

## MCexample3\_fragment

August 9, 2024

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[ ]: #
# Metropolis-Hastings demonstrating burn-in
#

#set.seed(12345) # Uncomment this line if reproducibility is required
library(MASS) # Load the MASS library for the mvrnorm function

nmh <- 50000 # Number of Metropolis-Hastings samples > 1
step <- 1.0 # Step size for the proposal distribution
#step <- 0.2 # Alternative smaller step size for the proposal distribution

# Define the target probability density (bivariate Gaussian)
cm <- matrix(c(1.0,0.6,0.6,1.0),2,2) # covariance matrix
pnorm <- 1.0/sqrt((2.0*pi)^2*det(cm)) # Normalization factor for the
↳bivariate Gaussian
icm <- solve(cm) # Inverse of the covariance matrix
p <- function(x) pnorm * exp(-0.5 * t(x) %*% icm %*%x) # Define the target
↳PDF

# Create a contour plot of the bivariate Gaussian PDF
xplot <- seq(-5.0,5.0,0.2) # zero centered x-values for plotting contour
n <- length(xplot)
pplot <- matrix(nrow=n,ncol=n)
for (i in 1:n) {
  for (j in 1:n) {
    pplot[i, j] <- p(c(xplot[i], xplot[j])) # Calculate the PDF values for the
↳contour plot
  }
}
contour(xplot, xplot, pplot, asp = TRUE, xlab = "x", ylab = "y",
  main = paste(toString(nmh), "samples, mvrnorm (green),
↳Metropolis-Hastings (red)")

# overlay samples from bivariate Gaussian
psam <- mvrnorm(nmh, c(0,0), cm) # Generate samples from the bivariate Gaussian
```

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points(psam[,1],psam[,2], cex=0.1, col=rgb(0,0.3,0,alpha=0.5)) # Plot the
↳samples in green

# Metropolis-Hastings samples
pmh <- matrix(nrow=nmh,ncol=2) # Matrix containing MH samples
pmh[1,] <- c(5.0, -5.0) # Start at an unlikely location
nAccept <- 0 # Initialize the count of accepted
↳samples

for (i in 2:nmh) {
  xcur <- pmh[i-1,] # Current state
  xprop <- xcur + runif(2,-0.5,0.5)*step # Propose new state (uncorrelated
↳uniform change, symmetric)

###
### Space reserved for your Metropolis-Hastings code:
### calculate the acceptance ratio and accept or reject the proposed state
###
}

points(pmh[,1],pmh[,2], cex=0.15, col=rgb(1.0,0.0,0,alpha=0.5))
cat("Number of accepted points: ", nAccept, "\n")

```

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