SLIIT UNI
THE KNOWLEDGE UNIVERSITY

Faculty of Computing

Year 2 Semester 1 (2025)

IT2120 - Probability and Statistics Lab Sheet 08

Exercise

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

```
Source on Save                                                    Run
 1  setwd("C:\\Users\\ip\\OneDrive\\Desktop\\Lab 8")
 2
 3  # Q1
 4  # Laptop bag weights
 5  Weight <- c(2.46, 2.45, 2.47, 2.71, 2.46, 2.05, 2.6, 2.42, 2.43, 2.53,
 6              2.57, 2.85, 2.7, 2.53, 2.28, 2.2, 2.57, 2.89, 2.51, 2.47,
 7              2.66, 2.06, 2.41, 2.65, 2.76, 2.43, 2.61, 2.57, 2.73, 2.17,
 8              2.67, 2.05, 1.71, 2.32, 2.23, 2.76, 2.7, 2.13, 2.75, 2.2)
 9
10  # Population mean and standard deviation
11  pop_mean <- mean(Weight)
12  pop_sd <- sd(Weight)
13
14  pop_mean
15  pop_sd
16
```

```
R 4.5.1 · C:/Users/ip/OneDrive/Desktop/Lab 8/
> setwd("C:\\Users\\ip\\OneDrive\\Desktop\\Lab 8")
> # Q1
> # Laptop bag weights
> Weight <- c(2.46, 2.45, 2.47, 2.71, 2.46, 2.05, 2.6, 2.42, 2.43, 2.53,
+             2.57, 2.85, 2.7, 2.53, 2.28, 2.2, 2.57, 2.89, 2.51, 2.47,
+             2.66, 2.06, 2.41, 2.65, 2.76, 2.43, 2.61, 2.57, 2.73, 2.17,
+             2.67, 2.05, 1.71, 2.32, 2.23, 2.76, 2.7, 2.13, 2.75, 2.2)
> # Population mean and standard deviation
> pop_mean <- mean(Weight)
> pop_sd <- sd(Weight)
> pop_mean
[1] 2.468
> pop_sd
[1] 0.2561069
> # Q2
```

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

```r
# Q2
set.seed(123)  # For reproducibility

# Create a matrix with 6 rows (sample size), 25 columns (samples)
samples <- matrix(nrow = 6, ncol = 25)

# Fill matrix with random samples
for (i in 1:25) {
  samples[, i] <- sample(Weight, 6, replace = TRUE)
}

# Sample means and standard deviations
sample_means <- apply(samples, 2, mean)
sample_sds <- apply(samples, 2, sd)

# Create a table of results
sample_stats <- data.frame(
  Sample = 1:25,
  Mean = round(sample_means, 4),
  SD = round(sample_sds, 4)
)

print(sample_stats)
```

```
> # Q2
> set.seed(123)  # For reproducibility
> # Create a matrix with 6 rows (sample size), 25 columns (samples)
> samples <- matrix(nrow = 6, ncol = 25)
> # Fill matrix with random samples
> for (i in 1:25) {
+   samples[, i] <- sample(Weight, 6, replace = TRUE)
+ }
> # Sample means and standard deviations
> sample_means <- apply(samples, 2, mean)
> sample_sds <- apply(samples, 2, sd)
> # Create a table of results
> sample_stats <- data.frame(
+   Sample = 1:25,
+   Mean = round(sample_means, 4),
+   SD = round(sample_sds, 4)
+ )
> print(sample_stats)
```

```
> print(sample_stats)
   Sample   Mean     SD
1       1 2.5300 0.1514
2       2 2.5733 0.1191
3       3 2.4733 0.1719
4       4 2.5917 0.1345
5       5 2.4567 0.2749
6       6 2.4017 0.2544
7       7 2.5900 0.2167
8       8 2.4667 0.4530
9       9 2.4017 0.2230
10     10 2.3350 0.3238
11     11 2.5867 0.1706
12     12 2.3783 0.3236
13     13 2.3817 0.2994
14     14 2.4650 0.2315
15     15 2.4850 0.1746
16     16 2.4517 0.2763
17     17 2.3850 0.2042
18     18 2.3383 0.2437
19     19 2.4283 0.2481
20     20 2.5517 0.2654
21     21 2.5383 0.1708
22     22 2.4667 0.2452
23     23 2.4700 0.2406
24     24 2.4483 0.2792
25     25 2.4750 0.2359
```

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.

```
41
42  # Q3
43  # From previous steps
44  sample_mean_of_means <- mean(sample_means)
45  sample_sd_of_means <- sd(sample_means)
46
47  # Population SD from Q1 was:
48  # pop_s d = 0.2169 (already calculated)
49
50  # Sample size
51  n <- 6
52
53  # Theoretical SD of sample means
54  theoretical_sd_of_means <- pop_sd / sqrt(n)
55
56  # Print all
57  sample_mean_of_means
58  sample_sd_of_means
59  theoretical_sd_of_means
60
```

```
> # Q3
> # From previous steps
> sample_mean_of_means <- mean(sample_means)
> # Q3
> # From previous steps
> sample_mean_of_means <- mean(sample_means)
> sample_sd_of_means <- sd(sample_means)
> # Sample size
> n <- 6
> # Theoretical SD of sample means
> theoretical_sd_of_means <- pop_sd / sqrt(n)
> # Print all
> sample_mean_of_means
[1] 2.4668
> sample_sd_of_means
[1] 0.07624874
> theoretical_sd_of_means
[1] 0.1045552
>
```