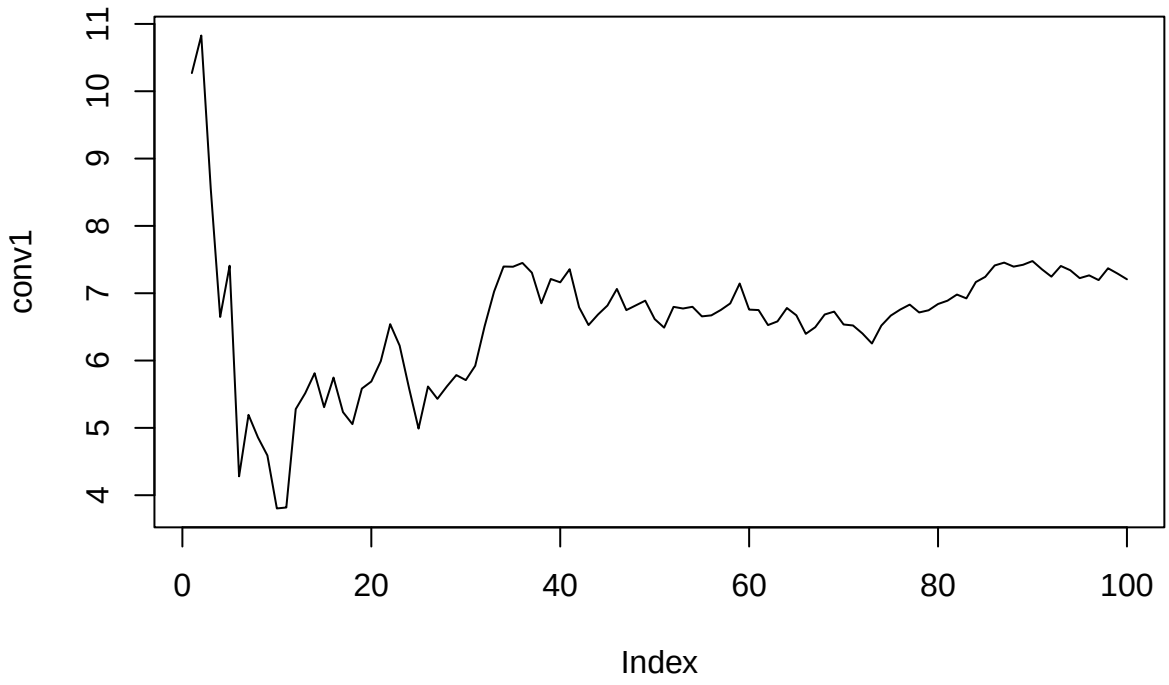
Macroeconometrics HW2 Exercise 4

Elisabeth Fidrmuc

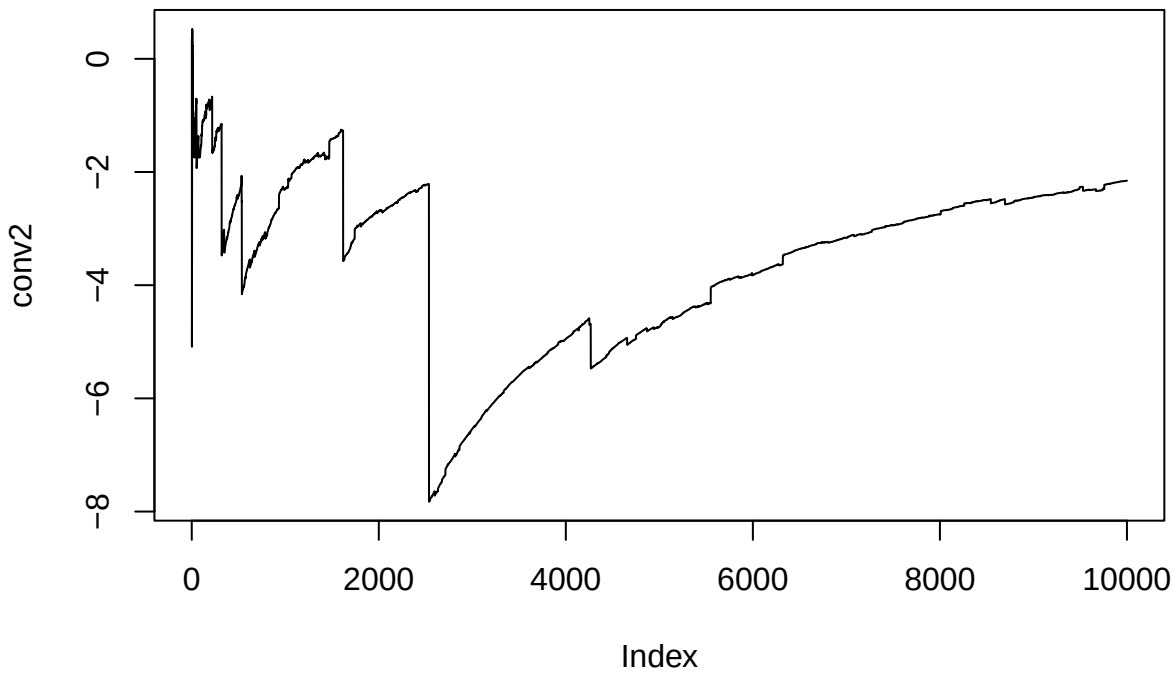
5 5 2023

Exercise 1

```
set.seed(12345)
draws1 <- rnorm(n=100,mean=5,sd=9)
conv1 <- cumsum(draws1)/1:100

draws2 <- rnorm(10000,mean=0,sd=1)/rnorm(10000,mean=0,sd=1)
conv2 <- cumsum(draws2)/1:10000

plot(conv1,type="l")
```

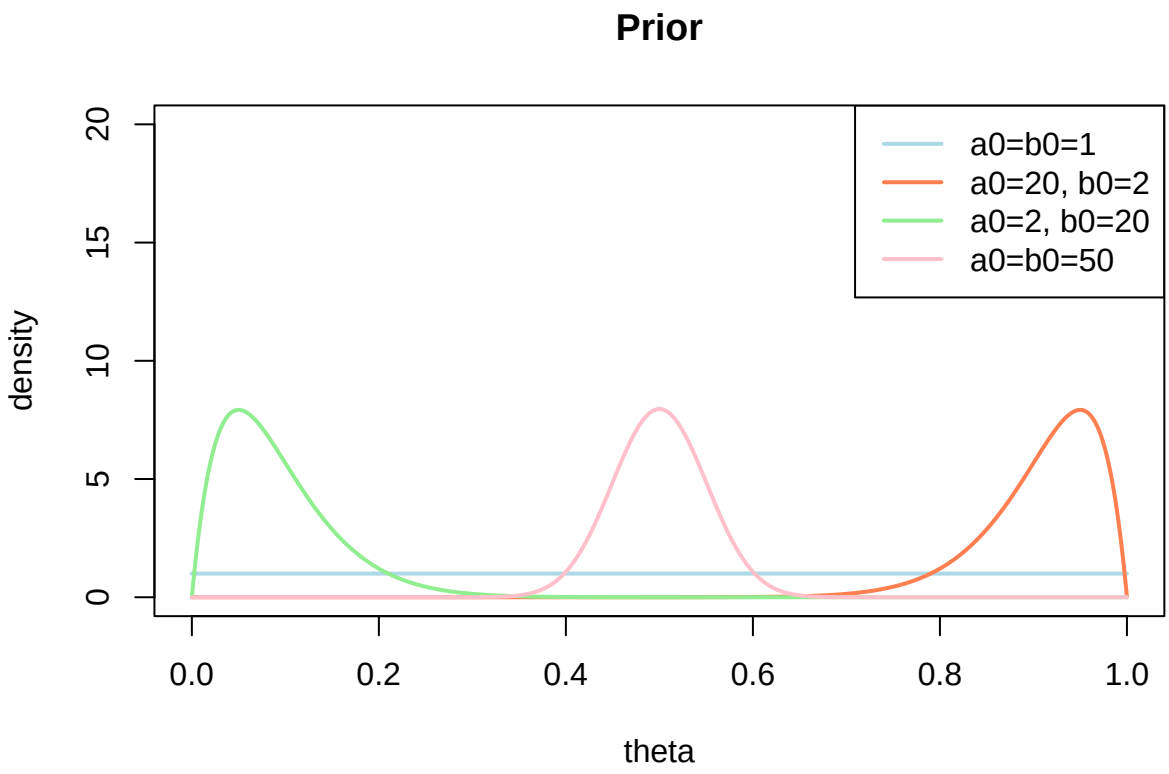


```
plot(conv2,type="l")
```

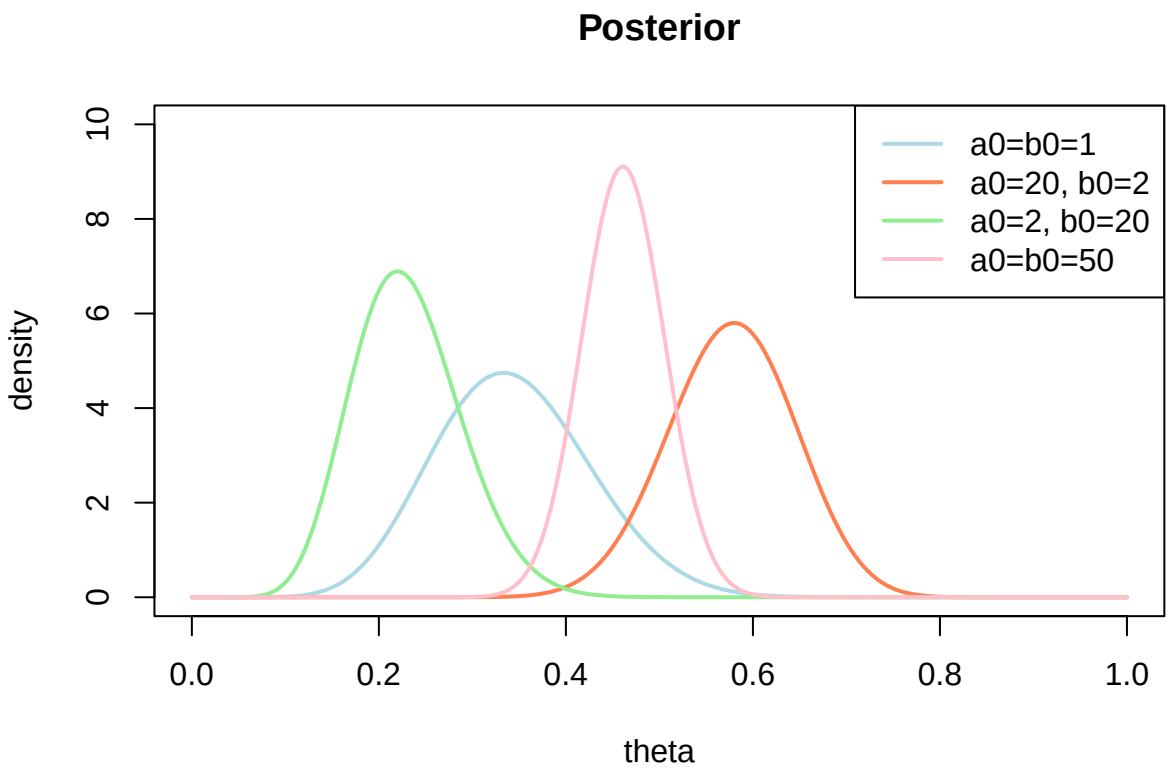


Exercise 2

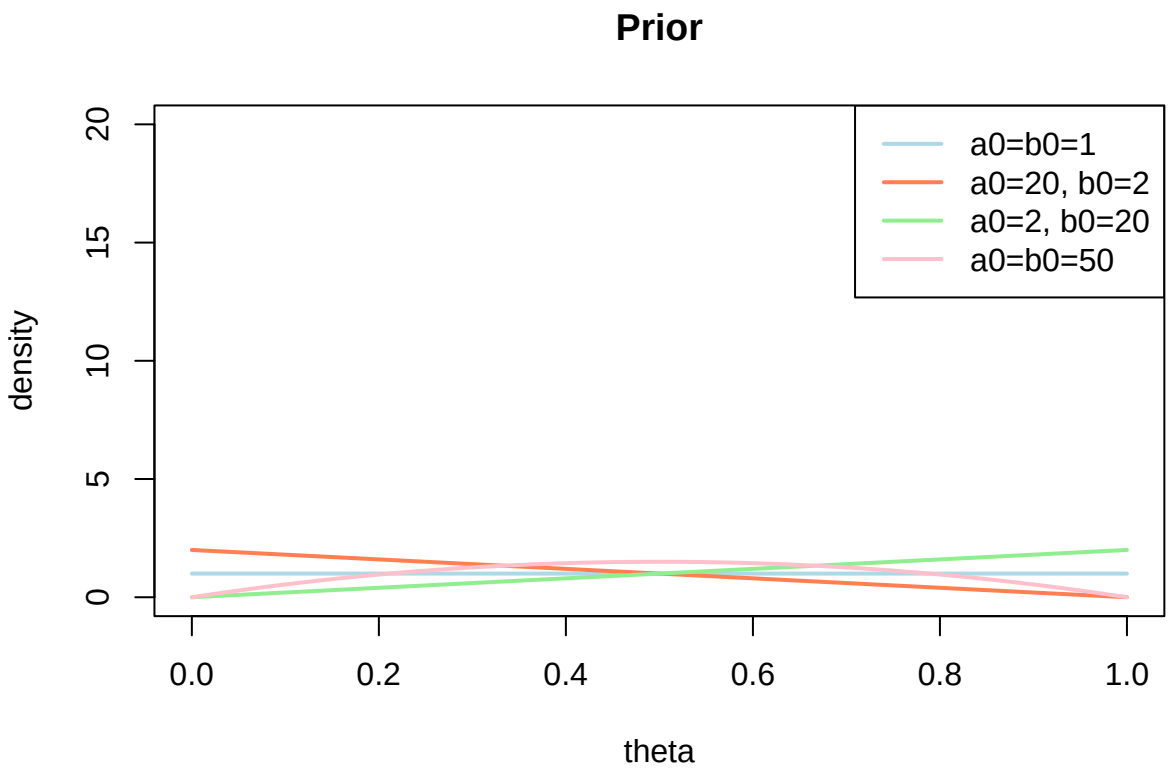
```
theta <- seq(0,1,length=1000)
plot(theta, dbeta(theta, 1,1), col="lightblue", lwd=2,
type="l", ylab="density", xlab="theta", main="Prior", ylim=c(0,20))
lines(theta, dbeta(theta, 20,2), col="coral", lwd=2)
lines(theta, dbeta(theta, 2,20), col="lightgreen", lwd=2)
lines(theta, dbeta(theta, 50,50), col="pink", lwd=2)
legend("topright", c("a0=b0=1", "a0=20, b0=2", "a0=2, b0=20", "a0=b0=50"),
lwd=c(2,2,2), col=c("lightblue", "coral", "lightgreen", "pink"))
```



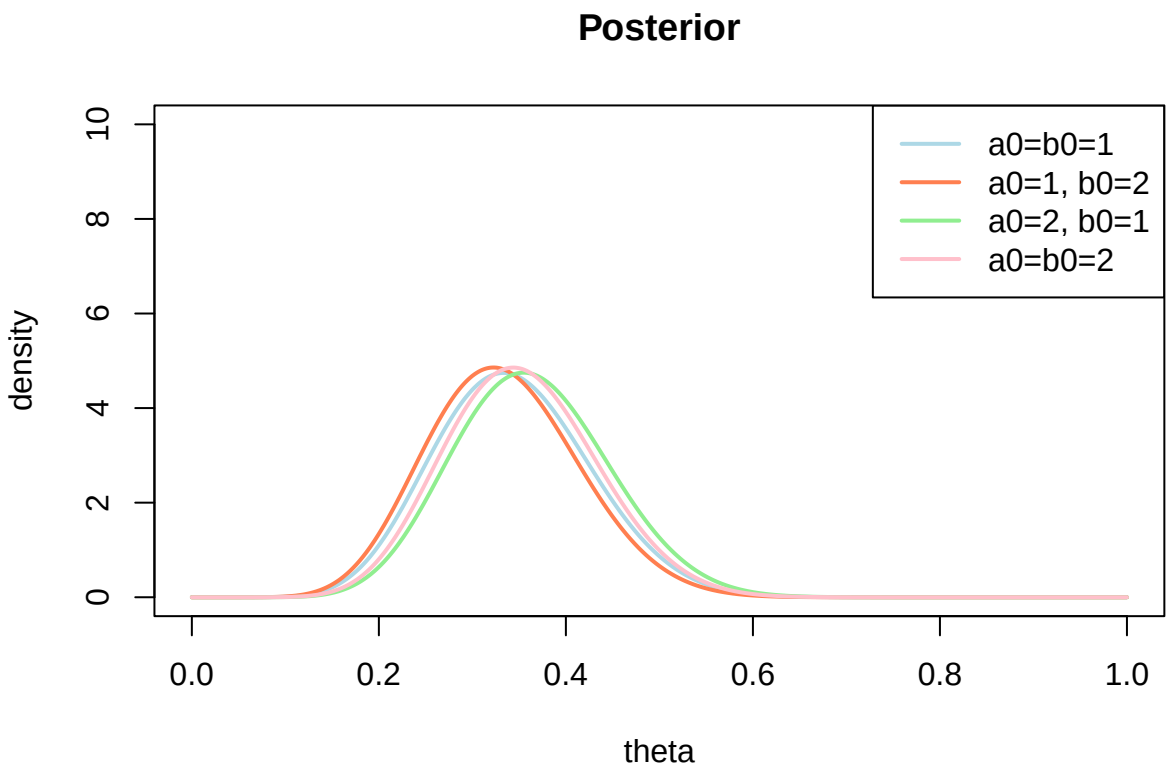

```
plot(theta, dbeta(theta, 1+10,1+20), type="l", col="lightblue", lwd=2,
ylab="density", xlab="theta", main="Posterior",ylim=c(0,10))
lines(theta, dbeta(theta, 20+10,2+20), col="coral", lwd=2)
lines(theta, dbeta(theta, 2+10,20+20), col="lightgreen", lwd=2)
lines(theta, dbeta(theta, 50+10,50+20), col="pink", lwd=2)
legend("topright", c("a0=b0=1", "a0=20, b0=2", "a0=2, b0=20", "a0=b0=50"),
lwd=c(2,2,2), col=c("lightblue", "coral", "lightgreen", "pink"))
```




```
theta <- seq(0,1,length=1000)
plot(theta, dbeta(theta, 1,1), col="lightblue", lwd=2,
type="l", ylab="density", xlab="theta", main="Prior", ylim=c(0,20))
lines(theta, dbeta(theta, 1,2), col="coral", lwd=2)
lines(theta, dbeta(theta, 2,1), col="lightgreen", lwd=2)
lines(theta, dbeta(theta, 2,2), col="pink", lwd=2)
legend("topright", c("a0=b0=1", "a0=20, b0=2", "a0=2, b0=20", "a0=b0=50"),
lwd=c(2,2,2), col=c("lightblue", "coral", "lightgreen", "pink"))
```



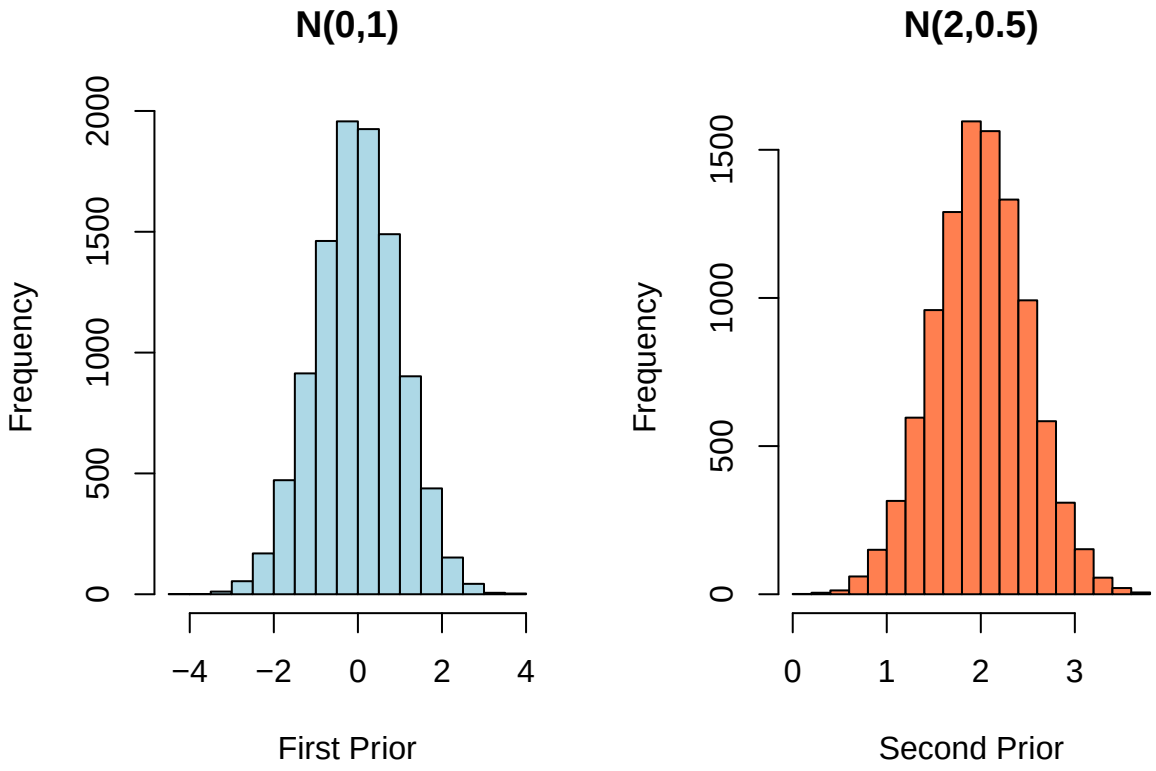

```
plot(theta, dbeta(theta, 1+10,1+20), type="l", col="lightblue", lwd=2,
ylab="density", xlab="theta", main="Posterior",ylim=c(0,10))
lines(theta, dbeta(theta, 1+10,2+20), col="coral", lwd=2)
lines(theta, dbeta(theta, 2+10,1+20), col="lightgreen", lwd=2)
lines(theta, dbeta(theta, 2+10,2+20), col="pink", lwd=2)
legend("topright", c("a0=b0=1", "a0=1, b0=2", "a0=2, b0=1", "a0=b0=2"),
lwd=c(2,2,2), col=c("lightblue", "coral", "lightgreen", "pink"))
```



Exercise 4

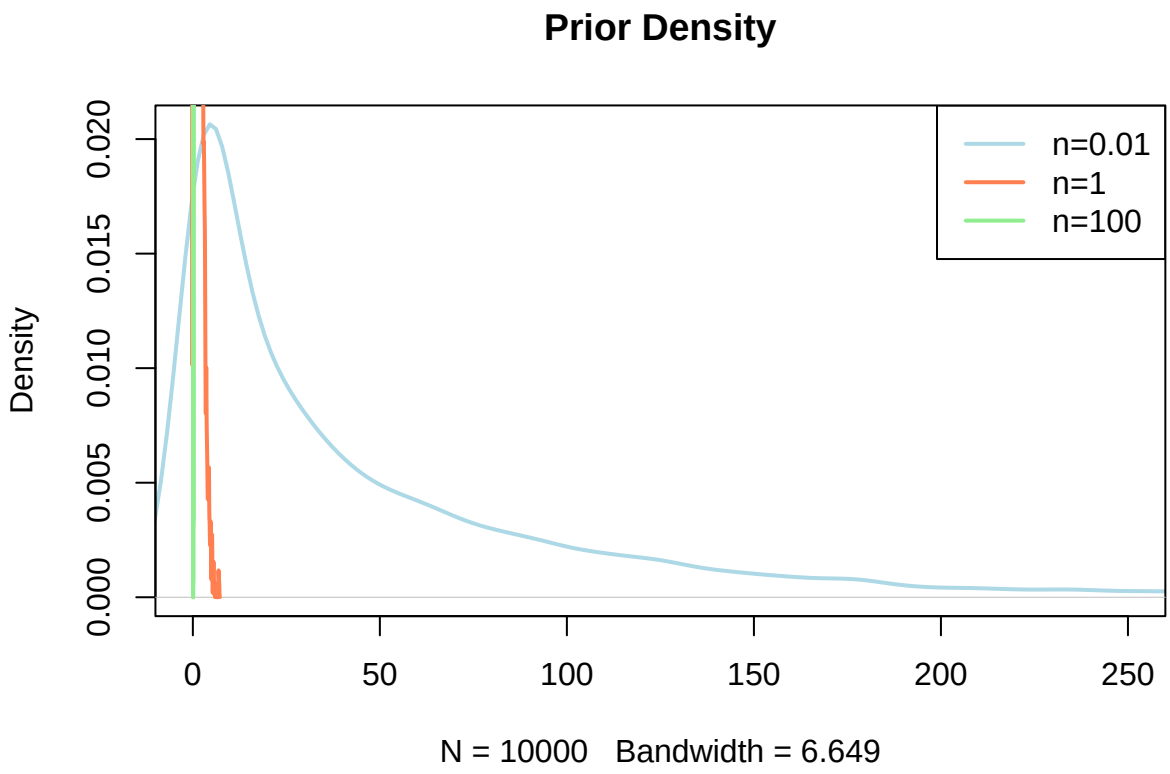
1.

```
n <- 10000
set.seed(202020)
prior1 <- rnorm(n)
prior2 <- rnorm(n,mean=2,sd=1/2)

par(mfrow=c(1,2))
hist(prior1,xlab="First Prior",col="lightblue",main="N(0,1)")
hist(prior2,xlab="Second Prior",col="coral",main="N(2,0.5)")
```



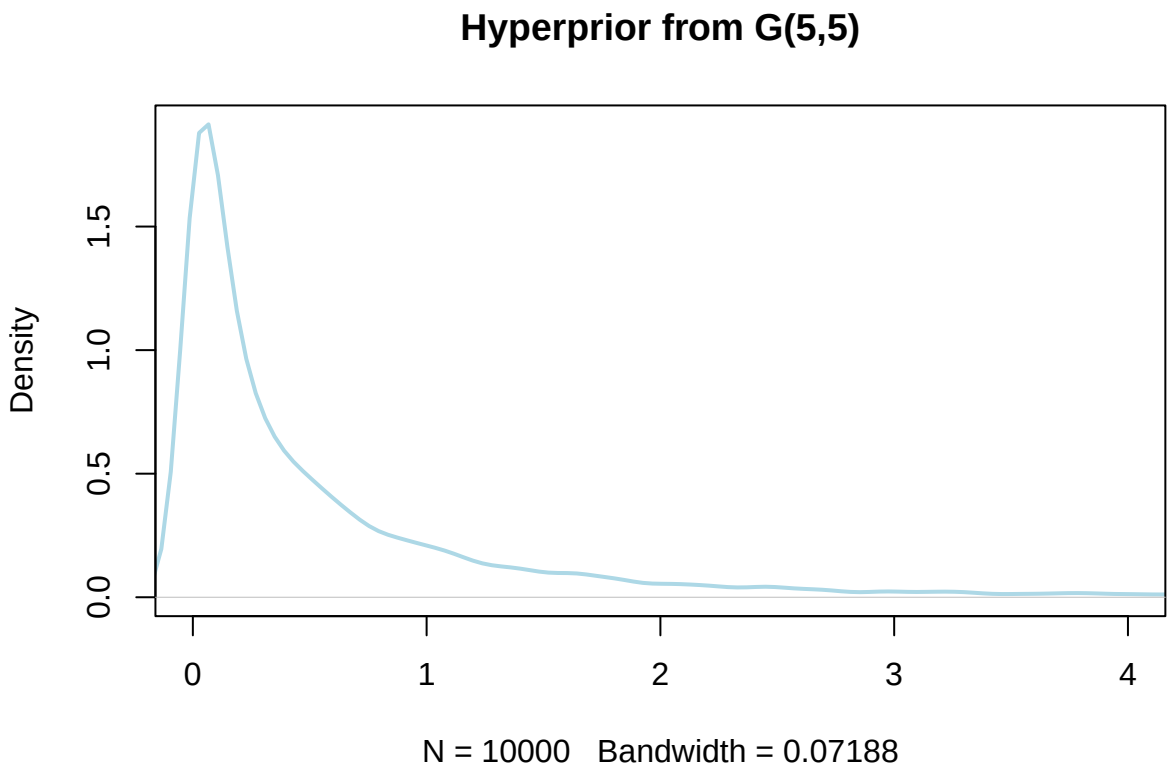
2.

```
set.seed(1234)
prior1 <- rgamma(10000,shape=0.5,rate=0.01)
prior2 <- rgamma(10000,shape=0.5,rate=1)
prior3 <- rgamma(10000,shape=0.5,rate=100)

plot(density(prior1),col="lightblue",xlim=c(0,250),lwd=2,main="Prior Density")
lines(density(prior2), col = "coral",lwd=2)
lines(density(prior3), col = "lightgreen",lwd=2)
legend("topright", c("n=0.01", "n=1", "n=100"),
       col =c("lightblue","coral","lightgreen"), lwd=2)
```

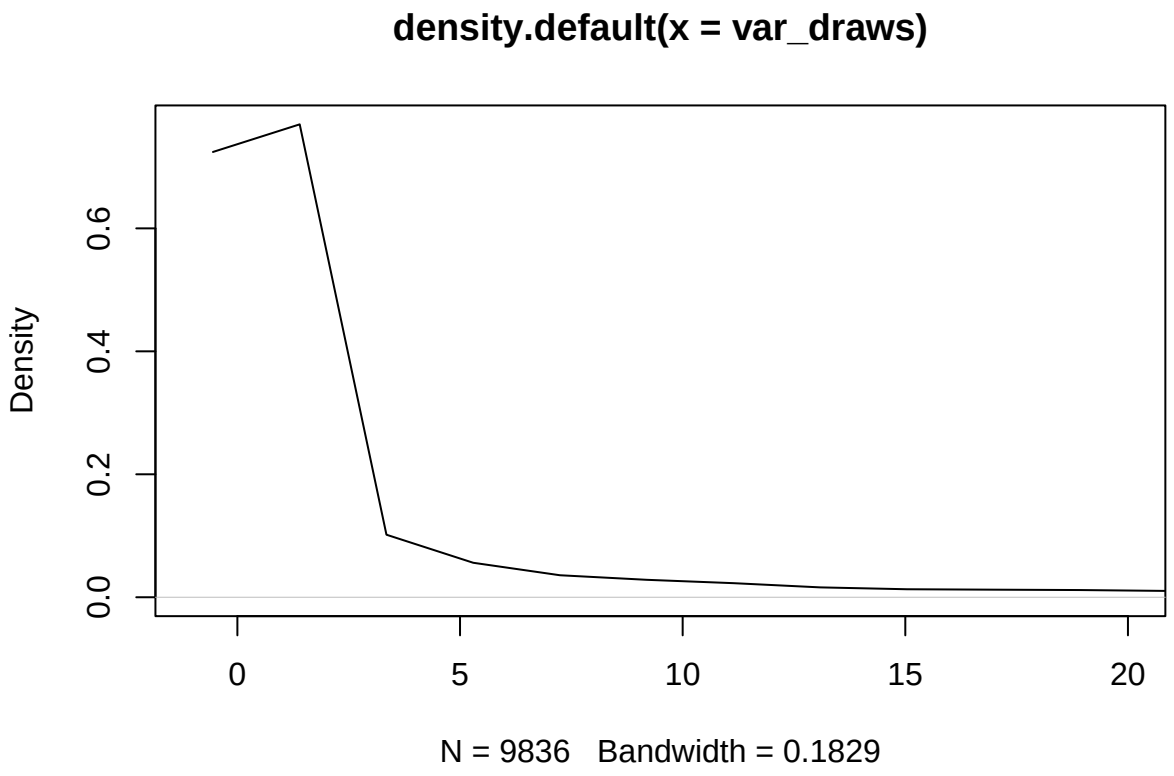


3.

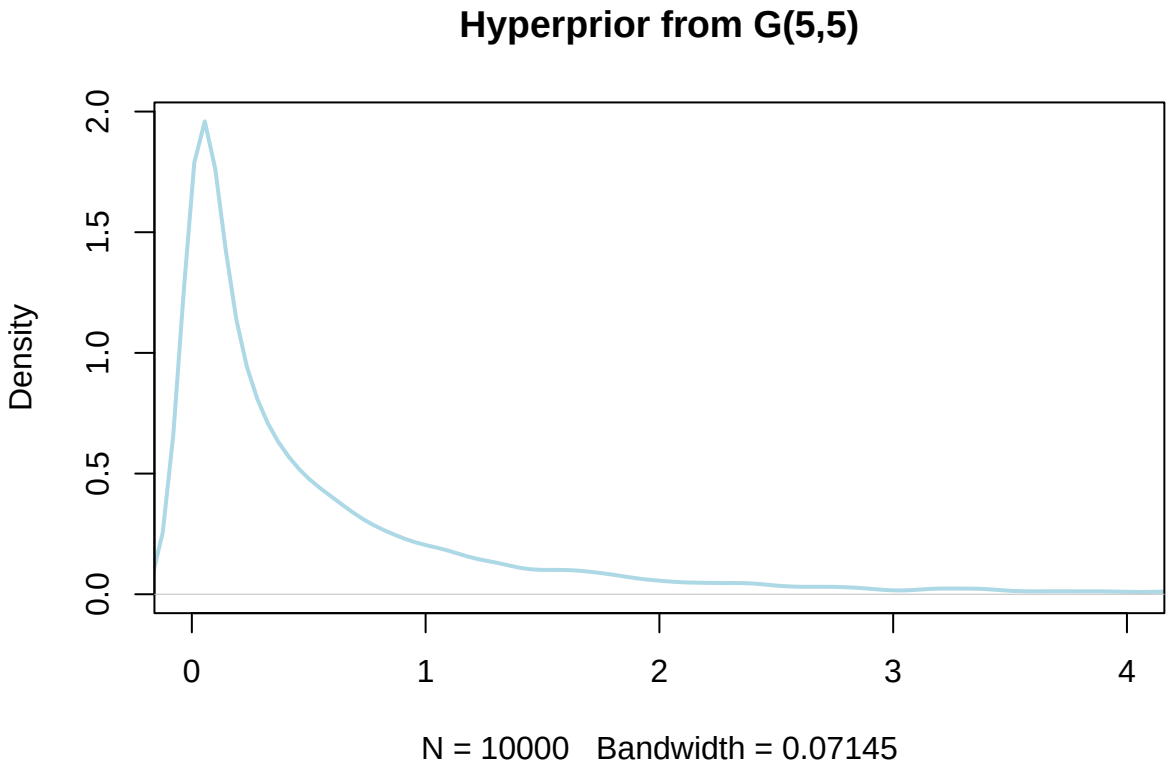
```
prior_eta <- rgamma(10000,shape=5,rate=5)
#prior_variance <- 1/rgamma(10000,shape=0.5,rate=prior_eta)
prior_variance <- rgamma(10000,shape=0.5,rate=prior_eta)
plot(density(prior_variance),main="Hyperprior from G(5,5)",col="lightblue",lwd=2,xlim=c(0,4))
```




```
eta_draws = rgamma(1e4, shape = 0.1, rate = 0.1)
var_draws = 1/rgamma(1e4, shape = 0.5, rate = eta_draws)
var_draws = var_draws[var_draws <= 1e3]
plot(density(var_draws),xlim=c(-1,20))
```




```
set.seed(55555555)
prior_eta <- rgamma(10000,shape=5,rate=5)
#prior_variance <- 1/rgamma(10000,shape=0.5,rate=prior_eta)
prior_variance <- rgamma(10000,shape=0.5,rate=prior_eta)
plot(density(prior_variance),main="Hyperprior from G(5,5)",col="lightblue",lwd=2,xlim=c(0,4))
```


Hyperprior from G(5,5)
Density
0.0
0.5
1.0
1.5
2.0
0
1
2
3
4
N = 10000 Bandwidth = 0.07145