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April 3rd, 2024

Confidence intervals with the t-distribution

Problem 2

Using the R data set mtcars, construct a level 90% confidence interval for the mean horsepower of all cars (a) by direct computation and (b) using the t.test function. Confirm that your answers agree with one another.

Answer:

Using direct computation (a):

```
data(mtcars)

hp_mean <- mean(mtcars$hp)
hp_sd <- sd(mtcars$hp)
cl <- 0.9
hp_count <- nrow(mtcars)

t <- qt(((1 - cl) / 2),(hp_count - 1))
mu_lower <- hp_mean - (abs(t) * ((hp_sd) / sqrt(hp_count)))
mu_upper <- hp_mean + (abs(t) * ((hp_sd) / sqrt(hp_count)))

cat("The mean horsepower of cars represented in the dataset",
    "\n are between"
    ,mu_lower,"and",mu_upper,"horsepowers. With 90% confidency rate.")
```

```
The mean horsepower of cars represented in the dataset
 are between 126.1373 and 167.2377 horsepowers. With 90% confidency rate.
```

Using the t.test function (b):

```
data(mtcars)

hp_mean <- mean(mtcars$hp)
hp_sd <- sd(mtcars$hp)
cl <- 0.9
```

```r
hp_count <- nrow(mtcars)

t_test <- t.test(mtcars$hp, conf.level = cl)
t_test_ci <- t_test$conf.int

cat("The mean horsepower of cars represented in the dataset",
    "\n are between"
    ,t_test_ci[1],"and",t_test_ci[2],"horsepowers. With 90% confidency rate.")
```

```
The mean horsepower of cars represented in the dataset
 are between 126.1373 and 167.2377 horsepowers. With 90% confidency rate.
```

We can verify our answer so:

```r
if((round(mu_lower,2) == round(t_test_ci[1],2) &&
    (round(mu_upper,2) == round(t_test_ci[2],2)))){
  cat("True")
}else{
  cat("False")
}
```

```
True
```

Problem 3

In a survey of 18 adults age 45-54, random individuals were asked how many minutes they spend eating breakfast each day. The results are:

24	17	26	33	21	38	24	13	41
17	15	19	12	29	19	24	31	15

Construct a level 99% confidence interval for the population mean (a) by direct computation and (b) using the t.test function. Confirm that your answers agree with one another.

Answer:

Inputing the data in R:

```r
x <- sort(c(24,17,17,15,26,19,33,12,21,29,38,19,24,24,13,31,41,15))
```

Using direct computation (a):

```
x_mean <- mean(x)
x_sd <- sd(x)
cl <- 0.99
x_count <- 18

t <- qt(((1 - cl) / 2),(x_count - 1))
mu_lower <- x_mean - (abs(t) * ((x_sd) / sqrt(x_count)))
mu_upper <- x_mean + (abs(t) * ((x_sd) / sqrt(x_count)))

cat("The mean time people spend eating breakfast each day",
    "\n is between"
    ,mu_lower,"and",mu_upper,"minutes With 99% confidency rate.")
```

```
The mean time people spend eating breakfast each day
 is between 17.4421 and 29.00235 minutes With 99% confidency rate.
```

Using the t.test function (b):

```
x_mean <- mean(x)
x_sd <- sd(x)
cl <- 0.99
x_count <- 18

t_test <- t.test(x, conf.level = cl)
t_test_ci <- t_test$conf.int

cat("The mean time people spend eating breakfast each day",
    "\n are between"
    ,t_test_ci[1],"and",t_test_ci[2],"minutes With 99% confidency rate.")
```

```
The mean time people spend eating breakfast each day
 are between 17.4421 and 29.00235 minutes With 99% confidency rate.
```

We can verify our answer so:

```
if((round(mu_lower,2) == round(t_test_ci[1],2) &&
    (round(mu_upper,2) == round(t_test_ci[2],2)))){
  cat("True")
```

```
}else{
  cat("False")
}
```

```
True
```