Kien Duc Vu Homework 5

**Problem 1:**

X ~ Gamma(a1, b1)

Y ~ Gamma(a2, b2)

a1, b1, a2, b2 ~ Gamma(0.001,0.001)

mean1 <- (a1/b1)

mean2 <- (a2/b2)

diff <- (mean2 -mean1)

Posterior distribution for difference in mean blood percentages for the 2 procedures are N(2.45, 0.7679)

95% credible set for the difference is [0.9526, 3.978], thus it does not contain 0.

**Blood Volume in Infants**

```
model{
for (i in 1:n){
x[i] ~ dgamma(a1, b1)
y[i] ~ dgamma(a2, b2)
}

a1 ~ dgamma(0.001, 0.001)
a2 ~ dgamma(0.001,0.001)
b1 ~ dgamma(0.001,0.001)
b2~ dgamma(0.001,0.001)
mean1 <- (a1/b1)
mean2 <- (a2/b2)
diff <- (mean1-mean2)

}


DATA

list(n=16, x=c(13.8, 8.0, 8.4, 8.8,  9.6, 9.8, 8.2, 8.0, 10.3, 8.5, 11.5, 8.2,  8.9, 9.4,  10.3, 12.6),
y=c(10.4, 13.1, 11.4, 9.0, 11.9, 16.2, 14.0, 8.2, 13.0, 8.8, 14.9, 12.2, 11.2, 13.9, 13.4, 11.9))

INITS
list(a1 = 5, a2 = 5, b1 = 1, b2 =1   )   # inits here
```

| node | mean | sd | MC error | 2.5% | median | 97.5% | start | sample |
|---|---|---|---|---|---|---|---|---|
| a1 | 32.66 | 12.26 | 1.014 | 13.63 | 31.18 | 60.09 | 1001 | 10000 |
| a2 | 27.93 | 9.164 | 0.6951 | 12.85 | 26.93 | 48.04 | 1001 | 10000 |
| b1 | 3.384 | 1.28 | 0.1058 | 1.411 | 3.223 | 6.216 | 1001 | 10000 |
| b2 | 2.31 | 0.7663 | 0.05821 | 1.038 | 2.225 | 4.004 | 1001 | 10000 |
| diff | -2.45 | 0.7679 | 0.007766 | -3.978 | -2.447 | -0.9526 | 1001 | 10000 |
| mean1 | 9.671 | 0.454 | 0.004821 | 8.814 | 9.653 | 10.62 | 1001 | 10000 |
| mean2 | 12.12 | 0.6187 | 0.006967 | 10.97 | 12.11 | 13.4 | 1001 | 10000 |

**Problem 2:**

Arctic ~ Bern(p[i])

Logit(p) = beta[1] + beta[2] * gender + beta[3] * x3 +beta[4] * x7

Beta[j] ~ N(0, 0.01)

Probability that a female wolf with measures x 3 = 5.28 and x7 = 1.78 comes from Arctic habitat is 49.93%

| node | mean | sd | MC error | 2.5% | median | 97.5% | start | sample |
|---|---|---|---|---|---|---|---|---|
| beta[1] | 0.1047 | 10.01 | 0.07112 | -19.65 | 0.09353 | 19.66 | 1001 | 20000 |
| beta[2] | 0.04629 | 10.01 | 0.06725 | -19.56 | 0.09329 | 19.62 | 1001 | 20000 |
| beta[3] | -0.03984 | 9.93 | 0.06369 | -19.36 | 0.005805 | 19.19 | 1001 | 20000 |
| beta[4] | -0.109 | 9.991 | 0.07341 | -19.81 | -0.04389 | 19.71 | 1001 | 20000 |
| pp | 0.4993 | 0.4926 | 0.004775 | 0.0 | 0.4847 | 1.0 | 11001 | 10000 |
| ympred | 0.4973 | 0.5 | 0.003403 | 0.0 | 0.0 | 1.0 | 1001 | 20000 |

```
model{
eps <- 0.0000001
for(i in 1:n){
artic[i] ~ dbern(p[i])
logit(p[i]) <-beta[1] + beta[2] * gender[i] +
              beta[3] * x3[i] + beta[4] * x7[i]
devres[i] <- 2*arctic[i]*log(arctic[i]/p[i] +eps)+
              2*(1-arctic[i])*log((1-arctic[i])/(1-p[i]) +eps)
}
for(j in 1:4){
beta[j] ~dnorm(0,0.01)
}
dev <-sum(devres[])
#Prediction
ympred ~ dbern(pp)
logit(pp) <- -beta[1] + beta[2] * 1 +
              beta[3] * 5.28 + beta[4] * 1.78
}

DATA

list(n=25 )

arctic[] gender[] x3[] x7[]
0   0   5.55   2
0   0   5.94   2.07
0   0   5.98   1.94
0   0   5.55   1.9
```

**Problem 3:**

y ~ Poiss(lambda)

lambda <-  exp(beta[1] + beta[2] *x)

beta ~ N(0, 0.001)

After 1000 burn-out and 4000 simulations

Beta =  [ -2.816, 0.6715]

Average number of nuclei for 3.5G dose is mean = 0.6232

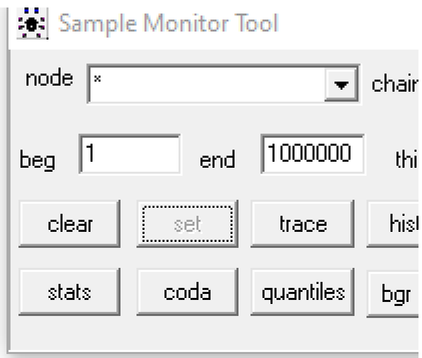
95% credible set =[ 0, 2]

```
model{
for(i in 1:n){
y[i] ~dpois(lambda[i])
lambda[i] <- exp(beta[1] + beta[2]*x[i])
}
for(j in 1:2){
beta[j] ~dnorm(0,0.001)
}

lambdastar <- exp(beta[1] + beta[2] * 3.5)
ystar ~dpois(lambdastar)
}

DATA
list(n=6000)

INITS
list(beta =c(1,1))
```




Node statistics

| node | mean | sd | MC error | 2.5% | median | 97.5% | start | sample |
|---|---|---|---|---|---|---|---|---|
| beta[1] | -2.816 | 0.06139 | 0.002911 | -2.942 | -2.816 | -2.696 | 1001 | 5000 |
| beta[2] | 0.6715 | 0.01883 | 8.842E-4 | 0.6342 | 0.672 | 0.7095 | 1001 | 5000 |
| lambdastar | 0.6279 | 0.01579 | 2.026E-4 | 0.5974 | 0.6275 | 0.6591 | 1001 | 5000 |
| ystar | 0.6232 | 0.778 | 0.01049 | 0.0 | 0.0 | 2.0 | 1001 | 5000 |