Act 9 SimCI: Stat 463/563

Dr. Islam

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Last Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ First Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Objectives

* Compute power of a CI. Here, we do it for 1-sample t-CI.
* Recall that 1-sample CI for unknown mean when the population standard deviation is unknown is given by
* What is the meaning of CI.
* How good is this CI?
* To answer this question, we do simulation.

How to do the simulation?

* Generate 1,000 random samples x of size n each, and construct the desired CI
* Determine what proportion of CIs constructed contains the unknown mean .
* Loop can be used to do so for storing results from each sample we take. We will demonstrate a for loop for this.

# Preliminary example to define a t.ci

set.seed(123)  
t.ci <- function(x, alpha) {  
 n<-length(x)  
 df=n-1  
 xbar=mean(x)  
 s=sd(x)  
 me=qt(1-alpha/2,df)\*s/sqrt(n)  
 ci=c(xbar-me,xbar+me)  
 output=ci  
 output  
}  
x=1:10  
t.ci(1:10,0.05)

[1] 3.334149 7.665851

# This result must agree with t.test() defined in R, as a default.  
t.test(x, conf.level=0.95)

One Sample t-test  
  
data: x  
t = 5.7446, df = 9, p-value = 0.0002782  
alternative hypothesis: true mean is not equal to 0  
95 percent confidence interval:  
 3.334149 7.665851  
sample estimates:  
mean of x   
 5.5

set.seed(123)  
r=20;  
n=25;  
mu=5;  
std=2;  
sto=array(0,c(r,2));  
  
for (i in 1:r){  
x=rnorm(n,mean=mu,sd=std)  
sto[i,]<-t.ci(x,0.05)  
}  
sto

[,1] [,2]  
 [1,] 4.151756 5.714923  
 [2,] 4.445690 5.962859  
 [3,] 4.217690 5.823274  
 [4,] 4.879590 6.250712  
 [5,] 3.801964 5.090800  
 [6,] 3.565417 5.510616  
 [7,] 4.612485 6.248486  
 [8,] 4.022814 5.426670  
 [9,] 4.409276 6.020716  
[10,] 3.988923 5.512921  
[11,] 4.516000 6.174888  
[12,] 4.914722 6.389996  
[13,] 4.055587 5.860321  
[14,] 4.234557 5.865968  
[15,] 4.232110 6.160577  
[16,] 3.746029 5.265284  
[17,] 4.126956 5.634129  
[18,] 3.908340 5.805738  
[19,] 4.681647 6.404104  
[20,] 4.889162 6.243539

#prop capturing the mu  
prop=mean(sto[,1]<=mu & sto[,2]>=mu)  
prop

[1] 1

#average CI  
meanL=mean(sto[,1])  
meanU=mean(sto[,2])  
avCI=c(meanL,meanU)  
avCI

[1] 4.270036 5.868326