# STA 602 Lab

Student

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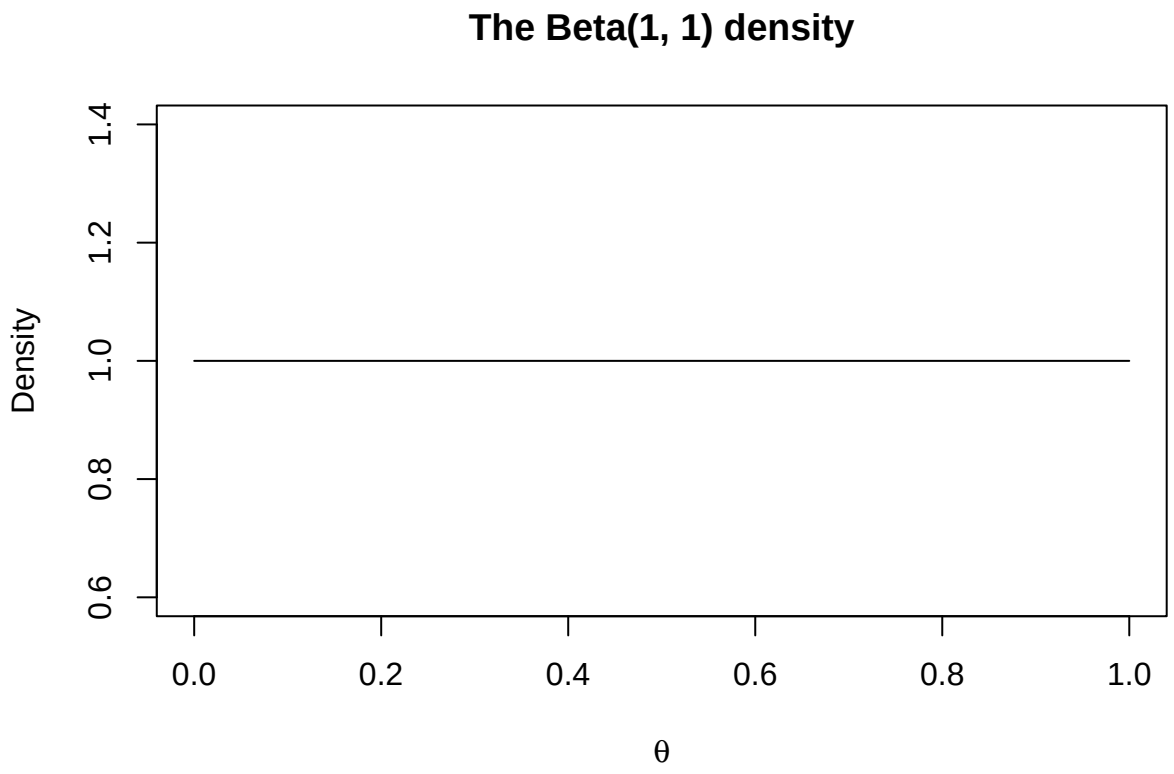
## Exercise 1

The histogram below is unimodal and approximately normal with mean around .155.

```
tumors <- read.csv(file = url("http://www.stat.columbia.edu/~gelman/book/data/rats.asc"),
                   skip = 2, header = T, sep = " ")[,c(1,2)]
y <- tumors$y
N <- tumors$N
n <- length(y)


plot(seq(0, 1, length.out = 1000),
     dbeta(seq(0, 1, length.out = 1000), 1, 1),
     type = 'l',
     xlab = expression(theta), ylab = "Density",
     main = "The Beta(1, 1) density")
```



```
stan_dat <- list(n = n, N = N, y =y, a = 1, b = 1)
fit_pool <- stan('lab-02-pool.stan', data = stan_dat, chains = 2, refresh = 0)
```

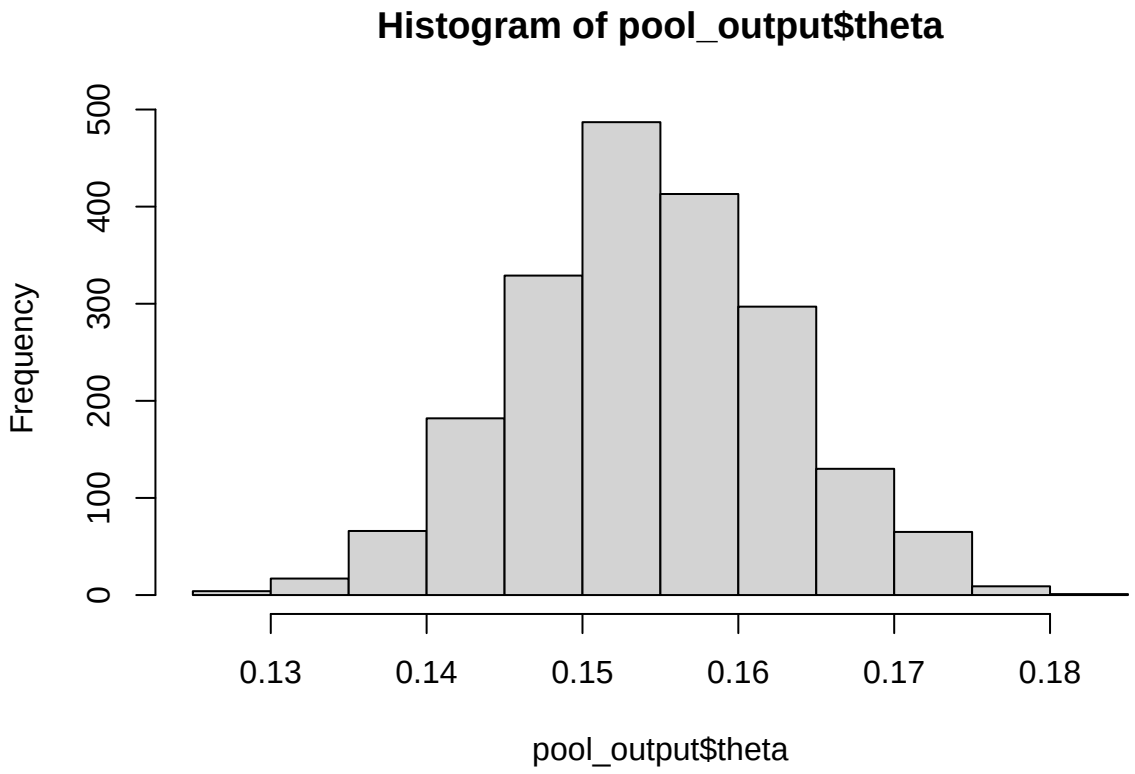
```
## Trying to compile a simple C file
```

```
## Running /usr/lib64/R/bin/R CMD SHLIB foo.c
## gcc -m64 -I"/usr/include/R" -DNDEBUG   -I"/usr/lib64/R/library/Rcpp/include/"  -I"/usr/lib64/R/libra
## In file included from /usr/lib64/R/library/RcppEigen/include/Eigen/Dense:1,
##                  from /usr/lib64/R/library/StanHeaders/include/stan/math/prim/mat/fun/Eigen.hpp:13,
##                  from <command-line>:
## /usr/lib64/R/library/RcppEigen/include/Eigen/Core:82:12: fatal error: new: No such file or directory
##    82 |   #include <new>
##       |            ^~~~~
## compilation terminated.
## make: *** [/usr/lib64/R/etc/Makeconf:168: foo.o] Error 1
```

```
pool_output <- rstan::extract(fit_pool)
mean(pool_output$theta)
```

```
## [1] 0.1543446
```

```
hist(pool_output$theta)
```




### Exercise 2

```
stan_dat <- list(n = n, N = N, y =y, a = 1, b = 1)
fit_nopool <- stan('lab-02-nopool.stan', data = stan_dat, chains = 2, refresh = 0)
```

```
## Trying to compile a simple C file
```

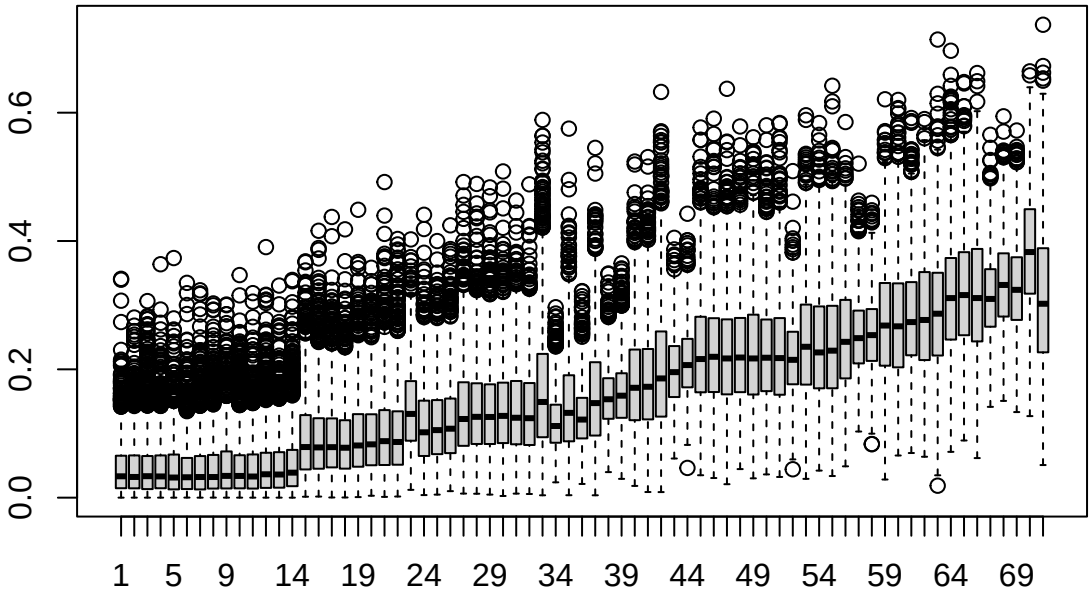
```
## Running /usr/lib64/R/bin/R CMD SHLIB foo.c
```

```
## gcc -m64 -I"/usr/include/R" -DNDEBUG   -I"/usr/lib64/R/library/Rcpp/include/"  -I"/usr/lib64/R/libra
## In file included from /usr/lib64/R/library/RcppEigen/include/Eigen/Dense:1,
##                  from /usr/lib64/R/library/StanHeaders/include/stan/math/prim/mat/fun/Eigen.hpp:13,
##                  from <command-line>:
## /usr/lib64/R/library/RcppEigen/include/Eigen/Core:82:12: fatal error: new: No such file or directory
##    82 |   #include <new>
##       |            ^~~~~
## compilation terminated.
## make: *** [/usr/lib64/R/etc/Makeconf:168: foo.o] Error 1
```

```
nopool_output <- rstan::extract(fit_nopool)
apply(nopool_output$theta,2,mean)
```

```
##  [1] 0.04567157 0.04576556 0.04660192 0.04626698 0.04571170 0.04391771
##  [7] 0.04575983 0.04654547 0.04886813 0.04818146 0.04693485 0.05020337
## [13] 0.04926412 0.05341878 0.09208530 0.09115428 0.09156452 0.08919683
## [19] 0.09532936 0.09568669 0.10048229 0.09996463 0.13931234 0.11332447
## [25] 0.11519755 0.11896966 0.13565440 0.13705860 0.13649618 0.13787223
## [31] 0.13720955 0.13556533 0.16700761 0.11711174 0.14425624 0.12640464
## [37] 0.15896685 0.15713905 0.16201851 0.18103734 0.18220362 0.19938092
## [43] 0.19914791 0.21155529 0.22683377 0.22704667 0.22413363 0.22667050
## [49] 0.22611509 0.22643210 0.22533897 0.21967675 0.24164775 0.23747238
## [55] 0.23871858 0.24989924 0.25190514 0.25527928 0.27311459 0.27401689
## [61] 0.28174911 0.28648723 0.29209355 0.31616697 0.31959054 0.31830428
## [67] 0.31217633 0.33338331 0.32673493 0.38528495 0.31192965
```

```
boxplot(nopool_output$theta)
```




## Exercise 3

I think the difference is that the pool file uses one random variable for all thetas, given by the "real" keyword i.e. all of the different labs are in the same pool. The nopool file uses different thetas, represented by a vector of thetas, for each lab.

## Exercise 4

**Exercise 5**

**Exercise 6**

**Exercise 7**

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