# Basic Statistics

Statistical tests, Power calculations

# Statistical Test

t.test()

Performs one and two sample (paired or independent) t-tests on vectors of data.

```
t.test(x, y = NULL,
alternative = c("two.sided", "less",
"greater"), mu = 0, paired = FALSE,
var.equal = FALSE,conf.level = 0.95)
```

# Statistical Test

t.test()

**Do it yourself:**

```
x1 <- rnorm(100,0,1)

x2 <- rnorm(100,3,1)

t.test(x1, x2)
```

Try different options of the t.test and see how the analysis outcome changes.

NOTE: This is an illustrative example. In practice you must make sure the data comes from a normal distribution.

# Statistical Test

## Linear models

Here is a brief summary of some useful regression tools; see the **excellent** book by Faraway (2005) for detail and first rate explanations.

Let's fit the simple **linear regression model**

$$y_i = \beta_0 + \beta_1 x_i + \varepsilon_i$$

to data points $(x_i, y_i)$ for i = 1, …, n.

# Statistical Test

## Linear Model

```
> x <- c(1,3,5,7)
> y <- c(2,8,13,19)
> plot(x, y, xlab = "x", ylab = "y")
> # Fit the linear regression model
> lm_model <- lm(y ~ x)
> lm_model
> # Add the fitted line to the graph
> abline(lm_model)
> summary(lm_model)
> anova(lm_model)
```

# Statistical Test

## Other functions

Other useful functions are:

- ✓ `aov(formula)` analysis of variance model
- ✓ `anova(fit,...)` analysis of variance (or deviance) tables for one or more fitted model objects.
- ✓ `binom.test(), pairwise.t.test(), prop.test(),…`

Use `help.search("test")`

# Sample Size

Power Calculations

# Sample Size

`power.t.test()` computes power of test, or determine parameters to obtain target power.

```
power.t.test(n = NULL, delta = NULL, sd
= 1, sig.level = 0.05,power = NULL,type
= c("two.sample", "one.sample",
"paired"), alternative = c("two.sided",
"one.sided"), strict = FALSE)
```

# Sample Size

**Do it yourself:**

```
> power.t.test(n = 20, delta = 1)

> power.t.test(power = .90, delta = 1)

> power.t.test(power = .90, delta = 1,
alternative = "one.sided")
```