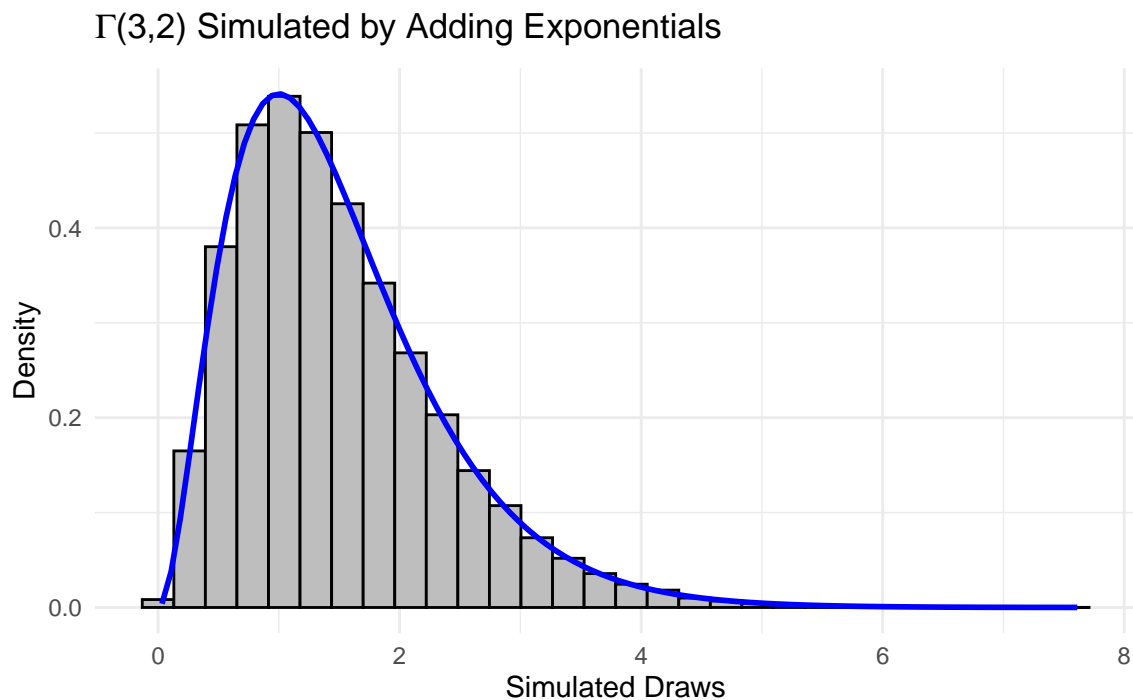


Question 4

4a.

```
exp_function <- function(n, lambda){  
  u <- runif(n)  
  x <- -(1/lambda)*log(1-u)  
  
  return(x)  
}  
  
n <- 100000  
g <- rep(NA, n)  
  
for (i in 1:n){  
  g[i] <- sum(exp_function(3, 2))  
}  
g <- data.frame(g)  
  
ggplot(g, aes(g)) +  
  geom_histogram(aes(y = ..density..), bins = 30, color = "black", fill = "grey") +  
  stat_function(fun = dgamma, args = list(shape = 3, rate = 2), size = 1, color = "blue") +  
  xlab("Simulated Draws") +  
  ylab("Density") +  
  ggtitle(TeX(c("$\\Gamma(3,2)$ Simulated by Adding Exponentials")) +  
  theme_minimal()
```



4b.

```
accept_reject <- function(n, lambda, alpha, beta){
  xmax <- (alpha - 1)/(1 - lambda)
  cee <- (1/(lambda*gamma(alpha)))*(xmax^(alpha-1))*exp(-(1+lambda)*xmax)

  accept <- 0
  x <- rep(NA, n)

  while(accept < n){
    y <- (-1/lambda)*log(1-runif(1))
    u <- runif(1)
    r <- (1/(cee*lambda*gamma(alpha)))*(y^(alpha-1))*exp(-(1+lambda)*y)
    if (u <= r){
      accept <- accept + 1
      x[accept] <- y/beta
    }
  }
  return(x)
}

g <- accept_reject(n = 100000, lambda = .01, alpha = 3, beta = 2)
g <- data.frame(g)

ggplot(g, aes(g)) +
  geom_histogram(aes(y = ..density..), bins = 30, color = "black", fill = "grey") +
  stat_function(fun = dgamma, args = list(shape = 3, rate = 2), size = 1, color = "blue") +
  xlab("Simulated Draws") +
  ylab("Density") +
  ggtitle(TeX(c("$\\Gamma(3,2)$ Simulated by the Accept-Reject Algorithm")) +
  theme_minimal()
```

$\Gamma(3,2)$ Simulated by the Accept-Reject Algorithm

