Central limit theorem and Convergence

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Contents

1 Exponential Distribuition

Simulating a exponential variable with lambda 0.2 and k = 10000

```
n= 40
lambda = 0.2
k=10000
list_of_exponential = array(1:k)

for(i in 1:k){
  list_of_exponential[i] = mean(rexp(n, lambda))
}
```

Let's calculate where the distribution of the mean when it's centered and compare to the theoretical center

```
mean_of_average = mean(list_of_exponential)
mean_of_average
```

```
## [1] 5.009134
```

Meanwhile, the expected value for mean is 1/lambda = 5.

```
sd_mean = sd(list_of_exponential)
sd_mean
```

```
## [1] 0.7948422
```

The expected Standard Deviation is {[1/(lambda)^(2)]/n}^(0.5)

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

1- When we compare the theoretical center we were expecting the average to be 5. it's 5.07.

2- And we were expecting the standard deviation to 0.79 and it's 0.784.

3-For the approximation to a normal, we can check the figure 1 in the appendix. the curve is a normal(5,0.7906) and the histogram is referent to the the mean distribution. We can see that it clearly looks like a normal. To understand how well fitted is the model I have generate 1000 normal variables (Figure 2) as if I wanted to check how they look like, and they are as good as the exponential distribution (even better in my opinion). So we can conclude that when n increases, the exponential converges to a normal.

4- As 1/lambda is the mean for this distribution we have that at 95% of confidence the mean is in this interval:

```
## [1] 4.993555 5.024713
```

2 Conclusion

From the points above we can conclude that the hypothesis of convergence is consistent for exponential distribution and the mean of n exponential converges to the distribution mean.

3 Appendix

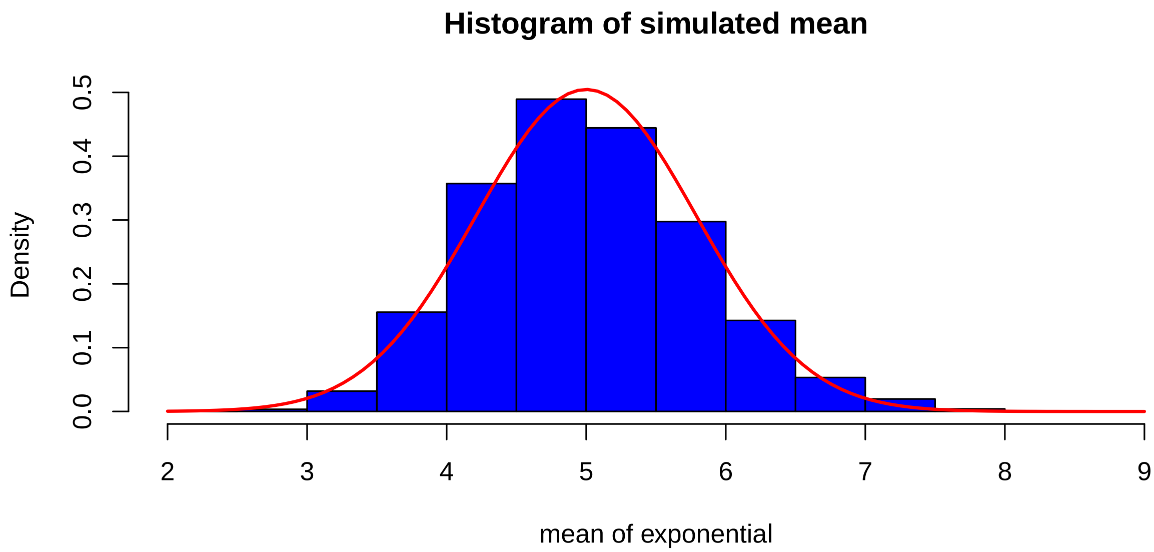

Figure 1: Histogram of Simulated Mean

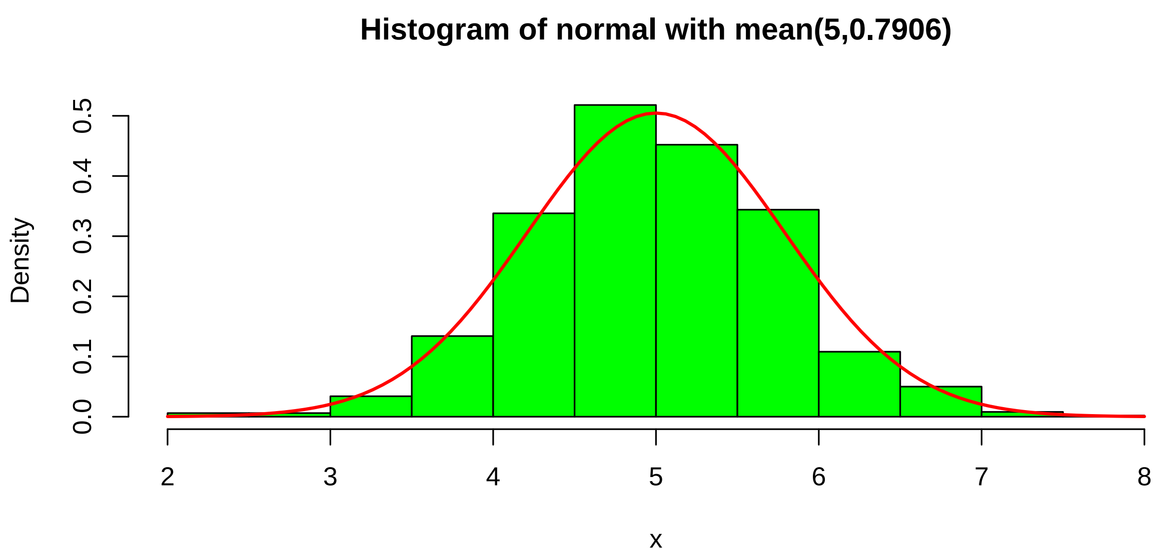

Figure 2: Histogram ofg a Normal distribution.