Statistical Inference - Part 1

Graeme Smith

This is the first part of the assignment, it creates a number of simulations of an exponential distibution with n=40 and lambda=0.2 and compares the distribution of the simulations to the expected distribution. 10,000 simulations were performed. The code to do this is as follows.

```
noSim = 10000
n <- 40
lambda <- 0.2

set.seed(1)
simulations <- data.frame(x=replicate(noSim, mean(rexp(n, lambda))))

mean <- mean(simulations$x)
stdError <- sd(simulations$x)
expectedMean <- 1 / lambda
expectedStdError <- 1 / lambda / sqrt(n)
```

Show where the distribution is centered at and compare it to the theoretical center of the distribution.

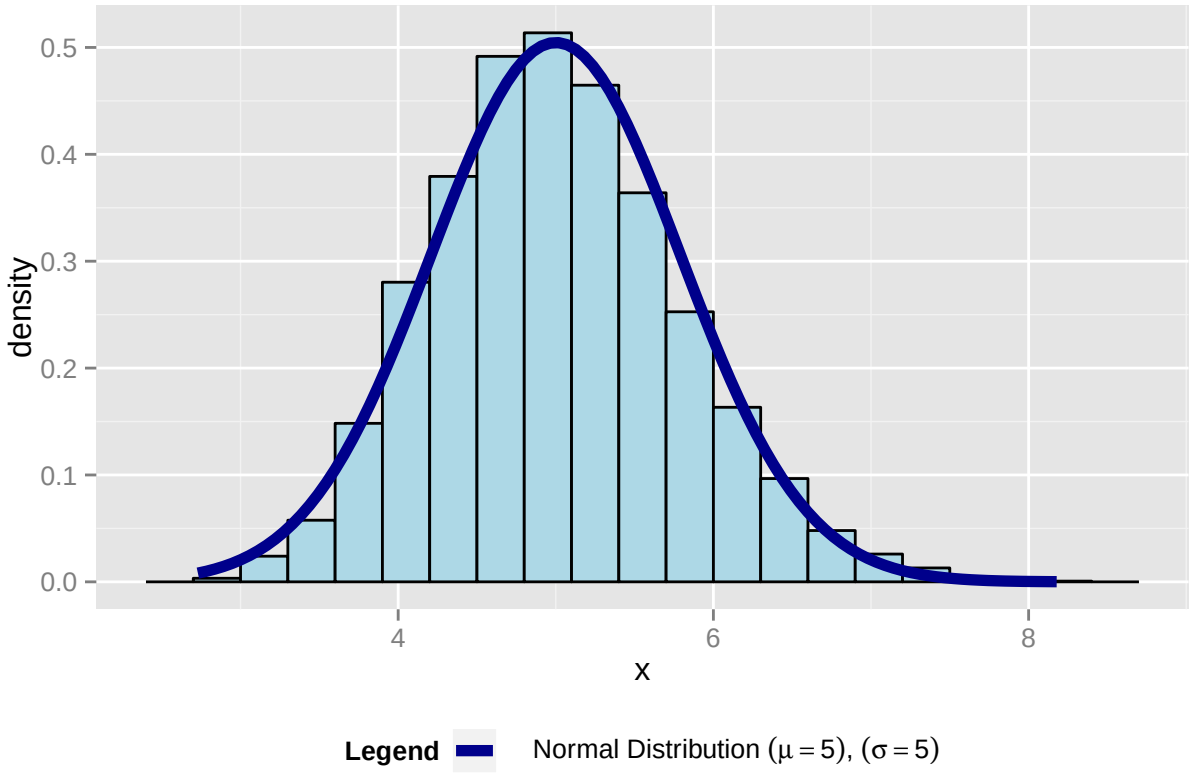
The expected center of the distribution (population mean) is 5.000 vs an actual mean for the simulations of 5.003.

Show how variable it is and compare it to the theoretical variance of the distribution

The expected variance of the distributions population is 0.625 vs an actual variance for the simulations of 0.615.

Show that the distribution is approximately normal

The result of these simulations are summarised in the graph below. As can be seen the simulations appears to be approximately normally distributed :



Evaluate the coverage of the confidence interval for 1/lambda: $\bar{X} \pm 1.96 Snv$.

The confidence interval of X +/- 1.96 S / sqrt(n) for the simulation of the exponential distibution with n=40 and lambda=0.2 is (3.466, 6.539). By definition 95.00% of the means would be expected to fall within this range. In the simulation 95.08% did.