Day 5: Bayesian Modelling in R – Part 3
R2WinBUGS

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9... Running WinBUGS from R

1. Download and install R2WinBUGS package.
2. Load R2WinBUGS package
3. Prepare a file with the WinBUGS model code. Place it in the directory you work.
4. Load Data in WinBUGS.
5. Put all objects in the current R workplace.
6. Put all names of data objects in a vector
7. Specify inits using a list with one list for each chain
8. Run WinBUGS using the bugs command.

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R Commands (1/3)

```
# loads the library/package
library(R2WinBUGS)
# reads the data from a txt file
estriol.ex <- read.table("estriol.txt", header=T)
#  defines the sample size
n<-nrow(estriol.ex)
# initial values (list with one list for each chain)
inits1<-list( list(a.star=0.0, b=0.0, tau=1.0) )
# we attaching the estriol.ex in the main workspace
# (otherwize R2WinBUGS will not be able to see them)
attach(estriol.ex)
```


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R Commands (2/3)

```
# defining the names of the data objects
data.names<-c(names(estriol.ex) ,'n')
# defining the names of the parameters we wish to monitor
parameter.names <- c( 'a', 'a.star', 'b', 's2')
# defining the directory of WinBUGS
# usual directory
#winbugs.dir <- "C:/Program Files (x86)/WinBUGS14"
# my laptop directory
winbugs.dir <- "D:/WinBUGS14"
# generating random samples using WinBUGS
model1.sim <- bugs( data.names, inits1, model.file =
    "model.odc", parameters = parameter.names,
    n.chains = 1, n.iter = 3000, n.burnin=1000, n.thin=1,
    bugs.directory = winbugs.dir, debug=F)
```

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R Commands (3/3)

```
# output with 3 digits
print(model1.sim,3)
#
names(model1.sim)
# calculates the probability of zero to be central in the
   posterior densities
p0(model1.sim)
#
# trace plots - in a window with 3 rows and 2 columns
plot.trace( model1.sim,3,2)
# ergodic mean plots - in a window with 3 rows and 2 columns
plot.trace( model1.sim,3,2, ergodic=T)
```


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Function plot.trace

```
# function for creating trace and ergodic mean plots
# 2013 April by Ioannis Ntzoufras
plot.trace <- function( bugs.object, nrow=5, ncol=NULL, ergodic=FALSE){
    mcmc.output<-bugs.object$sims.matrix
    n.iter <- nrow(mcmc.output)
    n.par  <- ncol(mcmc.output)
    if (is.null(ncol)) ncol <- (n.par %/% nrow)+1*( (n.par %% nrow)!=0 )
    par(mfcol=c(nrow,ncol) )
    if (ergodic){
        for (k in 1:n.par){
                plot( cumsum(mcmc.output[,k])/1:n.iter, type='l',
                                        main=colnames(mcmc.output)[k]) }
    }else{
        for (k in 1:n.par){ plot( mcmc.output[,k], type='l',
                                        main=colnames(mcmc.output)[k]) }
    }
}
```

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Function p0

```
#
# function for checking the centrality of zero
# 2013 April by Ioannis Ntzoufras
#
p0 <- function( bugs.object, digits=3){
    mcmc.output<-bugs.object$sims.matrix
    n.iter <- nrow(mcmc.output)
    n.par  <- ncol(mcmc.output)
    mcmc.output<-mcmc.output[ , -n.par]
    temp<-apply( mcmc.output < 0, 2, mean)
    res <- pmin( temp, 1-temp)
    return( round(res,digits) )
}
```


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Results

```
> print(model1.sim,3)
Inference for Bugs model at "model.odc", fit using WinBUGS,
 1 chains, each with 3000 iterations (first 1000 discarded)
 n.sims = 2000 iterations saved
             mean    sd    2.5%     25%     50%     75%   97.5%
a          21.520 2.709  16.189  19.767  21.515  23.212  26.680
a.star     32.004 0.712  30.649  31.520  31.990  32.460  33.440
b           0.609 0.151   0.317   0.509   0.609   0.705   0.895
s2         15.645 4.506   9.119  12.397  14.865  17.960  26.132
deviance  172.173 2.586 169.200 170.300 171.500 173.200 178.700

DIC info (using the rule, pD = Dbar-Dhat)
pD = 3.1 and DIC = 175.3
DIC is an estimate of expected predictive error (lower deviance $
```

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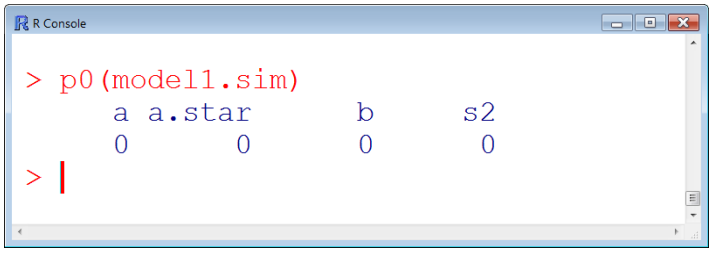
Results



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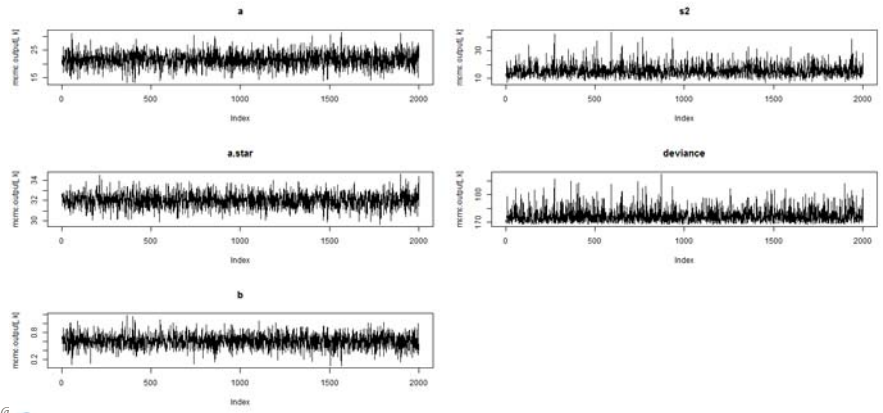
Results

```
> plot.trace( model1.sim,3,2)
```



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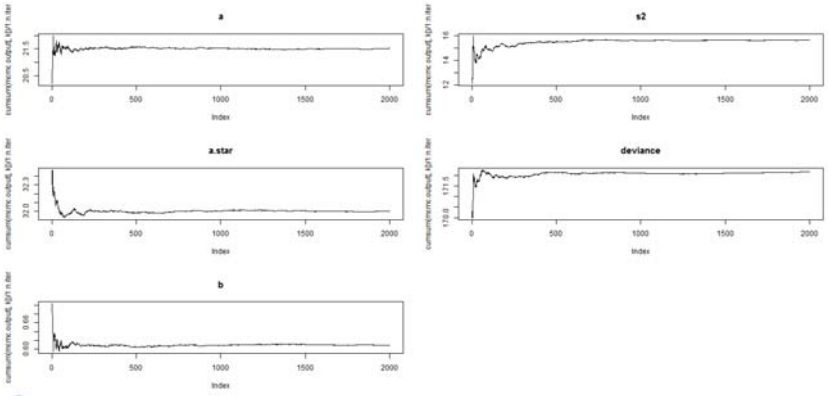
Results

```
>plot.trace( model1.sim,3,2, ergodic=T)
```



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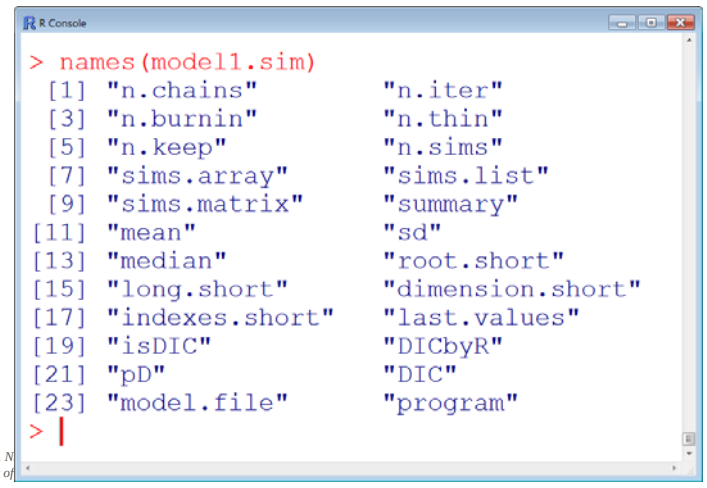
Components of the result of R2WinBUGS



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Components of the result of R2WinBUGS

```
> model1.sim$sims.array
```

Simulated values formatted in an array of dimension (iter.keep) x (nchains) x (monitored parameters)
e.g. here
2000 1 5

```
> model1.sim$sims.list
```

Simulated values formatted in a list with objects the simulated values for each monitored parameter arranged in a single vector (with the values of all chains)

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Components of the result of R2WinBUGS

```
> model1.sim$sims.matrix
```

Simulated values formatted in a matrix with rows equal to (iter.keep x nchains) and with each column referring to each monitored parameter

```
> model1.sim$last.values
```

List with the last values of the mcmc. It can be used to continue the MCMC from the iteration which is stopped by using this as initial values.