HW03_Code8_16

```
# Install nimble package if not already installed
#install.packages("nimble")

library(nimble)
```

```
nimble version 1.3.0 is loaded.
For more information on NIMBLE and a User Manual,
please visit https://R-nimble.org.

Note for advanced users who have written their own MCMC samplers:
  As of version 0.13.0, NIMBLE's protocol for handling posterior
  predictive nodes has changed in a way that could affect user-defined
  samplers in some situations. Please see Section 15.5.1 of the User Manual.


Attaching package: 'nimble'

The following object is masked from 'package:stats':

    simulate

The following object is masked from 'package:base':

    declare
```

```
# Given data
data <- c(-0.04, -6.01, 1.05, 2.10, -2.76, -2.60, 4.02, 10.50, 2.75, 3.31, -1.21, 3.26)

# Step 1: Calculate the MLE for sigma (mean of absolute values of data)
sigma_hat <- mean(abs(data))

print (sigma_hat)
```

```
[1] 3.300833
```

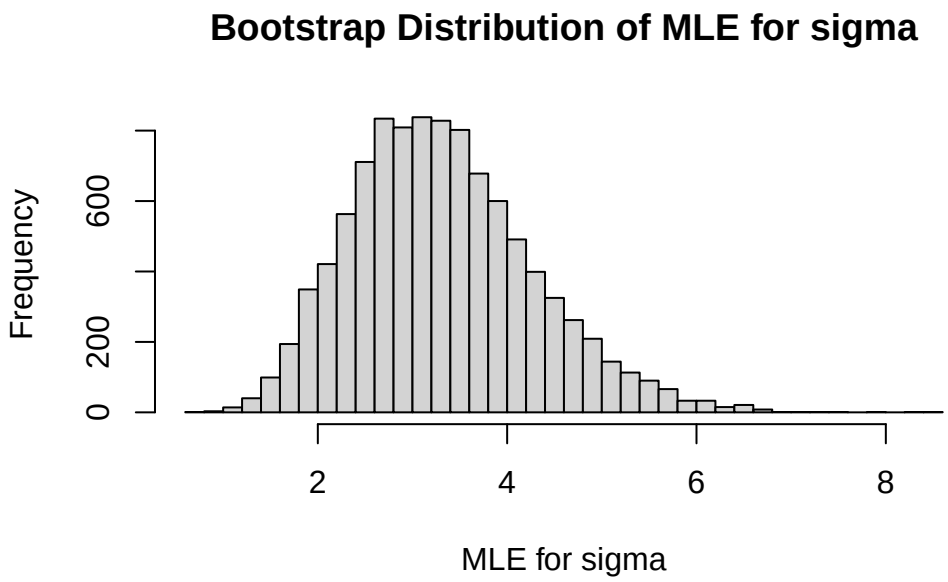
```
############################################################

# Step 2: Set up parametric bootstrap
B <- 10000  # Number of bootstrap samples
n <- length(data)  # Sample size

# Step 3: Generate bootstrap estimates
set.seed(42)  # For reproducibility
bootstrap_mles <- replicate(B, {
  # Generate bootstrap sample from the  distribution
  sim_data <- rdexp(n, location = 0, scale = sigma_hat)
    # Calculate the MLE for this bootstrap sample
  sigma_hat_boot <- mean(abs(sim_data))
    return(sigma_hat_boot)
})

# Step 4: Estimate the standard error of the MLE
bootstrap_se <- sd(bootstrap_mles)

# Print results
cat("MLE for sigma: ", sigma_hat, "\n")
```

```
MLE for sigma:  3.300833
```

```
cat("Standard Error from bootstrap: ", bootstrap_se, "\n")
```

```
Standard Error from bootstrap:  0.9587341
```

```
# Step 5: Plot the distribution of bootstrap estimates
hist(bootstrap_mles, main = "Bootstrap Distribution of MLE for sigma", xlab = "MLE for sigma
```




```
############################################################
n <- length(data)

# Calculate the asymptotic variance estimate
asymptotic_variance <- sigma_hat^2 / n
# Print the result
cat("Asymptotic Variance Estimate: ", asymptotic_variance, "\n")
```

```
Asymptotic Variance Estimate:  0.9079584
```