STAT601 Lab3

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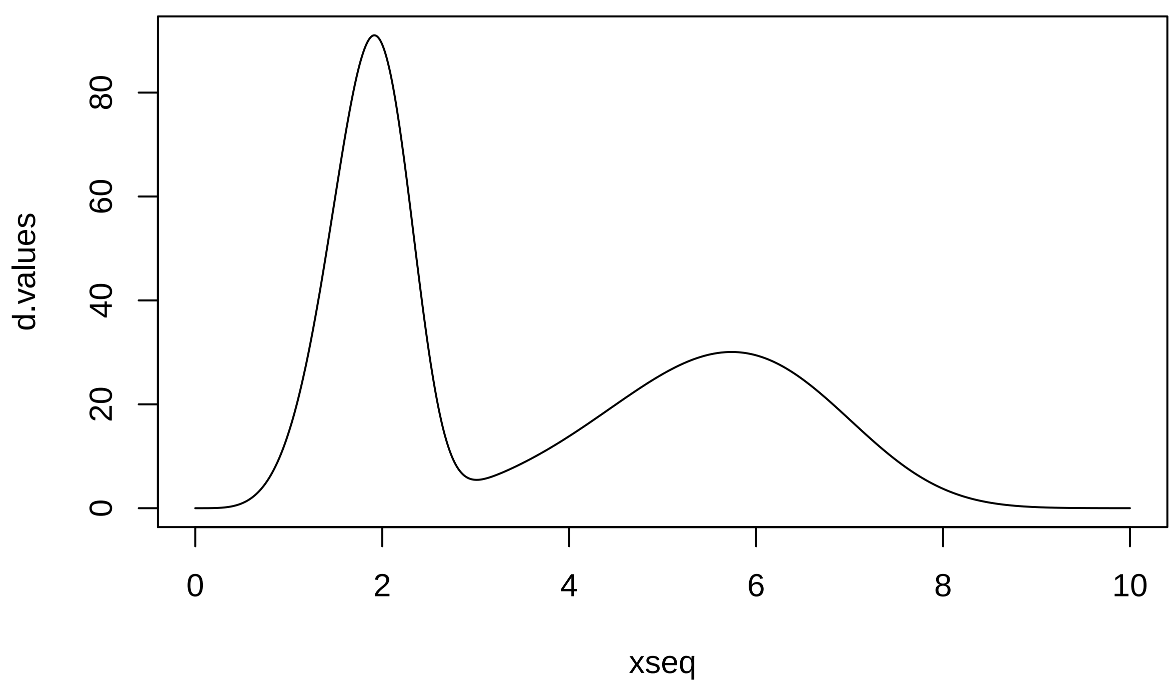
Exercise 2

Question 1

```
#### Plot the density ####
xseq <- seq(0,10,0.01)
d.values <- (xseq^4) * (15*exp(-(xseq/2)^5)+(5/81)*exp(-(xseq/6)^5))
plot(xseq,d.values,type = 'l')
```

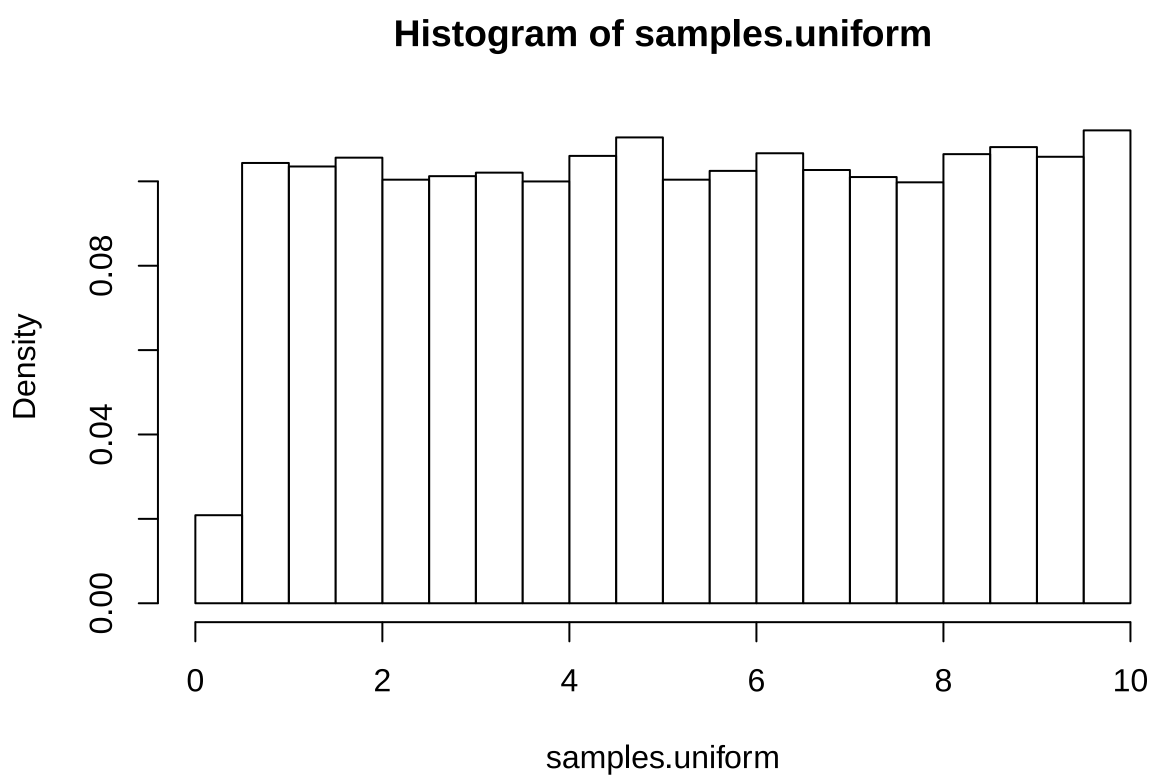


Question 2

```
density.function <- function(x){
  return((x^4) * (15*exp(-(x/2)^5)+(5/81)*exp(-(x/6)^5)))
}
```

```
samples.uniform <- NULL
N=10000
for ( i in 1:N ) {
  proposal <- runif(1,0,10) # Here we get a proposal value
  density.ratio <- density.function(proposal)/dunif(proposal)  # We calculate the ratio of the densitie
  if ( runif(1) < density.ratio ) samples.uniform <- c(samples.uniform,proposal) # If a random uniform
}

hist(samples.uniform,freq=FALSE)
```




```
print(paste("Acceptance Ratio: ",length(samples.uniform)/N))
```

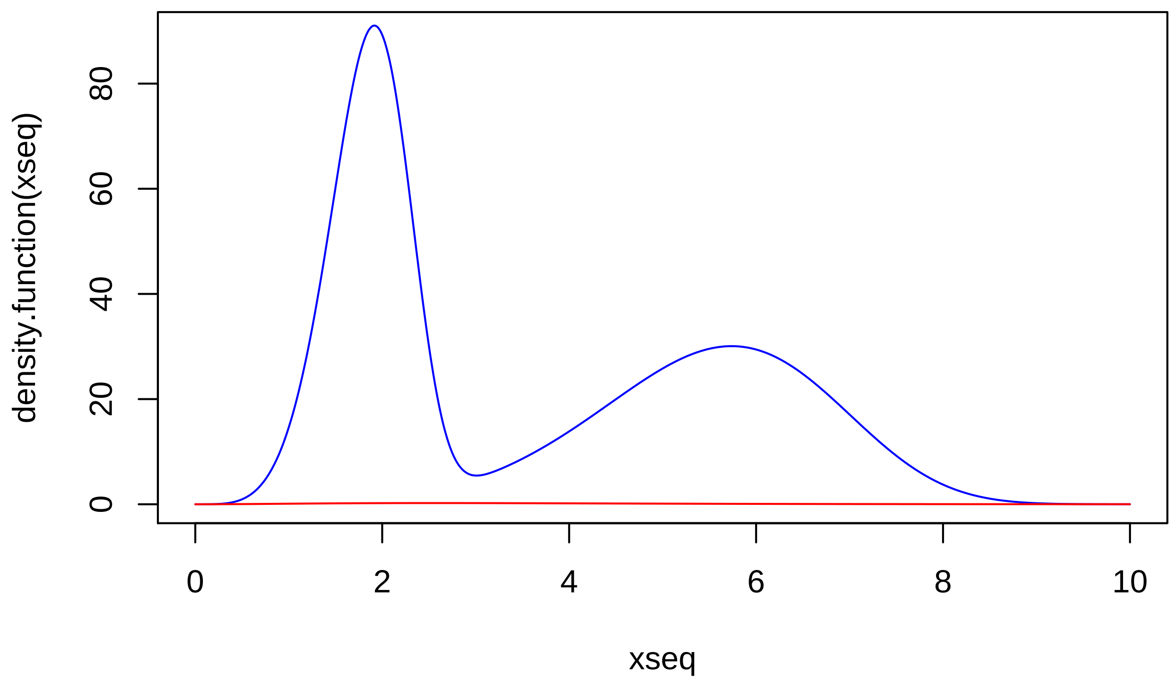
```
## [1] "Acceptance Ratio:  0.9582"
```

Question 3

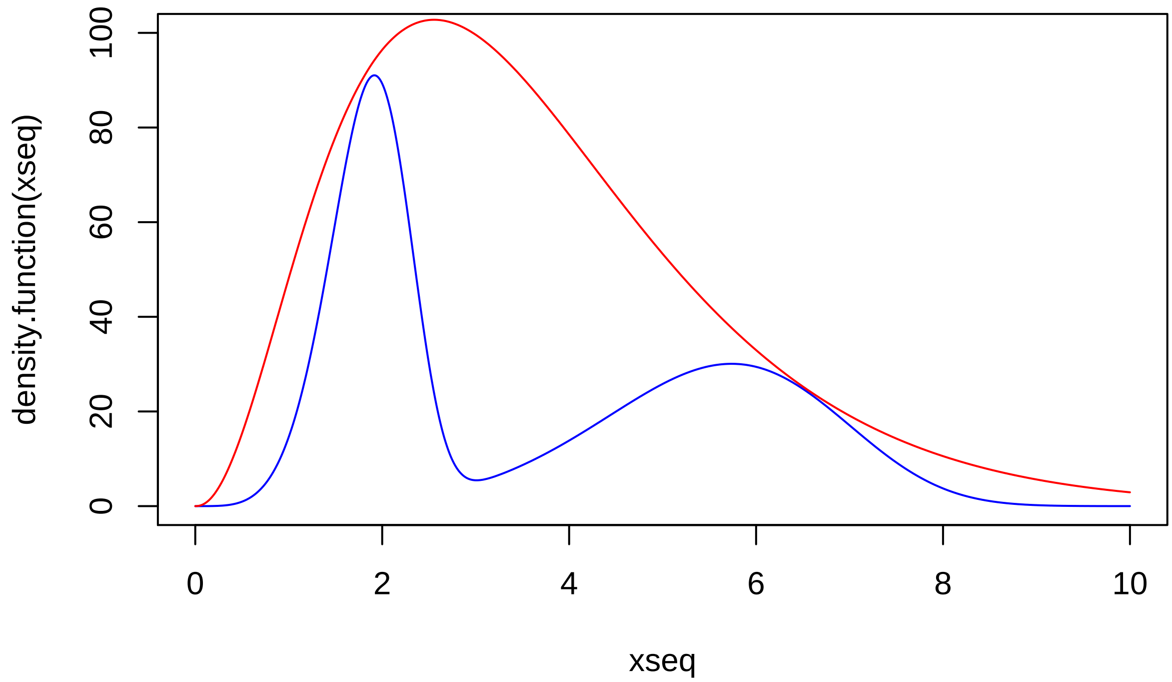
A good proposal function need to be greater or equal to the distribution that we are going to sample. And also fit the distribution as much as possible.

This desnsity function graph looks close to Gamma(3,2). Therefore I would contruct the density function based on it with adjustments.

```
plot(xseq,density.function(xseq),type="l",col="blue",ylim=c(0,90))
lines(xseq,dgamma(xseq,3.3,0.9),col="red")
```




```
M=450
plot(xseq,density.function(xseq),type="l",col="blue",ylim=c(0,100))
lines(xseq,M*dgamma(xseq,3.3,0.9),col="red")
```

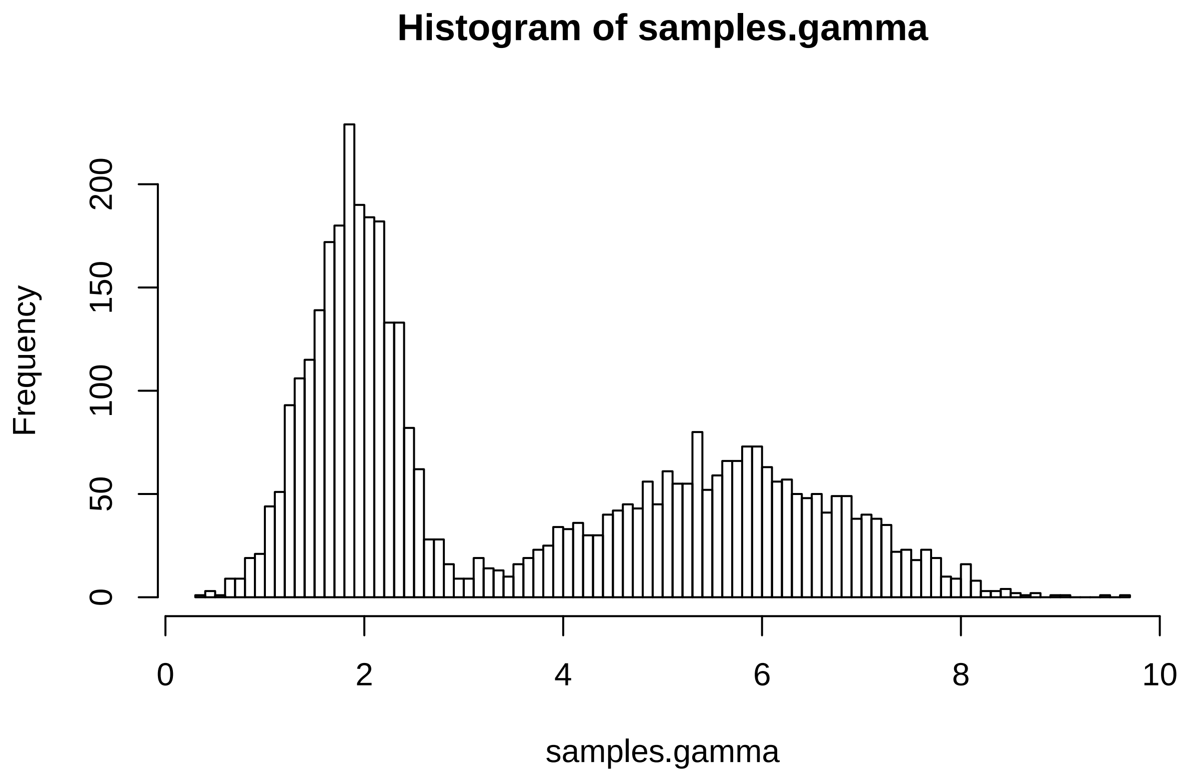


Question 4

```r
samples.gamma <- NULL

for ( i in 1:N ) {
  proposal  = rgamma(1,3.3,0.9)
  density.ratio = density.function(proposal)/(M*dgamma(proposal,3.3,0.9))
  if (runif(1) < density.ratio ) samples.gamma<- c(samples.gamma,proposal)
}

hist(samples.gamma,breaks=100)
```




```r
print(paste("Acceptance Ratio: ",length(samples.gamma)/N))
```

```
## [1] "Acceptance Ratio:  0.4242"
```

Question 5

No

Excercise 3

Question1

$$p(x) = \int_a^x \frac{1}{\int_a^b exp(-\frac{(x-m)^2}{2v}} \exp(-\frac{(x-m)^2}{2v})dx$$

There for it is a truncated normal distribution

Question2

Using a normal distribution as proposal funtion.

Question3

The inverse transform sampling method works as follows:

Generate a random number u from the standard uniform distribution in the interval [0,1]. Compute the value x such that F(x) = u. Take x to be the random number drawn from the distribution described by F.