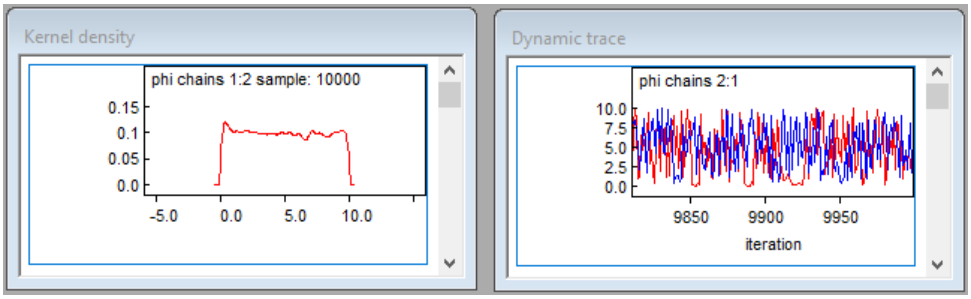
Homework 5(Name: Laha Ale)

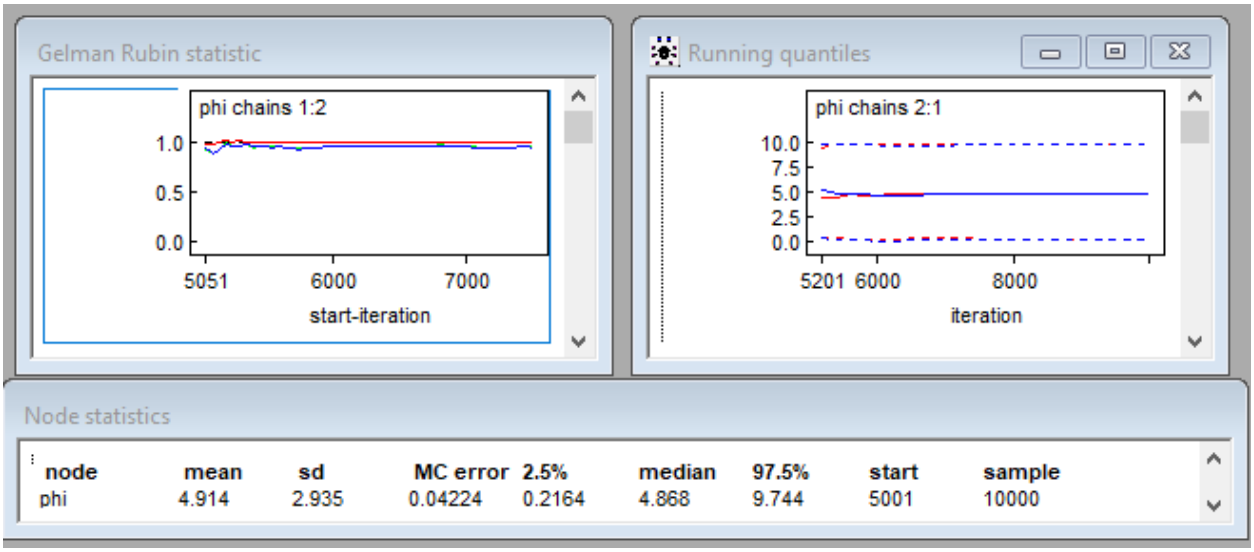
4 (a)

```
model
{
        for (i in 1:N){
                Y[i] ~ dnorm(mu[i], error.prec)
                mu[i] <- inprod(X[i,],beta[]) + W[i]
                muW[i] <- 0.0
                useless[i] <- x[i]+y[i]
        }
        error.prec ~ dgamma(0.1,0.1)
        tausq <- 1/error.prec
        for (i in 1:p){beta[i] ~ dnorm(0.0, 0.001)}
        W[1:N] ~ dmnorm(muW[], Omega[,])
        spat.prec ~ dgamma(0.1,0.1)
        sigmasq <- 1/spat.prec
        phi ~ dunif(0,10)
        for (i in 1:N){
                for (j in 1:N){
                        H[i,j] <- sigmasq*exp(-phi*d[i,j])
                }
        }
        Omega[1:N,1:N] <- inverse(H[,])
}
```

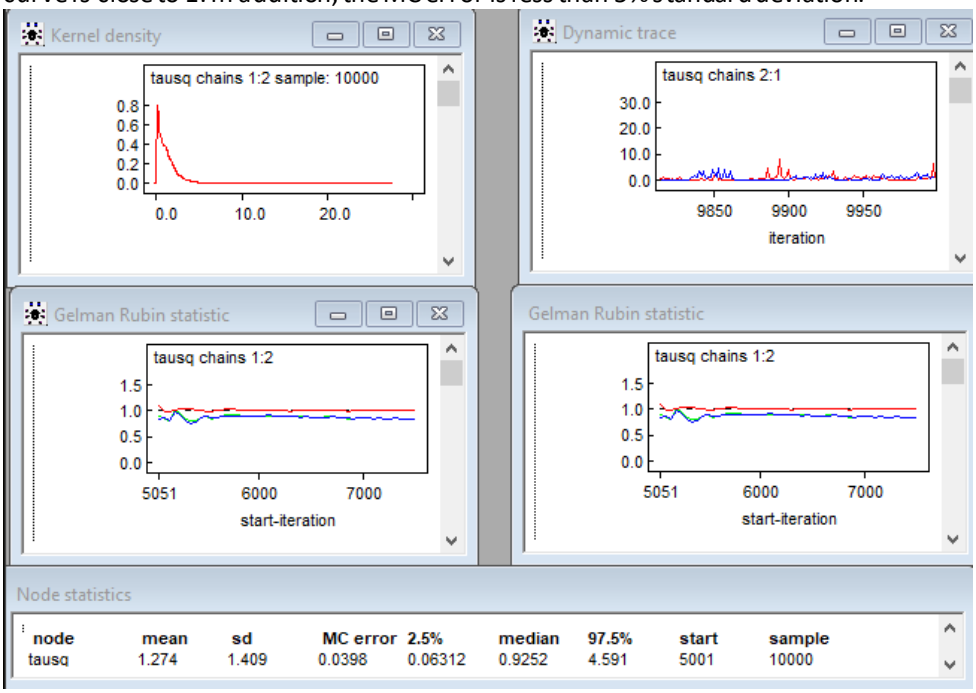
```
#Initial Values
list(beta=c(0),phi=5.0,error.prec=1.0,spat.prec=1.0,W=c(0,0,0,0,0,0,0,0,0,0))
list(beta=c(0),phi=1.0,error.prec=0.5,spat.prec=1.0,W=c(0,0,0,0,0,0,0,0,0,0))
```

In order to analysis, I have added another initial value.





As we can see from above results about parameter Phi, the distribution almost keeps as its prior set (uniform distribution), which indicate that it has not update so much. Standard deviation 2.9 is relatively big given range of Phi. However, other measures are considered reasonably good, the traces are mostly mixed together and bgr diag curve is close to 1. In addition, the MC error is less than 5% standard deviation.



As we can see from above results about parameters tausq, the distribution has initialized as flat inverse gamma distribution and end up to curve now but far from smooth. Other measures are OK, the traces are mostly mixed together and bgr diag red curve is close to 1. In addition, the MC error is less than 5% standard deviation.

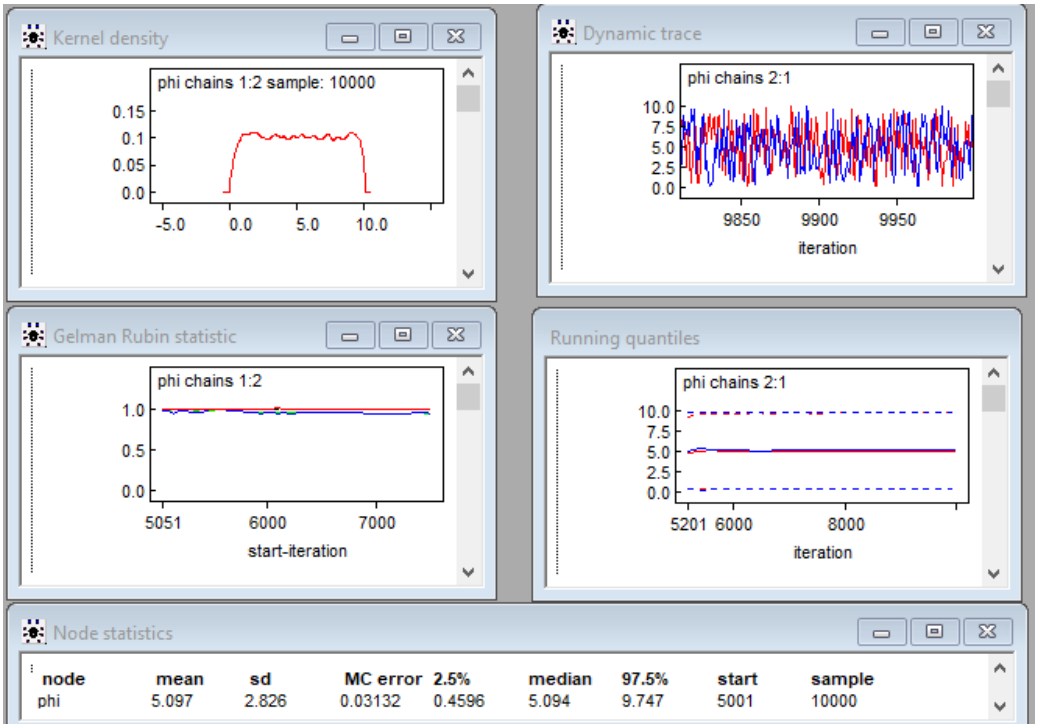
4 (b)

model

```
{
    for (i in 1:N){
        Y[i] ~ dnorm(mu[i], error.prec)
        mu[i] <- inprod(X[i,],beta[]) + W[i]
        muW[i] <- 0.0
        useless[i] <- x[i]+y[i]
    }
    error.prec ~ dgamma(0.1,0.1)
    tausq <- 1/error.prec
    for (i in 1:p){beta[i] ~ dnorm(0.0, 0.001)}
    W[1:N] ~ spatial.exp(muW[],x[],y[],spat.prec,phi,1)
    spat.prec ~ dgamma(0.1,0.1)
    sigmasq <- 1/spat.prec
    phi ~ dunif(0,10)
    for (i in 1:N){
        for (j in 1:N){
            H[i,j] <- sigmasq*exp(-phi*d[i,j])
        }
    }

    Omega[1:N,1:N] <- inverse(H[,])

}
```

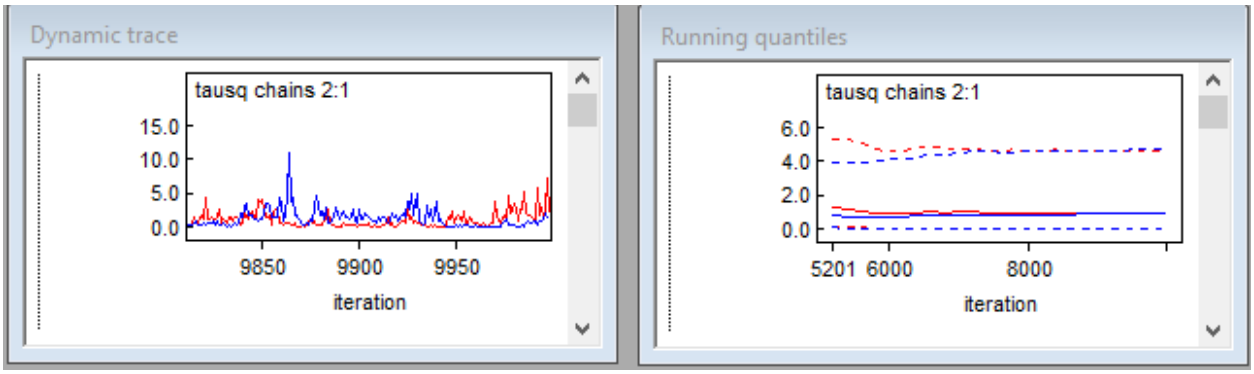
Phi results:

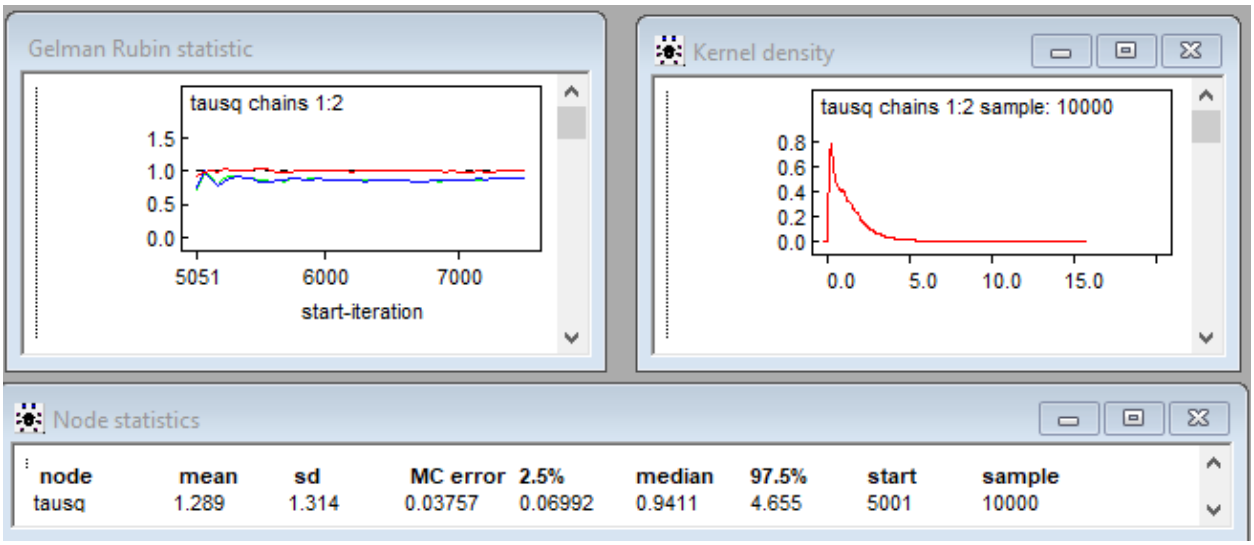
As we can see from below results about parameter Phi, the distribution almost keeps as its prior set (uniform distribution), which indicate that it has not update so much. Standard deviation 2.8 is a relatively big given range of Phi. However, other measures are considered reasonably good, the traces are mostly mixed together and bgr diag curve is close to 1. Also, the MC error is less than 5% standard deviation.



Tausq results:

As we can see from below results about parameter tausq, the distribution has initialized as flat inverse gamma distribution and end up to curve now. The traces are mostly mixed splited. Other measures are Ok but not good enough, and bgr diag red curve is close to 1. In addition, the MC error is less than 5% standard deviation.



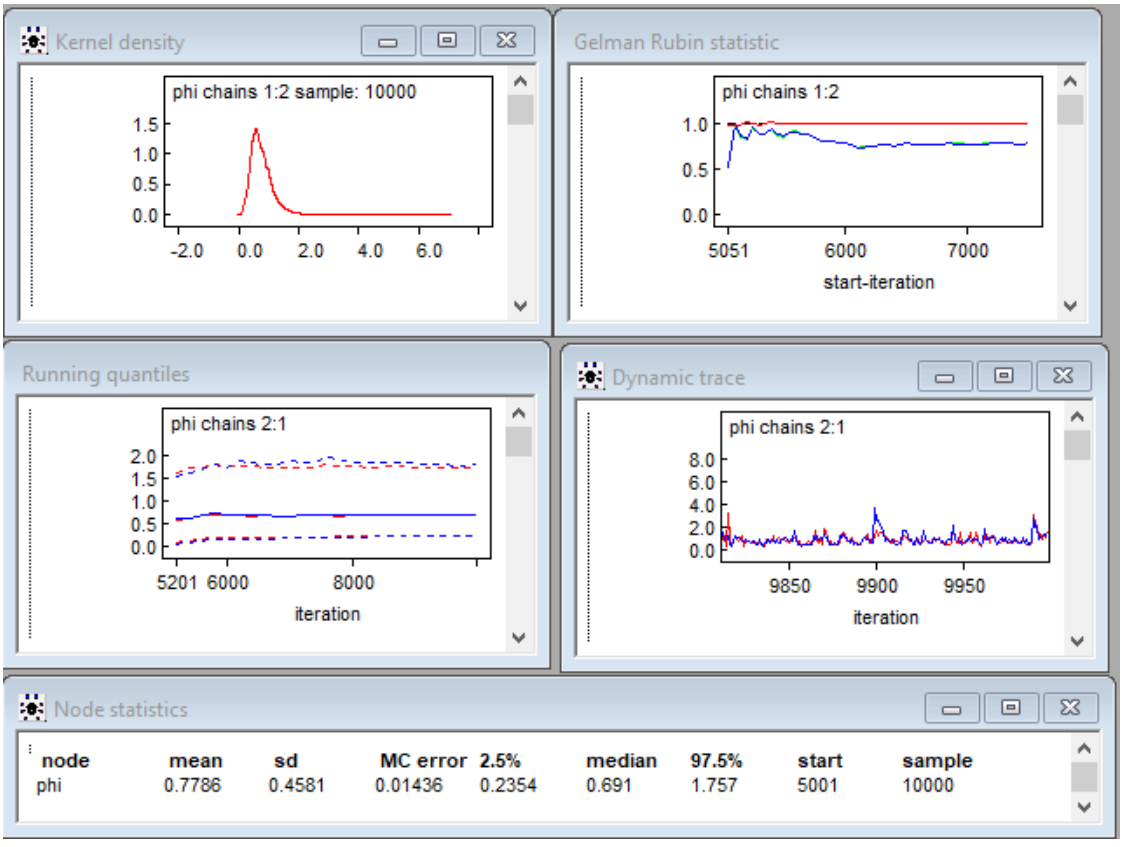


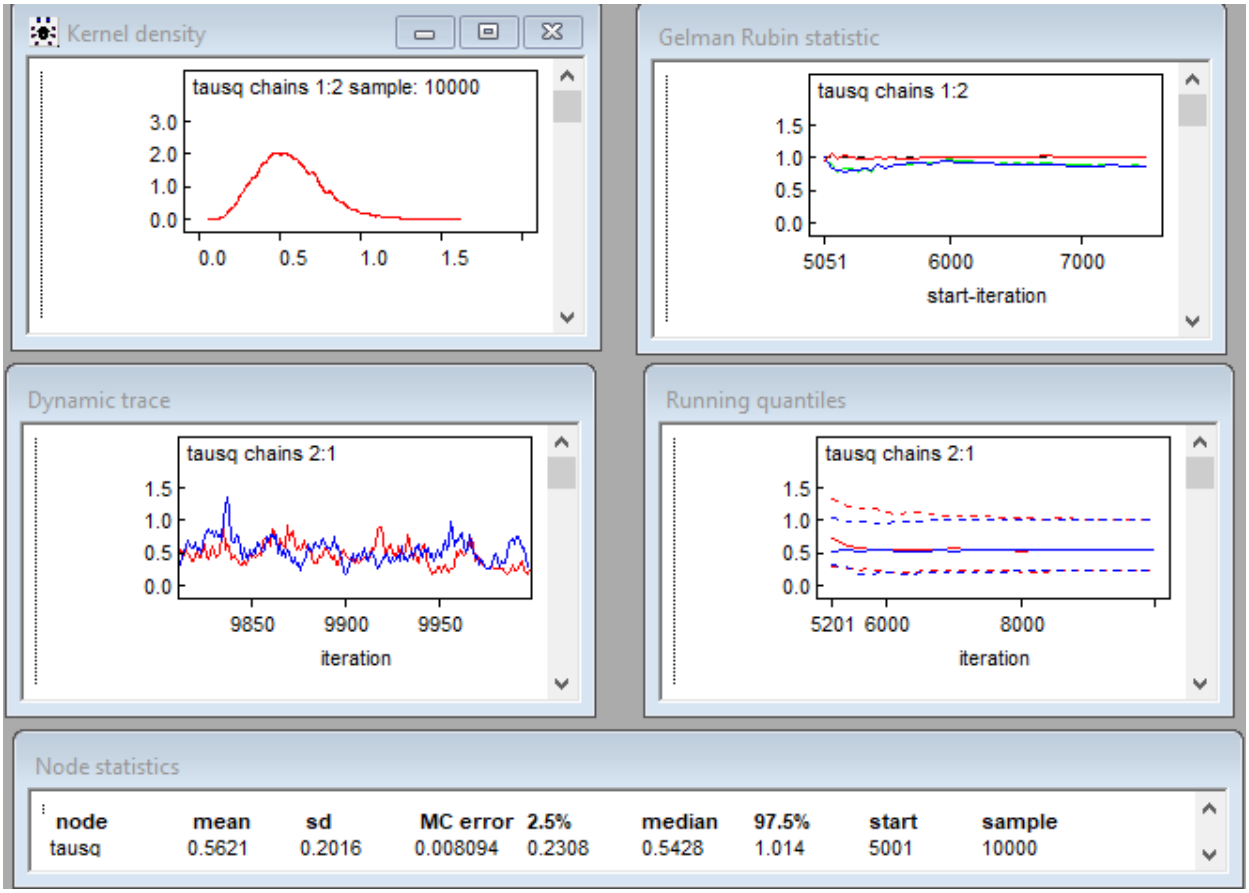
4 (c)

As we can from the above results, it agrees with results from(a). However, the runtime of (b) is much less than the runtime of (a).

4 (d)

As we can see from below, the density is much smooth and more like a gamma distribution rather than uniform distribution, the bgr diag red curve is close to 1, and traces are mixed together. MC error is less than standard deviation is less than 5%. The credit set is 0.06992 to 4.655 is much small than previous results.

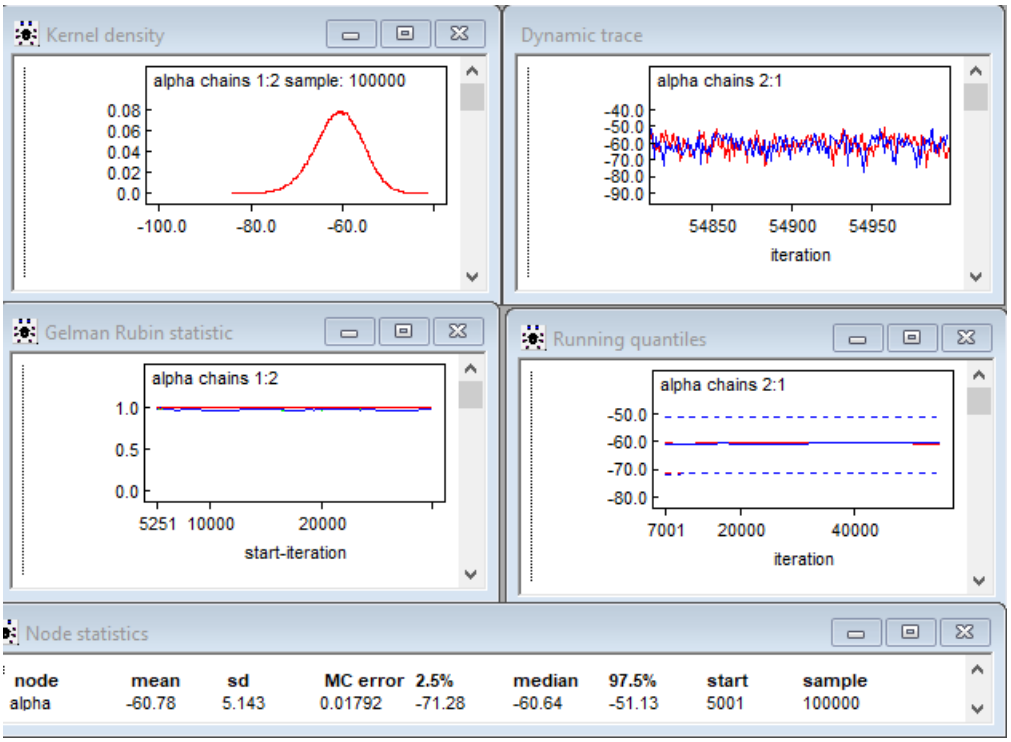




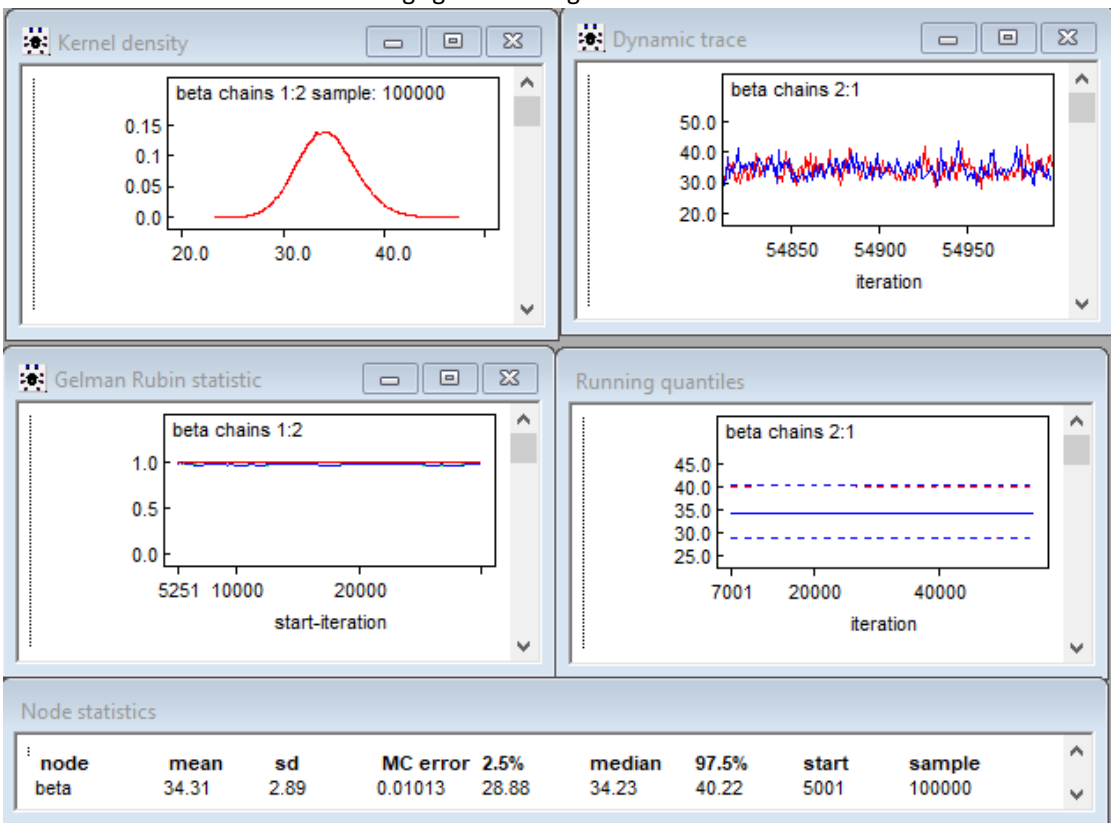
As we can see from the above results, the density is much smooth than previous models, the bgr diagred curve is close to 1, and traces are mixed together. MC error is less than standard deviation is less than 5%. The standard deviation is 0.2 is much smaller than previous case 2.8 or 2.9. The credit set is 0. 2308 to 1.014 is much small than previous results.

Beetles

```
model
{
        for( i in 1 : N ) {
        r[i] ~ dbin(p[i],n[i])
                logit(p[i]) <- alpha.star + beta * (x[i] - mean(x[]))
        rhat[i] <- n[i] * p[i]
        }
        alpha <- alpha.star - beta * mean(x[])
        beta ~ dnorm(0.0,0.001)
        alpha.star ~ dnorm(0.0,0.001)
}

# Data

list( x = c(1.6907, 1.7242, 1.7552, 1.7842, 1.8113, 1.8369, 1.8610, 1.8839),
                n = c(59, 60, 62, 56, 63, 59, 62, 60),
                r = c(6, 13, 18, 28, 52, 53, 61, 60), N = 8)

# Inits

list(alpha.star=0, beta=0)
list(alpha.star=1, beta=1)
```



As we can see from the above results above alpha, the density is considerably smooth as bell curve, the bgr diag red curve is close to 1 and traces are mixed together. MC error is less than standard deviation is less than 5%. The standard deviation is 5 is small enough given its range.



As we can see from the above results above beta, the density is considerably smooth as bell curve, the bgr diagred curve is close to 1, and traces are mixed together which means initial conditions are not such important. MC error is less than standard deviation is less than 5%. The standard deviation is 2.89 is small enough given its range. Credit set is 28.88 to 40.22.