Home Work 4

Rick Glabo, more functions

March 19, 2016

Problem 1

Using the provided matrix of freethrows and McNemar's test, will check if the probability of making the first freethrow is the same as making the second.

```
#load data
mat<-matrix(c(4,5,14,7),ncol=2)
rownames(mat)<-c("Made First","Missed First")
colnames(mat)<-c("Made Second","Missed Second")


#a) using McNemar's
tst = (abs(mat[1,2]-mat[2,1])-1)**2/(mat[1,2]+mat[2,1])

n<-mat[1,2]+mat[2,1]

#pvalues
2*(1-pbinom(mat[1,2]-1,n,.5))
```

```
## [1] 0.06356812
```

```
#using test
mcnemar.test(mat,correct=TRUE)
```

```
##
##  McNemar's Chi-squared test with continuity correction
##
## data:  mat
## McNemar's chi-squared = 3.3684, df = 1, p-value = 0.06646
```

```
#can see that there is no significant difference
#seen from using the McNemar test at alpha = 0.5 level
```

Problem 2

Create a function to perform bootstrapping techniques on the rabbit blood data

```
#load data
rabbits<-c(55,140,91,122,111,185,203,101,
              76,145,95,101,196,45,299,226,
              65,70,196,72,121,171,151,113,
              112,67,276,125,100,81,122,71,
              158,78,162,128,96,79,67,119)
```

```r
#use bootstrapping to sample from the data
#function boots that takes in data, and number of simulations
#returns the MSE
boots = function(data, nsims){
  #function for preforming bootstrap sampling
  #calc theta hat
  theta_hat = mean(data)

  #sample the provided data to get theta instances
  sampler = function(data){
    boot_theta = mean(sample(data,length(data),replace = TRUE))
    return(boot_theta)
  }

  #generate bootstrap_thetas
  boot_thetas = replicate(nsims,sampler(data))
  mse_est = mean((boot_thetas - theta_hat )^2)

  #bootstrap standard error
  e_hat = sum(boot_thetas)/nsims
  bias = e_hat - theta_hat

  #bootstrap var
  var_boot = sum((boot_thetas - e_hat)^2)/nsims

  #calculate confidence intervals
  xbar = mean(data)
  s = sd(data)
  tint =  c(xbar-qt(0.975,n-1)*s/sqrt(n),xbar+qt(0.975,n-1)*s/sqrt(n))

  confidence_boot = function(data){
    n = length(data)
    new = sample(data,n,replace = TRUE)
    tboot = mean((new-xbar)/sd(new)/sqrt(n))
    return(tboot)
  }

  tboots = replicate(nsims,confidence_boot(data))
  tq = quantile(tboots,c(0.025,0.975))
  #calculate bootstrap interval
  cint = c(xbar-tq[2]*s/sqrt(n),xbar-tq[1]*s/sqrt(n))

  results = data.frame(c(mse_est,bias,var_boot,cint),
                       row.names = c('Bootstrap MSE','Bias','Bootstrap Var',
                                     'CI Lower','CI Upper'))

  return(results)
}

boots(rabbits, 10000)
```

```
##                c.mse_est..bias..var_boot..cint.
## Bootstrap MSE                        82.5045117
```

```
## Bias                                    -0.0149375
## Bootstrap Var                           82.5042886
## CI Lower                               124.1653731
## CI Upper                               125.5959021
```

Problem 3

Simulation study of normal data of size n = 15, mean = 5, variance of 36

```r
#generate data
normdat = rnorm(15,6,36)
#calculate sample mean
mu = mean(normdat)
#get variance
v = var(normdat)

boots(normdat,1000)
```

```
##                c.mse_est..bias..var_boot..cint.
## Bootstrap MSE                         142.6618708
## Bias                                    0.1732453
## Bootstrap Var                         142.6318569
## CI Lower                               16.7599664
## CI Upper                               19.9917204
```