# R Lab #8d - Normal distribution of one sample

## Contents



## 95% confidence interval of mean

In Chapter 4 the 95% confidence interval of a mean was described, and the 2xSE rule was introduced.

In Chapter 11 the *t*-distribution is introduced, and this can be used to accurately calculate the 95% confidence interval of the mean.

### 95% CI of mean: stalk-eyed fly example

Chapter 11 offers an example of collecting a sample of the eyespans in stalk-eyed flies.

Import the sample of nine observations:

```
eyes <- c(8.69, 8.15, 9.25, 9.45, 8.96, 8.65, 8.43, 8.79, 8.63)
```

Instead of the approximate 2xSE rule, now we can use the *t*-distribution to accurately calculate the 95% CI of the mean. This is done with t.test(), which was briefly introduced in R Lab #5. This command can do more than calculated the 95% CI (see below for one-sample t.test), but you can have only the 95% CI output with t.test(x)$confint.

```
t.test(eyes)$conf.int
## [1] 8.471616 9.083940
## attr(,"conf.level")
## [1] 0.95
```

This tells us that, based on our sample, we are 95% confident that the population mean eyespan is between 8.47 and 9.08 mm.

## One-sample *t*-test

In a one-sample *t*-test you have one sample of observations, and the null hypothesis is the sample mean is equal to some a priori value. The test uses the sample mean, standard error of the sample mean, sample size (degrees of freedom), and the *t*-distribution to calculate a P-value.

### One-sample *t*-test: human body temp example

Chapter 11 provides an example of the one-sample *t*-test by testing if a sample of body temperatures has a mean of 98.6 degrees F.

Import data and view structure of data frame:

```
bt <- read.csv("chap11e3Temperature.csv")
str(bt)
## 'data.frame':    25 obs. of  2 variables:
##  $ individual : int  1 2 3 4 5 6 7 8 9 10 ...
##  $ temperature: num  98.4 98.6 97.8 98.8 97.9 99 98.2 98.8 98.8 99 ...
```

We can see that the sample has 25 observations, with numeric values stored as $temperature.

Now we can use t.test() to run a one-sample *t*-test. The command takes two arguements: the vector of observations (x) and the hypothesized mean (mu):

```
t.test(bt$temperature, mu = 98.6)
##
##  One Sample t-test
##
## data:  bt$temperature
## t = -0.56065, df = 24, p-value = 0.5802
## alternative hypothesis: true mean is not equal to 98.6
## 95 percent confidence interval:
##  98.24422 98.80378
## sample estimates:
## mean of x
##    98.524
```

By default a two-sided test is run. That is, the alternative is that the mean does not equal 98.6. Here the *P*-value is 0.5802. This is above an alpha of 0.05, and thus we fail to reject the null hypothesis that mean body temperature is 98.6 degrees F.

Notice that the 95% CI of the mean is also reported in the output, which is the same that you would get with `t.test(bt$temperature)$conf.int`

# R commands summary

- **One-sample t-test**
  - t.test(x,mu)