Sri Lanka Institute of Information Technology

Lab Submission
Lab sheet 08

IT23746046

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Probability and Statistics| IT2120

B.Sc. (Hons) in Information Technology

Exercise

1. Calculate the population mean and population standard deviation of the laptop bag weights.
2. Draw 25 random samples of size 6 (with replacement) and calculate the sample mean and sample standard deviation for each sample.
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.

```r
nicotine <- scan("Data - Lab 8.txt", what = numeric(), skip = 1)
weights  <- scan("Exercise - LaptopsWeights.txt", what = numeric(), skip = 1)

pop_mean_nic <- mean(nicotine)

pop_var_nic  <- sum((nicotine - pop_mean_nic)^2) / length(nicotine)
pop_sd_nic   <- sqrt(pop_var_nic)

pop_mean_nic
pop_var_nic
pop_sd_nic
var(nicotine)
sd(nicotine)

set.seed(123)
nic_sample_means <- replicate(30, mean(sample(nicotine, size = 5, replace = TRUE)))
nic_sample_sds   <- replicate(30, sd(sample(nicotine, size = 5, replace = TRUE)))
```

```r
set.seed(123)
nic_sample_means <- replicate(30, mean(sample(nicotine, size = 5, replace = TRUE)))
nic_sample_sds   <- replicate(30, sd(sample(nicotine, size = 5, replace = TRUE)))

nic_sample_means
mean(nic_sample_means)
sd(nic_sample_means)

pop_sd_nic / sqrt(5)

pop_mean_w <- mean(weights)
pop_var_w  <- sum((weights - pop_mean_w)^2) / length(weights)
pop_sd_w   <- sqrt(pop_var_w)
```

```r
pop_mean_w
pop_var_w
pop_sd_w
var(weights)
sd(weights)
```

```
> sd(nicotine)
[1] 0.3904559
> set.seed(123)
> nic_sample_means <- replicate(30, mean(sample(nicotine, size = 5, replace = TRUE)))
> nic_sample_sds   <- replicate(30, sd(sample(nicotine, size = 5, replace = TRUE)))
> nic_sample_means
 [1] 1.886 1.782 2.034 1.518 2.046 1.688 1.772 1.638 1.716 1.850 1.598 1.848 1.604 1.800
[15] 1.916 2.116 1.606 1.594 1.884 2.124 1.590 1.562 1.836 1.744 1.494 1.542 1.854 1.914
[29] 1.834 1.538
> mean(nic_sample_means)
[1] 1.764267
> sd(nic_sample_means)
[1] 0.1811235
> pop_sd_nic / sqrt(5)
[1] 0.1724207
> pop_mean_w <- mean(weights)
> pop_var_w  <- sum((weights - pop_mean_w)^2) / length(weights)
> pop_sd_w   <- sqrt(pop_var_w)
> pop_mean_w
[1] 2.468
> pop_var_w
[1] 0.063951
> pop_sd_w
[1] 0.2528853
> var(weights)
[1] 0.06559077
```

```
set.seed(123)
w_sample_means <- replicate(25, mean(sample(weights, size = 6, replace = TRUE)))
w_sample_sds   <- replicate(25, sd(sample(weights, size = 6, replace = TRUE)))

w_sample_means
mean(w_sample_means)
sd(w_sample_means)

pop_sd_w / sqrt(6)

write.csv(data.frame(nicotine = nicotine), "nicotine_data.csv", row.names = FALSE)
write.csv(data.frame(weights = weights),  "weights_data.csv",  row.names = FALSE)
```

```
> sd(weights)
[1] 0.2561069
> set.seed(123)
> w_sample_means <- replicate(25, mean(sample(weights, size = 6, replace = TRUE)))
> w_sample_sds   <- replicate(25, sd(sample(weights, size = 6, replace = TRUE)))
> w_sample_means
 [1] 2.530000 2.573333 2.473333 2.591667 2.456667 2.401667 2.590000 2.466667 2.401667
[10] 2.335000 2.586667 2.378333 2.381667 2.465000 2.485000 2.451667 2.385000 2.338333
[19] 2.428333 2.551667 2.538333 2.466667 2.470000 2.448333 2.475000
> mean(w_sample_means)
[1] 2.4668
> sd(w_sample_means)
[1] 0.07624874
> pop_sd_w / sqrt(6)
[1] 0.10324
> write.csv(data.frame(nicotine = nicotine), "nicotine_data.csv", row.names = FALSE)
> write.csv(data.frame(weights = weights),  "weights_data.csv",  row.names = FALSE)
```

Values	
nic_sample_means	num [1:30] 1.89 1.78 2.03 1.52 2.05 ...
nic_sample_sds	num [1:30] 0.371 0.346 0.236 0.549 0.608 ...
nicotine	num [1:40] 1.09 1.74 1.58 2.11 1.64 1.79 1.3…
pop_mean_nic	1.77425
pop_mean_w	2.468
pop_sd_nic	0.385544339214052
pop_sd_w	0.252885349516337
pop_var_nic	0.1486444375
pop_var_w	0.063951
w_sample_means	num [1:25] 2.53 2.57 2.47 2.59 2.46 ...
w_sample_sds	num [1:25] 0.249 0.36 0.154 0.372 0.153 ...
weights	num [1:40] 2.46 2.45 2.47 2.71 2.46 2.05 2.6…