344HW6

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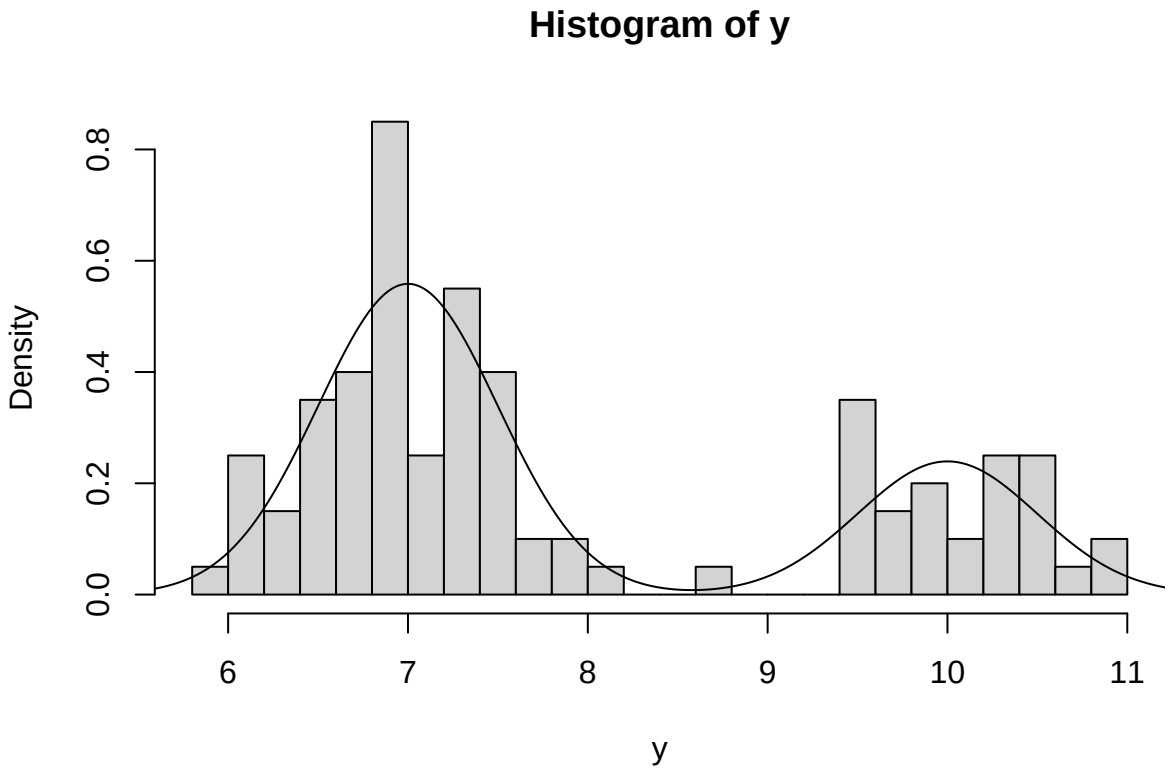
Problem 7.1 of Textbook

a)

```
#a
y = c(7.25325222659913, 6.85652267046824, 7.23643792894966, 7.03343611519664, 6.9186591609056, 6.656498
par(mfrow = c(1,1))
x = seq(5, 14, by = 0.01)
d = .7 * dnorm(x, 7, .5) + .3 * dnorm(x, 10, .5)
hist(y, breaks = 20, freq = FALSE, ylab = "Density")
points (x, d, type = 'l')
```



We see that the histogram follows relatively closely to the distribution.

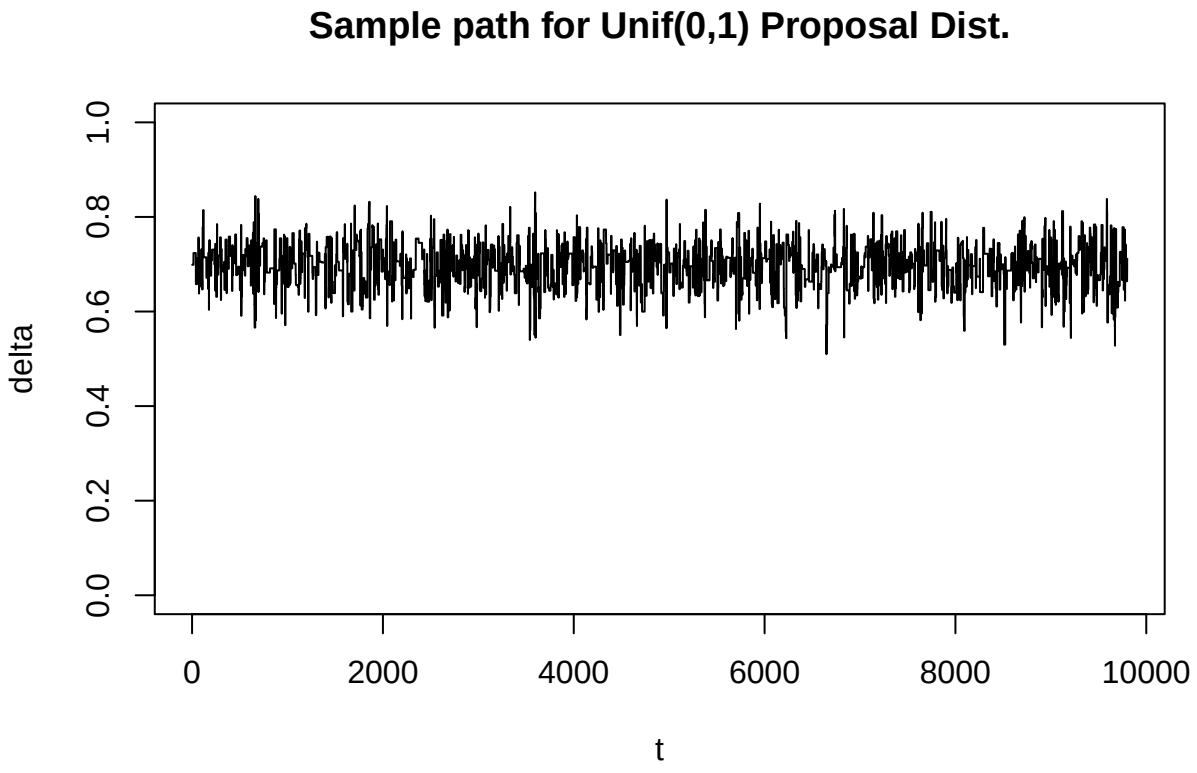
b)

```
#b
n = 10000
x.val1 = NULL
x.val2=NULL
```

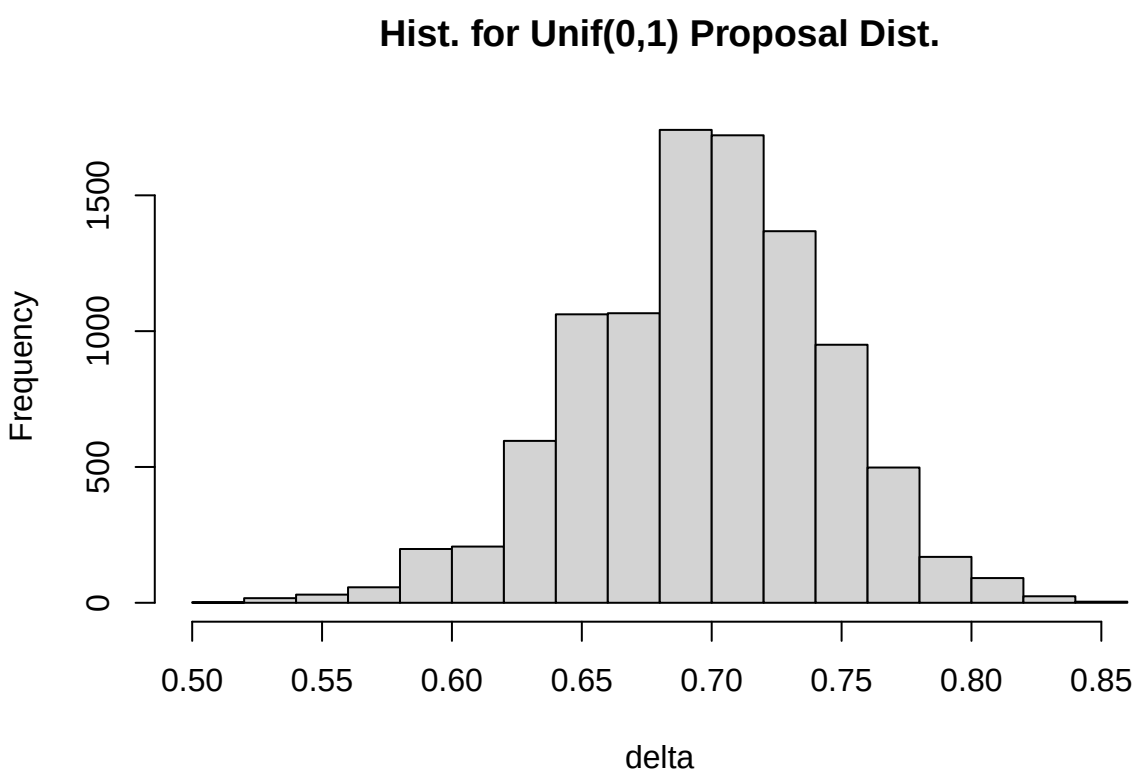
```r
set.seed(0)

f = function(x) {
  prod(x * dnorm(y, 7, 0.5) + (1 - x)*dnorm(y, 10, 0.5))
}

R = function(xt,x) {
  f(x)*g(xt)/(f(xt)*g(x))
}

g = function(x) {
  dunif(x, 0, 1)
}

x.val1[1] = runif (1, 0, 1)

for(i in 1:n){
      xt = x.val1[i]
      x = runif(1, 0, 1)
      p = min(R(xt, x), 1)
      d = rbinom(1, 1, p)
      x.val1[i + 1] = x*d + xt*(1 - d)
}
mean(x.val1[201:(n + 1)])
```

```
## [1] 0.6972622
```

```r
plot(x.val1[201:(n + 1)], ylim = c(0, 1), type="l", ylab="delta", xlab="t")
title("Sample path for Unif(0,1) Proposal Dist.")
```



```
hist(x.val1[201:(n + 1)], breaks = 20, xlab = "delta", main="Hist. for Unif(0,1) Proposal Dist.")
```



We get an average delta value of 0.697, and see that the sample path for Unif(0,1) proposal distribution has good mixing.

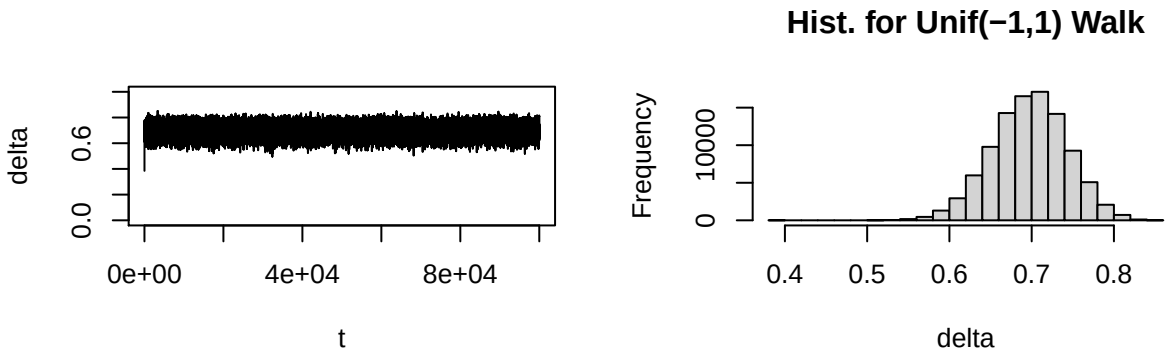
d)

```
num.its = 100000
set.seed(1)

u = rep(0, num.its)
u[1] = runif(1, -1, 1)
p = rep(0, num.its)
p[1] = exp(u[1])/(1 + exp(u[1]))

log.like<-function(p, y) {
      sum(log(p*dnorm(y, 7, 0.5) + (1 - p)*dnorm(y, 10, 0.5)))
}

for (i in 1:(num.its - 1)) {
    u[i + 1] = u[i] + runif(1, -1, 1)
    p[i + 1] = exp(u[i + 1])/(1 + exp(u[i + 1]))
    R = exp(log.like(p[i+1],y)-log.like(p[i],y))*exp(u[i+1])/(1+exp(u[i+1]))^2/exp(u[i])*(1+exp(u[i]))^

    if (R<1) {
         if(rbinom(1,1,R)==0)   {
           p[i+1]=p[i]; u[i+1]=u[i]
         }
  }
}

burn.in=1:1000
```

```
mean(p[-burn.in])
```

```
## [1] 0.6970154
```

```
par(mfrow = c(2, 2))
plot(p,ylim = c(0,1),type="l", ylab = "delta", xlab = "t")
hist(p,breaks = 20, xlab = "delta", main = "Hist. for Unif(-1,1) Walk")
```



Using a random walk analysis in U sapce, we get a very similar average value for delta of 0.697. Again, we see great mixing.