Sri Lanka Institute of Information Technology

Lab Submission

Lab Sheet 08

IT24102699
Mummullage B.U.T

Probability and Statistics| IT2120

B.Sc.(Hons) in Information Technology

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. Calculate the population mean and population standard deviation of the laptop bag weights.

```
 8
 9  getwd()
10  setwd("F:\\SLIIT\\_Year_02_\\Semester 01\\PS - Probability and Statistics\\Lab Practicals\\Lab 08\\IT24102699")
11  getwd()
12
13
14
15  # Question 01
16
17  laptops <- read.table("Exercise - LaptopsWeights.txt", header = TRUE)
18
19  attach(laptops)
20
21  pop_mean <- mean(Weight.kg.)
22  print(paste("Population Mean:", pop_mean))
23
24  n <- length(Weight.kg.)
25  pop_var <- var(Weight.kg.) * (n - 1) / n
26  pop_sd <- sqrt(pop_var)
27
28  print(paste("Population Standard Deviation:", pop_sd))
29
30
31
32
30:1  (Top Level)
```

```
Console  Terminal  Background Jobs
R 4.5.1 · F:/SLIIT/_Year_02_/Semester 01/PS - Probability and Statistics/Lab Practicals/Lab 08/IT24102699/
[1] "C:/Users/UsEr/Documents"
> setwd("F:\\SLIIT\\_Year_02_\\Semester 01\\PS - Probability and Statistics\\Lab Practicals\\Lab 08\\IT24102699")
> getwd()
[1] "F:/SLIIT/_Year_02_/Semester 01/PS - Probability and Statistics/Lab Practicals/Lab 08/IT24102699"
> laptops <- read.table("Exercise - LaptopsWeights.txt", header = TRUE)
> attach(laptops)
>
> pop_mean <- mean(Weight.kg.)
> print(paste("Population Mean:", pop_mean))
[1] "Population Mean: 2.468"
>
> n <- length(Weight.kg.)
> pop_var <- var(Weight.kg.) * (n - 1) / n
> pop_sd <- sqrt(pop_var)
>
> print(paste("Population Standard Deviation:", pop_sd))
[1] "Population Standard Deviation: 0.252885349516337"
>
```

2. Draw 25 random samples of size 6 (with replacement) and calculate the sample mean and sample standard deviation for each sample.

```r
# Question 02

sample_means <- c()
sample_sds <- c()

for (i in 1:25) {
  s <- sample(Weight.kg., size = 6, replace = TRUE)
  sample_means <- c(sample_means, mean(s))
  sample_sds <- c(sample_sds, sd(s))
}

results_table <- data.frame(
  Sample_Number = 1:25,
  Mean = sample_means,
  Standard_Deviation = sample_sds
)

print("25 Sample Means and Standard Deviations")
print(results_table)
```

46:34 (Top Level)

Console Terminal Background Jobs

R 4.5.1 · F:/SLIIT/_Year_02_/Semester 01/PS - Probability and Statistics/Lab Practicals/Lab 08

```
> # Question 02
>
> sample_means <- c()
> sample_sds <- c()
>
> for (i in 1:25) {
+   s <- sample(Weight.kg., size = 6, replace = TRUE)
+   sample_means <- c(sample_means, mean(s))
+   sample_sds <- c(sample_sds, sd(s))
+ }
>
> results_table <- data.frame(
+   Sample_Number = 1:25,
+   Mean = sample_means,
+   Standard_Deviation = sample_sds
+ )
```

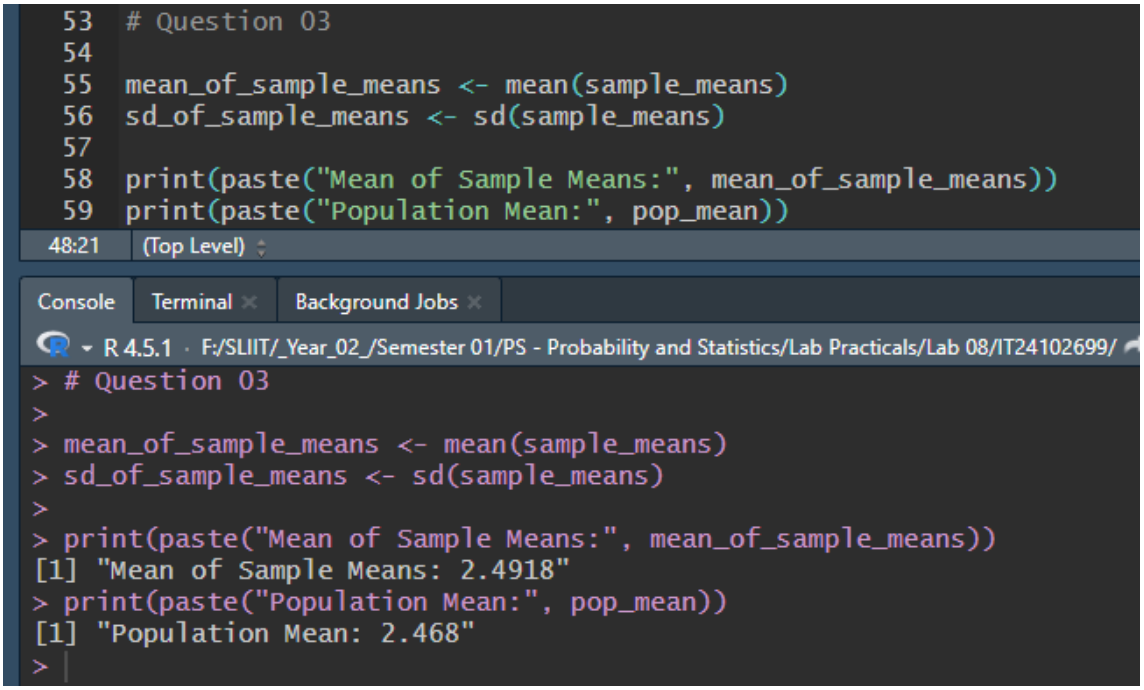
46:34 (Top Level)

Console Terminal Background Jobs

R 4.5.1 · F:/SLIIT/_Year_02_/Semester 01/PS - Probability and Statistics/Lab Practicals/Lab 08/IT24102699/

```
> print("25 Sample Means and Standard Deviations")
[1] "25 Sample Means and Standard Deviations"
> print(results_table)
   Sample_Number     Mean Standard_Deviation
1              1 2.490000          0.1181524
2              2 2.310000          0.3879691
3              3 2.415000          0.2864088
4              4 2.493333          0.2991098
5              5 2.635000          0.1578290
6              6 2.703333          0.1608312
7              7 2.443333          0.3929207
8              8 2.405000          0.1899210
9              9 2.603333          0.1684834
10            10 2.370000          0.2760435
11            11 2.545000          0.4104997
12            12 2.588333          0.1752046
13            13 2.551667          0.2428511
14            14 2.478333          0.2757112
15            15 2.565000          0.2078220
16            16 2.438333          0.2036091
17            17 2.620000          0.1979899
18            18 2.578333          0.1670230
19            19 2.410000          0.1862257
20            20 2.431667          0.2086544
21            21 2.650000          0.1050714
22            22 2.411667          0.1863778
23            23 2.420000          0.2836195
24            24 2.553333          0.1561623
25            25 2.521667          0.2563136
>
```

3. Calculate the mean and standard deviation of the 25 sample means and state the relationship of them with true mean and true standard deviation.

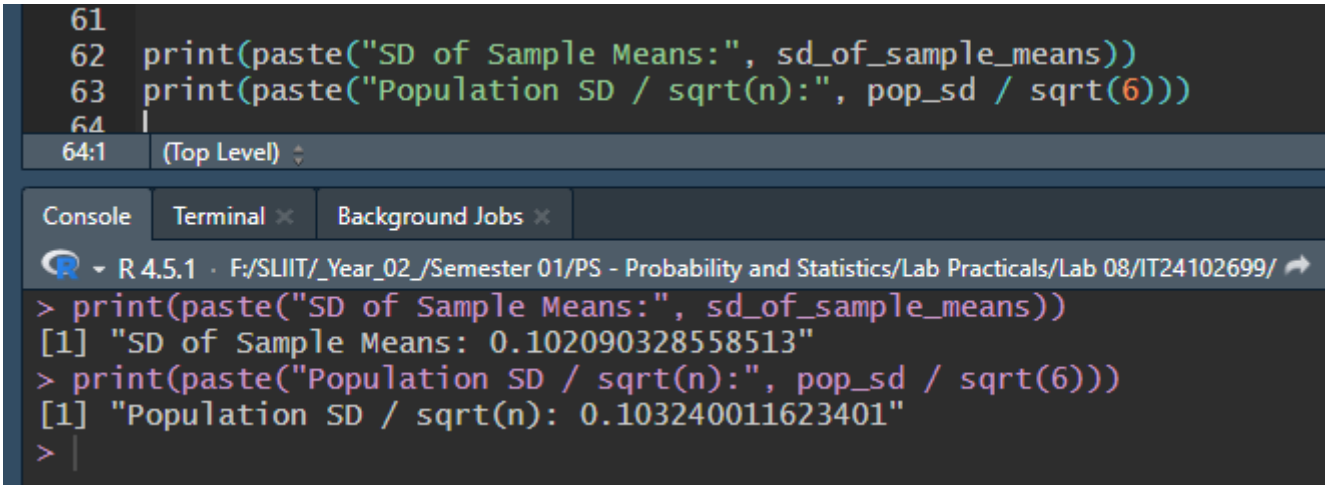


```
53  # Question 03
54
55  mean_of_sample_means <- mean(sample_means)
56  sd_of_sample_means <- sd(sample_means)
57
58  print(paste("Mean of Sample Means:", mean_of_sample_means))
59  print(paste("Population Mean:", pop_mean))
48:21  (Top Level)

Console  Terminal  Background Jobs
R 4.5.1 · F:/SLIIT/_Year_02_/Semester 01/PS - Probability and Statistics/Lab Practicals/Lab 08/IT24102699/
> # Question 03
>
> mean_of_sample_means <- mean(sample_means)
> sd_of_sample_means <- sd(sample_means)
>
> print(paste("Mean of Sample Means:", mean_of_sample_means))
[1] "Mean of Sample Means: 2.4918"
> print(paste("Population Mean:", pop_mean))
[1] "Population Mean: 2.468"
>
```

Relationship:

The mean of the sample means is approximately equal to the population mean.



```
61
62  print(paste("SD of Sample Means:", sd_of_sample_means))
63  print(paste("Population SD / sqrt(n):", pop_sd / sqrt(6)))
64
64:1  (Top Level)

Console  Terminal  Background Jobs
R 4.5.1 · F:/SLIIT/_Year_02_/Semester 01/PS - Probability and Statistics/Lab Practicals/Lab 08/IT24102699/
> print(paste("SD of Sample Means:", sd_of_sample_means))
[1] "SD of Sample Means: 0.102090328558513"
> print(paste("Population SD / sqrt(n):", pop_sd / sqrt(6)))
[1] "Population SD / sqrt(n): 0.103240011623401"
>
```

Relationship:

The standard deviation of the sample means is approximately equal to the population standard deviation divided by the square root of the sample size.

Self-Try Codes

1. Calculate population mean and variance of the dataset.

IT24102699.R | IT24102699_Self_Try_Codes.R

Source on Save

```
                                    # 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 08\\IT24102699")
getwd()



## Question 01 --- Calculate population mean and variance of the data set.

# Importing the data set
data <- read.table("Data - Lab 8.txt", header=TRUE)
attach(data)

# Calculate population mean and variance
popmn <- mean(Nicotine)
popvar <- var(Nicotine)

# Display the results
print(paste("Population Mean:", popmn))
print(paste("Population Variance:", popvar))
```

Console | Terminal | Background Jobs

R 4.5.1 · F:/SLIIT/_Year_02_/Semester 01/PS - Probability and Statistics/Lab Practicals/Lab 08/IT24102699/

```
> # IT24102699
>
> # Mummullage B.U.T
>
> # IT2120 - Probability and Statistics - Lab 08
>
>
>
> getwd()
[1] "F:/SLIIT/_Year_02_/Semester 01/PS - Probability and Statistics/Lab Practicals/Lab 08/IT24102699"
> setwd("F:\\SLIIT\\_Year_02_\\Semester 01\\PS - Probability and Statistics\\Lab Practicals\\Lab 08\\IT24102699")
> getwd()
[1] "F:/SLIIT/_Year_02_/Semester 01/PS - Probability and Statistics/Lab Practicals/Lab 08/IT24102699"
>
>
>
> ## Question 01 --- Calculate population mean and variance of the data set.
>
> # Importing the data set
> data <- read.table("Data - Lab 8.txt", header=TRUE)
> attach(data)
The following object is masked from data (pos = 3):

    Nicotine

The following object is masked from data (pos = 4):

    Nicotine

>
> # Calculate population mean and variance
> popmn <- mean(Nicotine)
> popvar <- var(Nicotine)
>
> # Display the results
> print(paste("Population Mean:", popmn))
[1] "Population Mean: 1.77425"
> print(paste("Population Variance:", popvar))
[1] "Population Variance: 0.152455833333333"
>
>
```

2. Get 30 random samples of size 5, with replacement and calculate sample mean and sample variance for each sample.

IT24102699.R | IT24102699_Self_Try_Codes.R

Source on Save

```r
## Question 02 --- Get 30 random samples of size 5, with replacement
                  # and calculate sample mean and sample variance for each sample

# Create empty vectors to store the samples and their means/variances
samples <- c()
s.means <- c()
s.vars <- c()

# Loop 30 times to get 30 samples
for (i in 1:30) {
  # Draw a random sample of size 5 with replacement
  s <- sample(Nicotine, 5, replace = TRUE)

  # Store the created sample in the 'samples' matrix
  samples <- cbind(samples, s)
}

# Calculate the mean for each sample (column)
s.means <- apply(samples, 2, mean)

# Calculate the variance for each sample (column)
s.vars <- apply(samples, 2, var)


# Display the means and variances for all 30 samples
results_table <- data.frame(
  Sample_Number = 1:30,
  Sample_Mean = s.means,
  Sample_Variance = s.vars
)
print(results_table)
```

R 4.5.1 · F:/SLIIT/_Year_02_/Semester 01/PS - Probability and Statistics/Lab Practicals/Lab 08/IT24102699/

```
> ## Question 02 --- Get 30 random samples of size 5, with replacement
>                   # and calculate sample mean and sample variance for each sample
>
> # Create empty vectors to store the samples and their means/variances
> samples <- c()
> s.means <- c()
> s.vars <- c()
>
> # Loop 30 times to get 30 samples
> for (i in 1:30) {
+   # Draw a random sample of size 5 with replacement
+   s <- sample(Nicotine, 5, replace = TRUE)
+
+   # Store the created sample in the 'samples' matrix
+   samples <- cbind(samples, s)
+ }
>
> # Calculate the mean for each sample (column)
> s.means <- apply(samples, 2, mean)
>
> # Calculate the variance for each sample (column)
> s.vars <- apply(samples, 2, var)
>
>
> # Display the means and variances for all 30 samples
> results_table <- data.frame(
+   Sample_Number = 1:30,
+   Sample_Mean = s.means,
+   Sample_Variance = s.vars
+ )
> print(results_table)
```

```
> print(results_table)
   Sample_Number Sample_Mean Sample_Variance
1              1       1.538          0.18597
2              2       1.476          0.18253
3              3       1.976          0.10448
4              4       1.646          0.20923
5              5       1.836          0.14068
6              6       2.008          0.14427
7              7       1.822          0.08077
8              8       1.948          0.13032
9              9       1.672          0.02007
10            10       1.854          0.18823
11            11       1.734          0.29608
12            12       1.716          0.00488
13            13       1.798          0.04482
14            14       1.952          0.15822
15            15       1.648          0.09237
16            16       1.920          0.10870
17            17       2.062          0.12877
18            18       1.334          0.12908
19            19       1.714          0.39423
20            20       1.770          0.03575
21            21       1.772          0.04457
22            22       1.876          0.11373
23            23       1.906          0.09163
24            24       1.696          0.07073
25            25       1.816          0.11248
26            26       1.860          0.02795
27            27       1.848          0.09432
28            28       1.666          0.06053
29            29       1.566          0.25393
30            30       1.718          0.14997
>
```

3. Calculate mean and variance of the Sample Means.

IT24102699.R | IT24102699_Self_Try_Codes.R

Source on Save

```
69
70  ## Question 03 --- Calculate mean and variance of the Sample Means.
71
72  # Calculate the mean of the 30 sample means
73  samplemean <- mean(s.means)
74
75  # Calculate the variance of the 30 sample means
76  samplevars <- var(s.means)
77
78
79  # Display the results
80  print(paste("Mean of the Sample Means:", samplemean))
81  print(paste("Variance of the Sample Means:", samplevars))
82
83
```

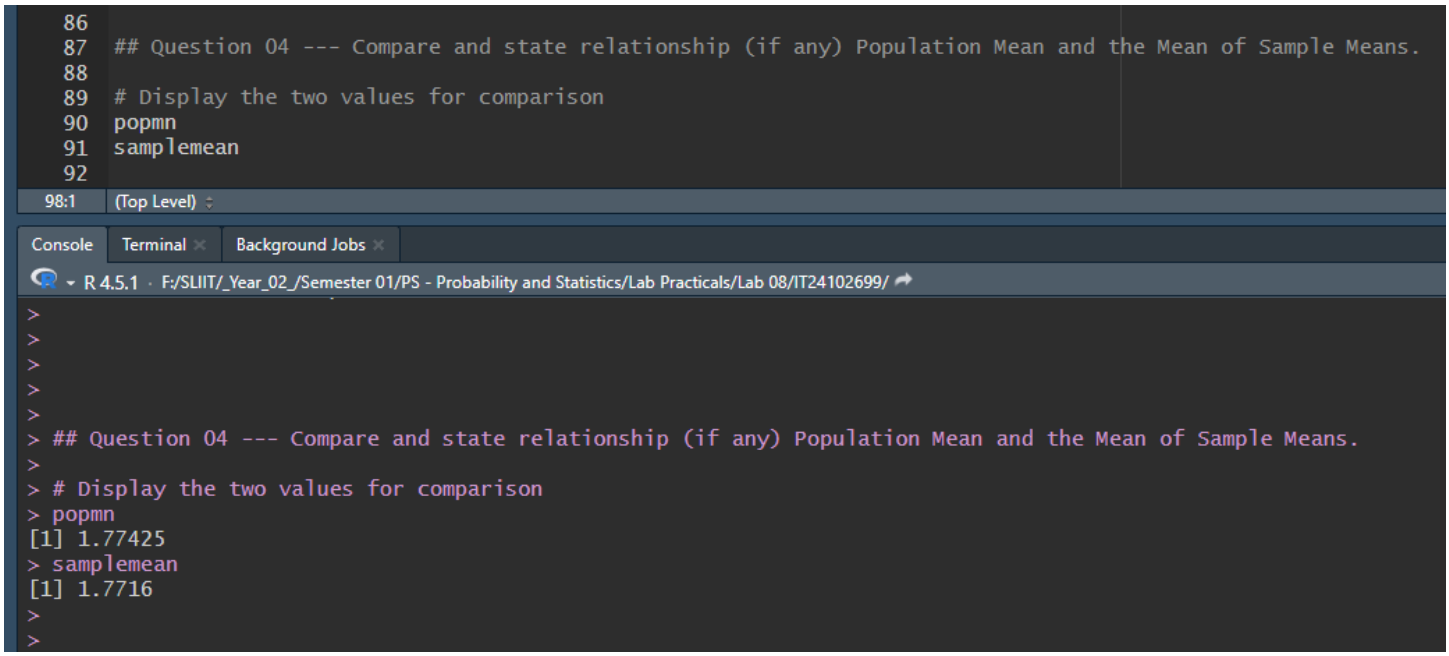
98:1 (Top Level)

Console | Terminal | Background Jobs

R 4.5.1 · F:/SLIIT/_Year_02_/Semester 01/PS - Probability and Statistics/Lab Practicals/Lab 08/IT24102699/

```
>
> ## Question 03 --- Calculate mean and variance of the Sample Means.
>
> # Calculate the mean of the 30 sample means
> samplemean <- mean(s.means)
>
> # Calculate the variance of the 30 sample means
> samplevars <- var(s.means)
>
>
> # Display the results
> print(paste("Mean of the Sample Means:", samplemean))
[1] "Mean of the Sample Means: 1.7716"
> print(paste("Variance of the Sample Means:", samplevars))
[1] "Variance of the Sample Means: 0.0265755586206896"
>
>
```

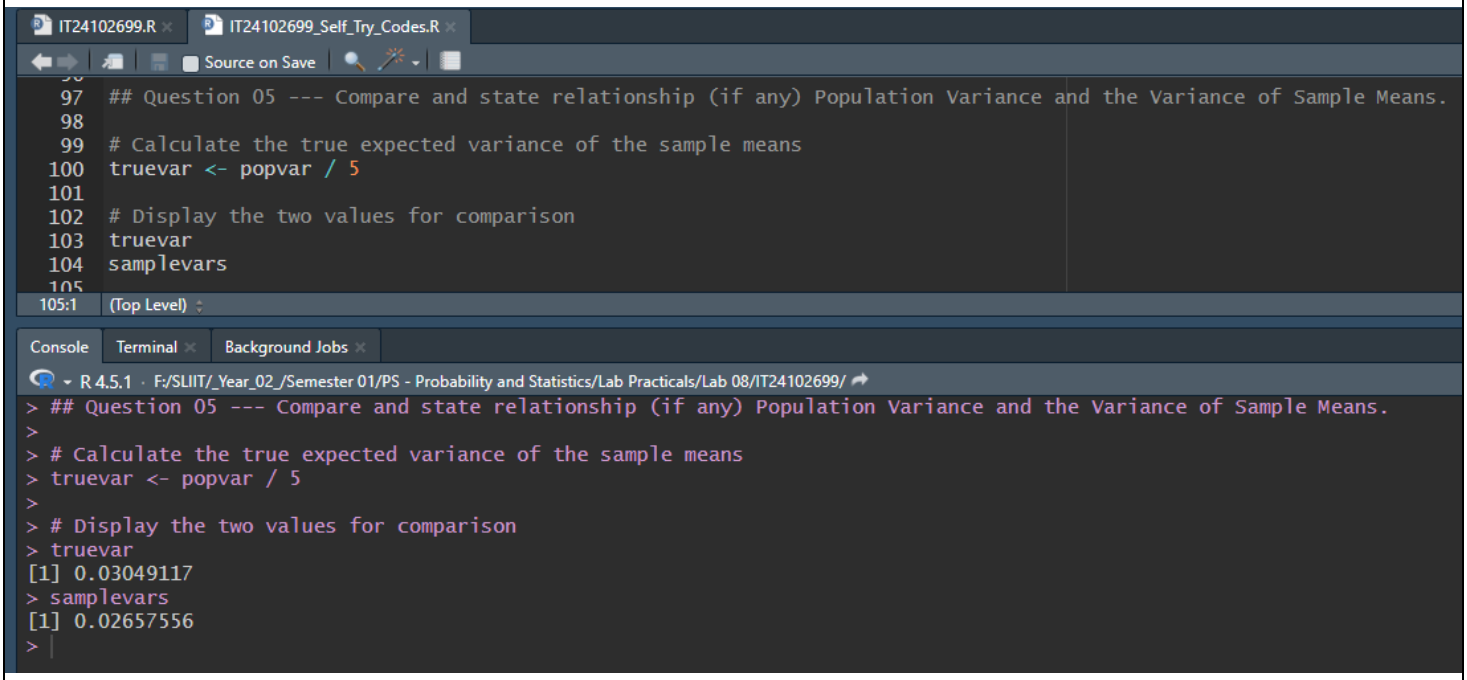
4. Compare and state relationship (if any) Population Mean and the Mean of Sample Means.



Relationship:

The mean of the sample means (samplemean) is approximately equal to the population mean (popmn). This demonstrates a key principle of the Central Limit Theorem.

5. Compare and state relationship (if any) Population Variance and the Variance of Sample Means.



Relationship:

The variance of the sample means (samplevars) is approximately equal to the population variance divided by the sample size, n (truevar). This shows that the distribution of sample means is less spread out than the population distribution.