Statistical Inference Course Project Part 1

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Show the sample mean and compare it to the theoretical mean of the distribution

Initial declarations

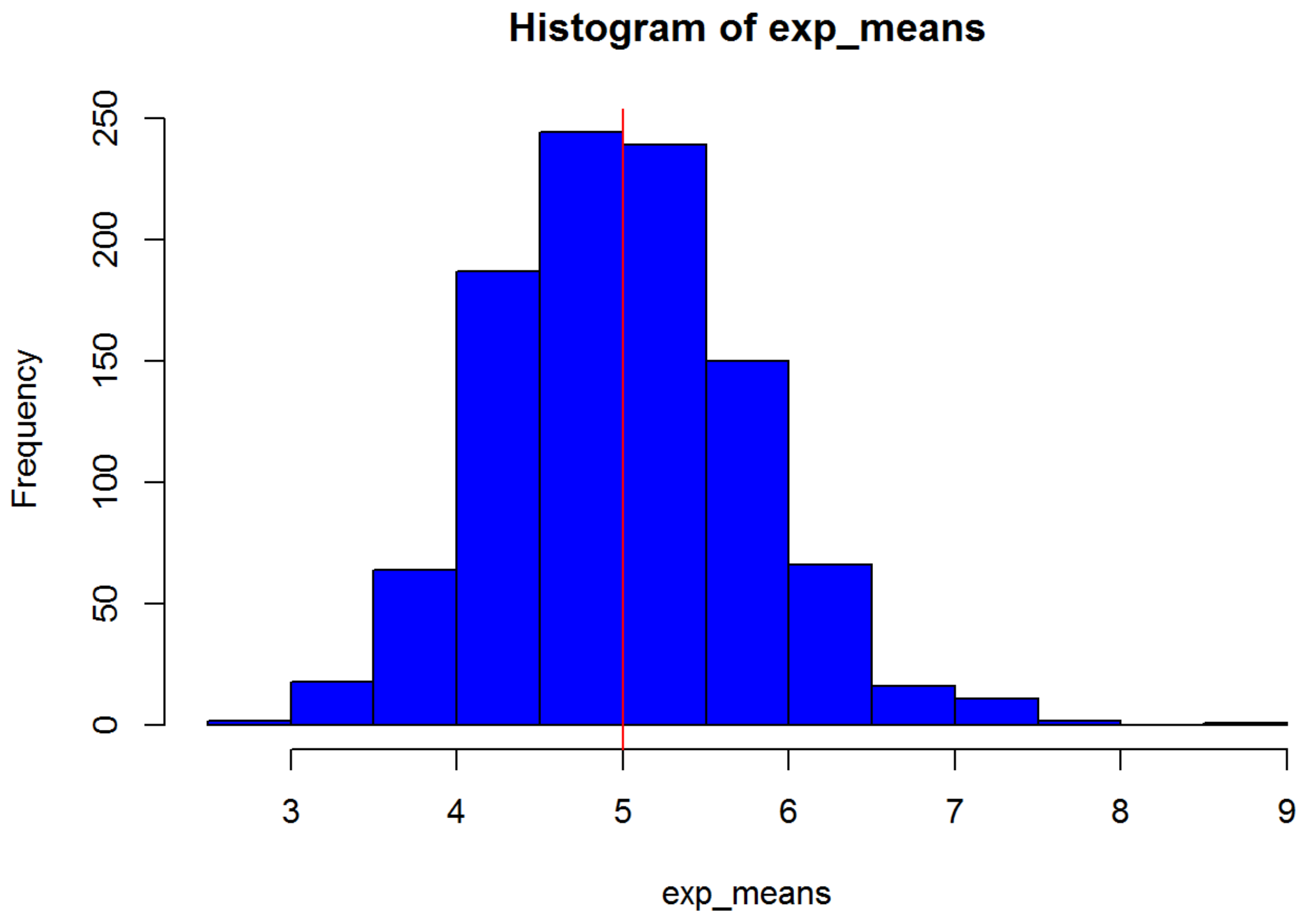
```
library(ggplot2)
lambda=0.2
n=40
theoretical_mean=1/lambda
theoretical_sd=(1/lambda)/sqrt(n)
nsim=1000
set.seed(820)
```

Calculating means of 1000 independant simulations of exponential data of size 40

```
exp_means=NULL
for(i in 1:nsim) exp_means=c(exp_means,mean(rexp(n,lambda)))
```

Plotting these means and showing where the mean of these simulations lies

```
hist(exp_means,col = "blue",breaks=20)
actual_mean<-mean(exp_means)
abline(v=actual_mean, col="red")
```



Theoretical mean of this data = 1/lambda

```
print(theoretical_mean)
```

```
## [1] 5
```

Show how variable the sample is (via variance) and compare it to the theoretical variance of the distribution

Calculation of standard deviation of the means for this data

```
sample_sd<-sd(exp_means)
print(sample_sd)
```

```
## [1] 0.7909422
```

Variance of exponential means

```
sample_variance<-sample_sd^2
print(sample_variance)
```

```
## [1] 0.6255895
```

Theoretical variance calculation = ((1/lambda)*(1/sqrt(n)))^2

```
print(theoretical_sd)
```

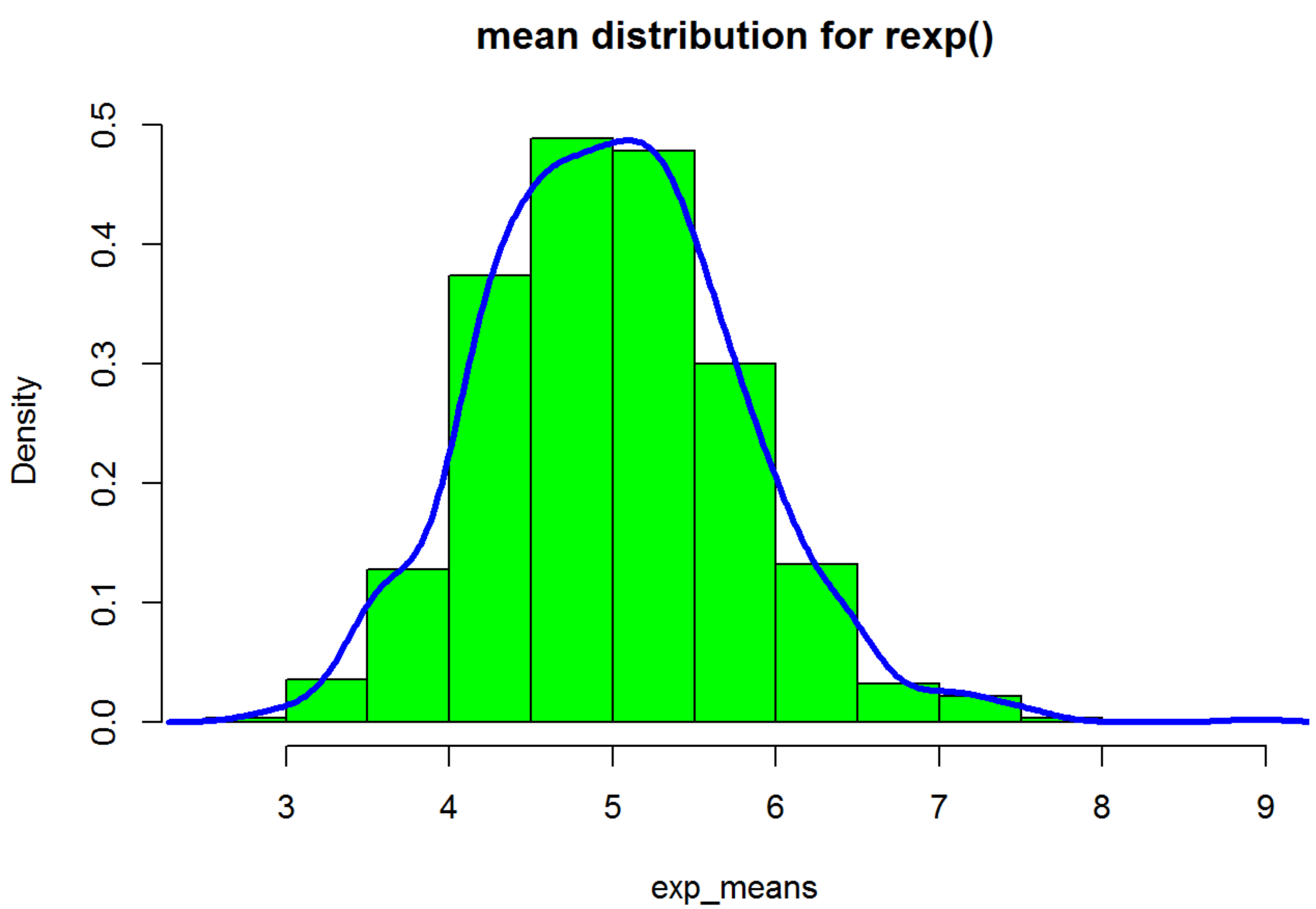
```
## [1] 0.7905694
```

```
theoretical_variance<-theoretical_sd^2
print(theoretical_variance)
```

```
## [1] 0.625
```

Show that the distribution is approximately normal

```
hist(exp_means, prob=TRUE, col="green", main="mean distribution for rexp()", breaks=20)
lines(density(exp_means), lwd=3, col="blue")
```



Coverage for confidence interval of 1/lambda

```
l<-seq(4,6, by=0.01)
coverage <- function(l){
  means<-rowMeans(matrix(rexp(n*nsim, rate = 0.2),nsim,n))
  ll<-means - qnorm(0.975)*sqrt(1/lambda**2/n)
  ul<-means + qnorm(0.975)*sqrt(1/lambda**2/n)
  mean(ll<l & ul>l)
}
l_coverages<-sapply(l,coverage)
qplot(l, l_coverages) + geom_hline(yintercept=0.95)
```