IT2120 - Probability and Statistics

IT24103917

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Lab-08

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.

```r
getwd()
setwd("C:\\Users\\it24103917\\Desktop\\IT24103917")

data<-read.table("Exercise - LaptopsWeights.txt",header = TRUE)
attach(data)

#Q1:
pop_mean <- mean(Weight.kg.)
pop_sd <- sd(Weight.kg.)

print(paste("Population Mean:", pop_mean))
print(paste("Population Standard Deviation:", pop_sd))
```

```
> getwd()
[1] "C:/Users/it24103917/Desktop/IT24103917"
> setwd("C:\\Users\\it24103917\\Desktop\\IT24103917")
>
> data<-read.table("Exercise - LaptopsWeights.txt",header = TRUE)
> attach(data)
> pop_mean <- mean(Weight.kg.)
> pop_sd <- sd(Weight.kg.)
>
> print(paste("Population Mean:", pop_mean))
[1] "Population Mean: 2.468"
> print(paste("Population Standard Deviation:", pop_sd))
[1] "Population Standard Deviation: 0.256106948813907"
```

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

```r
#Q2:
samples <- c()
n_samples <- 25
sample_size <- 6

for (i in 1:n_samples) {
  s <- sample(Weight.kg., size = sample_size, replace = TRUE)
  samples <- cbind(samples, s)
}
colnames(samples) <- paste0("Sample_", 1:n_samples)
sample_means <- apply(samples, 2, mean)
sample_sds <- apply(samples, 2, sd)

print("Sample Means:")
print(sample_means)
print("Sample Standard Deviations:")
print(sample_sds)
```

```
> print("Sample Means:")
[1] "Sample Means:"
> print(sample_means)
 Sample_1  Sample_2  Sample_3  Sample_4  Sample_5  Sample_6  Sample_7 
 2.465000  2.631667  2.331667  2.466667  2.461667  2.611667  2.410000 
 Sample_8  Sample_9 Sample_10 Sample_11 Sample_12 Sample_13 Sample_14 
 2.446667  2.540000  2.531667  2.466667  2.531667  2.566667  2.293333 
Sample_15 Sample_16 Sample_17 Sample_18 Sample_19 Sample_20 Sample_21 
 2.426667  2.433333  2.326667  2.423333  2.451667  2.640000  2.400000 
Sample_22 Sample_23 Sample_24 Sample_25 
 2.516667  2.521667  2.603333  2.665000 
> print("Sample Standard Deviations:")
[1] "Sample Standard Deviations:"
> print(sample_sds)
  Sample_1   Sample_2   Sample_3   Sample_4   Sample_5   Sample_6 
0.17829750 0.12937027 0.36245919 0.43839100 0.34579859 0.14716204 
  Sample_7   Sample_8   Sample_9  Sample_10  Sample_11  Sample_12 
0.28975852 0.13485795 0.21456934 0.20778996 0.23226422 0.20341255 
 Sample_13  Sample_14  Sample_15  Sample_16  Sample_17  Sample_18 
0.16729216 0.33547976 0.24138489 0.25912674 0.15448840 0.30183881 
 Sample_19  Sample_20  Sample_21  Sample_22  Sample_23  Sample_24 
0.28024394 0.10430724 0.38652296 0.15845083 0.19114567 0.15731073 
 Sample_25 
0.09648834 
```

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
#Q3;
#Calculate the mean and standard deviation of the 25 sample means
# and state the relationship of them with true mean and true standard deviation.
mean_of_sample_means <- mean(sample_means)
sd_of_sample_means <- sd(sample_means)

print(paste("Mean of Sample Means:", mean_of_sample_means))
print(paste("Standard Deviation of Sample Means (Standard Error):", sd_of_sample_means))

# Compare and state the relationship
# The theoretical standard deviation of the sample means is pop_sd / sqrt(sample_size)
theoretical_sd_of_means <- pop_sd / sqrt(sample_size)

print("--- Relationships ---")
print("Relationship between Population Mean and Mean of Sample Means:")
print(paste("Population Mean (", pop_mean, ") is approximately equal to the Mean of Sample Means (", mean_of_sample_means, ")"))

print("Relationship between Population Standard Deviation and Standard Deviation of Sample Means:")
print(paste("The Standard Deviation of Sample Means (", sd_of_sample_means, ") is approximately equal to the Population Standard Deviation divided by the squa
```

```
> #Calculate the mean and standard deviation of the 25 sample means
> # and state the relationship of them with true mean and true standard deviation.
> 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: 2.48653333333333"
> print(paste("Standard Deviation of Sample Means (Standard Error):", sd_of_sample_means))
[1] "Standard Deviation of Sample Means (Standard Error): 0.0992808866018251"
>
> # Compare and state the relationship
> # The theoretical standard deviation of the sample means is pop_sd / sqrt(sample_size)
> theoretical_sd_of_means <- pop_sd / sqrt(sample_size)
>
> print("--- Relationships ---")
[1] "--- Relationships ---"
> print("Relationship between Population Mean and Mean of Sample Means:")
[1] "Relationship between Population Mean and Mean of Sample Means:"
> print(paste("Population Mean (", pop_mean, ") is approximately equal to the Mean of Sample Means (", mean_of_sample_means, ")"))
[1] "Population Mean ( 2.468 ) is approximately equal to the Mean of Sample Means ( 2.48653333333333 )"
>
> print("Relationship between Population Standard Deviation and Standard Deviation of Sample Means:")
[1] "Relationship between Population Standard Deviation and Standard Deviation of Sample Means:"
> print(paste("The Standard Deviation of Sample Means (", sd_of_sample_means, ") is approximately equal to the Population Standard Deviation divided by the square r
oot of the sample size (", theoretical_sd_of_means, ")"))
[1] "The Standard Deviation of Sample Means ( 0.0992808866018251 ) is approximately equal to the Population Standard Deviation divided by the square root of the sam
ple size ( 0.104555224029194 )"
```