R code for Bivariate Normal Example

```
#  True mean and true covariance matrix.
m <- c(2,1)
S <- matrix(c(1,0.7,0.7,1),2,2)

# Vectors to evaluate density function
x1 <- seq(m[1]-3*sqrt(S[1,1]),m[1]+3*sqrt(S[1,1]),by=0.25)
x2 <- seq(m[2]-3*sqrt(S[2,2]),m[2]+3*sqrt(S[2,2]),by=0.25)
# Gibbs Sampler
M <- 999
x <- c(-1,3)
xs <- x
for (i in 1:M){
 x[1]<- rnorm(1,m[1]+S[1,2]/S[2,2]*(x[2]-m[2]),
sqrt(S[1,1]-S[1,2]^2/S[2,2]))
 x[2]<- rnorm(1,m[2]+S[2,1]/S[1,1]*(x[1]-m[1]),
sqrt(S[2,2]-S[2,1]^2/S[1,2]))
 xs<- rbind(xs,x)
}
```

```
# histograms and density
par(mfrow=c(2,1))
hist(xs[,1],prob=T,col=0,xlab="x1")
lines(x1,dnorm(x1,m[1],sqrt(S[1,1])))
hist(xs[,2],prob=T,col=0,xlab="x2")
lines(x2,dnorm(x2,m[2],sqrt(S[2,2])))
# Autocorrelation plot
par(mfrow=c(2,1))
acf(xs[,1],lag=50)
acf(xs[,2],lag=50)
# Ergodic Average
par(mfrow=c(2,1))
plot(cumsum(xs[,1])/1:(M+1),
type="l",xlab="iteration",ylab="x1")
abline(h=m[1])
plot(cumsum(xs[,2])/1:(M+1),
type="l",xlab="iteration",ylab="x2")
abline(h=m[2])
```