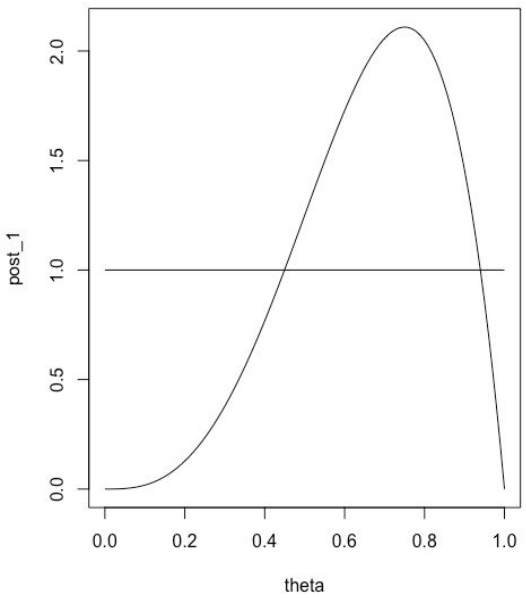
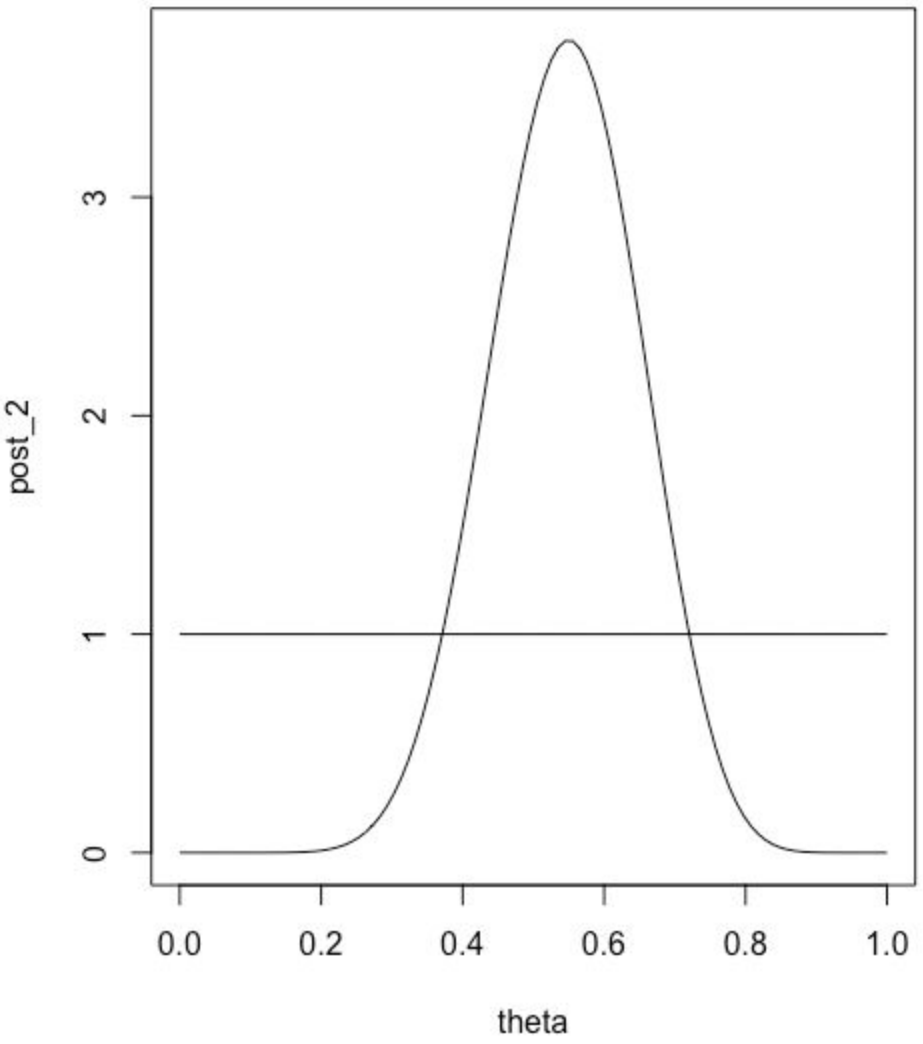
Module 12 Homework - Noboru Hayashi

a)

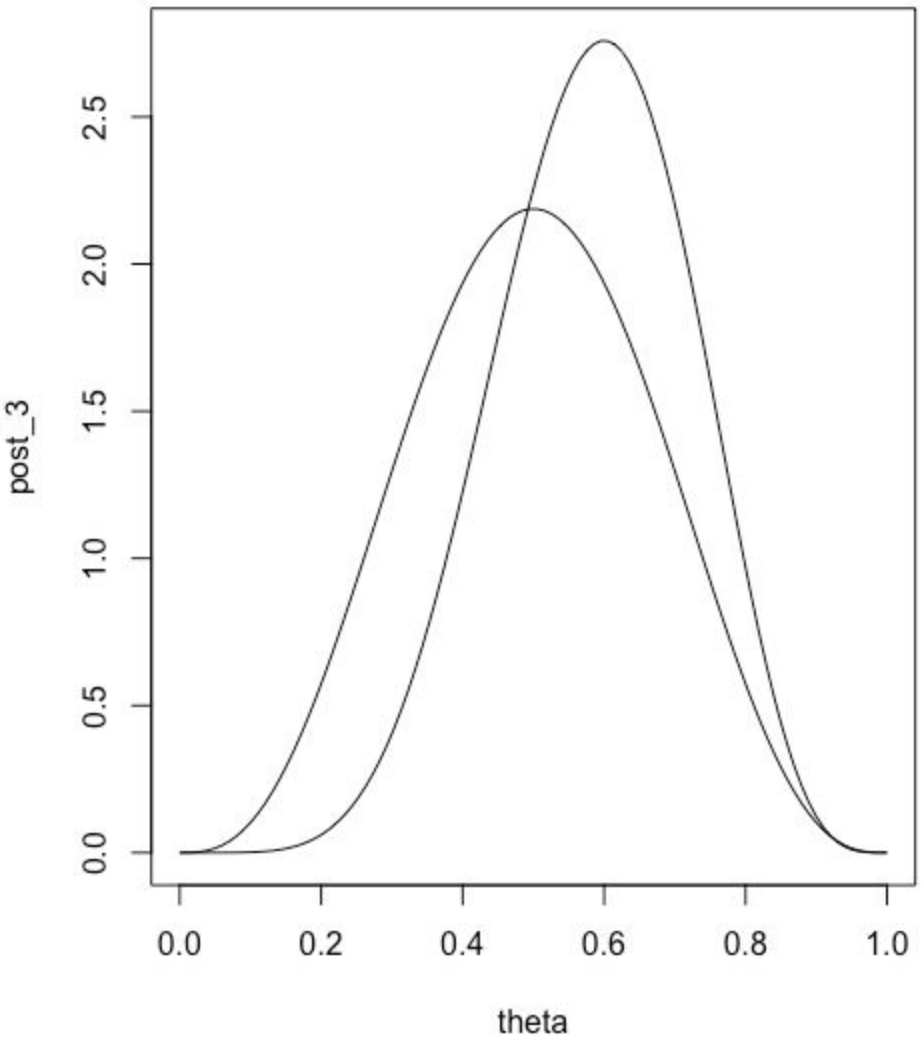
```
> # init prior & posterior
> prior = function(r, s, theta){
+     (gamma(r+s)/(gamma(r)*gamma(s)))*theta^(r-1)*(1-theta)^(s-1)
+ }
>
> posterior = function(r, s, n, k, theta){
+     (gamma(n+r+s)/(gamma(r+k)*gamma(s+n-k)))*theta^(r+k-1)*(1-theta)^(n+s-k-1)
+ }
>
> # init theta
> theta = seq(0,1,length=100)
>
> # (r,s) = (1,1) & (n,k) = (4,3)
> r = 1
> s = 1
> n = 4
> k = 3
> prior_1 = prior(r,s,theta)
> post_1 = posterior(r,s,n,k,theta)
> plot(theta, post_1,"l")
> lines(theta, prior_1)
```



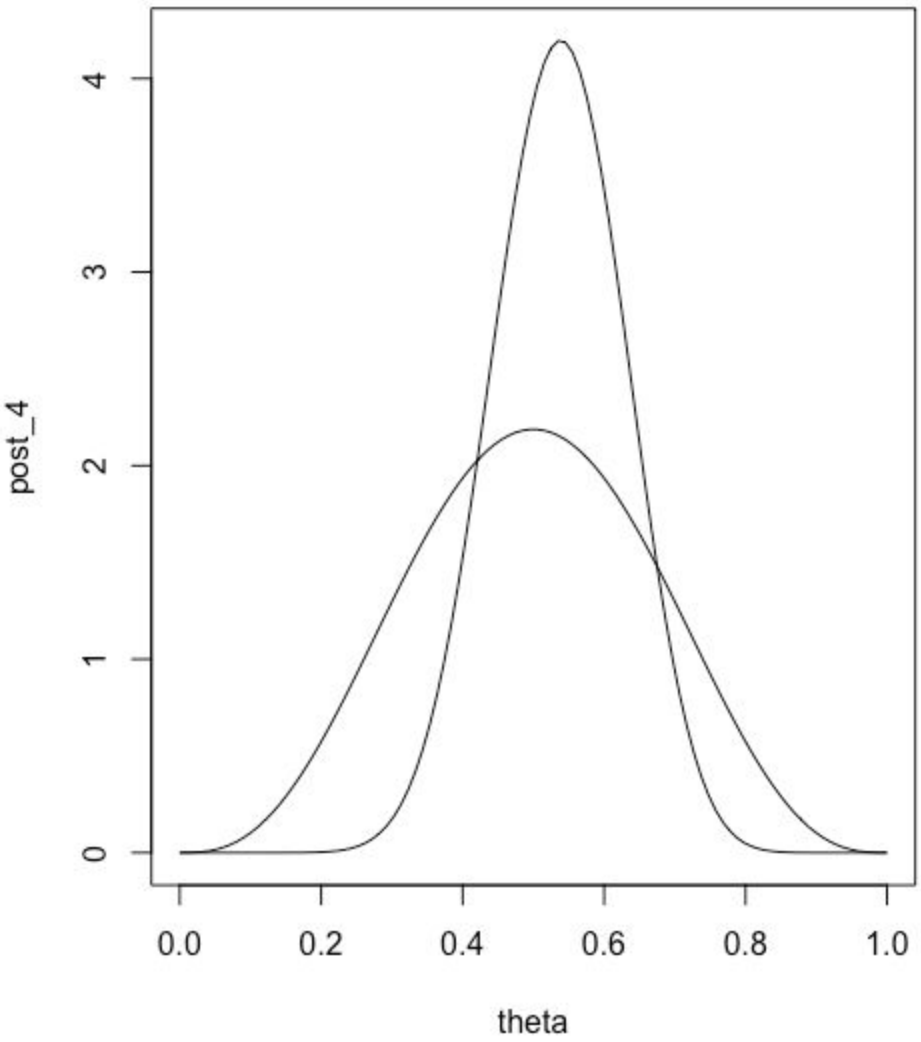
```
> # (r,s) = (1,1) & (n,k) = (20,11)
> r = 1
> s = 1
> n = 20
> k = 11
> prior_2 = prior(r,s,theta)
> post_2 = posterior(r,s,n,k,theta)
> plot(theta, post_2,"l")
> lines(theta, prior_2)
```



```
> # (r,s) = (4,4) & (n,k) = (4,3)
> r = 4
> s = 4
> n = 4
> k = 3
> prior_3 = prior(r,s,theta)
> post_3 = posterior(r,s,n,k,theta)
> plot(theta, post_3,"l")
> lines(theta, prior_3)
```



```
> # (r,s) = (4,4) & (n,k) = (20,11)
> r = 4
> s = 4
> n = 20
> k = 11
> prior_4 = prior(r,s,theta)
> post_4 = posterior(r,s,n,k,theta)
> plot(theta, post_4,"l")
> lines(theta, prior_4)
```



b)
```
> # (r,s) = (1,1) & (n,k) = (4,3)
> r = 1
> s = 1
> n = 4
> k = 3
> a = r + k
> b = n + s - k
> p1 = 1 - pbeta(0.5, a,b)
> p1
[1] 0.8125

> # (r,s) = (1,1) & (n,k) = (20,11)
> r = 1
> s = 1
> n = 20
> k = 11
> a = r + k
> b = n + s - k
> p2 = 1 - pbeta(0.5, a,b)
> p2
[1] 0.6681881

> # (r,s) = (4,4) & (n,k) = (4,3)
> r = 4
> s = 4
> n = 4
> k = 3
> a = r + k
> b = n + s - k
> p3 = 1 - pbeta(0.5, a,b)
> p3
[1] 0.7255859

> # (r,s) = (4,4) & (n,k) = (20,11)
> r = 4
> s = 4
> n = 20
> k = 11
> a = r + k
> b = n + s - k
> p4 = 1 - pbeta(0.5, a,b)
> p4
[1] 0.649446
```