Assignment 3

1.(a)(i)

```
> d <- read.table("polls2016.txt", header=TRUE)
> d$sigma <- d$ME/2
> library(rjags)
Loading required package: coda
Linked to JAGS 4.3.0
Loaded modules: basemod,bugs
> initial.vals <- list(list(mu=100,tau=0.01),list(mu=-100,tau=0.01),list(mu=100,tau=1
00),list(mu=-100,tau=100))
> m1 <- jags.model("polls20161.bug", d, initial.vals, n.chains=4, n.adapt=1000)
Compiling model graph
   Resolving undeclared variables
   Allocating nodes
Graph information:
   Observed stochastic nodes: 7
   Unobserved stochastic nodes: 9
   Total graph size: 42

Initializing model

  |++++++++++++++++++++++++++++++++++++++++++++++++++| 100%
```

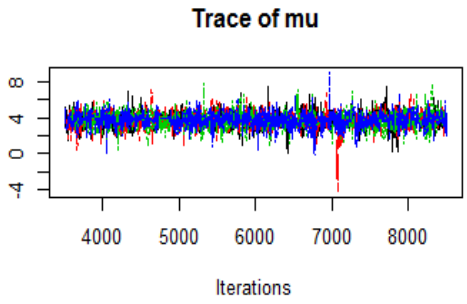
(ii)

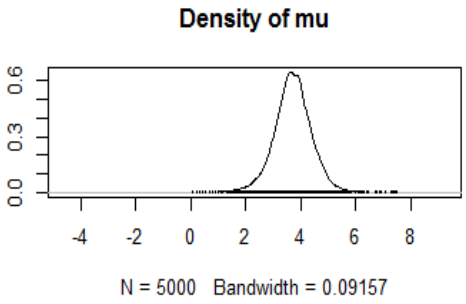
```
> update(m1, 2500)
  |**************************************************| 10
0%
> x1 <- coda.samples(m1, c("mu","tau"), n.iter = 5000)
  |**************************************************| 10
0%
```

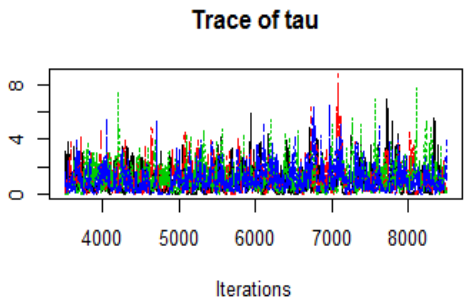
(iii)

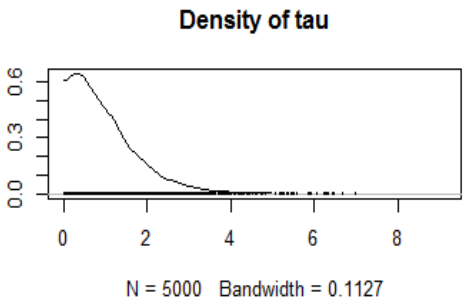
```
plot(x1, smooth=FALSE)
```

No, there is no convergence problem. The trace plot looks good.



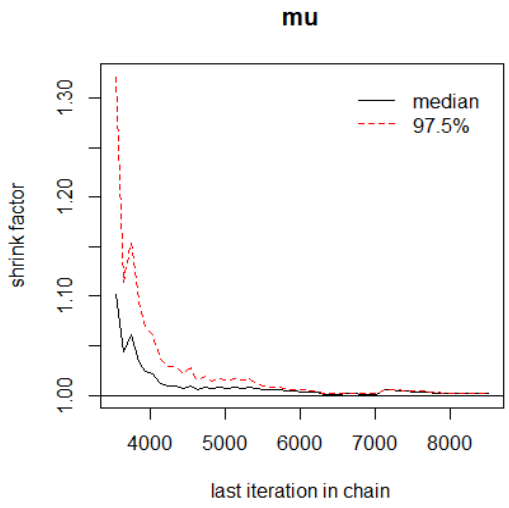


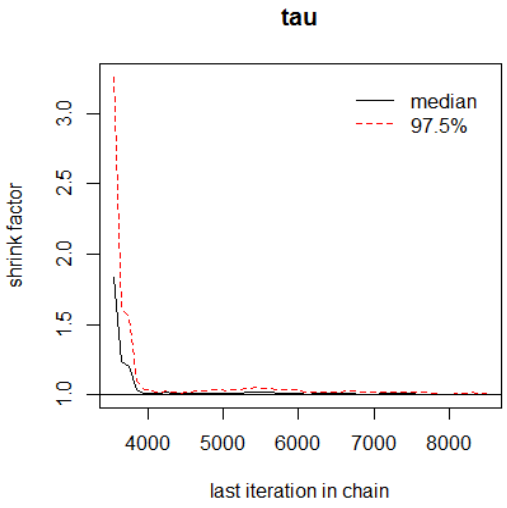




(iv)

```
> gelman.diag(x1, autoburnin=FALSE)
Potential scale reduction factors:

    Point est. Upper C.I.
mu        1.00       1.00
tau       1.01       1.02

Multivariate psrf

1.01
> gelman.plot(x1, autoburnin=FALSE)
```

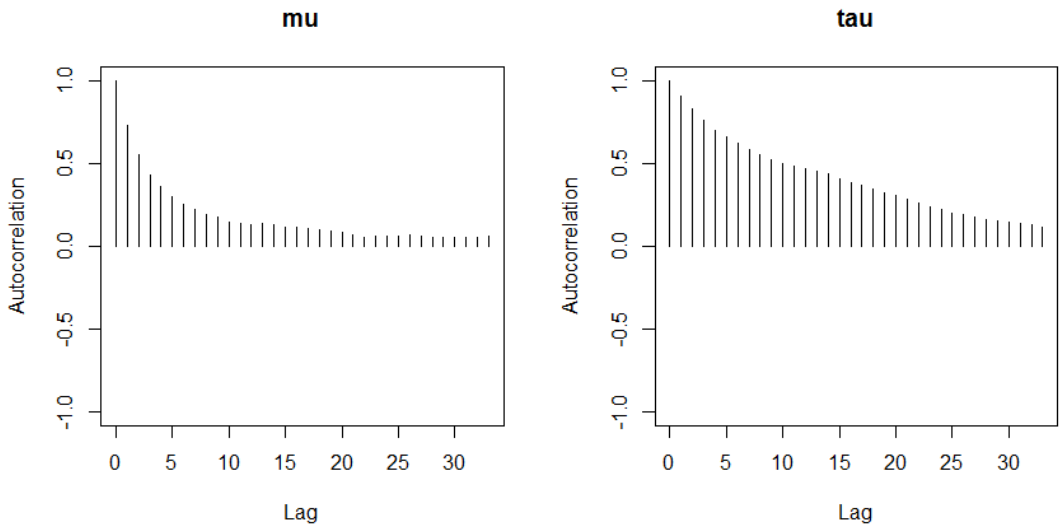




No, there is no convergence problem.

(v)

```
autocorr.plot(x1[[1]])
```



Some high autocorrelations, but essentially zero by lag 20 for mu, lag 30 for tau.

(vi)

```
> effectiveSize(x1)
      mu      tau
2212.7527  789.3187
```

All these diagnostics suggest adequate convergence and sampling.

(b)(i)

```
model {

  for (j in 1:length(y)) {
    y[j] ~ dnorm(theta[j], 1/sigma[j]^2)
    theta[j] ~ dnorm(mu, 1/tau^2)
  }
```

```
  mu ~ dunif(-1000,1000)

  logtau ~ dunif(-100,100)
  tau <- exp(logtau)
}
```

(ii)

```
> d <- read.table("polls2016.txt", header=TRUE)
> d$sigma <- d$ME/2
> library(rjags)
Loading required package: coda
Linked to JAGS 4.3.0
Loaded modules: basemod,bugs
> initial.vals <- list(list(mu=100,logtau=log(0.01, base = exp(1))),list(mu=-100,logtau=log(0.01, base = exp(1))),list(mu=100,logtau=log(100, base = exp(1))),list(mu=-100,logtau=log(100, base = exp(1))))
> m1 <- jags.model("polls20161.bug", d, initial.vals, n.chains=4, n.adapt=1000)
Compiling model graph
   Resolving undeclared variables
   Allocating nodes
Graph information:
   Observed stochastic nodes: 7
   Unobserved stochastic nodes: 9
   Total graph size: 44

Initializing model

  |++++++++++++++++++++++++++++++++++++++++++++++++++| 100%
```

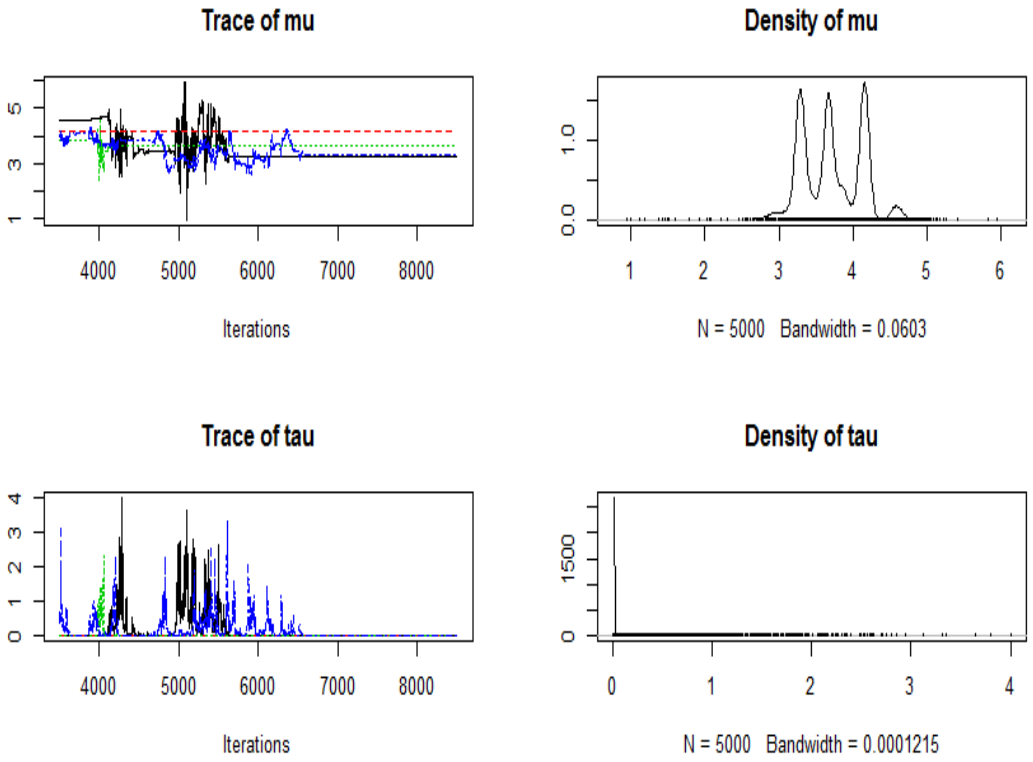
(iii)

```
> update(m1, 2500)
  |**************************************************| 100%
> x1 <- coda.samples(m1, c("mu","tau"), n.iter = 5000)
  |**************************************************| 100%
```

(iv)

```
> plot(x1, smooth=FALSE)
```

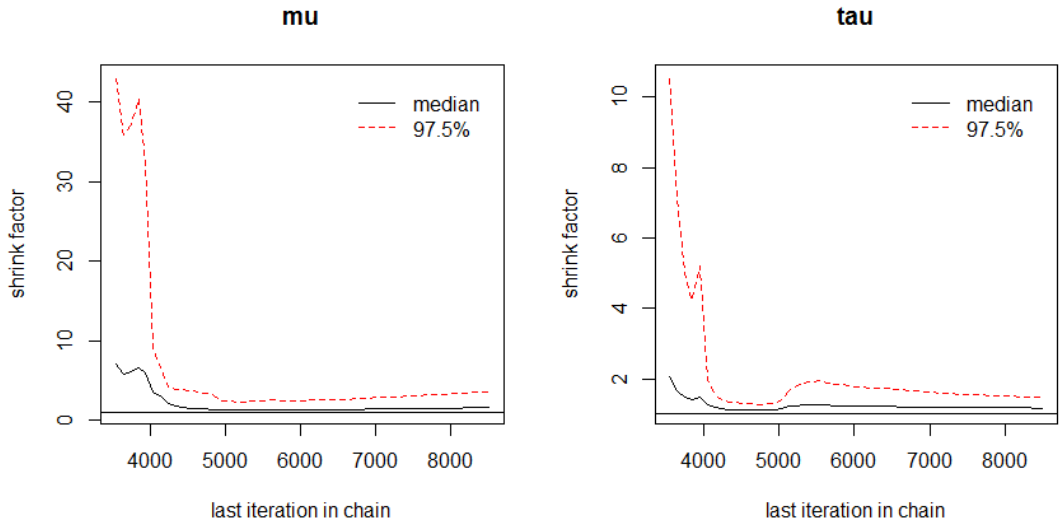
Yes, there is a problem for mu, it converges to different values.



(v)

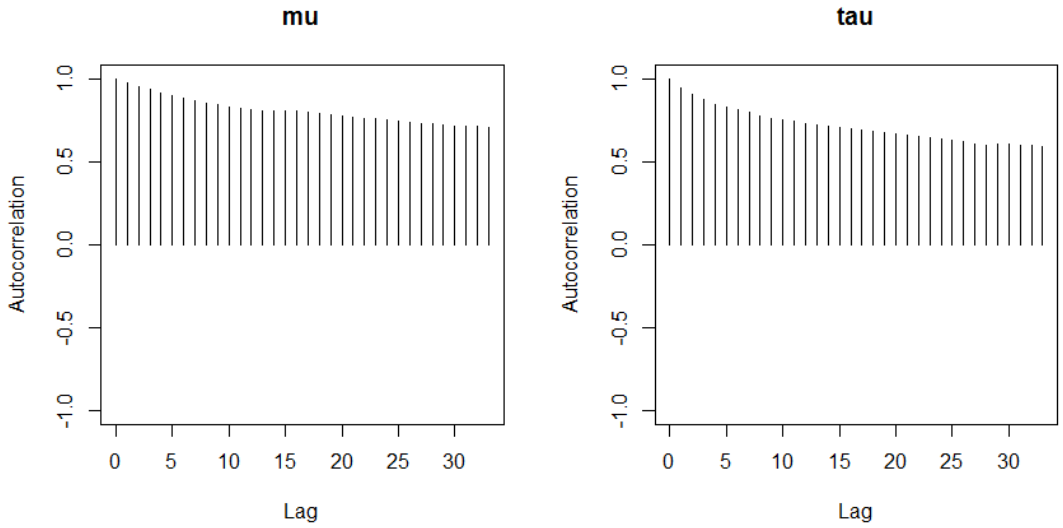
```
> gelman.diag(x1, autoburnin=FALSE)
Potential scale reduction factors:

    Point est. Upper C.I.
mu        1.62       3.60
tau       1.18       1.48

Multivariate psrf

1.59
> gelman.plot(x1, autoburnin=FALSE)
```

Yes, there is a problem. For both mu and tau, 97.5% line and median line converges to slightly different values.



(vi)

```
> autocorr.plot(x1[[1]])
Neither mu nor tau goes to zero even after lag 30.
```



(vii) Because an almost flat prior for tau is on the log scale, logtau follows uniform distribution, but after exponentiation, tau does not follow uniform distribution, this might lead to the divergence of mu and tau, which causes the problems in the previous analysis.