Module 4 Homework

Yanhe Wen

2/4/2017

Question 1

(a)

```
data1 <- matrix(rnorm(10000*5, mean = 5, sd = 3), nrow = 10000)
Ex1 <- mean(data1)
sd1 <- sd(data1)
cat("The mean is: ", Ex1, " The sd is: ", sd1)
```

```
## The mean is:  5.002405  The sd is:  2.998553
```

(b)

```
count<-0
for(i in 1:length(data1)){
  if(data1[i]>2&data1[i]<5.1){
    count = count + 1
  }
}
p <- count/length(data1)
cat("Yes, we can find P(2<X<5.1), it is: ", p)
```

```
## Yes, we can find P(2<X<5.1), it is:  0.35562
```

```
cat("Just to confirmed the result, we use formula: ",
pnorm(5.1, mean = 5, sd = 3) - pnorm(2, mean = 5, sd = 3))
```

```
## Just to confirmed the result, we use formula:  0.3546404
```

Question 2

```
meanX2 <- 20*0.7
sdX2 <- sqrt(20*0.7*(1-0.7))
p2 <- 1 - pnorm(15, meanX2, sdX2)
cat("P(Y>15) = ", p2)
```

```
## P(Y>15) =  0.3127926
```

Question 3

```
require(mvtnorm)
```

```
## Loading required package: mvtnorm
```

```r
nsim3 <- 1000
XmeanData <- rep(NA, nsim3)
for(i in 1:nsim3){
  data3 <- rmvnorm(50, mean = c(9,10), sigma = matrix(c(3,2,2,5), nrow = 2))
  meanX <- apply(data3, 1, mean)
  meanY <- apply(data3, 2, mean)
  XmeanData[i] <- (meanX + 0.5 < meanY)
}
p3 <- mean(XmeanData)
S <- p3 + c(-1,1)*1.96*sqrt(var(XmeanData)/nsim3)
cat("We expect P(X+0.5<Y) is between ", S)
```

```
## We expect P(X+0.5<Y) is between  0.2618615 0.3181385
```

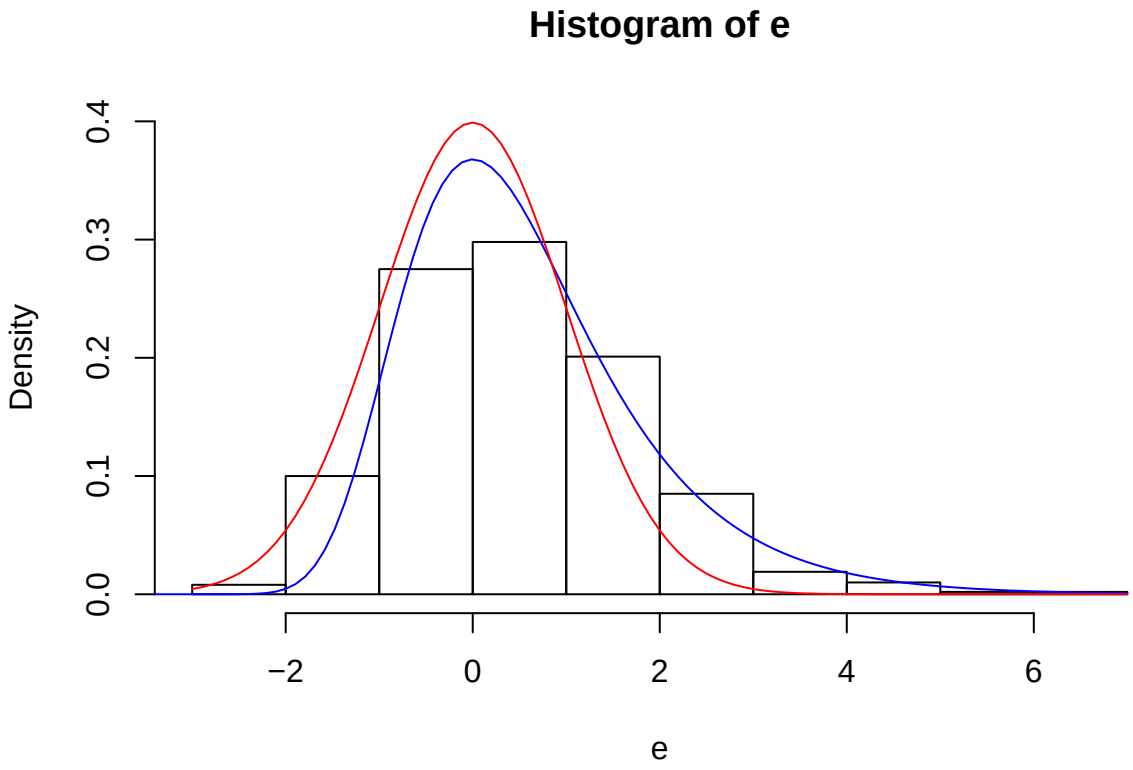
Question 4

```r
nsim4 <- 10000
X1 <- rchisq(nsim4, 10)
X2 <- rgamma(nsim4, 1, 2)
X3 <- rt(nsim4, 3)
Y <- sqrt(X1)*X2+4*(X3)^2
meanY <- mean(Y)
cat("The mean of Y is: ", meanY)
```

```
## The mean of Y is:  14.16735
```

Question 5

```r
nsim5 <- 1000
an <- function(n) {sqrt(2*log(n)) - 0.5*(log(log(n))+log(4*pi))*(2*log(n))^(-1/2)}
bn <- function(n) {(2*log(n))^(-1/2)}
fx <- function(x) {(exp(-x)*exp(-exp(-x)))}
e <- rep(NA, nsim5)
for(i in 1:nsim5){
  e[i] <- (max(rnorm(nsim5))-an(nsim5))/bn(nsim5)
}
hist(e, freq = FALSE, ylim = c(0,0.4))
curve(fx, density(e)$x, add = TRUE, col = "blue", ylim = c(0,0.4))
curve(dnorm,add=TRUE,col = "red")
```


Histogram of e
Density
0.0
0.1
0.2
0.3
0.4
−2
0
2
4
6
e