IT2120 - Probability and Statistics

Lab Sheet 08

IT24103555

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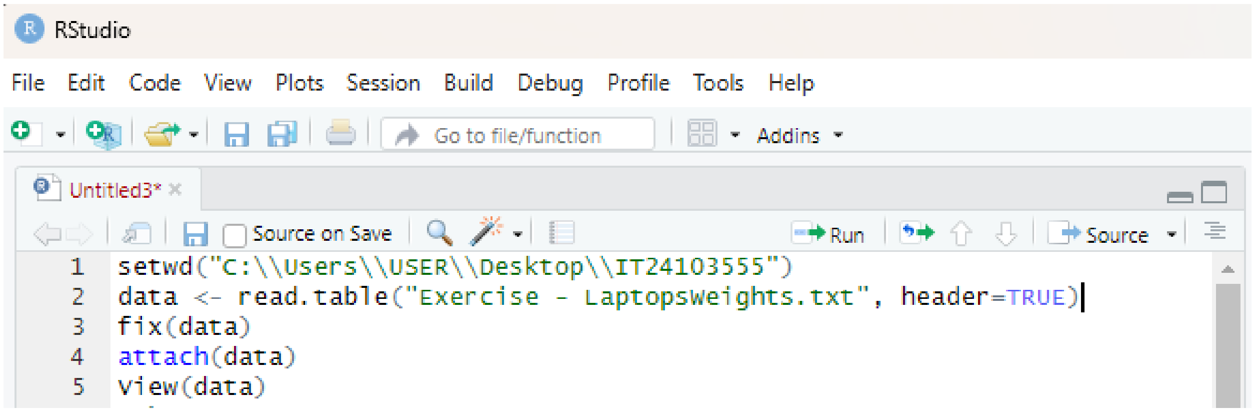
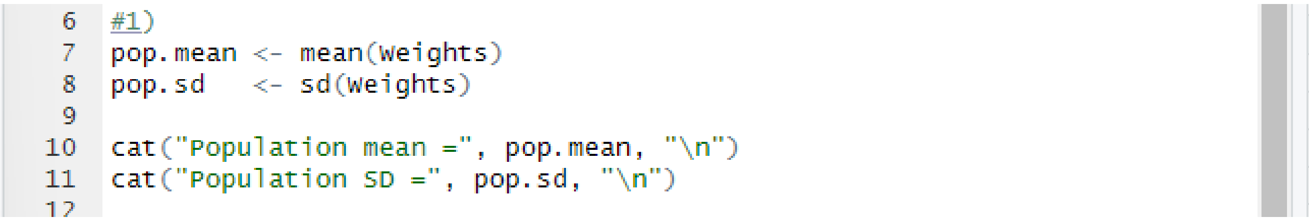
Exercise

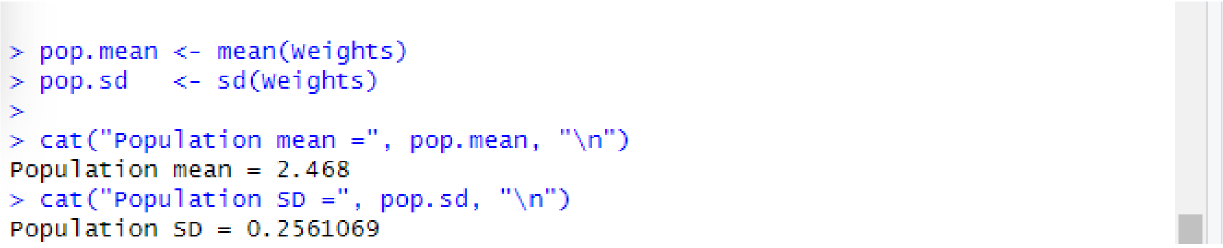


```
setwd("C:\\Users\\USER\\Desktop\\IT24103555")
data <- read.table("Exercise - LaptopsWeights.txt", header=TRUE)
fix(data)
attach(data)
View(data)
```

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

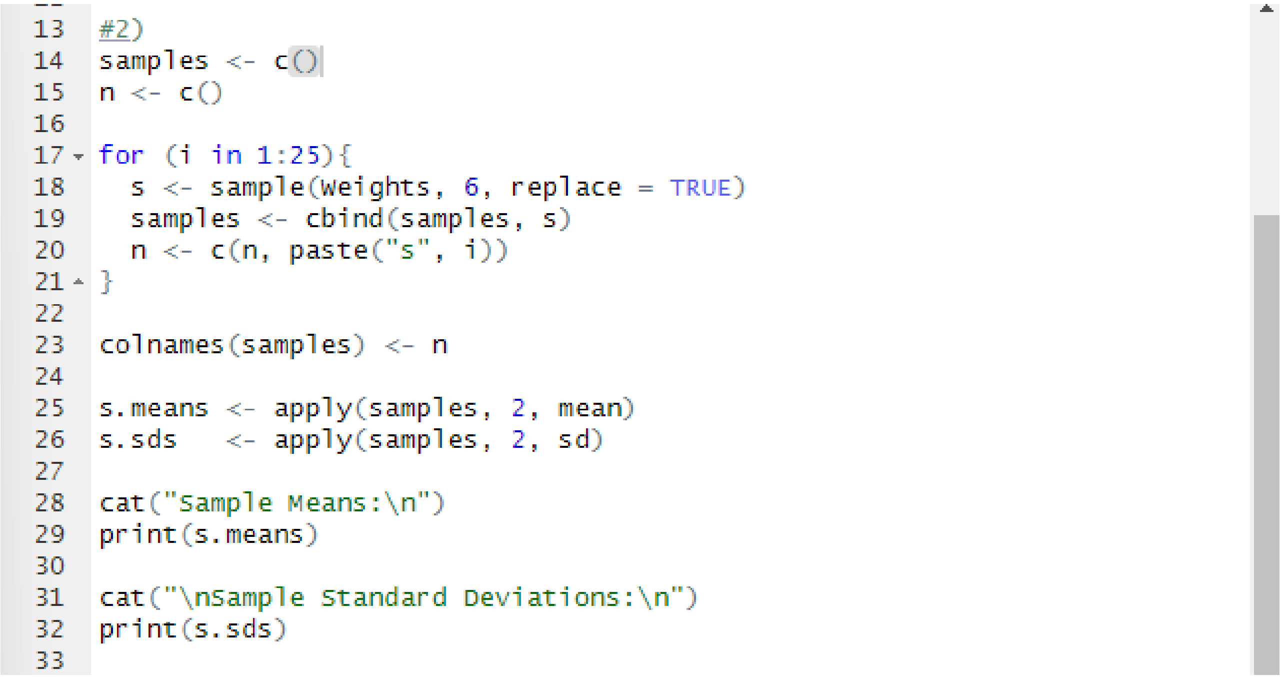


```
#1)
pop.mean <- mean(Weights)
pop.sd   <- sd(Weights)

cat("Population mean =", pop.mean, "\n")
cat("Population SD =", pop.sd, "\n")
```

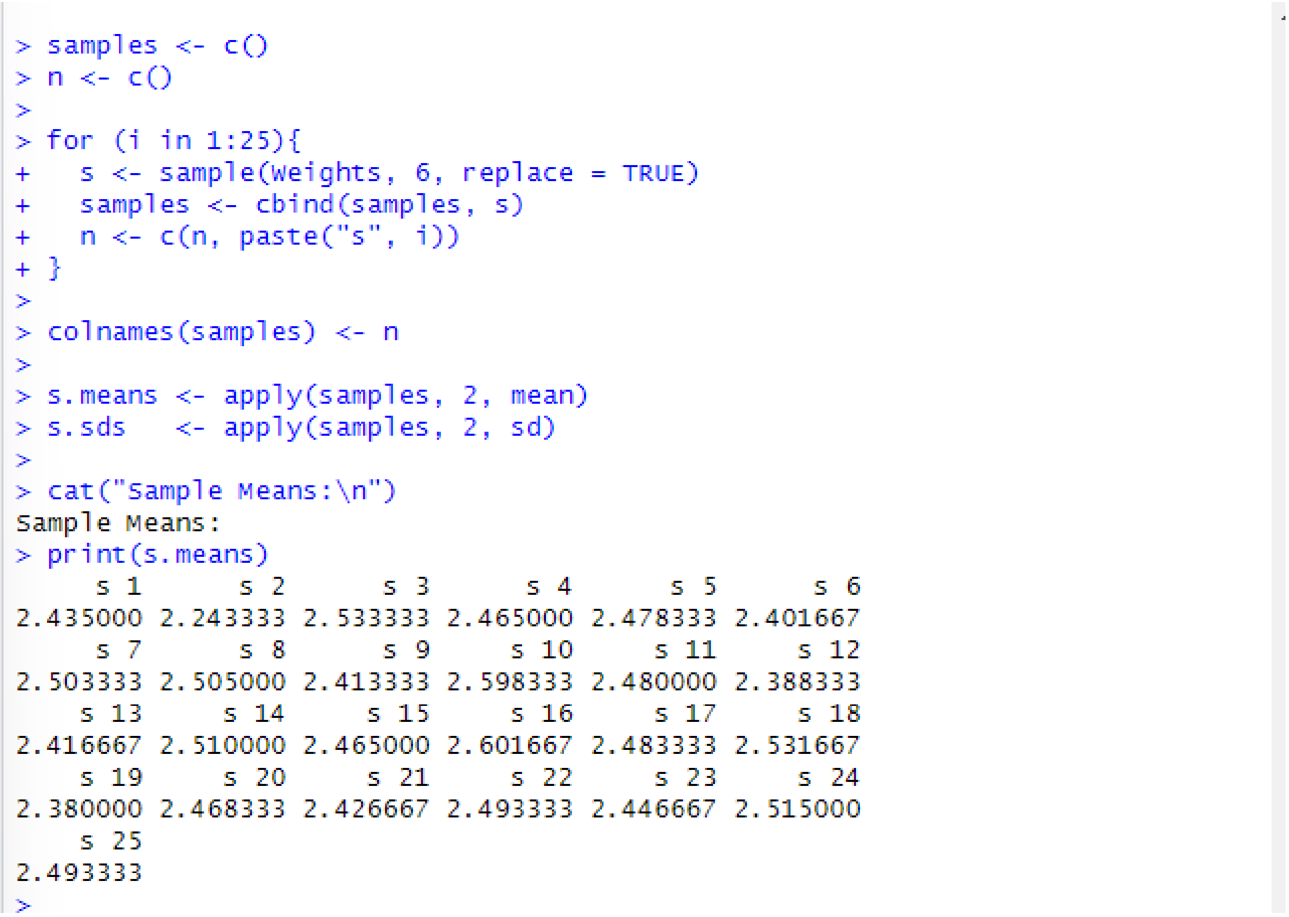


```
> pop.mean <- mean(Weights)
> pop.sd   <- sd(Weights)
>
> cat("Population mean =", pop.mean, "\n")
Population mean = 2.468
> cat("Population SD =", pop.sd, "\n")
Population SD = 0.2561069
```

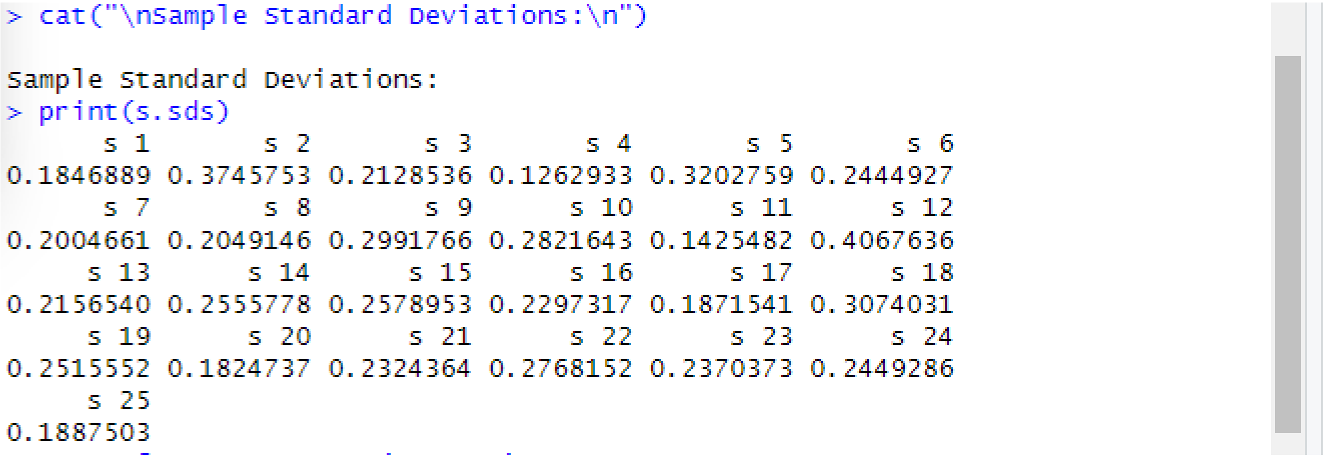
2. Draw 25 random samples of size 6 (with replacement) and calculate the sample mean and sample standard deviation for each sample.



```r
#2)
samples <- c()
n <- c()

for (i in 1:25){
  s <- sample(Weights, 6, replace = TRUE)
  samples <- cbind(samples, s)
  n <- c(n, paste("s", i))
}

colnames(samples) <- n

s.means <- apply(samples, 2, mean)
s.sds   <- apply(samples, 2, sd)

cat("Sample Means:\n")
print(s.means)

cat("\nSample Standard Deviations:\n")
print(s.sds)

```

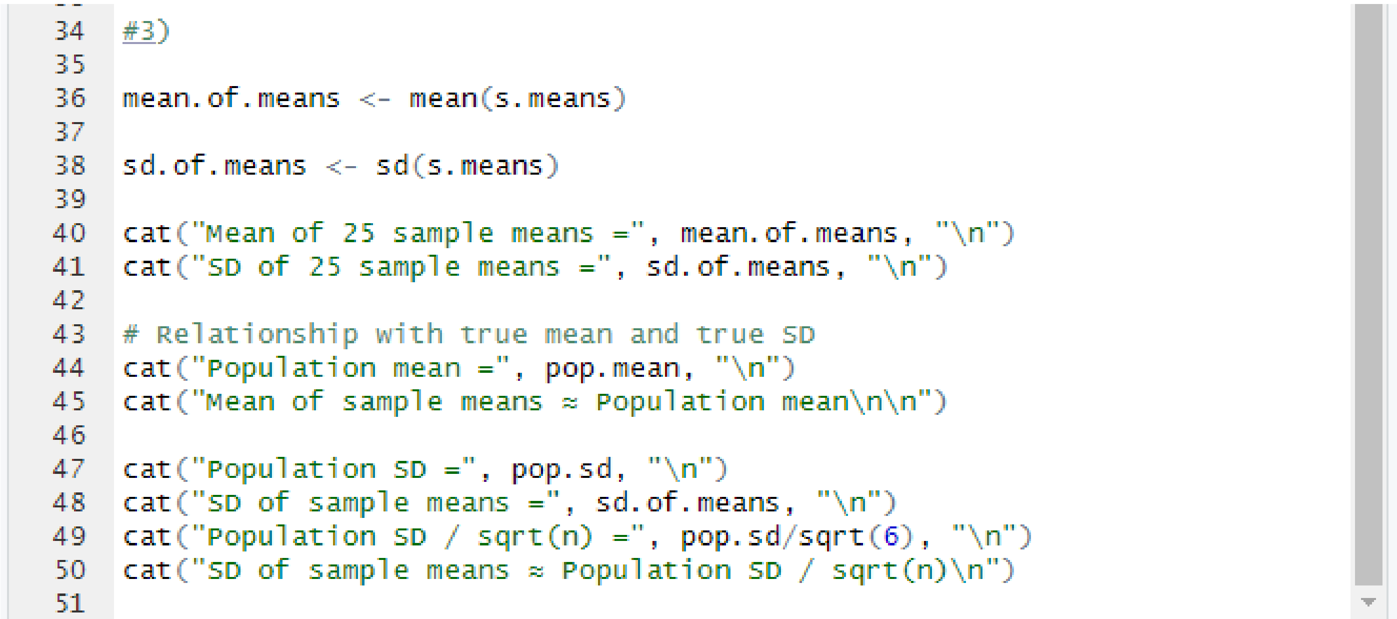


```
> samples <- c()
> n <- c()
> 
> for (i in 1:25){
+   s <- sample(Weights, 6, replace = TRUE)
+   samples <- cbind(samples, s)
+   n <- c(n, paste("s", i))
+ }
> 
> colnames(samples) <- n
> 
> s.means <- apply(samples, 2, mean)
> s.sds   <- apply(samples, 2, sd)
> 
> cat("Sample Means:\n")
Sample Means:
> print(s.means)
     s 1      s 2      s 3      s 4      s 5      s 6 
2.435000 2.243333 2.533333 2.465000 2.478333 2.401667 
     s 7      s 8      s 9     s 10     s 11     s 12 
2.503333 2.505000 2.413333 2.598333 2.480000 2.388333 
    s 13     s 14     s 15     s 16     s 17     s 18 
2.416667 2.510000 2.465000 2.601667 2.483333 2.531667 
    s 19     s 20     s 21     s 22     s 23     s 24 
2.380000 2.468333 2.426667 2.493333 2.446667 2.515000 
    s 25 
2.493333 
> 
```

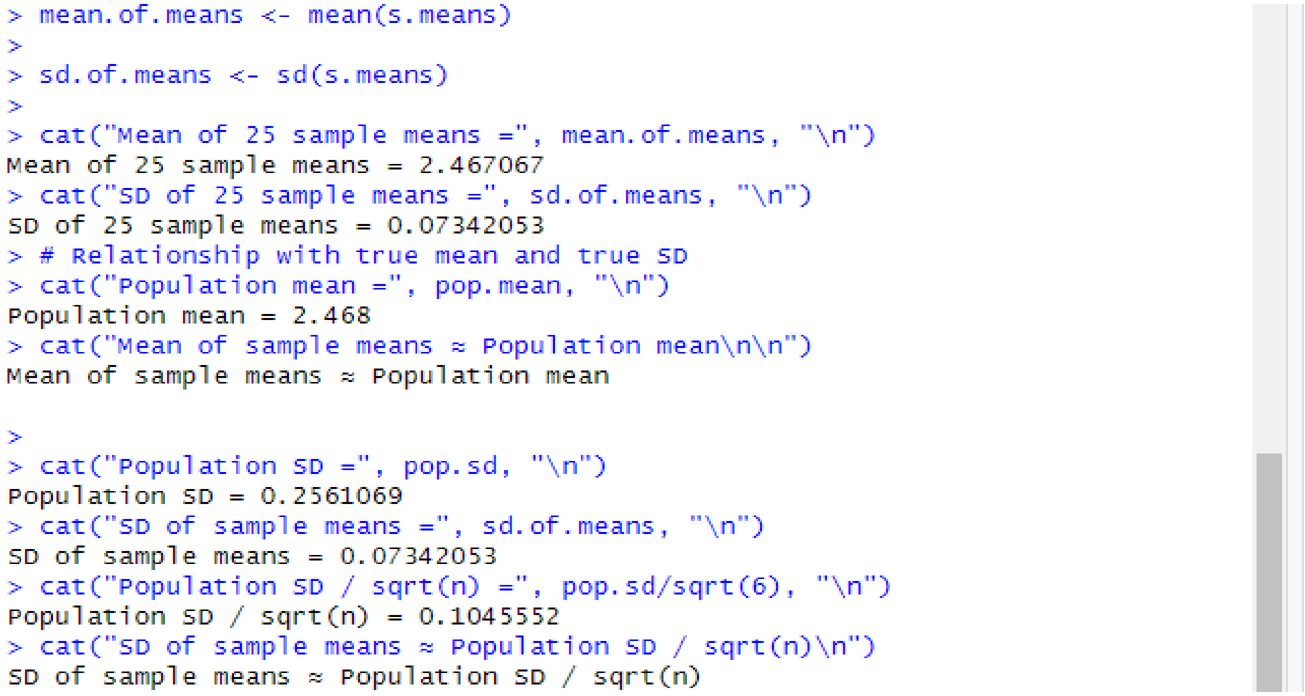


```
> cat("\nSample Standard Deviations:\n")

Sample Standard Deviations:
> print(s.sds)
      s 1       s 2       s 3       s 4       s 5       s 6 
0.1846889 0.3745753 0.2128536 0.1262933 0.3202759 0.2444927 
      s 7       s 8       s 9      s 10      s 11      s 12 
0.2004661 0.2049146 0.2991766 0.2821643 0.1425482 0.4067636 
     s 13      s 14      s 15      s 16      s 17      s 18 
0.2156540 0.2555778 0.2578953 0.2297317 0.1871541 0.3074031 
     s 19      s 20      s 21      s 22      s 23      s 24 
0.2515552 0.1824737 0.2324364 0.2768152 0.2370373 0.2449286 
     s 25 
0.1887503 
```

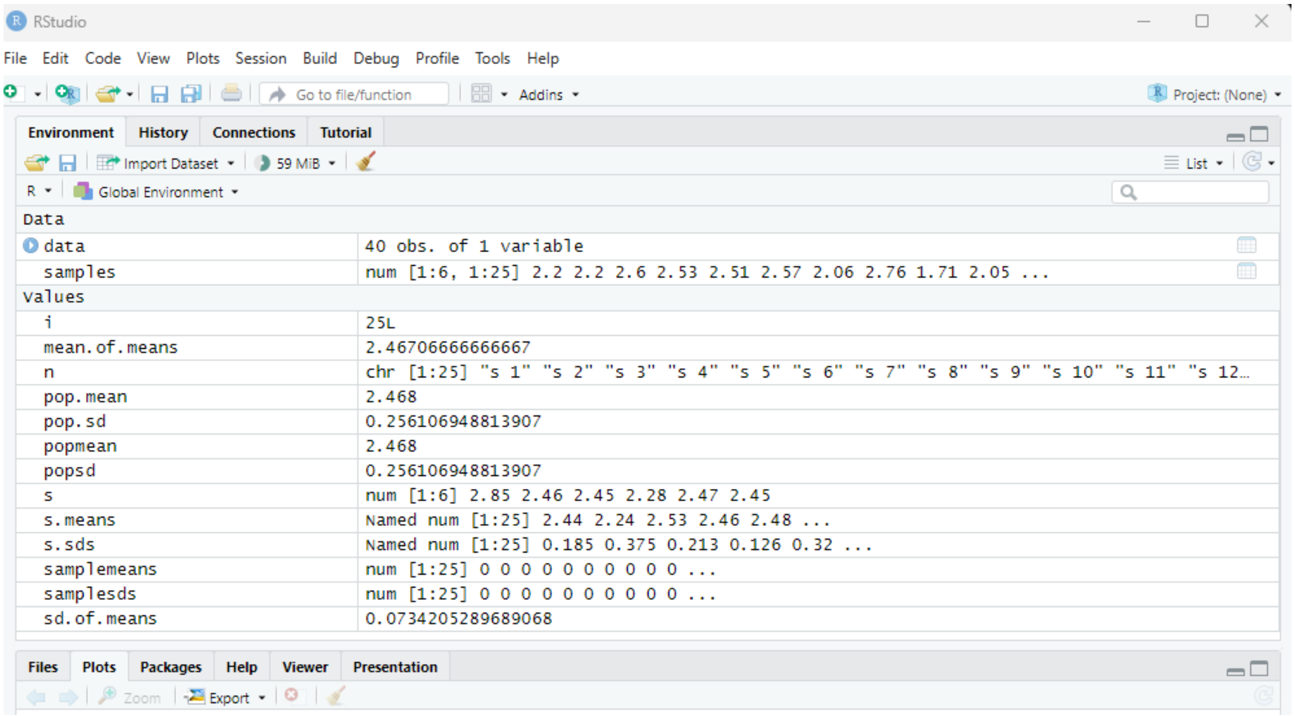
3. Calculate the mean and standard deviation of the 25 sample means and state the relationship of them with true mean and true standard deviation.



```
#3)

mean.of.means <- mean(s.means)

sd.of.means <- sd(s.means)

cat("Mean of 25 sample means =", mean.of.means, "\n")
cat("SD of 25 sample means =", sd.of.means, "\n")

# Relationship with true mean and true SD
cat("Population mean =", pop.mean, "\n")
cat("Mean of sample means ≈ Population mean\n\n")

cat("Population SD =", pop.sd, "\n")
cat("SD of sample means =", sd.of.means, "\n")
cat("Population SD / sqrt(n) =", pop.sd/sqrt(6), "\n")
cat("SD of sample means ≈ Population SD / sqrt(n)\n")

```



```
> mean.of.means <- mean(s.means)
>
> sd.of.means <- sd(s.means)
>
> cat("Mean of 25 sample means =", mean.of.means, "\n")
Mean of 25 sample means = 2.467067
> cat("SD of 25 sample means =", sd.of.means, "\n")
SD of 25 sample means = 0.07342053
> # Relationship with true mean and true SD
> cat("Population mean =", pop.mean, "\n")
Population mean = 2.468
> cat("Mean of sample means ≈ Population mean\n\n")
Mean of sample means ≈ Population mean

>
> cat("Population SD =", pop.sd, "\n")
Population SD = 0.2561069
> cat("SD of sample means =", sd.of.means, "\n")
SD of sample means = 0.07342053
> cat("Population SD / sqrt(n) =", pop.sd/sqrt(6), "\n")
Population SD / sqrt(n) = 0.1045552
> cat("SD of sample means ≈ Population SD / sqrt(n)\n")
SD of sample means ≈ Population SD / sqrt(n)
```



RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function
Addins
Project: (None)
Environment History Connections Tutorial
Import Dataset
59 MiB
List
R
Global Environment
Files Plots Packages Help Viewer Presentation
Zoom
Export

Data	
data	40 obs. of 1 variable
samples	num [1:6, 1:25] 2.2 2.2 2.6 2.53 2.51 2.57 2.06 2.76 1.71 2.05 ...
Values	
i	25L
mean.of.means	2.46706666666667
n	chr [1:25] "s 1" "s 2" "s 3" "s 4" "s 5" "s 6" "s 7" "s 8" "s 9" "s 10" "s 11" "s 12…
pop.mean	2.468
pop.sd	0.256106948813907
popmean	2.468
popsd	0.256106948813907
s	num [1:6] 2.85 2.46 2.45 2.28 2.47 2.45
s.means	Named num [1:25] 2.44 2.24 2.53 2.46 2.48 ...
s.sds	Named num [1:25] 0.185 0.375 0.213 0.126 0.32 ...
samplemeans	num [1:25] 0 0 0 0 0 0 0 0 0 0 ...
samplesds	num [1:25] 0 0 0 0 0 0 0 0 0 0 ...
sd.of.means	0.0734205289689068