Sri Lanka Institute of Information Technology

Lab Submission 09

IT24102218

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Probability and Statistics - IT2120

B.Sc. (Hons) in Information Technology

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.

```
setwd("C:\\Users\\User\\Desktop\\IT24102218")

## (01)
x <- c(3, 7, 11, 0, 7, 0, 4, 5, 6, 2)
t.test(x, mu = 3)
```

```
> setwd("C:\\Users\\User\\Desktop\\IT24102218")
> 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.

```r
## (02)
# (i)
Weight <- c(17.6, 20.6, 22.2, 15.3, 20.9, 21.0, 18.9, 18.9, 18.9, 18.2)
t.test(Weight, mu = 25, alternative = "less")
# (ii)
res <- t.test(Weight, mu = 25, alternative = "less")
res$statistic
res$p.value
res$conf.int
```

```
> ## (02)
> # (i)
> Weight <- c(17.6, 20.6, 22.2, 15.3, 20.9, 21.0, 18.9, 18.9, 18.9, 18.2)
> t.test(Weight, mu = 25, alternative = "less")

        One Sample t-test

data:  Weight
t = -9.0783, df = 9, p-value = 3.977e-06
alternative hypothesis: true mean is less than 25
95 percent confidence interval:
     -Inf 20.41105
sample estimates:
mean of x
    19.25

> # (ii)
> res <- t.test(Weight, mu = 25, alternative = "less")
> res$statistic
        t
-9.078319
> res$p.value
[1] 3.976692e-06
> 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.

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

```r
## (03)
# (i)
y <- rnorm(30, mean = 9.8, sd = 0.05)
y
# (ii)
t.test(y, mu = 10, alternative = "greater")
```

```
> ## (03)
> # (i)
> y <- rnorm(30, mean = 9.8, sd = 0.05)
> y
 [1] 9.746830 9.810163 9.785576 9.842477 9.876849 9.846982 9.796930 9.748229 9.715433 9.740847 9.745904 9.802648
[13] 9.879876 9.824674 9.810172 9.790069 9.752522 9.743080 9.864004 9.758746 9.892029 9.708903 9.842546 9.755753
[25] 9.762489 9.792859 9.712873 9.788507 9.845507 9.790748
> # (ii)
> t.test(y, mu = 10, alternative = "greater")

        One Sample t-test

data:  y
t = -21.919, df = 29, p-value = 1
alternative hypothesis: true mean is greater than 10
95 percent confidence interval:
 9.776387      Inf
sample estimates:
mean of x
 9.792474
```