Mini project 6 You Jia yxj161630

Question 1

Bias of theta.hat is -0.0009165916

Standard error of theta.hat is 0.09921397

Question 2

2.5th and 97.5th percentiles of the sampling distribution of thetahat is 3.679671 and 4.072440

Question 3

2.5th and 97.5th percentiles of the sampling distribution of theta.hat-theta is -0.1963894 and 0.1963798

Question 4

95% confidence interval for theta using bootstrap methods

Normal approximation method:(3.683, 4.071)

Basic bootstrap method:(3.680, 4.072)

Percentile bootstrap method:(3.680, 4.072)

Code

```
library(boot)
getwd()
setwd("/Users/youjia/Desktop")
# Read data
cpu <- scan(file = "cputime.txt")
# The parameter of interest is theta=log(E(X))
logmean <- function(x, indices){
  result <- log(mean(x[indices]), base = exp(1))
  return(result)
}
logmean.boot <- boot(cpu, logmean, R=999, sim = "ordinary", stype = "i")
logmean.boot
# Let's see the results after running ordinary nonparametric bootstrap
# ORDINARY NONPARAMETRIC BOOTSTRAP
#
#
# Call:
# boot(data = cpu, statistic = logmean, R = 999, sim = "ordinary",
#       stype = "i")
#
#
# Bootstrap Statistics :
#     original        bias    std. error
# t1*  3.87605 -0.0009165916  0.09921397
```

```r
# Let's verify the calculations just for fun
thetahat <- logmean.boot$t0
thetahat  # 3.87605
mybias <- mean(logmean.boot$t)-logmean.boot$t0
mybias   # -0.0009165916
mysd <- sd(logmean.boot$t)
mysd  # 0.09921397

##########Question 1############################
## bias of theta.hat is -0.0009165916
## standard error of theta.hat is 0.09921397
################################################

# 2.5th and 97.5th percentiles of the sampling distribution of thetahat
sort(logmean.boot$t)[c(25, 975)]  # [1] 3.679671 4.072440
# 2.5th and 97.5th percentiles of the sampling distribution of theta.hat-theta
sort(logmean.boot$t0-logmean.boot$t)[c(25, 975)]  # [1] -0.1963894  0.1963798

##########Question 2 and 3#####################################
## 2.5th and 97.5th percentiles of the sampling distribution
## of thetahat is 3.679671 4.072440
## 2.5th and 97.5th percentiles of the sampling distribution
## of theta.hat-theta is -0.1963894  0.1963798
#################################################################
# Get the 95% confidence interval for log(E(X))
boot.ci(logmean.boot)
# BOOTSTRAP CONFIDENCE INTERVAL CALCULATIONS
#Based on 999 bootstrap replicates
#
#CALL :
#  boot.ci(boot.out = logmean.boot)
#
#Intervals :
#  Level      Normal              Basic
#95%   ( 3.683,  4.071 )   ( 3.680,  4.072 )
#
#Level     Percentile            BCa
#95%   ( 3.680,  4.072 )   ( 3.691,  4.082 )
#Calculations and Intervals on Original Scale

##########Question 4 ############################################
## 95% confidence interval for theta using bootstrap methods
## Normal approximation method:( 3.683,  4.071 )
## Basic bootstrap method:( 3.680,  4.072 )
## Percentile bootstrap method:( 3.680,  4.072 )
#################################################################
```