

## Assignment2\_Part1\_Step6

```
source("mcmc_functions.R")
trueA <- 5
trueB <- 0
trueSd <- 10
sampleSize <- 31

# create independent x-values
x <- (-(sampleSize-1)/2):((sampleSize-1)/2)
# create dependent values according to  $ax + b + N(0, sd)$ 
y <- trueA * x + trueB + rnorm(n=sampleSize, mean=0, sd=trueSd)
```

- Compare Results

```
set.seed(1)
compare_outputs <- function (iterations) {
  burnIn <- 0.5 * iterations
  for(i in 1:10){
    startvalue = c(runif(1, 0, 10), runif(1, 0, 5), runif(1, 0, 20))
    chain <- run_metropolis_MCMC(startvalue, iterations)
    a <- chain[-(1:burnIn), 1]
    mean_a <- mean(a)
    sd_a <- sd(a)
    print(c("iterations", iterations, "mean(a) = ", mean_a))
    print(c("iterations", iterations, "sd(a) = ", sd_a))
  }
}

compare_outputs(1000)
```

```
## [1] "iterations"      "1000"      "mean(a) = "
## [4] "4.72282865653936"
## [1] "iterations"      "1000"      "sd(a) = "
## [4] "0.13469887596028"
## [1] "iterations"      "1000"      "mean(a) = "
## [4] "4.63949035750317"
## [1] "iterations"      "1000"      "sd(a) = "
## [4] "0.135142957520542"
## [1] "iterations"      "1000"      "mean(a) = "
## [4] "4.67652236387289"
## [1] "iterations"      "1000"      "sd(a) = "
## [4] "0.208668321195573"
## [1] "iterations"      "1000"      "mean(a) = "
## [4] "4.68712372708846"
## [1] "iterations"      "1000"      "sd(a) = "
## [4] "0.146563671238488"
## [1] "iterations"      "1000"      "mean(a) = "
## [4] "4.69708642595755"
## [1] "iterations"      "1000"      "sd(a) = "
## [4] "0.15293798203126"
## [1] "iterations"      "1000"      "mean(a) = "
## [4] "4.69856661019231"
```

```
## [1] "iterations"      "1000"      "sd(a) = "
## [4] "0.135478907595414"
## [1] "iterations"      "1000"      "mean(a) = "
## [4] "4.73495400400354"
## [1] "iterations"      "1000"      "sd(a) = "
## [4] "0.158144149665136"
## [1] "iterations"      "1000"      "mean(a) = "
## [4] "4.67743828062874"
## [1] "iterations"      "1000"      "sd(a) = "
## [4] "0.137117109058196"
## [1] "iterations"      "1000"      "mean(a) = "
## [4] "4.66064944108498"
## [1] "iterations"      "1000"      "sd(a) = "
## [4] "0.166892729335127"
## [1] "iterations"      "1000"      "mean(a) = "
## [4] "4.62832125762661"
## [1] "iterations"      "1000"      "sd(a) = "
## [4] "0.132603631562699"
```

```
compare_outputs(10000)
```

```
## [1] "iterations"      "10000"     "mean(a) = "
## [4] "4.68516604268025"
## [1] "iterations"      "10000"     "sd(a) = "
## [4] "0.177373994554198"
## [1] "iterations"      "10000"     "mean(a) = "
## [4] "4.68218034124227"
## [1] "iterations"      "10000"     "sd(a) = "
## [4] "0.153810060762507"
## [1] "iterations"      "10000"     "mean(a) = "
## [4] "4.66515932735404"
## [1] "iterations"      "10000"     "sd(a) = "
## [4] "0.173713131094555"
## [1] "iterations"      "10000"     "mean(a) = "
## [4] "4.69729072396584"
## [1] "iterations"      "10000"     "sd(a) = "
## [4] "0.167550978313088"
## [1] "iterations"      "10000"     "mean(a) = "
## [4] "4.68715347195558"
## [1] "iterations"      "10000"     "sd(a) = "
## [4] "0.164957548229452"
## [1] "iterations"      "10000"     "mean(a) = "
## [4] "4.67752369002233"
## [1] "iterations"      "10000"     "sd(a) = "
## [4] "0.159294952519143"
## [1] "iterations"      "10000"     "mean(a) = "
## [4] "4.67941987568163"
## [1] "iterations"      "10000"     "sd(a) = "
## [4] "0.156084318551745"
## [1] "iterations"      "10000"     "mean(a) = "
## [4] "4.68007541472492"
## [1] "iterations"      "10000"     "sd(a) = "
## [4] "0.160470850314713"
## [1] "iterations"      "10000"     "mean(a) = "
## [4] "4.68622251206277"
```

```
## [1] "iterations"      "10000"      "sd(a) = "
## [4] "0.157476155906893"
## [1] "iterations"      "10000"      "mean(a) = "
## [4] "4.69005955771811"
## [1] "iterations"      "10000"      "sd(a) = "
## [4] "0.166681491658683"
```

```
compare_outputs(100000)
```

```
## [1] "iterations"      "1e+05"      "mean(a) = "
## [4] "4.67458140990228"
## [1] "iterations"      "1e+05"      "sd(a) = "
## [4] "0.162898590211565"
## [1] "iterations"      "1e+05"      "mean(a) = "
## [4] "4.67628329896551"
## [1] "iterations"      "1e+05"      "sd(a) = "
## [4] "0.16345527700577"
## [1] "iterations"      "1e+05"      "mean(a) = "
## [4] "4.67911466002464"
## [1] "iterations"      "1e+05"      "sd(a) = "
## [4] "0.16534569947533"
## [1] "iterations"      "1e+05"      "mean(a) = "
## [4] "4.67538566221791"
## [1] "iterations"      "1e+05"      "sd(a) = "
## [4] "0.16607549348614"
## [1] "iterations"      "1e+05"      "mean(a) = "
## [4] "4.68392482746049"
## [1] "iterations"      "1e+05"      "sd(a) = "
## [4] "0.165783341949001"
## [1] "iterations"      "1e+05"      "mean(a) = "
## [4] "4.68116331764737"
## [1] "iterations"      "1e+05"      "sd(a) = "
## [4] "0.16201884020848"
## [1] "iterations"      "1e+05"      "mean(a) = "
## [4] "4.68314195065518"
## [1] "iterations"      "1e+05"      "sd(a) = "
## [4] "0.169480193558678"
## [1] "iterations"      "1e+05"      "mean(a) = "
## [4] "4.67785040404549"
## [1] "iterations"      "1e+05"      "sd(a) = "
## [4] "0.166681844825895"
## [1] "iterations"      "1e+05"      "mean(a) = "
## [4] "4.67927282045408"
## [1] "iterations"      "1e+05"      "sd(a) = "
## [4] "0.164890633748334"
## [1] "iterations"      "1e+05"      "mean(a) = "
## [4] "4.68240954040206"
## [1] "iterations"      "1e+05"      "sd(a) = "
## [4] "0.161790084395081"
```

- True value is a, and the computed a is close to the true a. The standard deviation of a is relatively small.