HW15

Use the Metropolis-Hastings algorithm to simulate a Markov chain of length 10,000. Use set.seed(440) in your simulation. Plot the histogram of this chain and the density of the target distribution

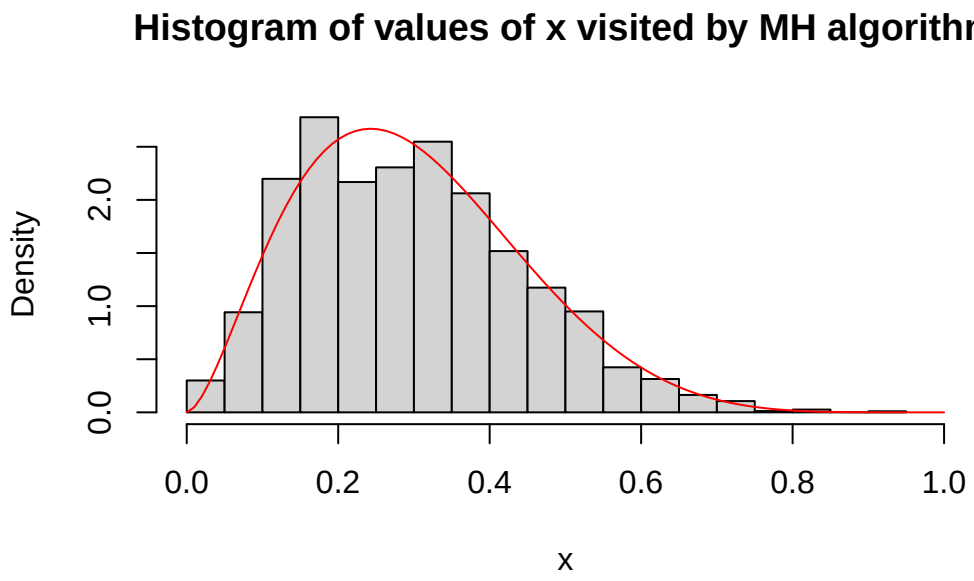
```
rm(list = ls())
set.seed(440)
```

```
x = rep(0,10000)
x[1] = .3 #initialize MH: I've set this arbitrarily to .3
a = 2.7
b = 6.3
```

```
target = function(x){
  return(dbeta(x,shape1 = a, shape2 = b))
}

for(i in 2:10000){
  current_x = x[i-1]
  proposed_x = current_x + rnorm(1,mean=0,sd=1)
  A = target(proposed_x)/target(current_x)
  if(runif(1)<A){
    x[i] = proposed_x # accept move with probability min(1,A)
  } else {
    x[i] = current_x # otherwise "reject" move, and stay where we are
  }
}
```

```r
hist(x,xlim=c(0,1),probability = TRUE, main="Histogram of values of x visited by MH algori
xx = seq(0,1,length=100)
lines(xx,target(xx),col="red")
```



Compute the sample mean and variance of the simulated Markov chain, and then compare them with the theoretical values of the target distribution.

The sample mean and variance of the simulated Markov chain

```r
mean(x)
```

```
[1] 0.2960322
```

```r
var(x)
```

```
[1] 0.02154892
```

Theoretical values of the target distribution

```
mean = a/(a+b)
mean
```

```
[1] 0.3
```

```
var = a*b/(((a+b)^2)*(a+b+1))
var
```

```
[1] 0.021
```