|  |
| --- |
| # 1. Calculate population mean and variance of the dataset.  laptop\_bag\_weights <- read.table("LaptopsWeights.txt", header = TRUE)  names(laptop\_bag\_weights)[names(laptop\_bag\_weights) == "Weight.kg."] <- "Weight"  laptop\_bag\_weights\_mean <- mean(laptop\_bag\_weights$Weight)  laptop\_bag\_weights\_variance <- var(laptop\_bag\_weights$Weight)  cat("The population mean of laptop bag weights is:", laptop\_bag\_weights\_mean, "kg\n")  cat("The population variance of laptop bag weights is:", laptop\_bag\_weights\_variance, "kg²\n")  # 2. Draw 25 random samples of size 6 (with replacement) and calculate the sample mean and sample standard deviation for each sample.  laptop\_bag\_weights\_samples <- matrix(nrow = 6, ncol = 25)  for (i in 1:25) {  laptop\_bag\_weights\_samples[, i] <- sample(laptop\_bag\_weights$Weight, 6, replace = TRUE)  }  colnames(laptop\_bag\_weights\_samples) <- paste0(1:25)  laptop\_bag\_weights\_samples\_summary <- data.frame(  Sample = 1:25,  Mean = apply(laptop\_bag\_weights\_samples, 2, mean),  Standard\_Deviation = apply(laptop\_bag\_weights\_samples, 2, sd)  )  View(laptop\_bag\_weights\_samples\_summary)  # 3. Calculate the mean and standard deviation of the 25 sample means  sample\_means <- laptop\_bag\_weights\_samples\_summary$Mean  sample\_means\_mean <- mean(sample\_means)  sample\_means\_sd <- sd(sample\_means)  cat("The mean of the 25 sample means is:", sample\_means\_mean, "kg\n")  cat("The standard deviation of the 25 sample means is:", sample\_means\_sd, "kg\n")  # Interpretation  cat("Interpretation:\n")  cat("The mean of the sample means is close to the population mean (", laptop\_bag\_weights\_mean, "kg),\n",  "which illustrates the Law of Large Numbers — sample means tend to converge to the population mean.\n")  cat("The standard deviation of the sample means is smaller than the population standard deviation,\n",  "reflecting the Central Limit Theorem — variability decreases as we average over samples.\n") |
| > # 1. Calculate population mean and variance of the dataset.  > laptop\_bag\_weights <- read.table("LaptopsWeights.txt", header = TRUE)  > names(laptop\_bag\_weights)[names(laptop\_bag\_weights) == "Weight.kg."] <- "Weight"  >  > laptop\_bag\_weights\_mean <- mean(laptop\_bag\_weights$Weight)  > laptop\_bag\_weights\_variance <- var(laptop\_bag\_weights$Weight)  > cat("The population mean of laptop bag weights is:", laptop\_bag\_weights\_mean, "kg\n")  The population mean of laptop bag weights is: 2.468 kg  > cat("The population variance of laptop bag weights is:", laptop\_bag\_weights\_variance, "kg²\n")  The population variance of laptop bag weights is: 0.06559077 kg²  >  > # 2. Draw 25 random samples of size 6 (with replacement) and calculate the sample mean and sample standard deviation for each sample.  > laptop\_bag\_weights\_samples <- matrix(nrow = 6, ncol = 25)  >  > for (i in 1:25) {  + laptop\_bag\_weights\_samples[, i] <- sample(laptop\_bag\_weights$Weight, 6, replace = TRUE)  + }  >  > colnames(laptop\_bag\_weights\_samples) <- paste0(1:25)  > laptop\_bag\_weights\_samples\_summary <- data.frame(  + Sample = 1:25,  + Mean = apply(laptop\_bag\_weights\_samples, 2, mean),  + Standard\_Deviation = apply(laptop\_bag\_weights\_samples, 2, sd)  + )  > View(laptop\_bag\_weights\_samples\_summary)  >  > # 3. Calculate the mean and standard deviation of the 25 sample means  > sample\_means <- laptop\_bag\_weights\_samples\_summary$Mean  > sample\_means\_mean <- mean(sample\_means)  > sample\_means\_sd <- sd(sample\_means)  >  > cat("The mean of the 25 sample means is:", sample\_means\_mean, "kg\n")  The mean of the 25 sample means is: 2.469133 kg  > cat("The standard deviation of the 25 sample means is:", sample\_means\_sd, "kg\n")  The standard deviation of the 25 sample means is: 0.0930441 kg  >  > # Interpretation  > cat("Interpretation:\n")  Interpretation:  > cat("The mean of the sample means is close to the population mean (", laptop\_bag\_weights\_mean, "kg),\n",  + "which illustrates the Law of Large Numbers — sample means tend to converge to the population mean.\n")  The mean of the sample means is close to the population mean ( 2.468 kg),  which illustrates the Law of Large Numbers — sample means tend to converge to the population mean.  > cat("The standard deviation of the sample means is smaller than the population standard deviation,\n",  + "reflecting the Central Limit Theorem — variability decreases as we average over samples.\n")  The standard deviation of the sample means is smaller than the population standard deviation,  reflecting the Central Limit Theorem — variability decreases as we average over samples. |