

Note: Submit the assignment online through [Moodle](#) either in .doc or .pdf format. Your final report file should be named as “YourName_BT307_Lab5_22022024”. Make sure that your name and roll numbers are written at the first page of your final report. Note that you can upload only one file; thus, put together all the answers in a single file.

Goal of this exercise is to learn about the basics of the hypothesis testing in R.

(1) ##### Confidence interval for the mean #####

```
x <- rnorm(50, mean = 10, sd = 2)
t.test(x, conf.level = 0.95)$conf.int
```

(2) ##### Confidence interval for the proportion #####

```
x <- c(15, 25)
n <- c(50, 50)
binom.test(x, n, conf.level = 0.95)$conf.int
```

(3) ##### One-sample t-test #####

```
data <- c(12, 10, 15, 14, 18, 20, 11, 9, 17, 13)
t.test(data, mu = 15)
```

- (a) State your null and alternative hypotheses.
- (b) Did you reject or fail to reject the null hypothesis?
- (c) What is the reason of your answer to the previous question?

(4) ##### Two-sample t-test #####

```
group1 <- c(12, 10, 15, 14, 18, 20, 11, 9, 17, 13)
group2 <- c(18, 17, 19, 20, 22, 21, 25, 28, 29, 24)
t.test(group1, group2)
```

- (a) State your null and alternative hypotheses.
- (b) Did you reject or fail to reject the null hypothesis?
- (c) What is the reason of your answer to the previous question?

(5) ##### Paired t-test #####

```
pre_treatment <- c(12, 10, 15, 14, 18, 20, 11, 9, 17, 13)
post_treatment <- c(14, 12, 17, 16, 20, 22, 13, 11, 19, 10)
t.test(pre_treatment, post_treatment, paired = TRUE)
```

- (a) State your null and alternative hypotheses.
- (b) Did you reject or fail to reject the null hypothesis?
- (c) What is the reason of your answer to the previous question?

(6) ##### Chi-squared test #####

```
data <- matrix(c(10, 20, 30, 40), nrow = 2, ncol = 2, byrow = TRUE)
chisq.test(data)
```

- (a) State your null and alternative hypotheses.
- (b) Did you reject or fail to reject the null hypothesis?
- (c) What is the reason of your answer to the previous question?

(7) ##### One-way ANOVA #####

```
install.packages("dplyr")
library(dplyr)
group1 <- c(5, 8, 6, 7, 5)
group2 <- c(3, 2, 4, 6, 4)
group3 <- c(9, 7, 8, 10, 11)

data <- data.frame(scores = c(group1, group2, group3),
                   group = factor(rep(
                     c("Group1", "Group2", "Group3"),
                     times = c(length(group1), length(group2), length(group3))
                   )))
anova_result <- aov(scores ~ group, data = data)
summary(anova_result)
```

- (a) State your null and alternative hypotheses.
- (b) Did you reject or fail to reject the null hypothesis?
- (c) What is the reason of your answer to the previous question?

(8) ##### Type I error #####

```
alpha <- 0.05
sample_size <- 30
num_simulations <- 10000
set.seed(123)
false_positives <- 0

for (i in 1:num_simulations) {
  sample1 <- rnorm(sample_size, mean = 0, sd = 1)
  sample2 <- rnorm(sample_size, mean = 0, sd = 1)

  test_result <- t.test(sample1, sample2)

  if (test_result$p.value < alpha) {
    false_positives <- false_positives + 1
  }
}

type1_error_rate <- false_positives / num_simulations
cat("Type I Error Rate:", type1_error_rate)
```

- (a) What is your opinion about the output?