# Stat 505 Assignment 11

*Leslie Gains-Germain*

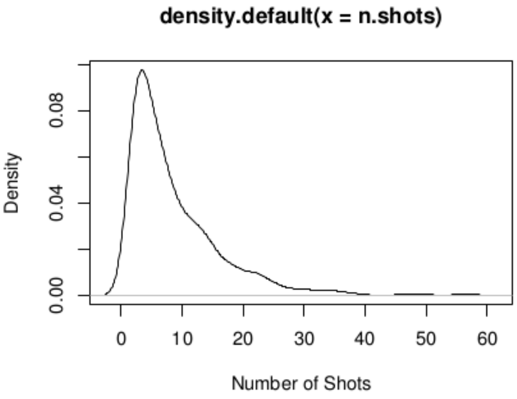
Excellent!
17.5 of 18

November 17, 2014

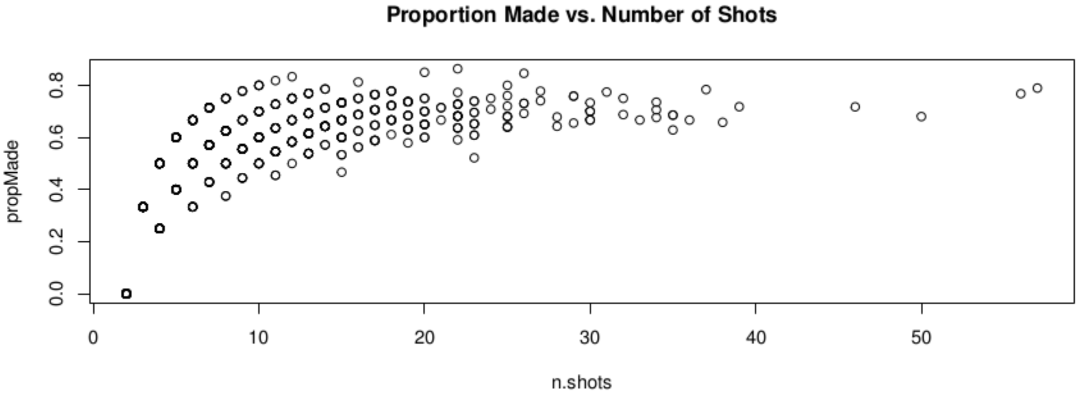
1. (a) *I built a while loop to do this. The loop keeps track of the number of shots taken and the proportion of shots made. See my code in the appendix.*

   (b) *I wrapped the while loop inside a for loop. For each "game", the number of shots taken and the proportion of shots made is recorded. I showed the results for the first six games. The mean and standard deviation of the number of shots taken in the* 1000 *games is 8.603 and 7.433 respectively.*

```
##      n.shots propMade
## [1,]       4    0.500
## [2,]       4    0.250
## [3,]       5    0.400
## [4,]       3    0.333
## [5,]      11    0.636
## [6,]       5    0.400
## [1] 8.6
## [1] 7.43
```



   (c) Below is a scatterplot of number of shots and proportion made.



2. (a) *In general, we sample from a known population distribution, then using this sample we build a confidence interval for a known population parameter. Then, we note*

*whether the interval contains the known population parameter. We do this many times (1000 or 10000 times), and this gives us an idea of the proportion of times that our confidence interval contains the true parameter.*

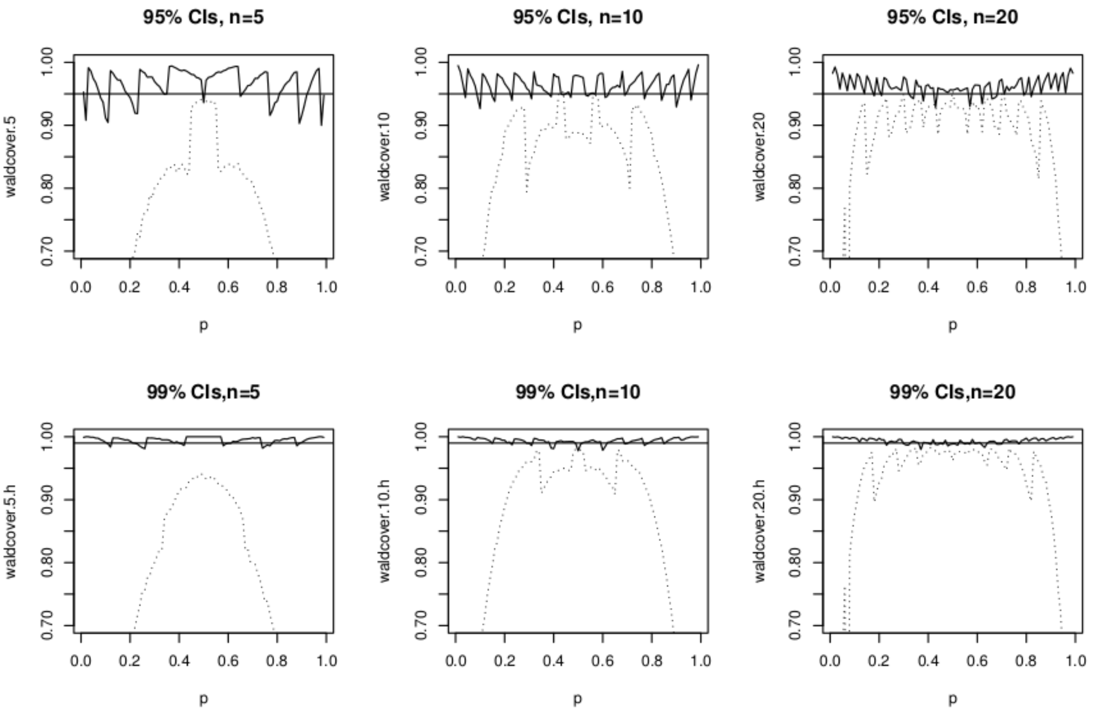
(b) *My* `cover` *function outputs the wald confidence intervals and the proportion of intervals that covered the true parameter. Here is an example:*

```
## $waldcis
##         [,1]  [,2]
##  [1,] 0.0992 0.501
##  [2,] 0.3320 0.768
##  [3,] 0.3320 0.768
##  [4,] 0.2809 0.719
##  [5,] 0.1853 0.615
##  [6,] 0.1853 0.615
##  [7,] 0.2320 0.668
##  [8,] 0.3320 0.768
##  [9,] 0.2320 0.668
## [10,] 0.1853 0.615
##
## $prop.cover
## [1] 1
```

(c) *My* `cover.wilson` *function outputs the wilson confidence intervals and the proportion of intervals that contain the true parameter. Here is an example:*

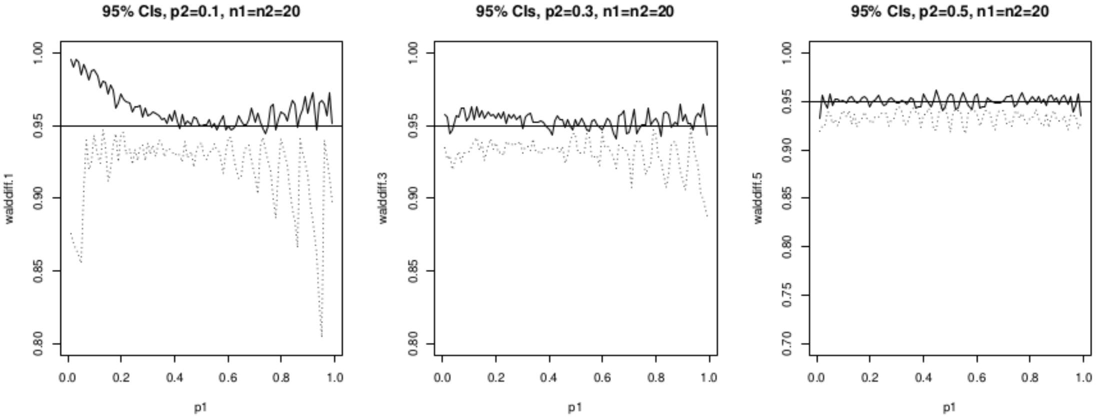
```
## $wilsoncis
##         [,1]  [,2]
##  [1,] 0.3861 0.781
##  [2,] 0.3000 0.700
##  [3,] 0.3423 0.741
##  [4,] 0.3423 0.741
##  [5,] 0.3423 0.741
##  [6,] 0.0768 0.423
##  [7,] 0.2194 0.614
##  [8,] 0.3861 0.781
##  [9,] 0.3423 0.741
## [10,] 0.5265 0.890
##
## $prop.cover
## [1] 0.8
```

(d) *Figure 1 recreated.*



We need a legend or caption to identify the 2 methods. -.5

(e) *Figure 4 recreated.*



## R Code

```r
n.shots <- rep(0,1000)
propMade <- rep(0,1000)
for(i in 1:1000){
keep.going <- 0
score <- 0
shots <- 0
miss <- 0
prev.miss <- 0
 while(keep.going<2){
   shots <- shots+1
   prev.miss <- miss
   miss <- ifelse(runif(1,0,1)>.6,1,0)
   score <- score+ifelse(miss==1,0,1)
   keep.going <- prev.miss+miss
   #keep.going <- ifelse(miss+prev.miss==2,FALSE,TRUE)
    ## set keep.going to FALSE when condition is met
 }
n.shots[i]<-shots
propMade[i] <- score/shots
#print(unlist( list( n.shots= shots, propMade = score / shots)))
}
```

Indent a loop, please

or just add 1-miss

```r
data <- cbind(n.shots,propMade)
head(data)
mean(n.shots)
sd(n.shots)
par(mfrow=c(1,2))
plot(density(n.shots), xlab="Number of Shots")
```

```r
plot(propMade~n.shots, main="Proportion Made vs. Number of Shots")
```

Indent a function by 2 spaces

```r
cover <- function (n,p,Nreps,confidence){
phat.vec<-rbinom(Nreps,n,p)/n
wald.ci.l<-phat.vec+qnorm((1-confidence)/2)*sqrt(phat.vec*(1-phat.vec)/n)
wald.ci.u<-phat.vec-qnorm((1-confidence)/2)*sqrt(phat.vec*(1-phat.vec)/n)
cis <- matrix(c(wald.ci.l,wald.ci.u),nrow=Nreps,ncol=2)
prop.cover <- sum(ifelse(cis[,1]<p & cis[,2]>p,1,0))/Nreps
finals <-list("waldcis"=cis,"prop.cover"=prop.cover)
return(finals)
}
cover(20,0.5,10,0.95)
```

```r
cover.wilson <- function (n,p,Nreps,confidence){
ptilde.vec<-(rbinom(Nreps,n,p)+2)/(n+4)
wald.ci.l<-ptilde.vec+qnorm((1-confidence)/2)*sqrt(ptilde.vec*(1-ptilde.vec)/(n+4))
wald.ci.u<-ptilde.vec-qnorm((1-confidence)/2)*sqrt(ptilde.vec*(1-ptilde.vec)/(n+4))
cis <- matrix(c(wald.ci.l,wald.ci.u),nrow=Nreps,ncol=2)
prop.cover <- sum(ifelse(cis[,1]<p & cis[,2]>p,1,0))/Nreps
finals <-list("wilsoncis"=cis,"prop.cover"=prop.cover)
return(finals)
}
cover.wilson(20,0.5,10,0.95)
```

```r
Nreps <- 10000
waldcover.5 <- rep(0,99)
for(i in seq(0.01,0.99,by=0.01)){
waldcover.5[100*i]<-cover(5,i,Nreps,0.95)$prop.cover
}
waldcover.10 <- rep(0,99)
```

```
for(i in seq(0.01,0.99,by=0.01)){
waldcover.10[100*i]<-cover(10,i,Nreps,0.95)$prop.cover
}
waldcover.20 <- rep(0,99)
for(i in seq(0.01,0.99,by=0.01)){
waldcover.20[100*i]<-cover(20,i,Nreps,0.95)$prop.cover
}

waldcover.5.h <- rep(0,99)
for(i in seq(0.01,0.99,by=0.01)){
waldcover.5.h[100*i]<-cover(5,i,Nreps,0.99)$prop.cover
}
waldcover.10.h <- rep(0,99)
for(i in seq(0.01,0.99,by=0.01)){
waldcover.10.h[100*i]<-cover(10,i,Nreps,0.99)$prop.cover
}
waldcover.20.h <- rep(0,99)
for(i in seq(0.01,0.99,by=0.01)){
waldcover.20.h[100*i]<-cover(20,i,Nreps,0.99)$prop.cover
}
```

```
Nreps<-10000
wilsoncover.5 <- c(rep(0,99))
for(i in seq(0.01,0.99,by=0.01)){
wilsoncover.5[zapsmall(100*i)] <- cover.wilson(5,i,Nreps,0.95)$prop.cover
}


wilsoncover.10 <- rep(0,99)
for(i in seq(0.01,0.99,by=0.01)){
wilsoncover.10[zapsmall(100*i)]<-cover.wilson(10,i,Nreps,0.95)$prop.cover
}
wilsoncover.20 <- rep(0,99)
for(i in seq(0.01,0.99,by=0.01)){
wilsoncover.20[zapsmall(100*i)]<-cover.wilson(20,i,Nreps,0.95)$prop.cover
}

wilsoncover.5.h <- rep(0,99)
for(i in seq(0.01,0.99,by=0.01)){
wilsoncover.5.h[zapsmall(100*i)]<-cover.wilson(5,i,Nreps,0.99)$prop.cover
}
wilsoncover.10.h <- rep(0,99)
for(i in seq(0.01,0.99,by=0.01)){
wilsoncover.10.h[zapsmall(100*i)]<-cover.wilson(10,i,Nreps,0.99)$prop.cover
}
wilsoncover.20.h <- rep(0,99)
for(i in seq(0.01,0.99,by=0.01)){
wilsoncover.20.h[zapsmall(100*i)]<-cover.wilson(20,i,Nreps,0.99)$prop.cover
}
```

```
par(mfrow=c(3,3))
p <- seq(0.01,0.99,by=0.01)
plot(p,waldcover.5, ylim=c(0.7,1), type="l", lty=3, main="95% CIs, n=5")
abline(h=0.95)
lines(p,wilsoncover.5)

plot(p,waldcover.10, ylim=c(0.7,1), type="l", lty=3, main="95% CIs, n=10")
abline(h=0.95)
lines(p,wilsoncover.10)

plot(p,waldcover.20, ylim=c(0.7,1), type="l", lty=3, main="95% CIs, n=20")
abline(h=0.95)
lines(p,wilsoncover.20)

plot(p,waldcover.5.h, ylim=c(0.7,1), type="l", lty=3, main="99% CIs,n=5")
```

```
abline(h=0.99)
lines(p,wilsoncover.5.h)

plot(p,waldcover.10.h, ylim=c(0.7,1), type="l", lty=3, main="99% CIs,n=10")
abline(h=0.99)
lines(p,wilsoncover.10.h)

plot(p,waldcover.20.h, ylim=c(0.7,1), type="l", lty=3, main="99% CIs,n=20")
abline(h=0.99)
lines(p,wilsoncover.20.h)
```

```
cover.diff <- function (n1,n2,p1,p2,Nreps,confidence){
phat1.vec<-rbinom(Nreps,n1,p1)/n1
phat2.vec<-rbinom(Nreps,n2,p2)/n2
wald.ci.l<-phat1.vec-phat2.vec+qnorm((1-confidence)/2)*sqrt(phat1.vec*(1-phat1.vec)/n1+phat2.vec*(1-phat2.vec)/n2)
wald.ci.u<-phat1.vec-phat2.vec-qnorm((1-confidence)/2)*sqrt(phat1.vec*(1-phat1.vec)/n1+phat2.vec*(1-phat2.vec)/n2)
cis <- matrix(c(wald.ci.l,wald.ci.u),nrow=Nreps,ncol=2)
diff<-p1-p2
prop.cover <- sum(ifelse(cis[,1]<diff & cis[,2]>diff,1,0))/Nreps
finals <-list("waldcis"=cis,"prop.cover"=prop.cover)
return(finals)
}
```

```
coverwilson.diff <- function (n1,n2,p1,p2,Nreps,confidence){
ptilde1.vec<-(rbinom(Nreps,n1,p1)+1)/(n1+2)
ptilde2.vec<-(rbinom(Nreps,n2,p2)+1)/(n2+2)
wald.ci.l<-ptilde1.vec-ptilde2.vec+qnorm((1-confidence)/2)*
  sqrt(ptilde1.vec*(1-ptilde1.vec)/(n1+2)+ptilde2.vec*(1-ptilde2.vec)/(n2+2))
wald.ci.u<-ptilde1.vec-ptilde2.vec-qnorm((1-confidence)/2)*
  sqrt(ptilde1.vec*(1-ptilde1.vec)/(n1+2)+ptilde2.vec*(1-ptilde2.vec)/(n2+2))
cis <- matrix(c(wald.ci.l,wald.ci.u),nrow=Nreps,ncol=2)
diff<-p1-p2
prop.cover <- sum(ifelse(cis[,1]<diff & cis[,2]>diff,1,0))/Nreps
finals <-list("waldcis"=cis,"prop.cover"=prop.cover)
return(finals)
}
```

```
Nreps <- 10000
walddiff.1 <- rep(0,99)
for(i in seq(0.01,0.99,by=0.01)){
walddiff.1[zapsmall(100*i)]<-cover.diff(20,20,i,0.1,Nreps,0.95)$prop.cover
}
walddiff.3 <- rep(0,99)
for(i in seq(0.01,0.99,by=0.01)){
walddiff.3[zapsmall(100*i)]<-cover.diff(20,20,i,0.3,Nreps,0.95)$prop.cover
}
walddiff.5 <- rep(0,99)
for(i in seq(0.01,0.99,by=0.01)){
walddiff.5[zapsmall(100*i)]<-cover.diff(20,20,i,0.5,Nreps,0.95)$prop.cover
}
```

```
Nreps<-10000
wilsondiff.1 <- c(rep(0,99))
for(i in seq(0.01,0.99,by=0.01)){
wilsondiff.1[zapsmall(100*i)] <- coverwilson.diff(20,20,i,0.1,Nreps,0.95)$prop.cover
}
wilsondiff.3 <- c(rep(0,99))
for(i in seq(0.01,0.99,by=0.01)){
wilsondiff.3[zapsmall(100*i)] <- coverwilson.diff(20,20,i,0.3,Nreps,0.95)$prop.cover
}
wilsondiff.5 <- c(rep(0,99))
for(i in seq(0.01,0.99,by=0.01)){
wilsondiff.5[zapsmall(100*i)] <- coverwilson.diff(20,20,i,0.5,Nreps,0.95)$prop.cover
}
```

```r
par(mfrow=c(1,3))
p <- seq(0.01,0.99,by=0.01)
plot(p,walddiff.1, ylim=c(0.8,1), type="l", lty=3, main="95% CIs, p2=0.1, n1=n2=20", xlab="p1")
abline(h=0.95)
lines(p,wilsondiff.1)

plot(p,walddiff.3, ylim=c(0.8,1), type="l", lty=3, main="95% CIs, p2=0.3, n1=n2=20", xlab="p1")
abline(h=0.95)
lines(p,wilsondiff.3)

plot(p,walddiff.5, ylim=c(0.7,1), type="l", lty=3, main="95% CIs, p2=0.5, n1=n2=20", xlab="p1")
abline(h=0.95)
lines(p,wilsondiff.5)
```