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IT24103522

Probability and Statistics

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

```
setwd("C:/Users/ROG/Desktop/IT24103522")
weights<-read.table("Exercise - LaptopsWeights.txt",header = TRUE, sep = ",")

#Q01
#Extract only the weight column
weights<-weights$Weight.kg.
# Population mean
pop_mean <- mean(weights)

# Population standard deviation
pop_sd <- sd(weights) * sqrt((length(weights)-1)/length(weights))

pop_mean
pop_sd
```

```
> setwd("C:/Users/ROG/Desktop/IT24103522")
> weights<-read.table("Exercise - LaptopsWeights.txt",header = TRUE, sep = ",")
>
> #Q01
> #Extract only the weight column
> weights<-weights$Weight.kg.
> # Population mean
> pop_mean <- mean(weights)
>
> # Population standard deviation
> pop_sd <- sd(weights) * sqrt((length(weights)-1)/length(weights))
>
> pop_mean
[1] 2.468
> pop_sd
[1] 0.2528853
```

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

```r
#Q02
#Generate 25 random samples of size 6
set.seed(123)

sample_means <- numeric(25)
sample_sds <- numeric(25)

for (i in 1:25) {
  samp_data <- sample(weights, size = 6, replace = TRUE)
  sample_means[i] <- mean(samp_data)
  sample_sds[i] <- sd(samp_data)
}

# Show results
sample_means
sample_sds
```

```
> #Q02
> #Generate 25 random samples of size 6
> set.seed(123)
>
> sample_means <- numeric(25)
> sample_sds <- numeric(25)
>
> for (i in 1:25) {
+   samp_data <- sample(weights, size = 6, replace = TRUE)
+   sample_means[i] <- mean(samp_data)
+   sample_sds[i] <- sd(samp_data)
+ }
>
> # Show results
> sample_means
 [1] 2.530000 2.573333 2.473333 2.591667 2.456667 2.401667 2.590000 2.466667 2.401667 2.335000 2.586667 2.378333
[13] 2.381667 2.465000 2.485000 2.451667 2.385000 2.338333 2.428333 2.551667 2.538333 2.466667 2.470000 2.448333
[25] 2.475000
> sample_sds
 [1] 0.1513935 0.1191078 0.1718914 0.1345239 0.2749303 0.2544340 0.2167026 0.4530195 0.2230172 0.3237746
[11] 0.1706068 0.3235686 0.2993604 0.2314951 0.1745566 0.2762909 0.2042303 0.2436733 0.2481465 0.2654367
[21] 0.1708118 0.2451666 0.2405826 0.2792430 0.2358601
```

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
#Q03
# Mean of sample means
mean_of_means <- mean(sample_means)

# Standard deviation of sample means
sd_of_means <- sd(sample_means)

mean_of_means
sd_of_means

# Relationship:
# - mean_of_means = population mean
# - sd_of_means = population_sd / sqrt(sample_size)
```

```
> #Q03
> # Mean of sample means
> mean_of_means <- mean(sample_means)
>
> # Standard deviation of sample means
> sd_of_means <- sd(sample_means)
>
> mean_of_means
[1] 2.4668
> sd_of_means
[1] 0.07624874
>
> # Relationship:
> # - mean_of_means = population mean
> # - sd_of_means = population_sd / sqrt(sample_size)
```

Values

i	25L
mean_of_means	2.4668
pop_mean	2.468
pop_sd	0.252885349516337
prob_at_least_47	0.0460465788923019
prob_exactly_15	0.0723911201466387
samp_data	num [1:6] 2.57 2.42 2.66 2.45 2.7 2.05
sample_means	num [1:25] 2.53 2.57 2.47 2.59 2.46 ...
sample_sds	num [1:25] 0.151 0.119 0.172 0.135 0.275 ...
sd_of_means	0.0762487401231677
weights	num [1:40] 2.46 2.45 2.47 2.71 2.46 2.05 2.6 2.42 2.43 2.53 ...