Quiz3

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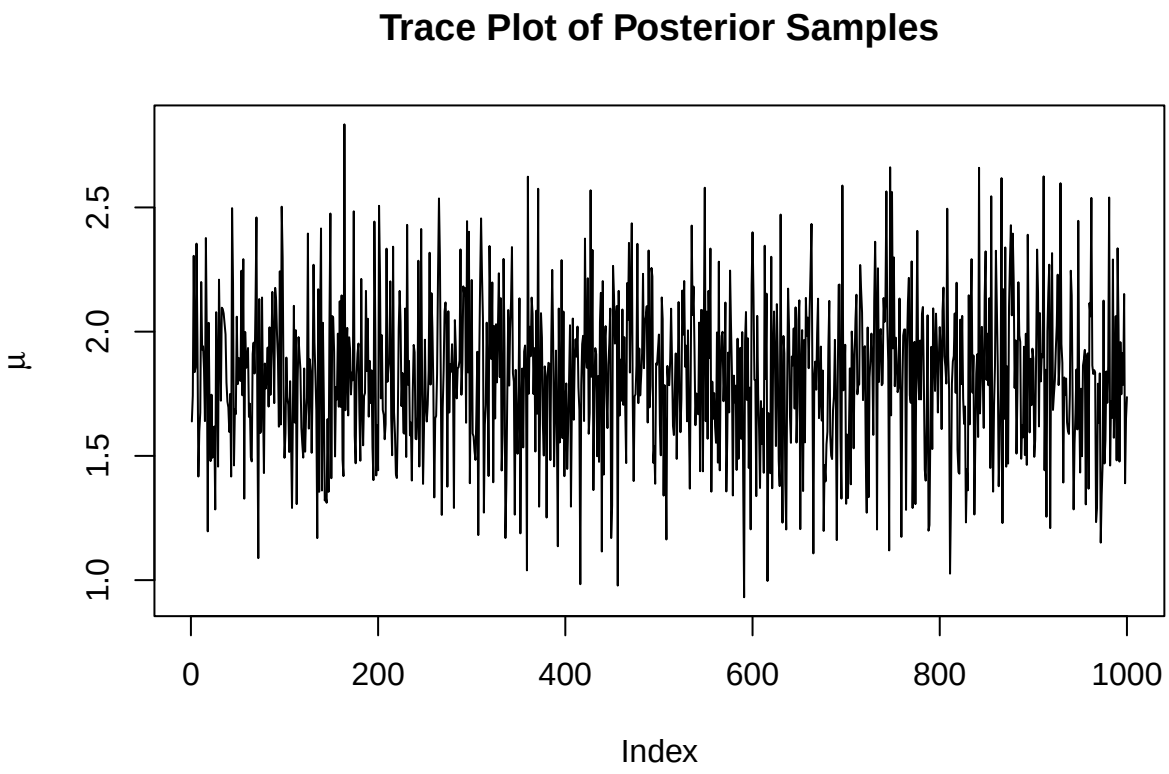
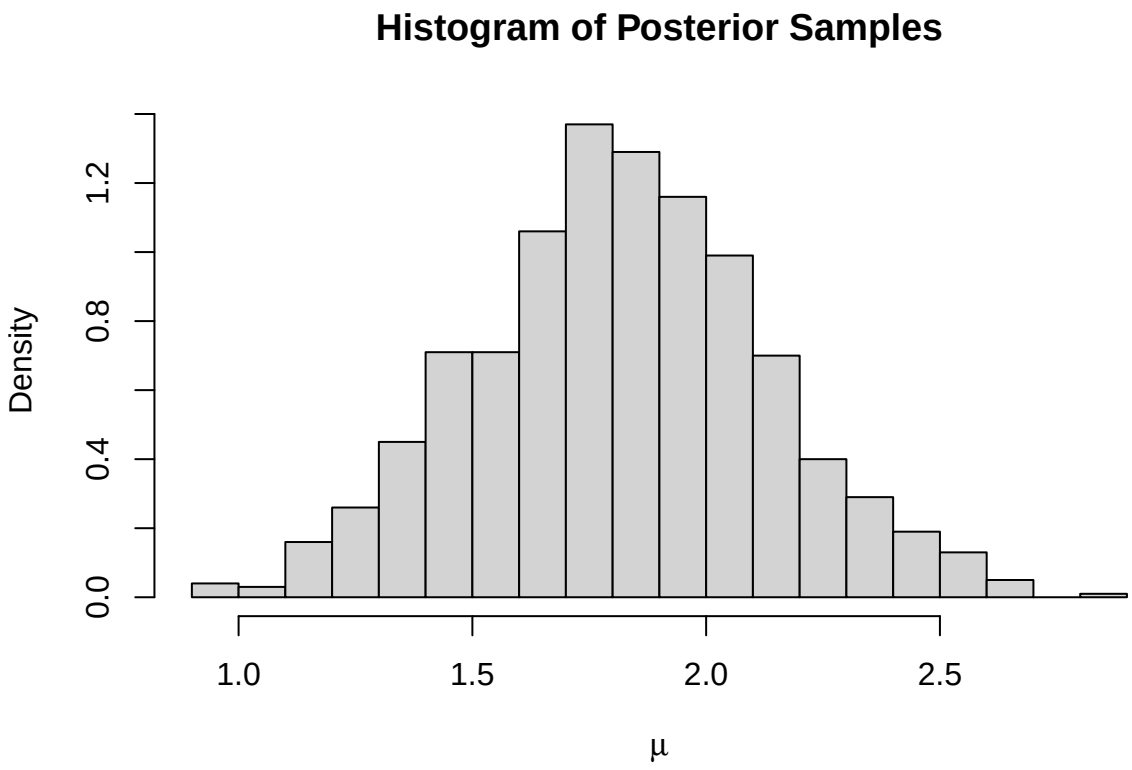
```r
y <- c(1.64,1.70,1.72,1.74,1.82,1.82,1.82,1.90,2.08)
n <- length(y)

mu0   <- 1.9
tau0  <- 0.95

precision0 <- 1 / (tau0^2)
precision  <- precision0 + n  # because sigma^2=1 => n / sigma^2 = n
tau_n2     <- 1 / precision
tau_n      <- sqrt(tau_n2)
mu_n       <- (mu0*precision0 + sum(y)) / precision

set.seed(123)
S <- 1000
mu_samples <- rnorm(S, mean=mu_n, sd=tau_n)

plot(mu_samples, type="l", main="Trace Plot of Posterior Samples", xlab="Index", ylab=expression(mu))
```




```r
library(coda)
ess <- effectiveSize(mu_samples)


hist(mu_samples, breaks=20, probability=TRUE,
     main="Histogram of Posterior Samples", xlab=expression(mu))
```




```
mean_est  <- mean(mu_samples)
ci_95     <- quantile(mu_samples, probs=c(0.025, 0.975))

cat("\n Ess:", ess)
```

```
##
##  Ess: 1000
```

```
cat("\n mean:",mean_est)
```

```
##
##  mean: 1.819992
```

```
cat("\n CI:", ci_95)
```

```
##
##  CI: 1.204236 2.455902
```

```
library(rjags)
```

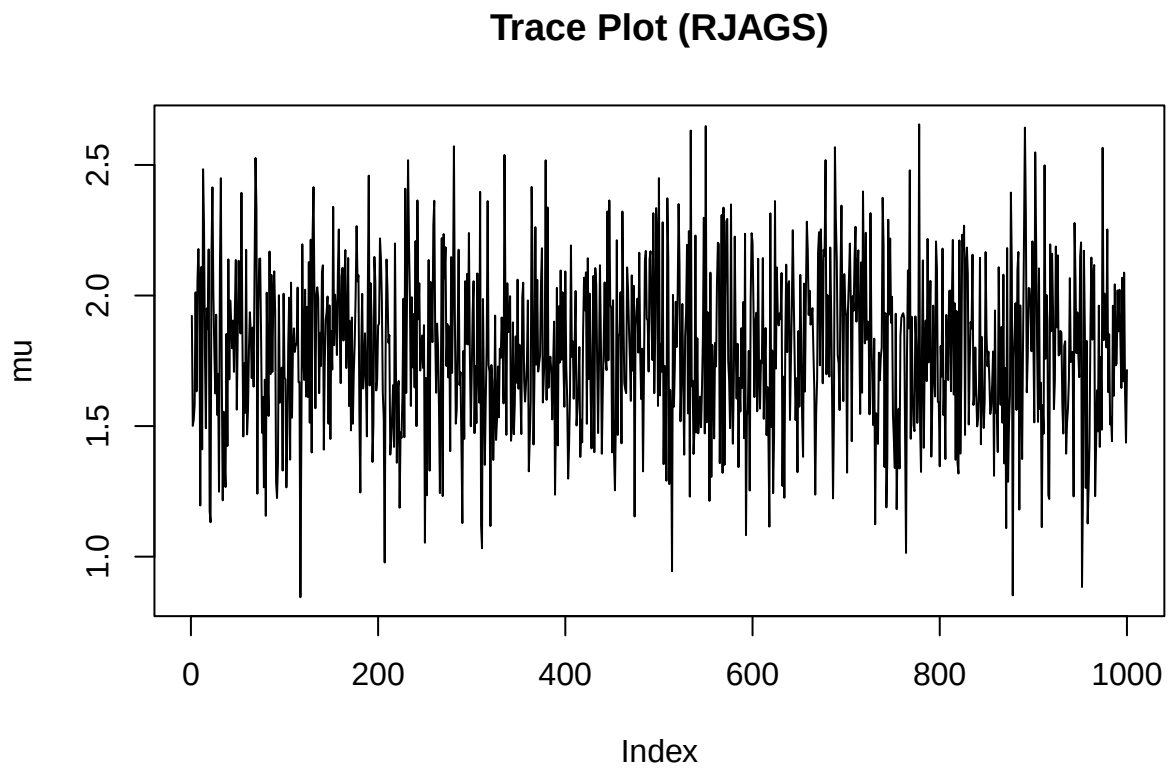
```
## Linked to JAGS 4.3.2
```

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

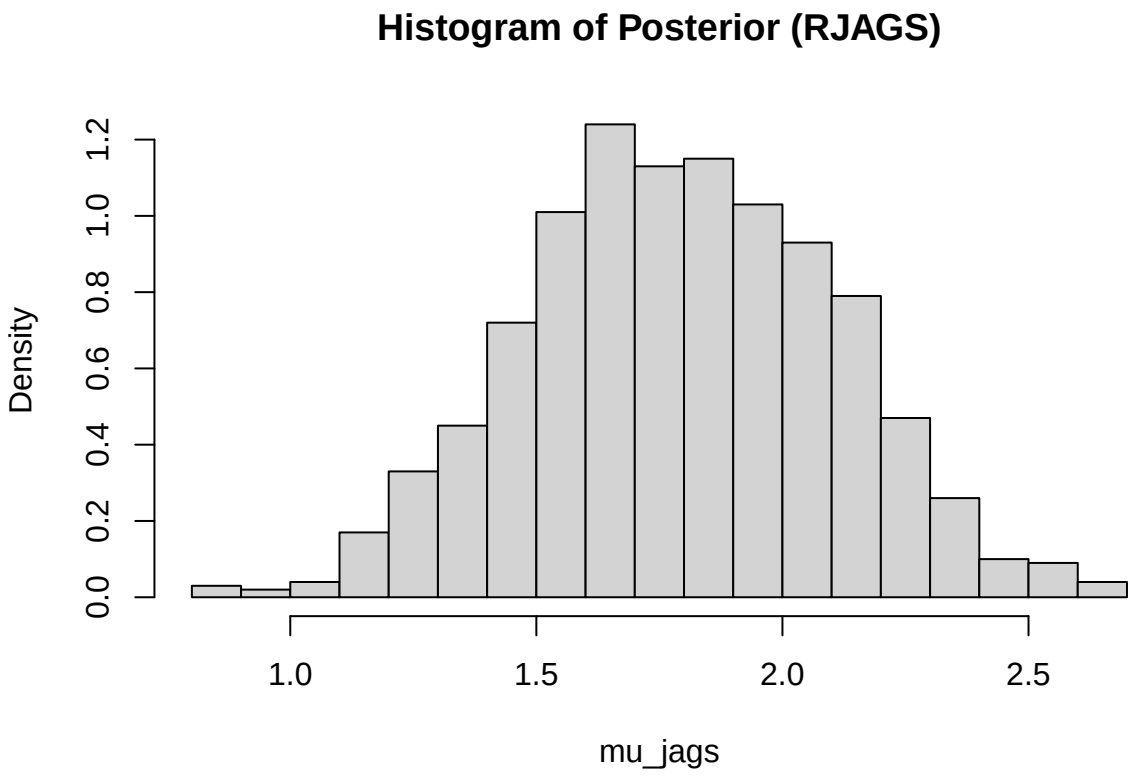
```r
# 1) JAGS model with Normal prior
model_string <- "
model {
  for(i in 1:N){
    y[i] ~ dnorm(mu, 1)
  }
  mu ~ dnorm(mu0, tau0_prec)
}
"

writeLines(model_string, con="model1.txt")

dataList  <- list(y = y, N = n,
                  mu0 = mu0,
                  tau0_prec = 1/(tau0^2))    # JAGS uses 'precision' = 1/variance

initsList <- list(mu = 1.7)

jagsModel <- jags.model("model1.txt", data=dataList, inits=initsList, n.chains=1)
```

```
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 9
##    Unobserved stochastic nodes: 1
##    Total graph size: 14
##
## Initializing model
```

```r
update(jagsModel, 500)

postSamples <- coda.samples(jagsModel, variable.names="mu", n.iter=1000)
mu_jags <- as.numeric(postSamples[[1]])

plot(mu_jags, type="l", main="Trace Plot (RJAGS)", ylab="mu")
```




```
ess_jags <- effectiveSize(mu_jags)
hist(mu_jags, breaks=20, probability=TRUE, main="Histogram of Posterior (RJAGS)")
```




```
mean_jags <- mean(mu_jags)
ci95_jags <- quantile(mu_jags, c(0.025, 0.975))

cat("\n Ess:", ess_jags)
```

```
##
##  Ess: 1000
```

```
cat("\n mean:",mean_jags)
```

```
##
##  mean: 1.792026
```

```
cat("\n CI:", ci95_jags)
```

```
##
##  CI: 1.195931 2.394251
```

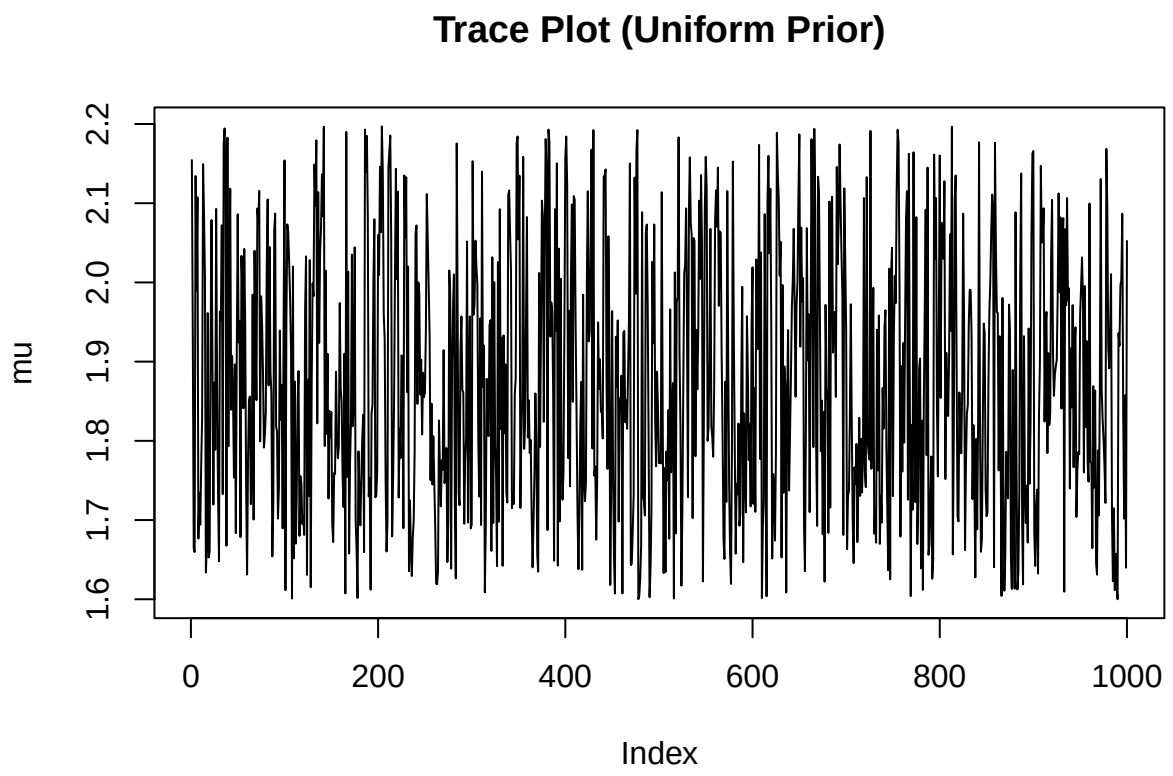
#Question 2

```
library(rjags)

model_string2 <- "
```

```
model {
  for(i in 1:N){
    y[i] ~ dnorm(mu, 1)  # precision=1 => variance=1
  }
  mu ~ dunif(1.6, 2.2)
}
"

writeLines(model_string2, con="model2.txt")

y <- c(1.64,1.70,1.72,1.74,1.82,1.82,1.82,1.90,2.08)
dataList2 <- list(y = y, N = length(y))

initsList2 <- list(mu = 1.8)

jagsModel2 <- jags.model("model2.txt", data=dataList2, inits=initsList2, n.chains=1)
```

```
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
## Graph information:
##    Observed stochastic nodes: 9
##    Unobserved stochastic nodes: 1
##    Total graph size: 14
##
## Initializing model
```

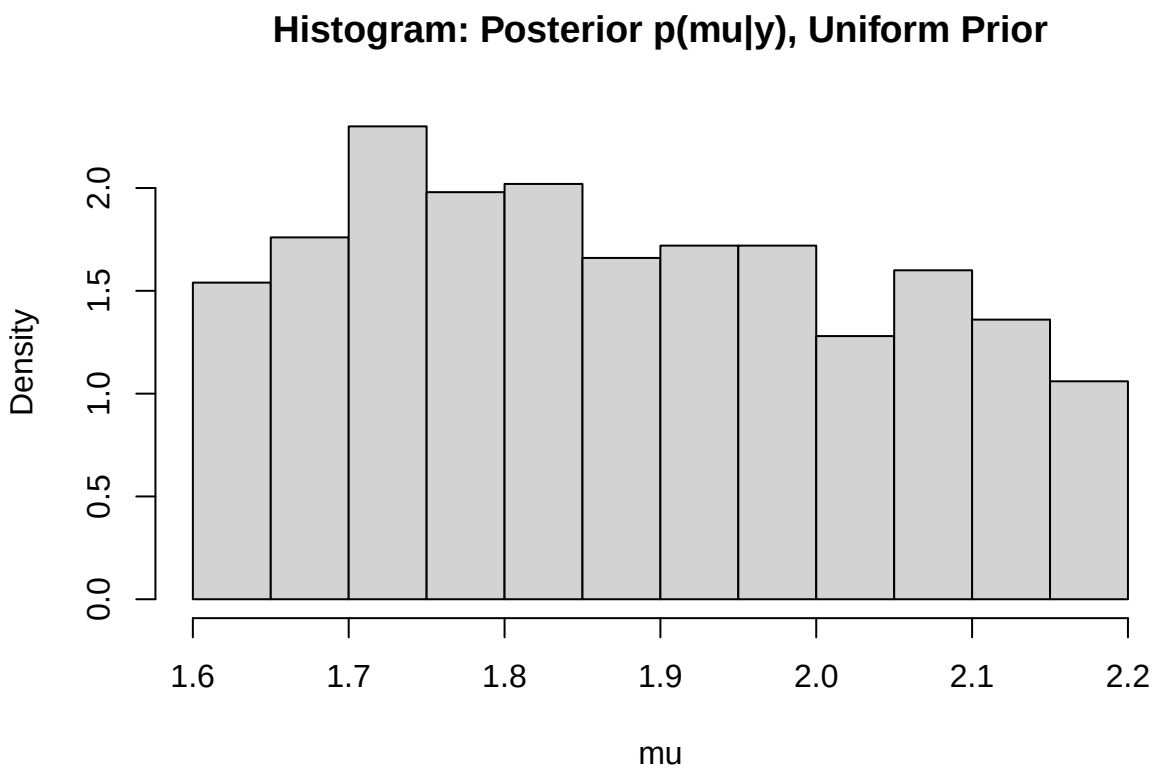
```
update(jagsModel2, 500)

S <- 1000
postSamples2 <- coda.samples(jagsModel2, variable.names="mu", n.iter=S)
mu_jags2 <- as.numeric(postSamples2[[1]])

plot(mu_jags2, type="l", main="Trace Plot (Uniform Prior)", ylab="mu")
```




```
ess2 <- effectiveSize(mu_jags2)
cat("\n Ess:", ess2)
```

```
##
##  Ess: 593.0312
```

```
hist(mu_jags2, breaks=20, probability=TRUE,
     main="Histogram: Posterior p(mu|y), Uniform Prior",
     xlab="mu")
```




```
mean_jags2 <- mean(mu_jags2)
cat("\n mean",mean_jags2)
```

```
##
##  mean 1.876706
```

```
ci95_jags2 <- quantile(mu_jags2, c(0.025, 0.975))
cat("\nCI:", ci95_jags2)
```

```
##
## CI: 1.615176 2.176266
```