Course Project for Statistical Inference

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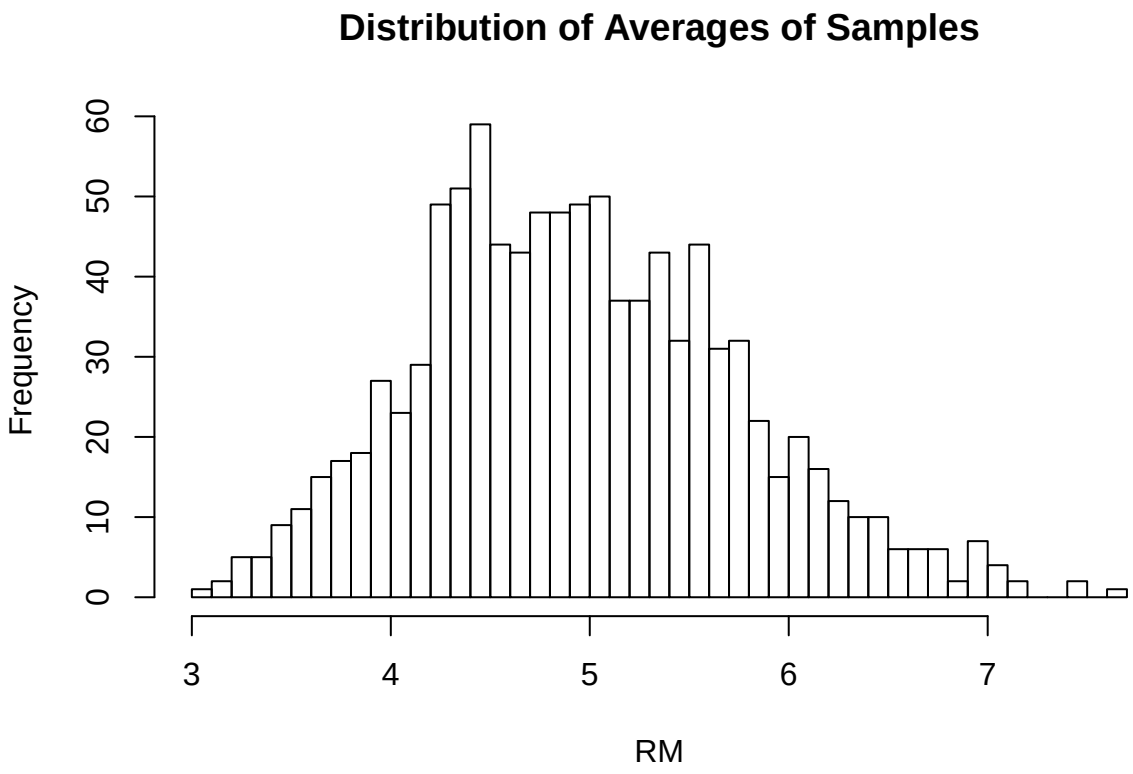
In this report, we try to stimulate the large number theory and the variance of exponential distribution and finally we want to show that the distribution is approximately normal.

During the whole project, we set that lambda=0.2 and we will investigate the distrubution of averages of 40 numbers sampled from exponential distribution.

Stimulation

We generate the data and draw the distribution:

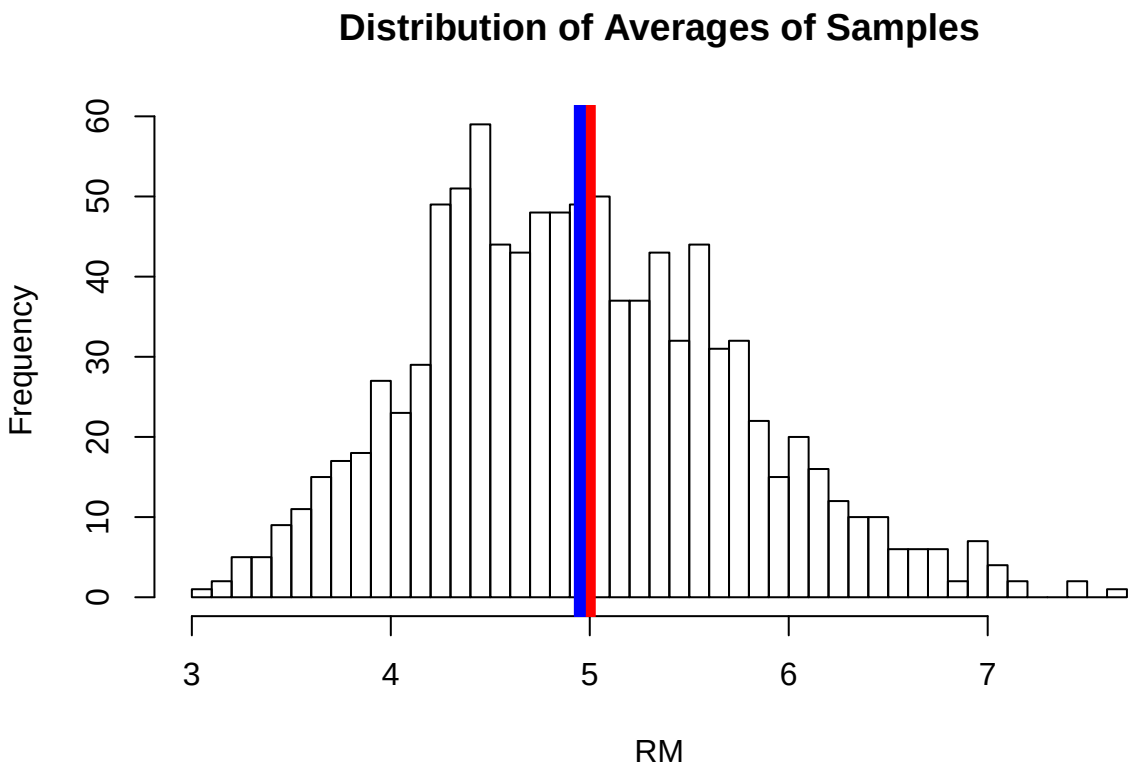
```
set.seed(6)
n<-1000
size<-40
lambda=0.2
sample<-matrix(rexp(n*size,0.2),n,size);
RM<-rowMeans(sample)
hist(RM, breaks=40,main="Distribution of Averages of Samples")
```



Sample Mean versus Theoretical Mean

We draw the sample mean and theoretical mean on the picture.

```
hist(RM, breaks=40,main="Distribution of Averages of Samples")
abline(v=1/lambda,col="red",lwd=6)
abline(v=mean(RM),col="blue",lwd=6)
```



The red line is the theoretical mean, which is lambdaˆ(-1)=5; the blue line is sample mean which is 5.0164. We can see that it is very close.

Sample Variance versus Theoretical Variance

The variance of the sample is calculated by

```
var(RM)
```

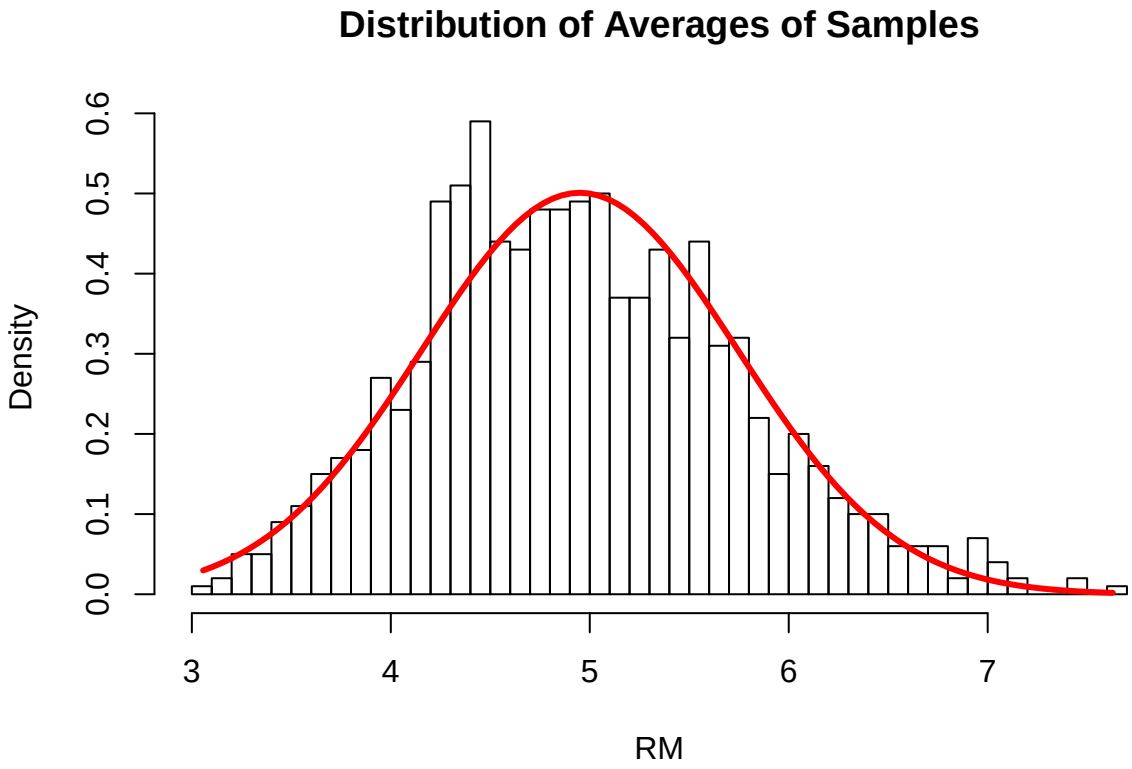
```
## [1] 0.6343684
```

It is 0.634; the theoretical variance is ((1/lambda)/sqrt(40))ˆ2=0.625. They are really close. If the size is larger, such as let n=10000, the difference will be smaller.

Distribution

Here, we draw the line of normal distribution with mean equal to the sample mean and variance equal to the variance of sample variance to show that the distribution is close t o normal distribution.

```
x<-seq(min(RM),max(RM),length=100)
y<-dnorm(x,mean=mean(RM),sd=sd(RM))
hist(RM, breaks=40,main="Distribution of Averages of Samples",freq=FALSE)
lines(x,y,col="red",lwd=3)
```



We could see that the line fits the hist well. So the distribution of averages of samples is normal.