2448030\_MDS272\_L5.R

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##Q1  
# Load dataset and conduct test  
data(sleep)  
t\_test\_result = t.test(sleep$extra, mu = 0)  
  
# Critical value  
alpha = 0.05  
df = length(sleep$extra) - 1  
critical\_value = qt(1 - alpha/2, df)  
  
# Display results  
list(t\_test\_result = t\_test\_result, critical\_value = critical\_value)

## $t\_test\_result  
##   
## One Sample t-test  
##   
## data: sleep$extra  
## t = 3.413, df = 19, p-value = 0.002918  
## alternative hypothesis: true mean is not equal to 0  
## 95 percent confidence interval:  
## 0.5955845 2.4844155  
## sample estimates:  
## mean of x   
## 1.54   
##   
##   
## $critical\_value  
## [1] 2.093024

##Q2  
# Load data  
data(airquality)  
  
# Normality tests  
shapiro\_temp = shapiro.test(airquality$Temp)  
shapiro\_wind = shapiro.test(airquality$Wind)  
  
# Variance test  
var\_test = var.test(airquality$Temp, airquality$Wind)  
  
# T-test  
t\_test\_airquality = t.test(airquality$Temp, airquality$Wind, var.equal = TRUE)  
  
# Critical value  
df = length(airquality$Temp) + length(airquality$Wind) - 2  
critical\_value = qt(1 - 0.05/2, df)  
  
list(shapiro\_temp = shapiro\_temp, shapiro\_wind = shapiro\_wind, var\_test = var\_test,  
 t\_test = t\_test\_airquality, critical\_value = critical\_value)

## $shapiro\_temp  
##   
## Shapiro-Wilk normality test  
##   
## data: airquality$Temp  
## W = 0.97617, p-value = 0.009319  
##   
##   
## $shapiro\_wind  
##   
## Shapiro-Wilk normality test  
##   
## data: airquality$Wind  
## W = 0.98575, p-value = 0.1178  
##   
##   
## $var\_test  
##   
## F test to compare two variances  
##   
## data: airquality$Temp and airquality$Wind  
## F = 7.2184, num df = 152, denom df = 152, p-value < 2.2e-16  
## alternative hypothesis: true ratio of variances is not equal to 1  
## 95 percent confidence interval:  
## 5.246117 9.932138  
## sample estimates:  
## ratio of variances   
## 7.21839   
##   
##   
## $t\_test  
##   
## Two Sample t-test  
##   
## data: airquality$Temp and airquality$Wind  
## t = 83.189, df = 304, p-value < 2.2e-16  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## 66.31811 69.53156  
## sample estimates:  
## mean of x mean of y   
## 77.882353 9.957516   
##   
##   
## $critical\_value  
## [1] 1.967798

##Q3  
# Define weights data  
weights\_before = c(209, 178, 169, 212, 180, 192, 158, 180, 170, 153, 183, 165, 201, 179, 243, 144)  
weights\_after = c(196, 171, 207, 177, 190, 159, 180, 164, 152, 179, 162, 199, 173, 231, 140, 159)  
  
# Paired t-test  
t\_test\_weights = t.test(weights\_before, weights\_after, paired = TRUE, conf.level = 0.99)  
  
# Critical value  
alpha = 0.01  
df = length(weights\_before) - 1  
critical\_value = qt(1 - alpha, df)  
  
list(t\_test\_weights = t\_test\_weights, critical\_value = critical\_value)

## $t\_test\_weights  
##   
## Paired t-test  
##   
## data: weights\_before and weights\_after  
## t = 0.51007, df = 15, p-value = 0.6174  
## alternative hypothesis: true mean difference is not equal to 0  
## 99 percent confidence interval:  
## -22.98962 32.61462  
## sample estimates:  
## mean difference   
## 4.8125   
##   
##   
## $critical\_value  
## [1] 2.60248

##Q4  
# Two-tailed  
alpha = 0.05  
df = 15  
critical\_values\_2\_tailed = c(qt(alpha / 2, df), qt(1 - alpha / 2, df));critical\_values\_2\_tailed

## [1] -2.13145 2.13145

# Single-tailed  
critical\_value\_1\_tailed = qt(1 - alpha, df);critical\_value\_1\_tailed

## [1] 1.75305