
Measure	10	8	12	11	12		

(c)

sample contains 5 subjects.

t statistic

A t statistic is the standard distance between the differences between sample means and an unknown population mean  $\mu$  (which is usually considered to be 0). The standard deviation is given by the estimated standard error of the difference se.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{se}$$

How to compute the t-value by hand, with R.

Cheat

Back

Close

Next

Standard error

t-value

Degrees of freedom

P-value

Statistical decision

Effect size

(d)

Write here your R code

Run (Ctrl-Enter)

You should assume that any scripts or data that you put into this service are public. Privacy policy. Computation provided by rdrr.io: hosting documentation for all R packages.

The value of the t statistic is 2.222 with 722 degrees of freedom, corresponding to a p-value 2.222 . Thus, we can conclude that the means of the grades of the students is 2222 equal. The corresponding effect size is 2.222 .

Standard error = 0

Test Statistic = 0

Degrees of freedom = 0

p-value: By hand Using R, SPSS

Decision: Do not reject H0 Reject H0

Effect size = 0

(e)

The value of the t statistic is -0.523 with 7.704 degrees of freedom, corresponding to a p-value 0.616 . Thus, we can conclude that the means of the grades of the students is equal. The corresponding effect size is 0.034 .

Standard error = 0.891

Test Statistic = -0.533

Degrees of freedom = 7.704

p-value = 0.023 0.616

Decision: Do not reject H0 Reject H0

Effect size = 0.56 0.034

(f)

5. Behind the scenes

- **R:** Simulate data and compute solutions.
- **R markdown:** Generate the HTML.
- **HTML:** Modify the HTML document created by R markdown.
- **CSS:** Modify the visual settings of the HTML.
- **Javascript:** Reactive actions in HTML.

6. Future features

- **Connect the app to a database** to keep track of the user’s results.
- Provide **individualized reports** with statistics based on the time series of the user’s results.
- **Adapt the exercises’ difficulty** and adjust the help information based on the user’s previous results.
- **Improve the appearance** of the app.
- Extend the app with **new statistical tests**.