

# Package ‘sprtt’

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**Type** Package

**Title** Sequential Probability Ratio Tests: Using t-Statistic

**Version** 0.1.0

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**Description** The seq\_ttest() function is the implementation of Abraham Wald’s (1947) <[doi:10.2134/agronj1947.00021962003900070011x](https://doi.org/10.2134/agronj1947.00021962003900070011x)> Sequential Probability Ratio Test (SPRT) for the test of a normal mean (difference) with unknown variance in R (R Core Team, 2018). It performs sequential t tests developed by Rushton (1950) <[doi:10.2307/2332385](https://doi.org/10.2307/2332385)>, Rushton (1952) <[doi:10.2307/2334026](https://doi.org/10.2307/2334026)> and Hajnal (1961) <[doi:10.2307/2333131](https://doi.org/10.2307/2333131)>, based on the SPRT. Specifically, seq\_ttest() performs one-sample, two-sample, and paired t tests for testing one- and two-sided hypotheses. The test is to be applied to the data during the sampling process, ideally after each observation. At any stage, it will return a decision to either continue sampling or terminate and accept one of the specified hypotheses. For more information on the SPRT t test, see Schnuerch & Erdfelder (2019) <[doi:10.1037/met0000234](https://doi.org/10.1037/met0000234)>.

**License** GPL (>= 3)

**URL** <https://meikesteinhilber.github.io/sprtt/>

**BugReports** <https://github.com/MeikeSteinhilber/sprtt/issues>

**Depends** R (>= 3.5.0)

**Imports** methods, stats

**Suggests** knitr, rmarkdown, testthat (>= 3.0.0), testthis, dplyr, effsize

**VignetteBuilder** knitr

**Encoding** UTF-8

**Language** en-US

**LazyData** true

**RoxygenNote** 7.1.1

**NeedsCompilation** no

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df_cancer	<i>Test data to run the examples</i>
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### Description

A dataset that includes 120 individuals.

### Usage

df\_cancer

### Format

A data frame with 2 variables:

**treatment\_group**

**control\_group**

---

df\_income

*Test data to run the examples*

---

### **Description**

A dataset that includes 120 individuals with sex gender and monthly income.

### **Usage**

df\_income

### **Format**

A data frame with 2 variables:

**monthly\_income**

**sex**

---

df\_stress

*Test data to run the examples*

---

### **Description**

A dataset that includes 120 individuals.

### **Usage**

df\_stress

### **Format**

A data frame with 2 variables:

**baseline\_stress**

**one\_year\_stress**

seq\_ttest

*Sequential Probability Ratio Test using t-statistic***Description**

Performs one and two sample sequential t-tests on vectors of data.

**Usage**

```
seq_ttest(
  x,
  y = NULL,
  data = NULL,
  mu = 0,
  d,
  alpha = 0.05,
  power = 0.95,
  alternative = "two.sided",
  paired = FALSE,
  na.rm = TRUE,
  verbose = TRUE
)
```

**Arguments**

x	Works with two classes: numeric and formula. Therefore you can write "x" or "x~y". <ul style="list-style-type: none"> <li>"numeric input": a (non-empty) numeric vector of data values.</li> <li>"formula input": a formula of the form lhs ~ rhs where lhs is a numeric variable giving the data values and rhs either 1 for a one-sample test or a factor with two levels giving the corresponding groups.</li> </ul>
y	an optional (non-empty) numeric vector of data values.
data	an optional data.frame, which you can use only in combination with a "formula input" in argument x.
mu	a number indicating the true value of the mean (or difference in means if you are performing a two sample test).
d	a number indicating the specified effect size (Cohen's d)
alpha	the type I error. A number between 0 and 1.
power	1 - beta (beta is the type II error probability). A number between 0 and 1.
alternative	a character string specifying the alternative hypothesis, must be one of two.sided (default), greater or less. You can specify just the initial letter.
paired	a logical indicating whether you want a paired t-test.
na.rm	a logical value indicating whether NA values should be stripped before the computation proceeds.
verbose	a logical value whether you want a verbose output or not.

**Value**

An object of the S4 class [seq\\_ttest\\_results](#). Click on the class link to see the full description of the slots. To get access to the object use the @-operator or []-brackets instead of \$. See the examples below.

**Examples**

```
# set seed -----
set.seed(333)

# load library -----
library(sprtt)

# one sample: numeric input -----
treatment_group <- rnorm(20, mean = 0, sd = 1)
results <- seq_ttest(treatment_group, mu = 1, d = 0.8)

# get access to the slots -----
# @ Operator
results@likelihood_ratio

# [] Operator
results["likelihood_ratio"]

# two sample: numeric input -----
treatment_group <- stats::rnorm(20, mean = 0, sd = 1)
control_group <- stats::rnorm(20, mean = 1, sd = 1)
seq_ttest(treatment_group, control_group, d = 0.8)

# two sample: formula input -----
stress_level <- stats::rnorm(20, mean = 0, sd = 1)
sex <- as.factor(c(rep(1, 10), rep(2, 10)))
seq_ttest(stress_level ~ sex, d = 0.8)

# NA in the data -----
stress_level <- c(NA, stats::rnorm(20, mean = 0, sd = 2), NA)
sex <- as.factor(c(rep(1, 11), rep(2, 11)))
seq_ttest(stress_level ~ sex, d = 0.8, na.rm = TRUE)

# work with dataset (data are in the package included) -----
seq_ttest(monthly_income ~ sex, data = df_income, d = 0.8)
```

---

seq\_ttest\_results-class

*An S4 class to represent the results of a sequential t-test.*

---

**Description**

An S4 class to represent the results of a sequential t-test.

**Slots**

`likelihood_ratio_log` the logarithmic test statistic.  
`decision` the test decision: "accept H1", "accept H0", or "continue sampling".  
`A_boundary_log` the lower logarithmic boundary of the test.  
`B_boundary_log` the upper logarithmic boundary of the test.  
`d` a number indicating the specified effect size (Cohen's d).  
`mu` a number indicating the true value of the mean (or difference in means if you are performing a two sample test).  
`alpha` the type I error. A number between 0 and 1.  
`power` 1 - beta (beta is the type II error probability). A number between 0 and 1.  
`likelihood_ratio` the likelihood ratio of the test without logarithm.  
`likelihood_1` the likelihood of the alternative Hypothesis (H1).  
`likelihood_0` the likelihood of the null Hypothesis (H0).  
`likelihood_1_log` the logarithmic likelihood of the alternative Hypothesis (H1).  
`likelihood_0_log` the logarithmic likelihood of the null Hypothesis (H0).  
`non centrality parameter` parameter to calculate the likelihoods  
`t_value` the t-value of the t-statistic.  
`p_value` the p-value of the t-test.  
`df` degrees of freedom.  
`mean_estimate` the estimated mean or difference in means depending on whether it was a one-sample test or a two-sample test.  
`alternative` a character string specifying the alternative hypothesis: "two.sided" (default), "greater" or "less".  
`one_sample` "true" if it is a one-sample test, "false" if it is a two-sample test.  
`ttest_method` a character string indicating what type of t-test was performed.  
`data_name` a character string giving the name(s) of the data.  
`verbose` a logical value whether you want a verbose output or not.

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sprtt

*sprtt: help page.*


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**Description**

This package provides the implementation of sequential probability ratio tests using t-statistic.

**detailed help pages**

For detailed instructions on the sprtt package, see: `vignette("sprtt")` or <https://meikesteinhilber.github.io/sprtt/>

**sprtt functions**

- `seq_ttest` Performs one and two sample sequential t-tests on vectors of data.

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[,seq\_ttest\_arguments-method

*Method to retrieve the contents of a slot of an object of the `seq_ttest_arguments` class.*

---

### Description

This method is only used internally to process the input arguments of the `seq_ttest` function. As a normal user, you can ignore this specific documentation.

### Usage

```
## S4 method for signature 'seq_ttest_arguments'  
x[i, j, drop]
```

### Arguments

`x` the `seq_ttest_arguments` object.  
`i` indices indicating elements to extract.  
`j` not used.  
`drop` not used.  
`seq_ttest_arguments`  
the corresponding class to this method.

### Value

Returns the contents of the specified slot of an `seq_ttest_arguments` object. For more information, see the arguments of the `seq_ttest` function.

---

[,seq\_ttest\_results-method

*Method to retrieve the contents of a slot of an object of the `seq_ttest_results` class.*

---

### Description

Method to retrieve the contents of a slot of an object of the `seq_ttest_results` class.

### Usage

```
## S4 method for signature 'seq_ttest_results'  
x[i, j, drop]
```

**Arguments**

<code>x</code>	the <code>seq_ttest_results</code> object.
<code>i</code>	indices indicating elements to extract.
<code>j</code>	not used.
<code>drop</code>	not used.
<code>seq_ttest_results</code>	the corresponding class to this method.

**Value**

Returns the contents of the specified slot. For more information, see the documentation for the [seq\\_ttest\\_results](#) class.



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