HW3

Aaron

2/2/2018

Problem1

```
a <- c(1:10)
b <- c(0:9)
paste("c_{",a,"}X_{",a,"}^",b,sep="",collapse = "+")
```

```
## [1] "c_{1}X_{1}^0+c_{2}X_{2}^1+c_{3}X_{3}^2+c_{4}X_{4}^3+c_{5}X_{5}^4+c_{6}X_{6}^5+c_{7}X_{7}^6+c_{8
```

Problem2-1

```
ptm <- proc.time()
sample_space <- c(rep("Y",3),rep("B",7))
n <- 1000000
acc <- 0
for (i in 1:n) {
  if (sum(sample(sample_space, 3) == "Y") == 1) {
    acc = acc + 1
  }
}
acc/n
```

```
## [1] 0.525404
```

```
proc.time() - ptm
```

```
##    user  system elapsed
##   6.022   0.071   6.462
```

Problem2-2

```
ptm <- proc.time()
acc <- 0
for (i in 1:n) {
  acc = acc + ifelse(sum(sample(sample_space, 3) == "Y") == 1,1,0)
}
acc/n
```

```
## [1] 0.52495
```

```
proc.time() - ptm
```

```
##    user  system elapsed
##   7.997   0.058   8.156
```

Problem2-3

```
ptm <- proc.time()
sum(sapply(1:n, function(x) sum(sample(sample_space, 3) == "Y") == 1))/n
```

```
## [1] 0.523996
```

```
proc.time() - ptm
```

```
##    user  system elapsed
##   6.963   0.114   7.305
```

The rank from the fastest to slowest: 1 -> 3 -> 2.

Problem3-1

```
sum(sapply(1:n, function(x) sum(sample(sample_space, 3) == "Y") <= 1))/n
```

```
## [1] 0.816286
```

Problem3-2

```
sum(sapply(1:n, function(x) sum(sample(sample_space, 3) == "Y") >= 1))/n
```

```
## [1] 0.708108
```

Problem4

```
open.account <- function(total, name) {
  n.dep <- 1
  n.withdrawal <- 0
  cat("Balance (",name,"): ", total, ". You made ", n.dep, " deposits and ",
      n.withdrawal,   " withdrawals.", sep = "")

  deposit <- function(amount) {
    if(amount <= 0)
      stop("Deposits must be positive!\n")
    total <<- total + amount
    n.dep <<- n.dep + 1
    cat(amount, " deposited. ", sep = "")
    balance()
  }

  withdraw <- function(amount) {
    if(amount <= 0)
      stop("Withdraw must be positive!\n")
    total <<- total - amount
    n.withdrawal <<- n.withdrawal + 1
    cat(amount, " withdrawn. ", sep = "")
    balance()
  }
```

```
  transfer <- function(amount, whom) {
    if(amount <= 0)
      stop("Transfering money must be positive!\n")
    if((total - amount) <= 0)
      stop("No enough money in deposits!\n")
    withdraw(amount)
    whom$deposit(amount)
  }

  balance <- function() {
    cat("Balance (",name,"): ", total, ". You made ", n.dep, " deposits and ",
        n.withdrawal, " withdrawals.\n", sep = "")
  }

  list(deposit = deposit,
       withdraw = withdraw,
       balance = balance,
       transfer = transfer)

}
```

```
lily <- open.account(200, "Lily")
```

```
## Balance (Lily): 200. You made 1 deposits and 0 withdrawals.
```

```
ross <- open.account(100, "Ross")
```

```
## Balance (Ross): 100. You made 1 deposits and 0 withdrawals.
```

```
lily$transfer(70,ross)
```

```
## 70 withdrawn. Balance (Lily): 130. You made 1 deposits and 1 withdrawals.
## 70 deposited. Balance (Ross): 170. You made 2 deposits and 0 withdrawals.
```

```
ross$withdraw(50)
```

```
## 50 withdrawn. Balance (Ross): 120. You made 2 deposits and 1 withdrawals.
```

```
lily$deposit(30)
```

```
## 30 deposited. Balance (Lily): 160. You made 2 deposits and 1 withdrawals.
```

```
ross$transfer(100,lily)
```

```
## 100 withdrawn. Balance (Ross): 20. You made 2 deposits and 2 withdrawals.
## 100 deposited. Balance (Lily): 260. You made 3 deposits and 1 withdrawals.
```

```
lily$balance()
```

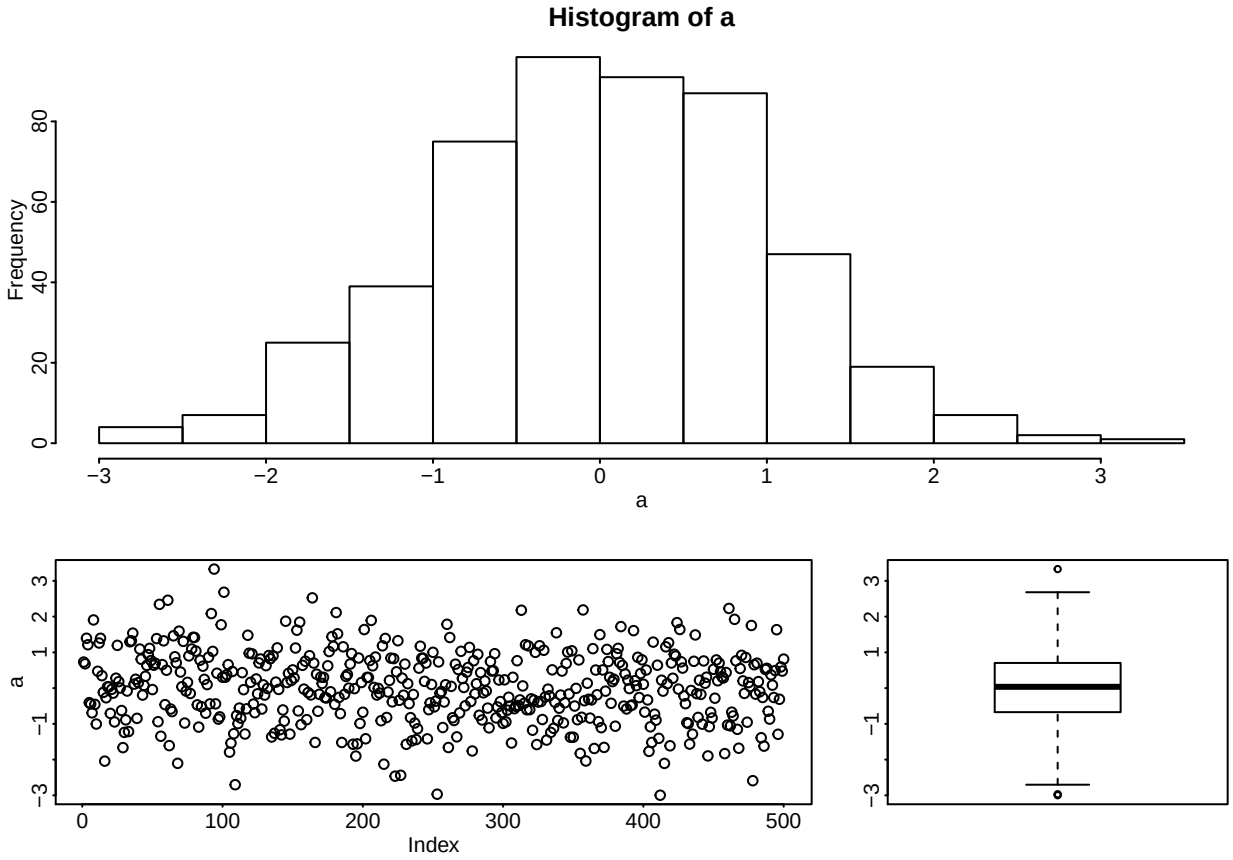
```
## Balance (Lily): 260. You made 3 deposits and 1 withdrawals.
```

```
ross$balance()
```

```
## Balance (Ross): 20. You made 2 deposits and 2 withdrawals.
```

Problem5

```r
par(mar=c(2, 2, 2, 1), mgp=c(1.1, 0.15, 0), tck=-0.01)
a <- rnorm(500)
layout(mat=matrix(c(2,2,2,
                    2,2,2,
                    2,2,2,
                    1,1,3,
                    1,1,3),nrow = 5,byrow=TRUE))
plot(a)
hist(a)
boxplot(a)
```



Problem6

```r
CIS <- function(n, conf.coeff, real.mu, real.var, B) {

  real.sd <- sqrt(real.var)
  s <- matrix(sapply(1:B, function(x) rnorm (n,real.mu,real.sd)),ncol = B)
  x <- colMeans(s)


  if (conf.coeff == 0.68) dev <- 1
  if (conf.coeff == 0.95) dev <- 1.96
  if (conf.coeff == 0.99) dev <- 3

  CIlow <- x - dev*real.sd/sqrt(n)
```

```r
  CIhigh <- x + dev*real.sd/sqrt(n)

  a <- CIlow <= real.mu & CIhigh >= real.mu
  y <- 1:B

  plot(x, y, xlab = "True mean (in blue) and CIs", ylab = "cases",
       xlim = c(7,13), ylim =c(0,100),
       main = paste("[successful CIs:", sum(a),"%]"), col = ifelse(a,"darkgreen","red"))
  abline(v = 10, lwd = 3, col = "blue", lty = 'dashed')
  segments(CIlow, y, CIhigh, y, col = ifelse(a, "darkgreen", "red"), lwd = 1)
}

CIS(10, 0.95, 10, 4, 100)
```