Sri Lanka Institute of Information Technology

Lab Submission

Lab Sheet 09

IT24102699
Mummullage B.U.T

Probability and Statistics| IT2120

B.Sc. (Hons) in Information Technology

Self-Try Codes

1. Let's suppose that a student is interested in estimating how many memes their professors know and love. So they go to class, and every time a professor uses a new meme, they write it down. After a year of classes, the student has recorded the following meme counts, where each count corresponds to a single class they took:

   $$3, 7, 11, 0, 7, 0, 4, 5, 6, 2$$

   Test weather on average, professors know 3 memes at 5% level of significance.

IT24102699_Self_Try_Codes.R* | IT24102699.R

Source on Save | Run

```r
# IT24102699

# Mummullage B.U.T

# IT2120 - Probability and Statistics - Lab 08

getwd()
setwd("F:\\SLIIT\\_Year_02_\\Semester 01\\PS - Probability and Statistics\\Lab Practicals\\Lab 09\\IT24102699")
getwd()


## Question 01

# Since the true variance is unknown and sample size is less than 30,
# we can apply one sample t-test.
# Hypothesis: H0: u = 3 Vs H1: u = 3
# Consider 5% level of significance
# To run the one-sample t test, "t.test" command can be used as follows.
x<-c(3, 7, 11, 0, 7, 0, 4, 5, 6, 2)
t.test(x, mu = 3)

# P value approach will be used to get the conclusion of hypothesis testing.
# Conclusion: Since p value (0.2012) is greater than 0.05, do not reject H0 at 5% level of significance.
# Therefore, we can conclude that the true average number of memes that professors know is not
# significantly different from 3 (exactly equal to 3).

```

28:1 (Top Level)

Console | Terminal | Background Jobs

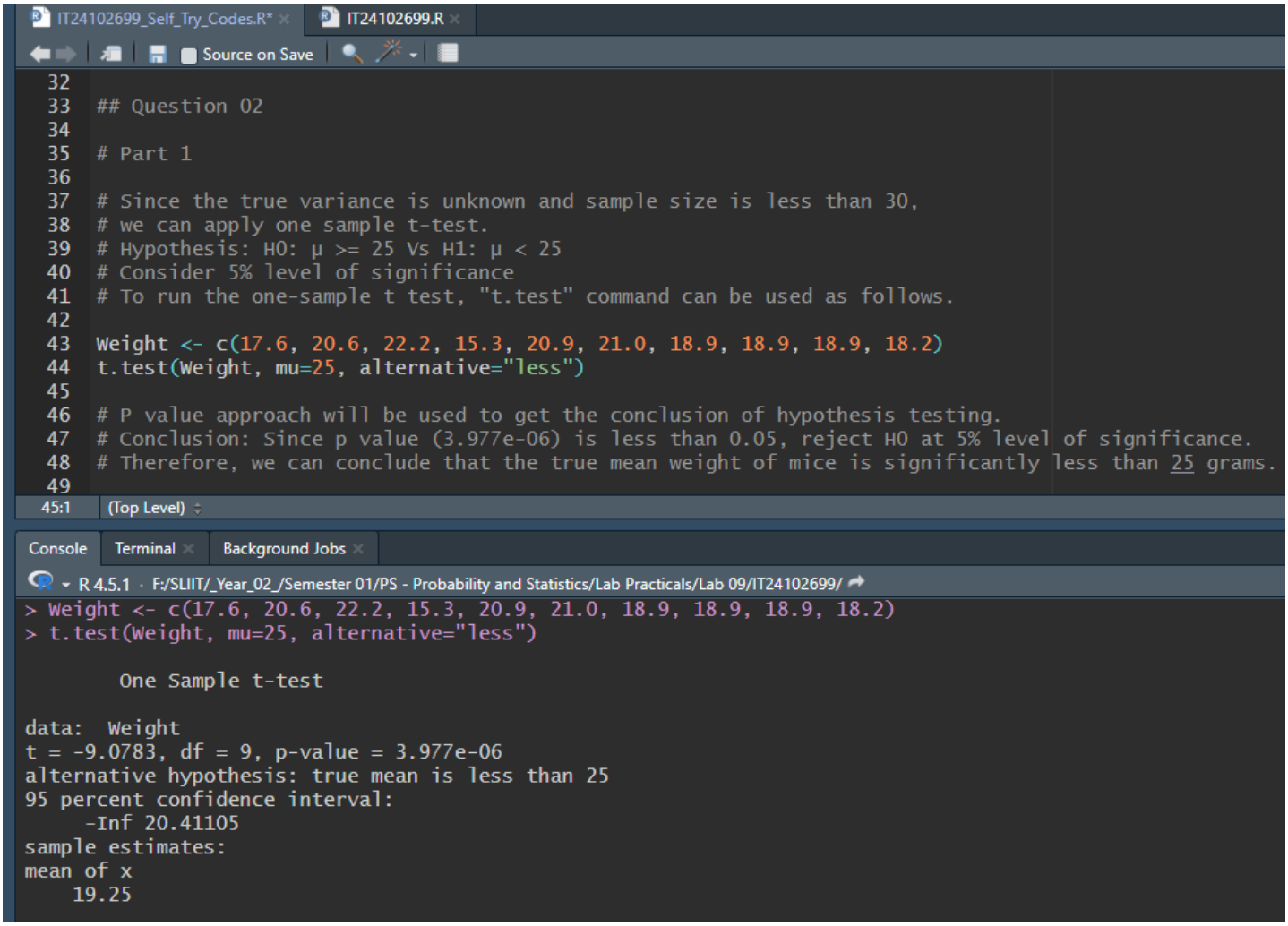
R 4.5.1 · F:/SLIIT/_Year_02_/Semester 01/PS - Probability and Statistics/Lab Practicals/Lab 09/IT24102699/

```
> x<-c(3, 7, 11, 0, 7, 0, 4, 5, 6, 2)
> t.test(x, mu = 3)

        One Sample t-test

data:  x
t = 1.3789, df = 9, p-value = 0.2012
alternative hypothesis: true mean is not equal to 3
95 percent confidence interval:
 2.0392 6.9608
sample estimates:
mean of x
      4.5
```

2. Let's consider the weight of 10 mice in gram:

$$17.6,\ 20.6,\ 22.2,\ 15.3,\ 20.9,\ 21.0,\ 18.9,\ 18.9,\ 18.9,\ 18.2.$$

i. Test whether the true mean weight of mice is less than 25g at 5% level of significance.



ii. Obtain the value of test statistic, p-value and confidence interval out of the test results separately using suitable R codes.

```
# Part 2
# To obtain each value separately, we need to store the results of the hypothesis testing into a variable.
# Accordingly, results were stored into "res" variable.
res <- t.test(Weight, mu=25, alternative="less")

# To extract test statistic, use "res$statistic" command as follows.
res$statistic

# To extract p value for the test, use "res$p.value" command as follows.
res$p.value

# To extract confidence interval for the test, use "res$conf.int" command as follows.
res$conf.int

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```

```
Console  Terminal  Background Jobs
R 4.5.1 · F:/SLIIT/_Year_02_/Semester 01/PS - Probability and Statistics/Lab Practicals/Lab 09/IT24102699/
> # Part 2
> # To obtain each value separately, we need to store the results of the hypothesis testing into a variable.
> # Accordingly, results were stored into "res" variable.
> res <- t.test(Weight, mu=25, alternative="less")
>
> # To extract test statistic, use "res$statistic" command as follows.
> res$statistic
        t
-9.078319
>
> # To extract p value for the test, use "res$p.value" command as follows.
> res$p.value
[1] 3.976692e-06
>
> # To extract confidence interval for the test, use "res$conf.int" command as follows.
> res$conf.int
[1]     -Inf 20.41105
attr(,"conf.level")
[1] 0.95
>
```

3. The Sugar level of a Cookie follows a normal distribution with mean 9.8 and the standard deviation 0.05. Let's take a sample of size 30.

   i. Generate 30 random numbers (sugar levels) from the above distribution.

```
## Question 03

# Part 1

# To generate random numbers from a Normal distribution, we can use "rnorm" command as follows.
y <- rnorm(30, mean = 9.8, sd = 0.05)

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```

```
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R 4.5.1 · F:/SLIIT/_Year_02_/Semester 01/PS - Probability and Statistics/Lab Practicals/Lab 09/IT24102699/
> ## Question 03
>
> # Part 1
>
> # To generate random numbers from a Normal distribution, we can use "rnorm" command as follows.
> y <- rnorm(30, mean = 9.8, sd = 0.05)
>
```
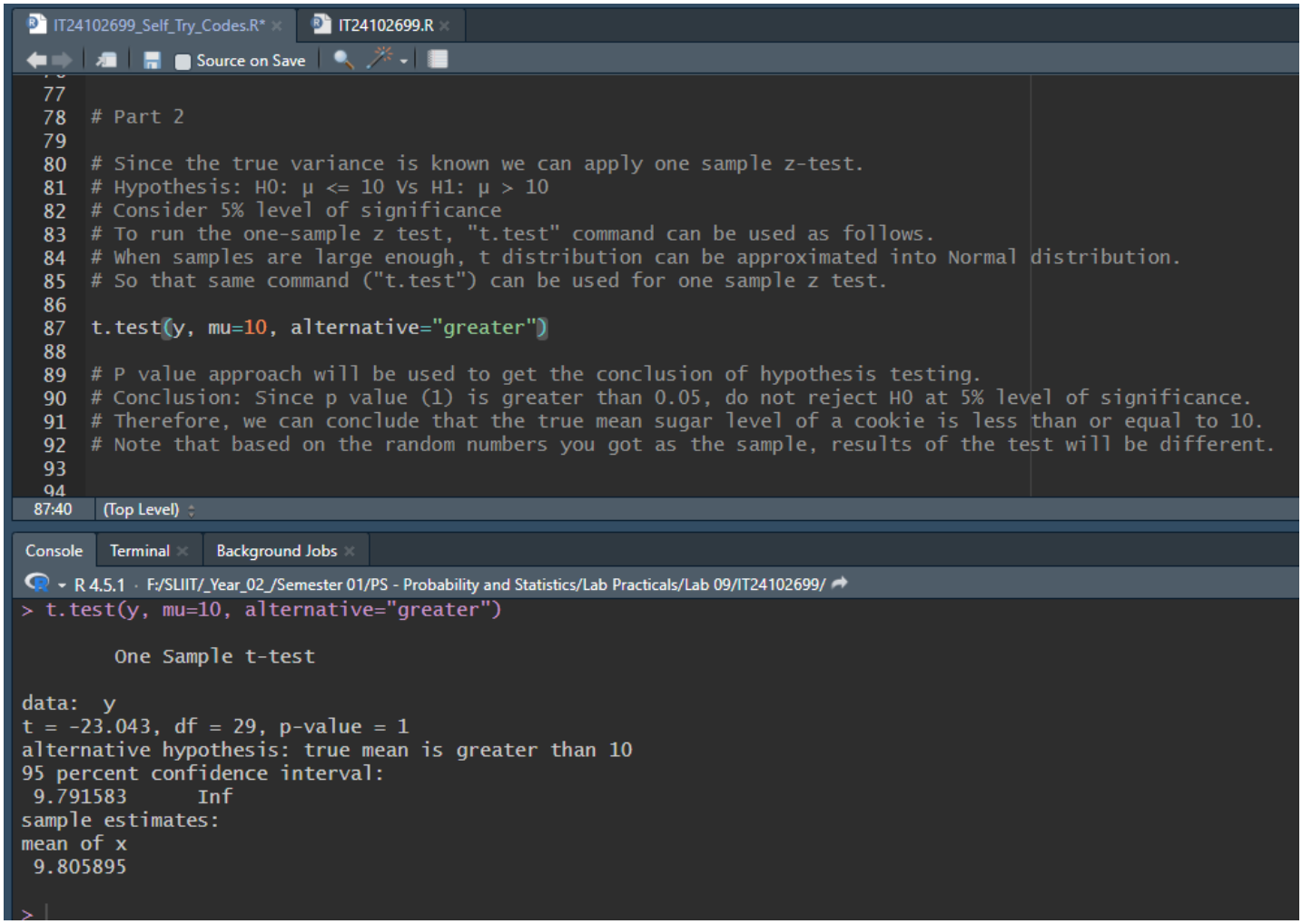

ii. Test whether the mean sugar level of the Cookies is greater than 10 at 5% level of significance.



```
IT24102699_Self_Try_Codes.R*   IT24102699.R
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77
78  # Part 2
79
80  # Since the true variance is known we can apply one sample z-test.
81  # Hypothesis: H0: μ <= 10 Vs H1: μ > 10
82  # Consider 5% level of significance
83  # To run the one-sample z test, "t.test" command can be used as follows.
84  # When samples are large enough, t distribution can be approximated into Normal distribution.
85  # So that same command ("t.test") can be used for one sample z test.
86
87  t.test(y, mu=10, alternative="greater")
88
89  # P value approach will be used to get the conclusion of hypothesis testing.
90  # Conclusion: Since p value (1) is greater than 0.05, do not reject H0 at 5% level of significance.
91  # Therefore, we can conclude that the true mean sugar level of a cookie is less than or equal to 10.
92  # Note that based on the random numbers you got as the sample, results of the test will be different.
93
94
87:40  (Top Level)

Console   Terminal   Background Jobs
R 4.5.1 · F:/SLIIT/_Year_02_/Semester 01/PS - Probability and Statistics/Lab Practicals/Lab 09/IT24102699/
> t.test(y, mu=10, alternative="greater")

        One Sample t-test

data:  y
t = -23.043, df = 29, p-value = 1
alternative hypothesis: true mean is greater than 10
95 percent confidence interval:
 9.791583      Inf
sample estimates:
mean of x
 9.805895

>
```

Exercise

Instructions: Create a folder in your desktop with your registration number (Eg: "IT....."). You need to save the R script file and take screenshots of the command prompt with answers and save it in a word document inside the folder. Save both R script file and word document with your registration number (Eg: "IT....."). After you finish the exercise, zip the folder and upload the zip file to the submission link.

1. Assume that the time taken to bake a batch of cookies is normally distributed with mean 45 minutes and standard deviation 2 minutes.

   i. Generate a random sample of size 25 for the baking time.

   ii. Test whether the average baking time is less than 46 minutes at a 5% level of significance.

```
 8  setwd("F:\\SLIIT\\_Year_02_\\Semester 01\\PS - Probability and Statistics\\Lab Practicals\\Lab 09\\IT24102699")
 9  getwd()
10
11
12  # Exercise
13
14  # Part i
15
16  baking_times <- rnorm(25, mean = 45, sd = 2)
17  print(baking_times)
18
19
20  # Part ii
21
22  t.test(baking_times, mu = 46, alternative = "less")
23
```

23:1 (Top Level)

Console | Terminal | Background Jobs

R 4.5.1 · F:/SLIIT/_Year_02_/Semester 01/PS - Probability and Statistics/Lab Practicals/Lab 09/IT24102699/

```
>
> # Exercise
>
> # Part i
>
> baking_times <- rnorm(25, mean = 45, sd = 2)
> print(baking_times)
 [1] 44.97996 45.34064 43.44288 43.97647 43.67674 45.93679 40.96677 46.16282 45.00349 45.81906 41.83532 47.62596 43.42704 42.02320
[15] 42.98409 43.95436 45.33096 43.56644 45.17716 45.68700 43.58766 42.25269 44.77530 41.84349 42.33064
>
>
> # Part ii
>
> t.test(baking_times, mu = 46, alternative = "less")

        One Sample t-test

data:  baking_times
t = -5.844, df = 24, p-value = 2.503e-06
alternative hypothesis: true mean is less than 46
95 percent confidence interval:
     -Inf 44.63381
sample estimates:
mean of x
 44.06828
```