HW-JAGS

Shangchen Han

4/10/2020

Exercise 8.1

```
data("Boston")
y <- Boston[,4]
s <- c(rep("black",100),rep("blue",200),rep("pink",206))
data <- data.frame(y=y,s=s)
colnames(data)[1] <- c("y")
rownames(data) <- c(1:506)
source("DBDA2E-utilities.R")
```

```
##
## *********************************************************************
## Kruschke, J. K. (2015). Doing Bayesian Data Analysis, Second Edition:
## A Tutorial with R, JAGS, and Stan. Academic Press / Elsevier.
## *********************************************************************
```

```
## Loading required package: coda
```

```
## Linked to JAGS 4.3.0
```

```
## Loaded modules: basemod,bugs
```

```
##
## Attaching package: 'runjags'
```

```
## The following object is masked from 'package:tidyr':
##
##     extract
```

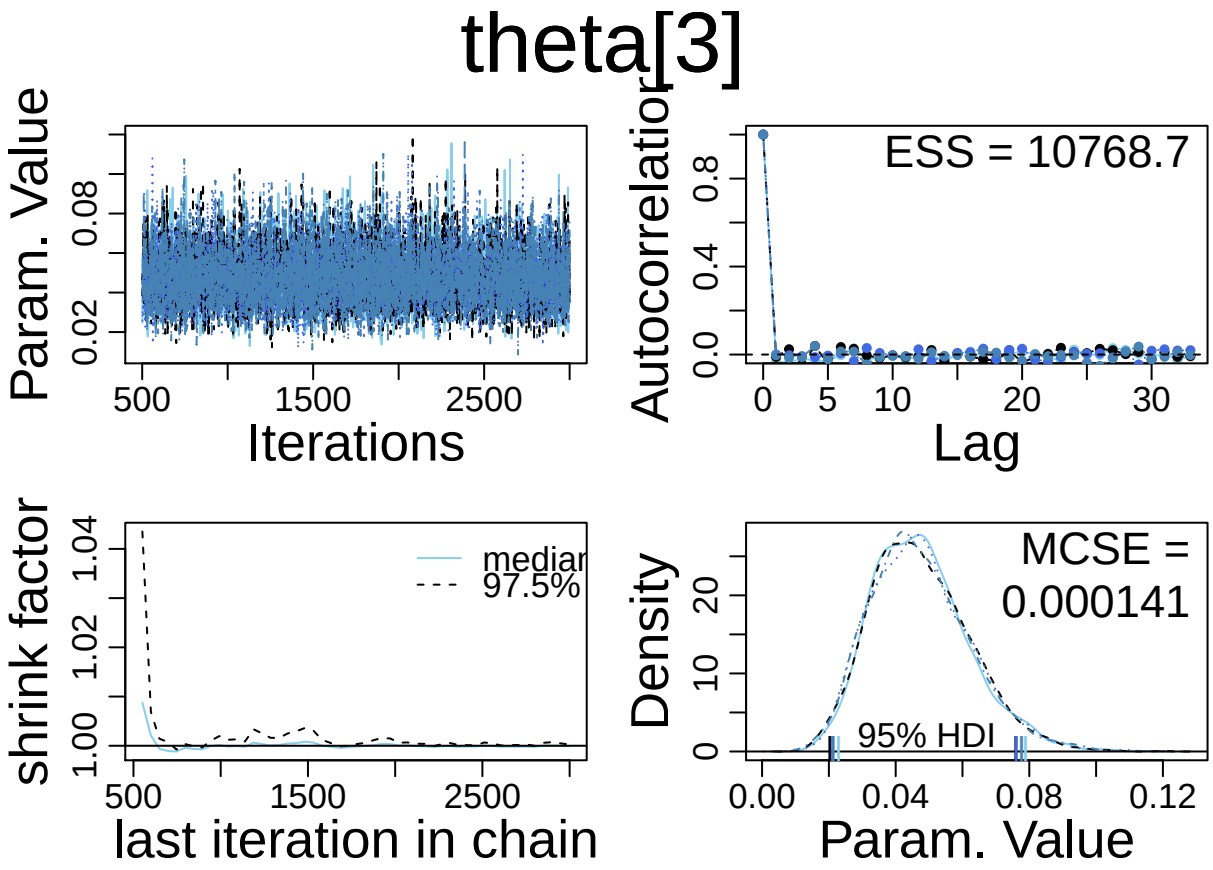
```
source("Jags-Ydich-XnomSsubj-MbernBeta.R")
```

```
##
## *********************************************************************
## Kruschke, J. K. (2015). Doing Bayesian Data Analysis, Second Edition:
## A Tutorial with R, JAGS, and Stan. Academic Press / Elsevier.
## *********************************************************************
```

```
mcmc <- genMCMC(data = data,numSavedSteps = 10000)
```

```
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 506
##    Unobserved stochastic nodes: 3
##    Total graph size: 1018
##
## Initializing model
##
## Burning in the MCMC chain...
## Sampling final MCMC chain...
```

```
parameterNames <- varnames(mcmc)
for (parName in parameterNames) {
  diagMCMC(codaObject = mcmc, parName = parName)
}
smryMCMC(mcmc,compVal = NULL,compValDiff = 0.0)
```




```
##                          Mean      Median          Mode     ESS HDImass
## theta[1]            0.01919706  0.01620819  0.009598729 10454.8    0.95
## theta[2]            0.14209730  0.14104603  0.135950163 10000.0    0.95
## theta[3]            0.04747394  0.04611025  0.044289555 11146.7    0.95
## theta[1]-theta[2] -0.12290024 -0.12250817 -0.118424208 10000.0    0.95
## theta[1]-theta[3] -0.02827688 -0.02879912 -0.031255713 11145.2    0.95
## theta[2]-theta[3]  0.09462336  0.09458688  0.096514069 10000.0    0.95
##                         HDIlow     HDIhigh CompVal PcntGtCompVal ROPElow
## theta[1]            0.0005067213  0.04481551      NA            NA      NA
## theta[2]            0.0954132872  0.18938289      NA            NA      NA
## theta[3]            0.0209099407  0.07695918      NA            NA      NA
## theta[1]-theta[2] -0.1804011109 -0.07308370       0          0.01      NA
## theta[1]-theta[3] -0.0683378972  0.01077290       0          7.58      NA
## theta[2]-theta[3]  0.0377939692  0.14930175       0         99.95      NA
##                   ROPEhigh PcntLtROPE PcntInROPE PcntGtROPE
## theta[1]                NA         NA         NA         NA
## theta[2]                NA         NA         NA         NA
## theta[3]                NA         NA         NA         NA
## theta[1]-theta[2]       NA         NA         NA         NA
## theta[1]-theta[3]       NA         NA         NA         NA
```

```
## theta[2]-theta[3]       NA         NA         NA         NA
```

```
##                          Mean      Median         Mode     ESS HDImass
## theta[1]           0.01919706  0.01620819  0.009598729 10454.8    0.95
## theta[2]           0.14209730  0.14104603  0.135950163 10000.0    0.95
## theta[3]           0.04747394  0.04611025  0.044289555 11146.7    0.95
## theta[1]-theta[2] -0.12290024 -0.12250817 -0.118424208 10000.0    0.95
## theta[1]-theta[3] -0.02827688 -0.02879912 -0.031255713 11145.2    0.95
## theta[2]-theta[3]  0.09462336  0.09458688  0.096514069 10000.0    0.95
##                         HDIlow     HDIhigh CompVal PcntGtCompVal ROPElow
## theta[1]           0.0005067213  0.04481551      NA            NA      NA
## theta[2]           0.0954132872  0.18938289      NA            NA      NA
## theta[3]           0.0209099407  0.07695918      NA            NA      NA
## theta[1]-theta[2] -0.1804011109 -0.07308370       0          0.01      NA
## theta[1]-theta[3] -0.0683378972  0.01077290       0          7.58      NA
## theta[2]-theta[3]  0.0377939692  0.14930175       0         99.95      NA
##                   ROPEhigh PcntLtROPE PcntInROPE PcntGtROPE
## theta[1]                NA         NA         NA         NA
## theta[2]                NA         NA         NA         NA
## theta[3]                NA         NA         NA         NA
## theta[1]-theta[2]       NA         NA         NA         NA
## theta[1]-theta[3]       NA         NA         NA         NA
## theta[2]-theta[3]       NA         NA         NA         NA
```

```
plotMCMC(mcmc,data = data,compVal = NULL,compValDiff = 0.0)
```

Exercise 8.2

```
smryMCMC(mcmc,compVal = 0.5,rope = c(0.45,0.55),compValDiff = 0.0,ropeDiff = c(-0.05,0.05))
```

```
##                          Mean      Median         Mode     ESS HDImass
## theta[1]           0.01919706  0.01620819  0.009598729 10454.8    0.95
## theta[2]           0.14209730  0.14104603  0.135950163 10000.0    0.95
## theta[3]           0.04747394  0.04611025  0.044289555 11146.7    0.95
## theta[1]-theta[2] -0.12290024 -0.12250817 -0.118424208 10000.0    0.95
## theta[1]-theta[3] -0.02827688 -0.02879912 -0.031255713 11145.2    0.95
## theta[2]-theta[3]  0.09462336  0.09458688  0.096514069 10000.0    0.95
##                         HDIlow     HDIhigh CompVal PcntGtCompVal ROPElow
## theta[1]           0.0005067213  0.04481551     0.5          0.00    0.45
## theta[2]           0.0954132872  0.18938289     0.5          0.00    0.45
## theta[3]           0.0209099407  0.07695918     0.5          0.00    0.45
## theta[1]-theta[2] -0.1804011109 -0.07308370     0.0          0.01   -0.05
## theta[1]-theta[3] -0.0683378972  0.01077290     0.0          7.58   -0.05
## theta[2]-theta[3]  0.0377939692  0.14930175     0.0         99.95   -0.05
##                   ROPEhigh PcntLtROPE PcntInROPE PcntGtROPE
## theta[1]              0.55     100.00       0.00       0.00
## theta[2]              0.55     100.00       0.00       0.00
## theta[3]              0.55     100.00       0.00       0.00
## theta[1]-theta[2]     0.05      99.58       0.42       0.00
## theta[1]-theta[3]     0.05      12.79      87.11       0.10
## theta[2]-theta[3]     0.05       0.00       5.77      94.23
```

```
##                          Mean      Median         Mode     ESS HDImass
## theta[1]           0.01919706  0.01620819  0.009598729 10454.8    0.95
## theta[2]           0.14209730  0.14104603  0.135950163 10000.0    0.95
```

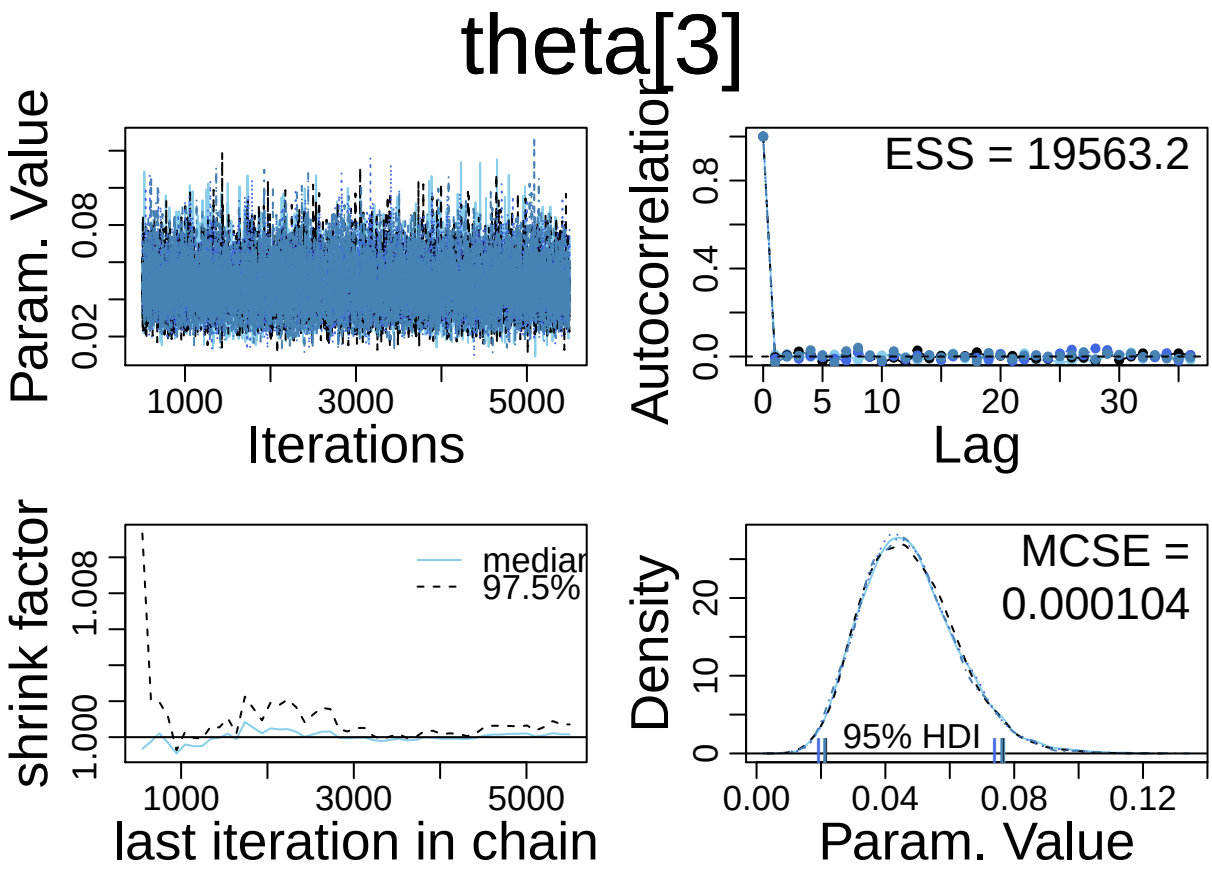
```
## theta[3]           0.04747394  0.04611025  0.044289555 11146.7    0.95
## theta[1]-theta[2] -0.12290024 -0.12250817 -0.118424208 10000.0    0.95
## theta[1]-theta[3] -0.02827688 -0.02879912 -0.031255713 11145.2    0.95
## theta[2]-theta[3]  0.09462336  0.09458688  0.096514069 10000.0    0.95
##                          HDIlow     HDIhigh CompVal PcntGtCompVal ROPElow
## theta[1]           0.0005067213  0.04481551     0.5          0.00    0.45
## theta[2]           0.0954132872  0.18938289     0.5          0.00    0.45
## theta[3]           0.0209099407  0.07695918     0.5          0.00    0.45
## theta[1]-theta[2] -0.1804011109 -0.07308370     0.0          0.01   -0.05
## theta[1]-theta[3] -0.0683378972  0.01077290     0.0          7.58   -0.05
## theta[2]-theta[3]  0.0377939692  0.14930175     0.0         99.95   -0.05
##                   ROPEhigh PcntLtROPE PcntInROPE PcntGtROPE
## theta[1]              0.55     100.00       0.00       0.00
## theta[2]              0.55     100.00       0.00       0.00
## theta[3]              0.55     100.00       0.00       0.00
## theta[1]-theta[2]     0.05      99.58       0.42       0.00
## theta[1]-theta[3]     0.05      12.79      87.11       0.10
## theta[2]-theta[3]     0.05       0.00       5.77      94.23
```

Exercise 8.3

```
fileNameRoot <- "Jags-Ydich-XnomSsubj-MbernBeta-Han"
graphFileType <- "eps"
mcmc <- genMCMC(data = data,numSavedSteps = 20000,saveName = fileNameRoot)
```

```
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 506
##    Unobserved stochastic nodes: 3
##    Total graph size: 1018
##
## Initializing model
##
## Burning in the MCMC chain...
## Sampling final MCMC chain...
```

```
parameterNames <- varnames(mcmc)
for (parName in parameterNames) {
  diagMCMC(codaObject = mcmc,parName = parName,saveName = fileNameRoot,saveType = graphFileType)
}
detail <- smryMCMC(mcmc,compVal = 0.5,rope = c(0.45,0.55),compValDiff = 0.0,ropeDiff = c(-0.05,0.05),sa
```




```
##                          Mean      Median        Mode     ESS HDImass
## theta[1]            0.01914234  0.01620756  0.01007641 20000.0    0.95
## theta[2]            0.14215136  0.14089105  0.13429168 20000.0    0.95
## theta[3]            0.04755352  0.04616834  0.04478380 20000.0    0.95
## theta[1]-theta[2] -0.12300902 -0.12235045 -0.11807183 19549.4    0.95
## theta[1]-theta[3] -0.02841118 -0.02880656 -0.03036534 20000.0    0.95
## theta[2]-theta[3]  0.09459784  0.09418834  0.09465423 20000.0    0.95
##                         HDIlow     HDIhigh CompVal PcntGtCompVal ROPElow
## theta[1]            0.0004204713  0.04495278     0.5          0.000    0.45
## theta[2]            0.0962669775  0.19080593     0.5          0.000    0.45
## theta[3]            0.0213120429  0.07648254     0.5          0.000    0.45
## theta[1]-theta[2] -0.1782298841 -0.06918780     0.0          0.005   -0.05
## theta[1]-theta[3] -0.0670871558  0.01116597     0.0          7.190   -0.05
## theta[2]-theta[3]  0.0425880737  0.15295796     0.0         99.940   -0.05
##                   ROPEhigh PcntLtROPE PcntInROPE PcntGtROPE
## theta[1]              0.55     100.00      0.000      0.000
## theta[2]              0.55     100.00      0.000      0.000
## theta[3]              0.55     100.00      0.000      0.000
## theta[1]-theta[2]     0.05      99.48      0.520      0.000
## theta[1]-theta[3]     0.05      12.72     87.210      0.070
## theta[2]-theta[3]     0.05       0.00      5.335     94.665
```

```
plotMCMC(mcmc,data = data,compVal = NULL,compValDiff = 0.0,saveName = fileNameRoot,saveType = graphFile
```

```
## pdf
##   2
```

Exercise 8.4

(a)

```
source("Jags-Ydich-XnomSsubj-MbernBeta.R")
```

```
##
## ********************************************************************
## Kruschke, J. K. (2015). Doing Bayesian Data Analysis, Second Edition:
## A Tutorial with R, JAGS, and Stan. Academic Press / Elsevier.
## ********************************************************************
```

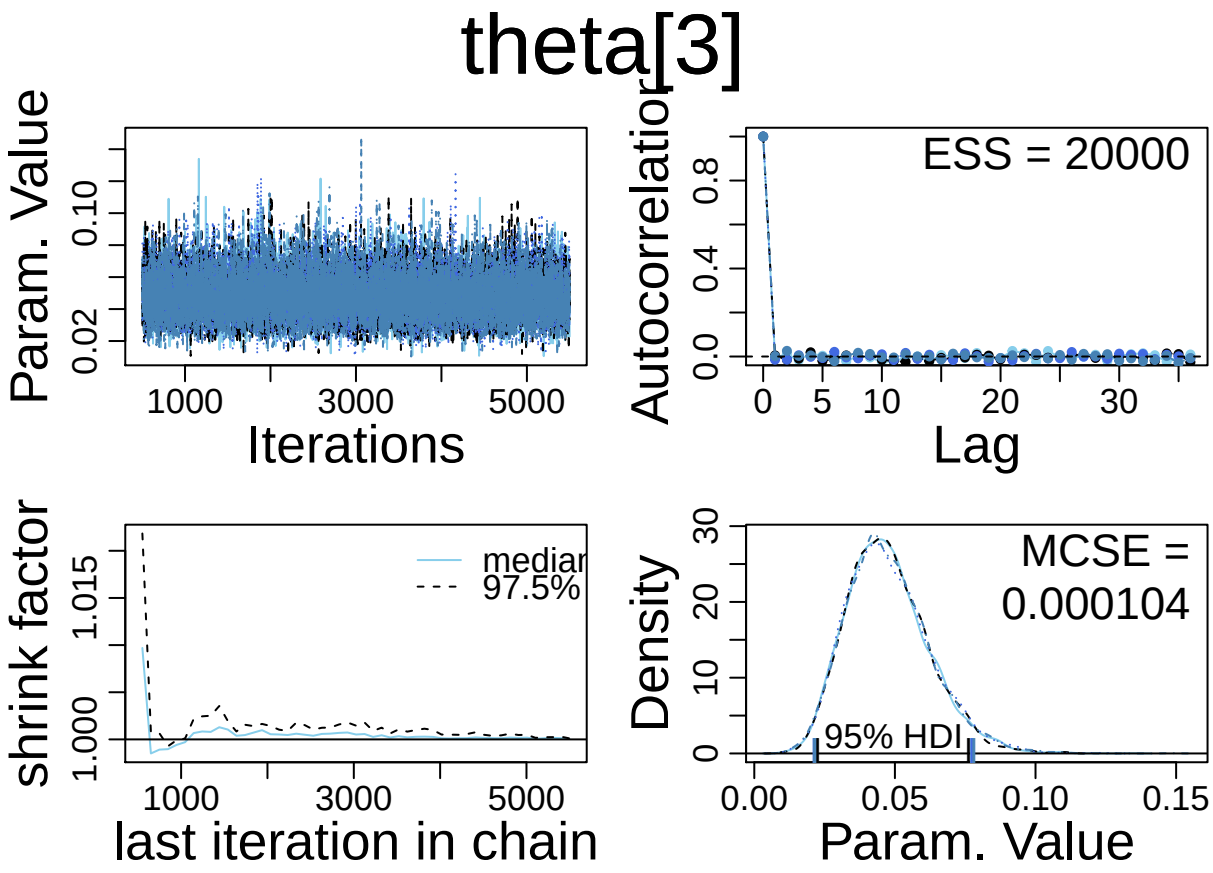
```
fileNameRoot = "Jags-Ydich-XnomSsubj-MbernBeta-Han8.4"
graphFileType = "eps"

mcmc = genMCMC( data=data , numSavedSteps=20000 , saveName=fileNameRoot )
```

```
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 506
##    Unobserved stochastic nodes: 3
##    Total graph size: 1018
##
## Initializing model
##
## Burning in the MCMC chain...
## Sampling final MCMC chain...
```

```
parameterNames = varnames(mcmc)
for ( parName in parameterNames ) {
  diagMCMC( codaObject=mcmc , parName=parName , saveName=fileNameRoot , saveType=graphFileType )
}


detail = smryMCMC(mcmc, compVal=0.5, rope=c(0.45,0.55),compValDiff=0.0, ropeDiff = c(-0.05,0.05) ,saveNa
```




```
##                          Mean      Median        Mode   ESS HDImass
## theta[1]           0.01933156  0.01626359  0.01023869 20000    0.95
## theta[2]           0.14212000  0.14093407  0.13714573 20000    0.95
## theta[3]           0.04767199  0.04614472  0.04324415 20000    0.95
## theta[1]-theta[2] -0.12278844 -0.12255678 -0.12562587 20000    0.95
## theta[1]-theta[3] -0.02834043 -0.02854855 -0.02889429 20000    0.95
## theta[2]-theta[3]  0.09444801  0.09385243  0.09351786 20000    0.95
##                         HDIlow     HDIhigh CompVal PcntGtCompVal ROPElow
## theta[1]           0.0003790817  0.04595300     0.5         0.000    0.45
## theta[2]           0.0959293340  0.19166410     0.5         0.000    0.45
## theta[3]           0.0213016054  0.07672613     0.5         0.000    0.45
## theta[1]-theta[2] -0.1802701978 -0.07025065     0.0         0.000   -0.05
## theta[1]-theta[3] -0.0669260925  0.01167340     0.0         7.320   -0.05
## theta[2]-theta[3]  0.0404799492  0.15203056     0.0        99.975   -0.05
##                   ROPEhigh PcntLtROPE PcntInROPE PcntGtROPE
## theta[1]              0.55    100.000      0.000      0.000
## theta[2]              0.55    100.000      0.000      0.000
## theta[3]              0.55    100.000      0.000      0.000
## theta[1]-theta[2]     0.05     99.545      0.455      0.000
## theta[1]-theta[3]     0.05     12.805     87.150      0.045
## theta[2]-theta[3]     0.05      0.000      5.640     94.360
```

```
plotMCMC( mcmc, data=data , compVal=NULL, compValDiff=0.0, saveName=fileNameRoot , saveType=graphFileTy
```

```
## pdf
##   2
```

(b)

```
source("Jags-Ydich-XnomSsubj-MbernBeta-8.4.b.R")
```

```
##
## ************************************************************************
## Kruschke, J. K. (2015). Doing Bayesian Data Analysis, Second Edition:
## A Tutorial with R, JAGS, and Stan. Academic Press / Elsevier.
## ************************************************************************
```

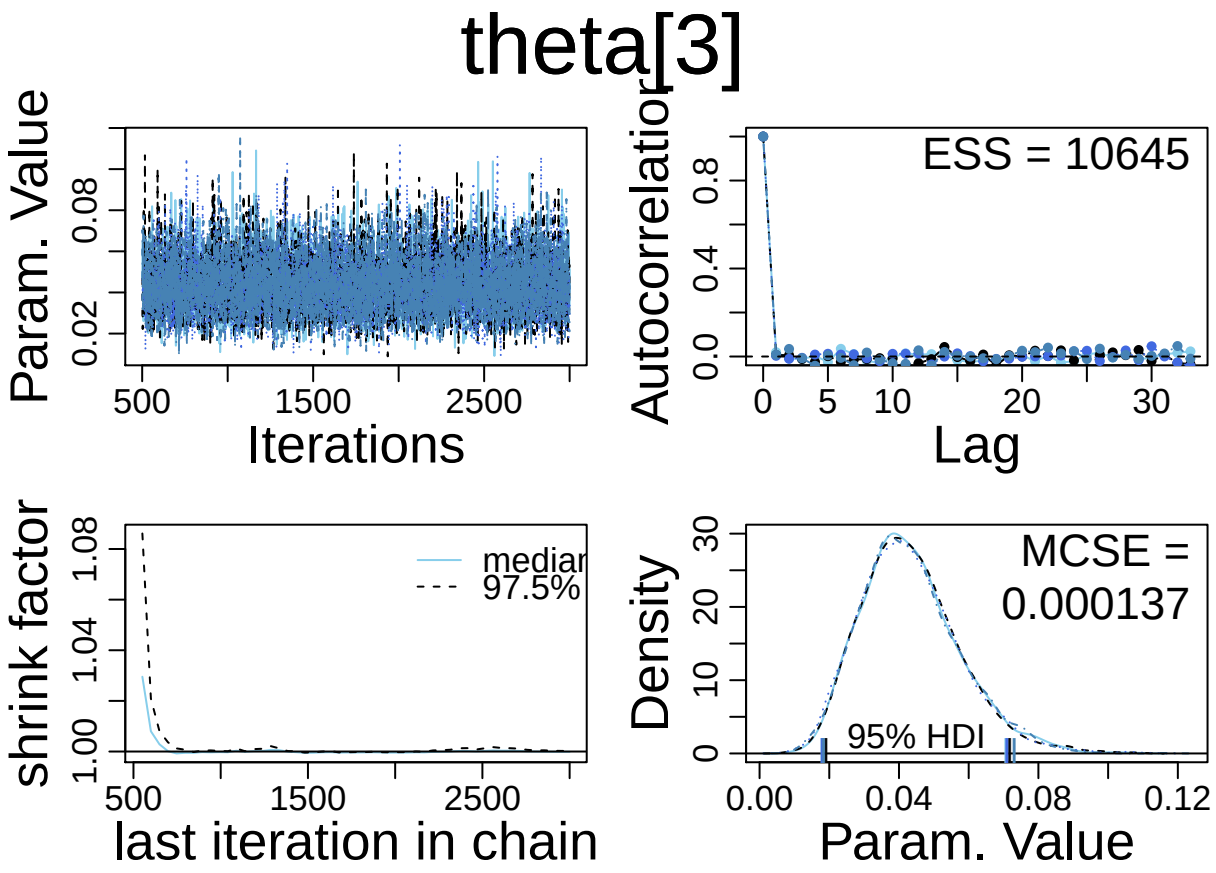
```
fileNameRoot = "Jags-Ydich-XnomSsubj-MbernBeta-8.4.b"
graphFileType = "eps"


mcmc = genMCMC( data=data , numSavedSteps=10000 , saveName=fileNameRoot )
```

```
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 506
##    Unobserved stochastic nodes: 3
##    Total graph size: 1018
##
## Initializing model
##
## Burning in the MCMC chain...
## Sampling final MCMC chain...
```

```
parameterNames = varnames(mcmc)
for ( parName in parameterNames ) {
  diagMCMC( codaObject=mcmc , parName=parName , saveName=fileNameRoot , saveType=graphFileType )
}

detail = smryMCMC(mcmc, compVal=0.5, rope=c(0.45,0.55),compValDiff=0.0, ropeDiff = c(-0.05,0.05) ,saveNa
```




```
##                          Mean       Median         Mode     ESS HDImass
## theta[1]           0.009736952  0.006815465  0.001978878 10000.0    0.95
## theta[2]           0.138720312  0.137329333  0.130508908 10000.0    0.95
## theta[3]           0.043284016  0.041844338  0.037828462 10000.0    0.95
## theta[1]-theta[2] -0.128983360 -0.127843572 -0.124689562  9492.5    0.95
## theta[1]-theta[3] -0.033547063 -0.033243374 -0.033059353 10000.0    0.95
## theta[2]-theta[3]  0.095436297  0.094738805  0.093509743 10000.0    0.95
##                         HDIlow       HDIhigh CompVal PcntGtCompVal ROPElow
## theta[1]           1.334637e-06  0.0292846427     0.5          0.00    0.45
## theta[2]           9.491420e-02  0.1881561676     0.5          0.00    0.45
## theta[3]           1.812198e-02  0.0715063068     0.5          0.00    0.45
## theta[1]-theta[2] -1.811398e-01 -0.0787848039     0.0          0.01   -0.05
## theta[1]-theta[3] -6.894492e-02 -0.0008036358     0.0          2.42   -0.05
## theta[2]-theta[3]  4.083822e-02  0.1506573591     0.0         99.96   -0.05
##                   ROPEhigh PcntLtROPE PcntInROPE PcntGtROPE
## theta[1]              0.55     100.00       0.00       0.00
## theta[2]              0.55     100.00       0.00       0.00
## theta[3]              0.55     100.00       0.00       0.00
## theta[1]-theta[2]     0.05      99.86       0.14       0.00
## theta[1]-theta[3]     0.05      15.52      84.47       0.01
## theta[2]-theta[3]     0.05       0.00       4.83      95.17
```

```
plotMCMC( mcmc, data=data , compVal=NULL, compValDiff=0.0, saveName=fileNameRoot , saveType=graphFileTy
```

```
## pdf
##   2
```

(c)

```
source("Jags-Ydich-XnomSsubj-MbernBeta-8.4.c.R")
```

```
##
## ************************************************************************
## Kruschke, J. K. (2015). Doing Bayesian Data Analysis, Second Edition:
## A Tutorial with R, JAGS, and Stan. Academic Press / Elsevier.
## ************************************************************************
```

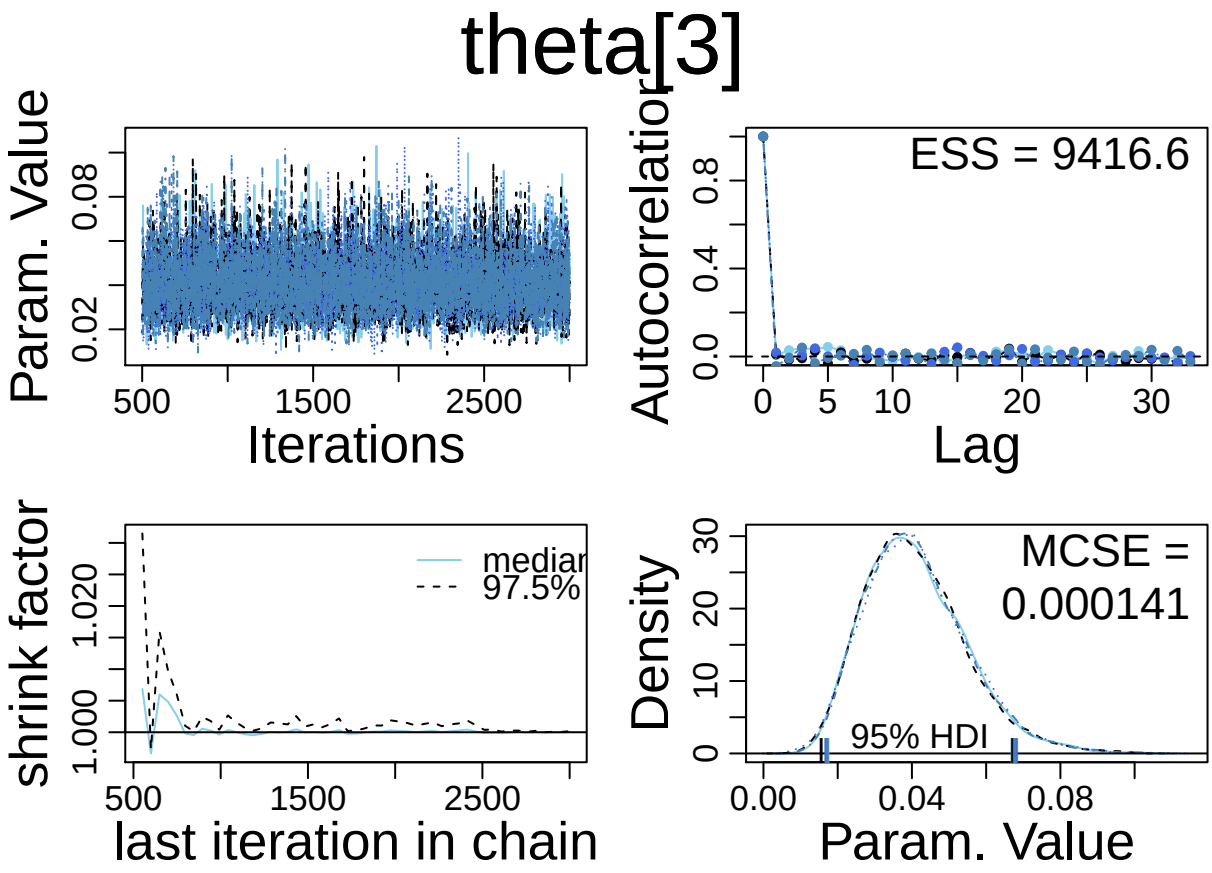
```
fileNameRoot = "Jags-Ydich-XnomSsubj-MbernBeta-8.4.c"
graphFileType = "eps"


mcmc = genMCMC( data=data , numSavedSteps=10000 , saveName=fileNameRoot )
```

```
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 506
##    Unobserved stochastic nodes: 3
##    Total graph size: 1018
##
## Initializing model
##
## Burning in the MCMC chain...
## Sampling final MCMC chain...
```

```
parameterNames = varnames(mcmc)
for ( parName in parameterNames ) {
  diagMCMC( codaObject=mcmc , parName=parName , saveName=fileNameRoot , saveType=graphFileType )
}

detail = smryMCMC(mcmc, compVal=0.5, rope=c(0.45,0.55),compValDiff=0.0, ropeDiff = c(-0.05,0.05) ,saveNa
```




```
##                          Mean       Median          Mode     ESS HDImass
## theta[1]           0.004890853  0.002301692  0.0004267035 10000.0    0.95
## theta[2]           0.136419479  0.135084775  0.1297331724 10000.0    0.95
## theta[3]           0.041111803  0.039754924  0.0384382364 10000.0    0.95
## theta[1]-theta[2] -0.131528626 -0.130584370 -0.1334952003 10000.0    0.95
## theta[1]-theta[3] -0.036220950 -0.035501523 -0.0343965804  9189.7    0.95
## theta[2]-theta[3]  0.095307676  0.094222845  0.0896380266 10306.2    0.95
##                         HDIlow      HDIhigh CompVal PcntGtCompVal ROPElow
## theta[1]           1.951589e-11  0.019279723     0.5          0.00    0.45
## theta[2]           9.343307e-02  0.187872279     0.5          0.00    0.45
## theta[3]           1.711196e-02  0.068013079     0.5          0.00    0.45
## theta[1]-theta[2] -1.819139e-01 -0.083574633     0.0          0.00   -0.05
## theta[1]-theta[3] -6.681587e-02 -0.006606878     0.0          1.10   -0.05
## theta[2]-theta[3]  3.929091e-02  0.148574331     0.0         99.98   -0.05
##                   ROPEhigh PcntLtROPE PcntInROPE PcntGtROPE
## theta[1]              0.55     100.00       0.00       0.00
## theta[2]              0.55     100.00       0.00       0.00
## theta[3]              0.55     100.00       0.00       0.00
## theta[1]-theta[2]     0.05      99.97       0.03       0.00
## theta[1]-theta[3]     0.05      17.33      82.66       0.01
## theta[2]-theta[3]     0.05       0.00       4.76      95.24
```

```
plotMCMC( mcmc, data=data , compVal=NULL, compValDiff=0.0, saveName=fileNameRoot , saveType=graphFileTy
```

```
## pdf
##   2
```