

## ORIE 678 — D. Ruppert

### R2WinBUGS example: sample from a univariate normal population

The following R program illustrates the use of WinBUGS and the R2WinBUGS package. It uses a BUGS program in the file “univnormal.bug”. This program is listed later. The R program produces three plots which are also included in this document.

```
library(R2WinBUGS)
# Program to simulate data from a normal distribution and
# then draw a sample from the posterior using R2WinBugs

# Generate data
N = 15
y = rnorm(N,mean=3,sd=2)
data=list("y","N")

# Run BUGS
inits=function(){list(mu=2,tau=1)}
univnorm.sim = bugs(data,inits,model.file="univnormal.bug",
parameters=c("mu","tau"),n.chains = 1,n.iter=15100,n.burnin=100,n.thin=1,
bugs.directory="c:/Program Files/WinBUGS14/",codaPkg=FALSE)
print(univnorm.sim)

# Output
mu = univnorm.sim$sims.array[,1,1]
tau = univnorm.sim$sims.array[,1,2]
sigma = 1/sqrt(tau)

# Plotting
pdf('univnorm_trace.pdf')
par(mfrow=c(3,1))
ts.plot(mu,xlab="iteration",ylab="",main="mu")
ts.plot(tau,xlab="iteration",ylab="",main="tau")
ts.plot(sigma,xlab="iteration",ylab="",main="sigma")

pdf('univnorm_kde.pdf')
par(mfrow=c(1,3))
plot(density(mu),main="mu")
plot(density(tau),main="tau")
plot(density(sigma),main="sigma")

pdf('univnorm_acf.pdf')
par(mfrow=c(3,1))
acf(mu,main="mu")
acf(tau,main="tau")
acf(sigma,main="sigma")
```

The following is the BUGS program in “univnormal.bug”.

```
model{
for(i in 1:N){
y[i] ~ dnorm(mu,tau)
}
mu ~ dnorm(0.0,1.0E-6)
tau ~ dgamma(0.1,0.01)
}
```

The output from the command “print(univnorm.sim)” in the R program is:

```
Inference for Bugs model at "univnormal.bug", fit using winbugs,
1 chains, each with 15100 iterations (first 100 discarded)
n.sims = 15000 iterations saved
      mean sd 2.5% 25% 50% 75% 97.5%
mu      2.5 0.6  1.4  2.2  2.5  2.9  3.7
tau     0.2 0.1  0.1  0.2  0.2  0.3  0.4
deviance 66.4 2.1 64.4 64.9 65.8 67.2 72.2
```

pD = 2.1 and DIC = 68.5 (using the rule, pD = Dbar-Dhat)

DIC is an estimate of expected predictive error (lower deviance is better).

The following pages contain the trace plots, kernel density estimates, and ACF plots in the files “univnorm\_trace.pdf,” “univnorm\_trace.pdf,” and “univnorm\_acf.pdf”.

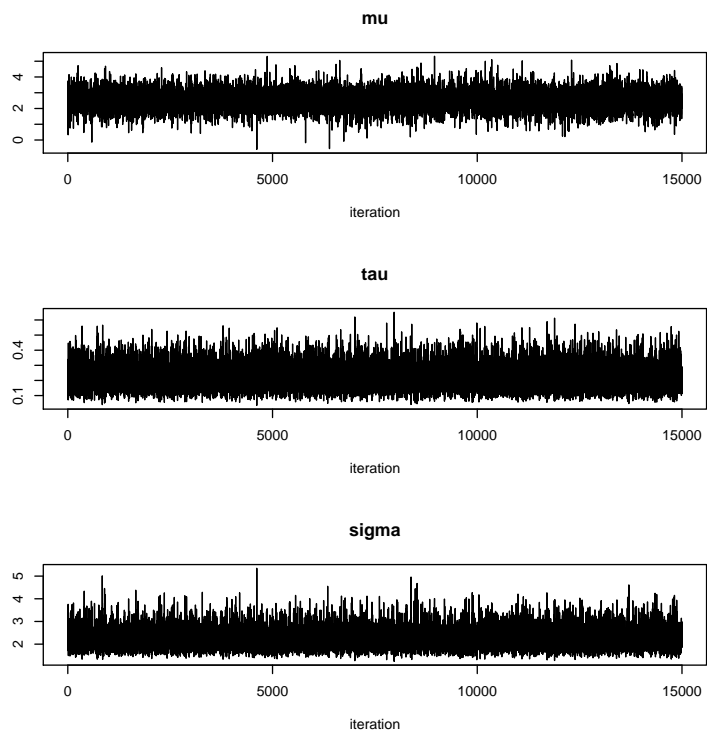


Figure 1: Trace plots.

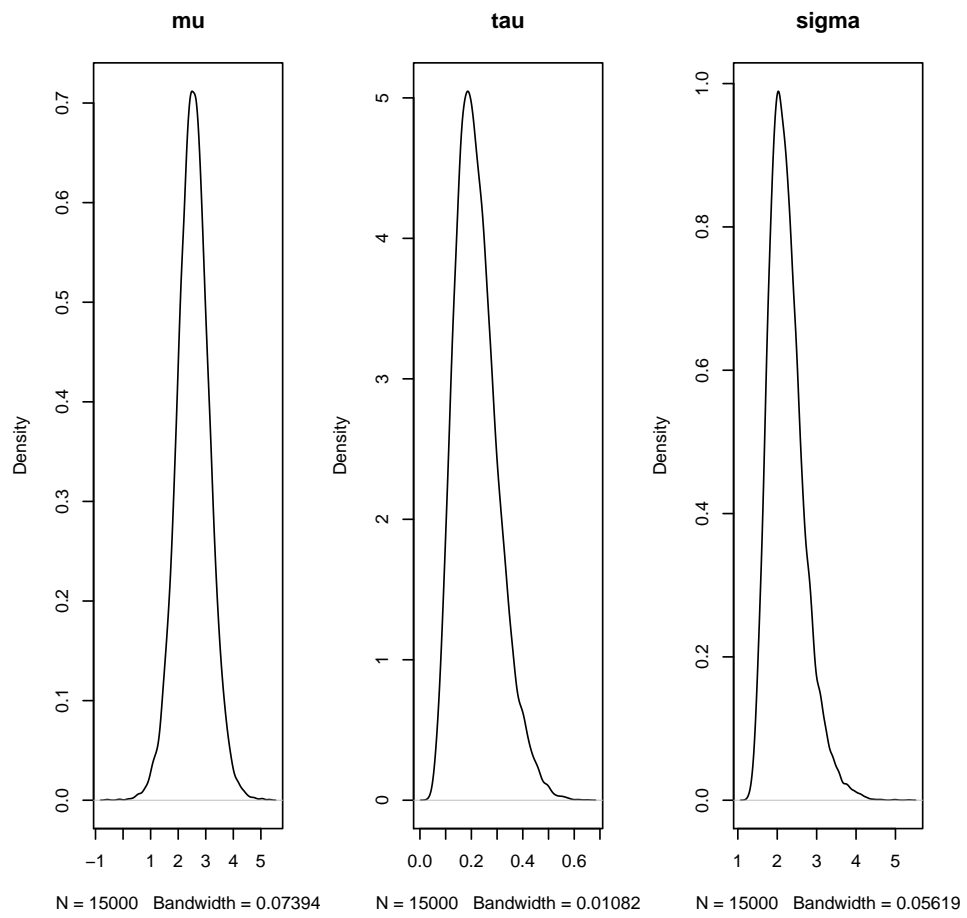


Figure 2: Kernel density estimates of the marginal posterior densities.

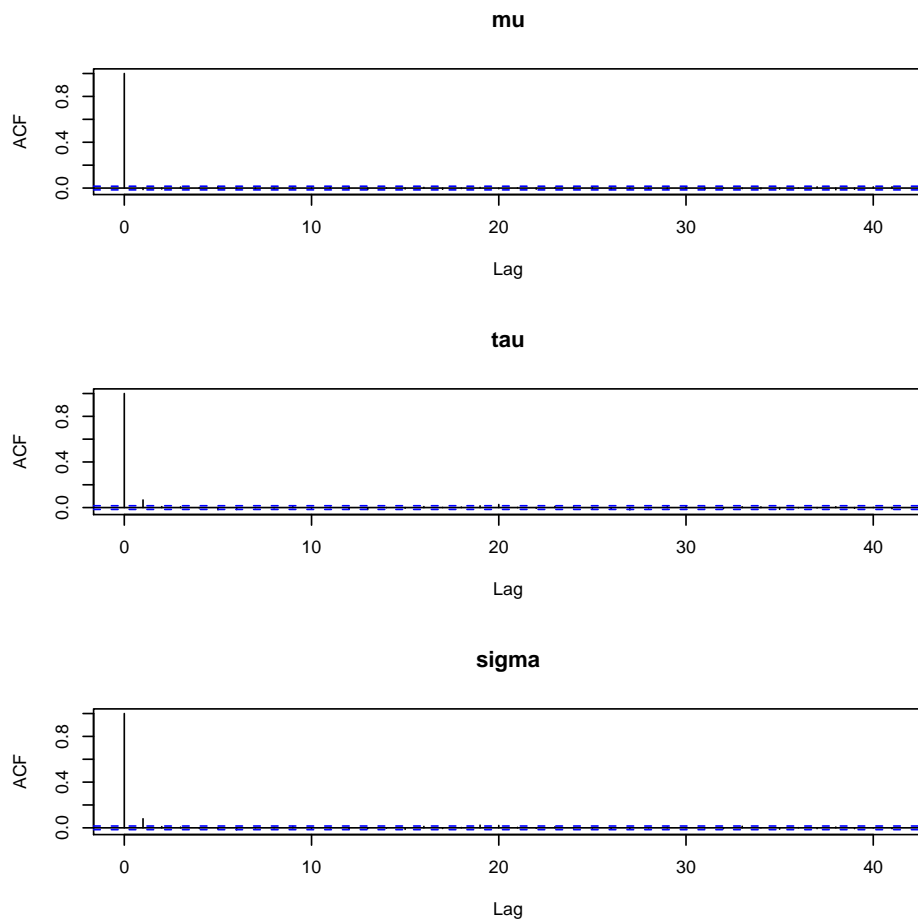


Figure 3: Plots of the ACFs.