

STAT601 Lab3

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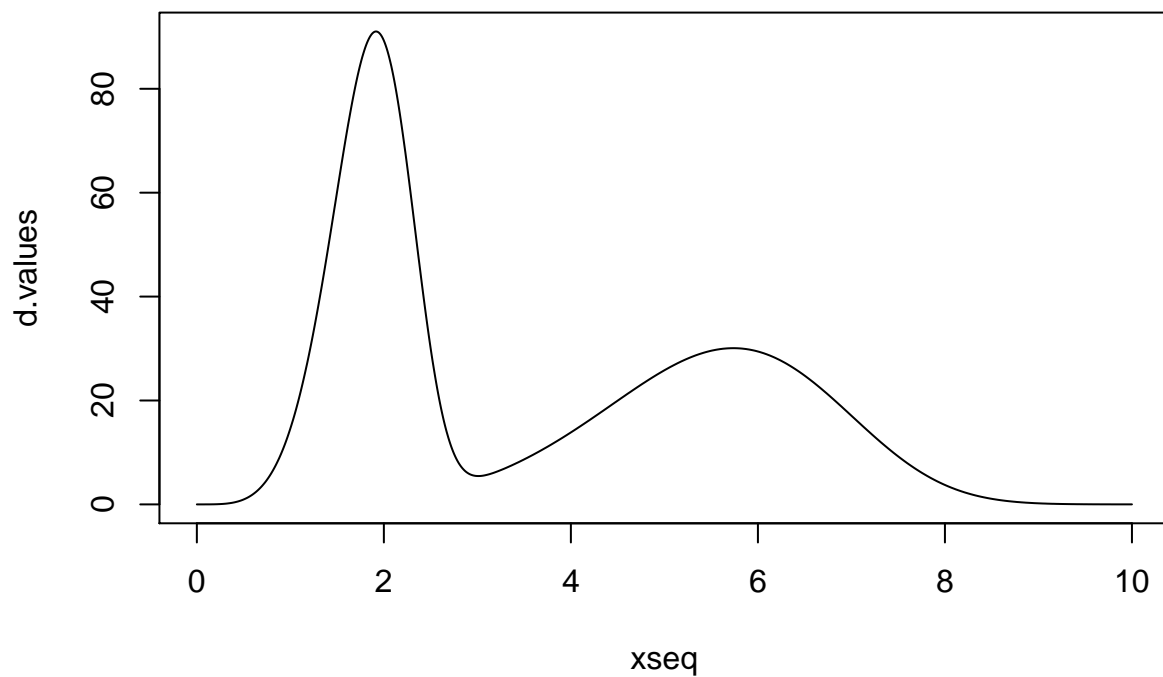
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Exercise 2

Question 1

fuck fcuk

```
#### 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)))  
}
```

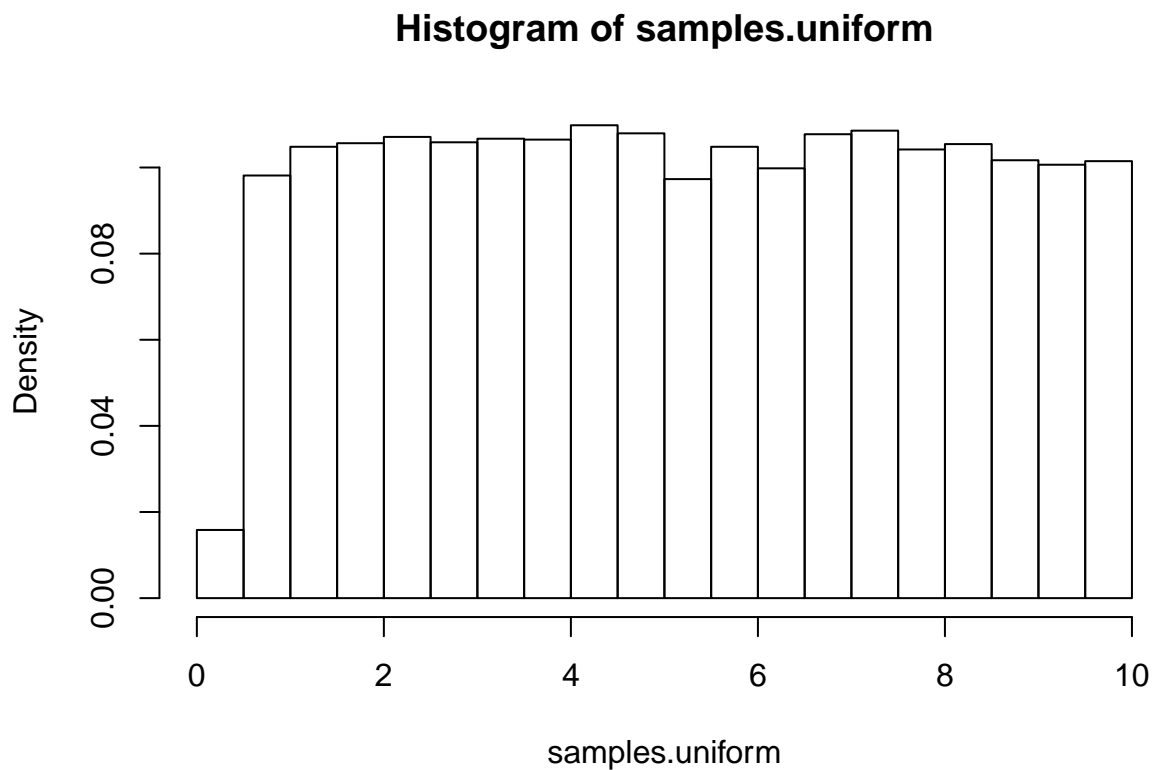
```

}

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 densities
  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))

```

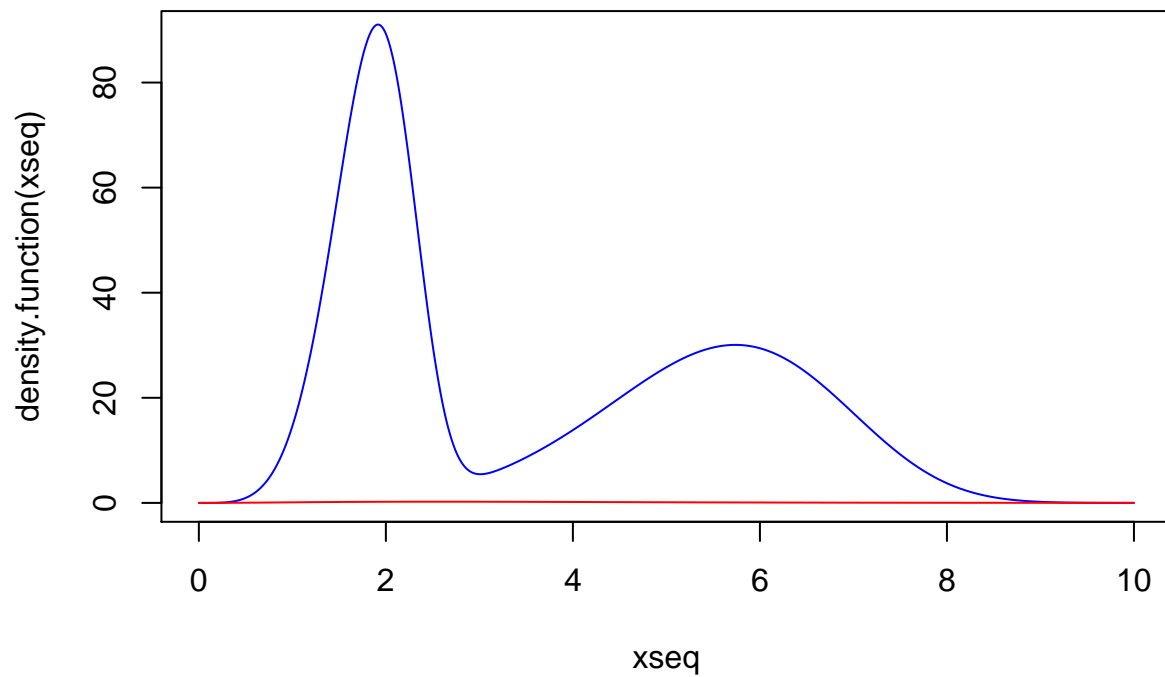
```
## [1] "Acceptance Ratio: 0.9598"
```

Question 3

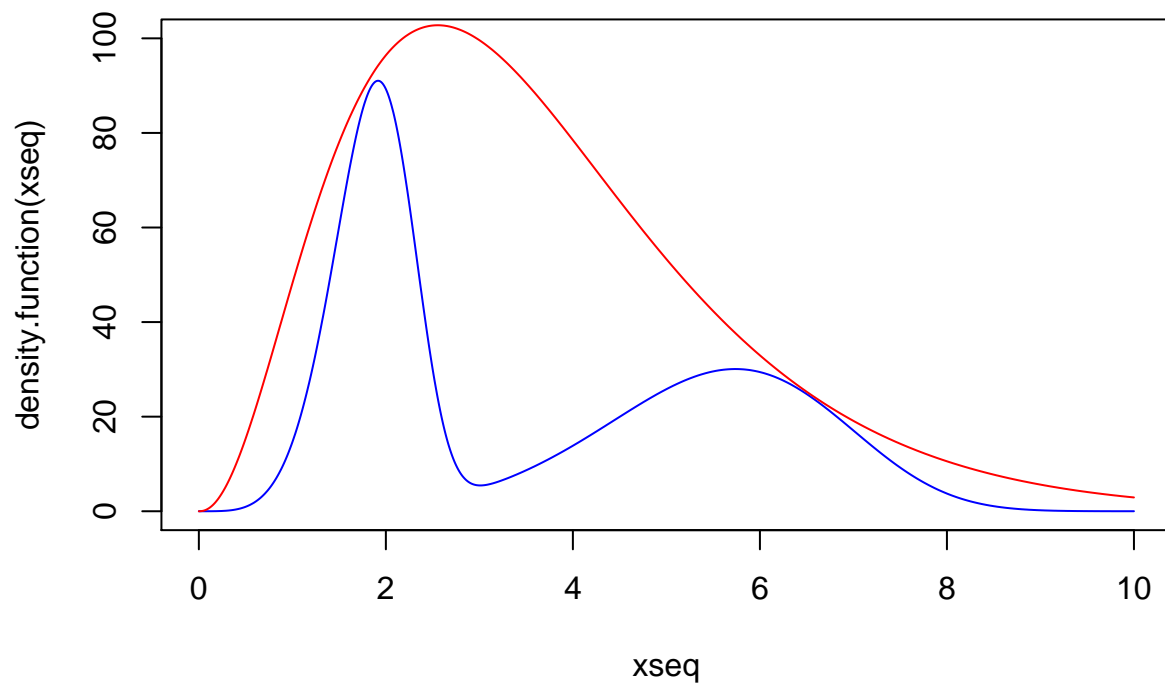
A good proposal function need to be greater or equal to the distribution that we are going to sample. And also fit the distribution as much as possible.

This desnsity function graph looks close to $\text{Gamma}(3,2)$. 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

```

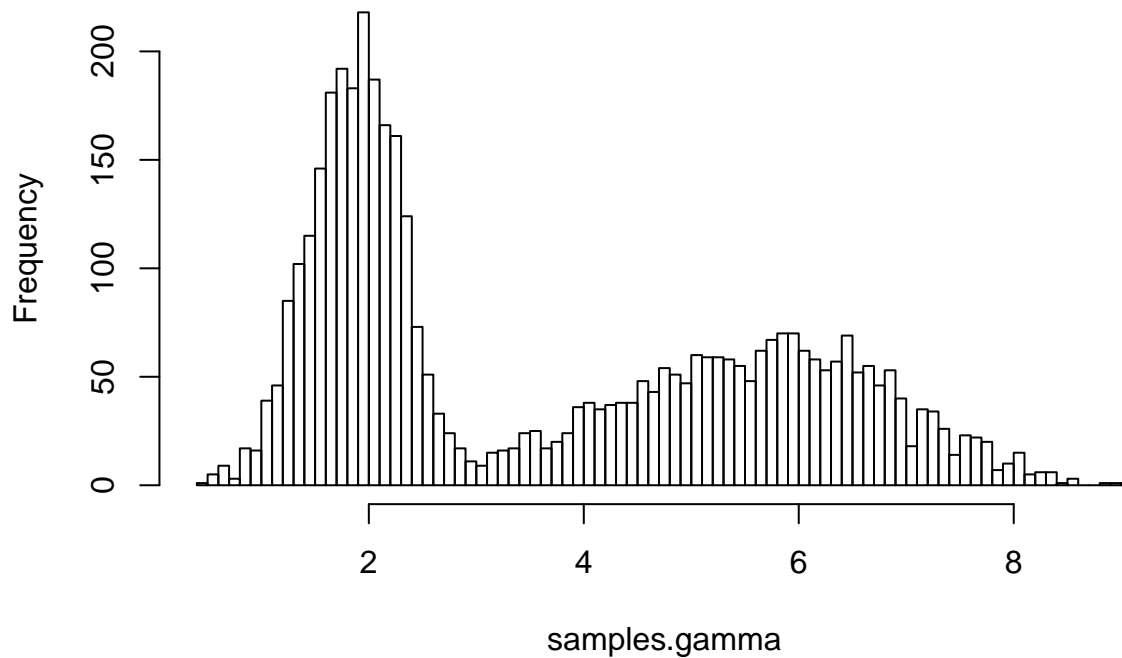
samples.gamma <- NULL

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)

```

Histogram of samples.gamma



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

```
## [1] "Acceptance Ratio: 0.4238"
```

Question 5

No. It is difficult to find a proposal function. And the acceptance rate will be low.

Excercise 3

Question1

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

Therefore it is a truncated normal distribution

Question2

Using a normal distribution as proposal function. And the parameter should be $\frac{1}{\phi(b) - \phi(a)}$

Question3

The inverse transform sampling method works as follows:

Generate a random number u from $U(0,1)$ find value x such when $F(x) = u$. Take x to be the random number drawn from the distribution described by F .