Part 1. Simulation exercises

Daniel A Dorado Fernández

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Exponential distribution `rexp(n, lambda)`. Lambda rate parameter. Mean is `1/lambda` and standard deviation also.

- lambda is **0.2**
- To investigate the distribution of averages of 40 exponential(0.2)s.

1. Where the distribution is centered?

Firstly, via simulation (I choose 1000 simulations):

```
nosim <- 1000
lambda <- 0.2
n = 40
mean_func <- function(x) mean(x)
means <- apply(matrix(rexp(n * nosim, lambda), nosim),c(1), mean_func)
dat <- data.frame(
  x = means,
  size = factor(rep(c(10), rep(nosim)))
)
mean(means)
```

```
## [1] 5.043
```

The theoretical center is:

```
1/lambda
```

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

2. How variable it is?

Variance calculated from simulation:

```
var(means)
```

```
## [1] 0.6409
```

Variance theoritical:

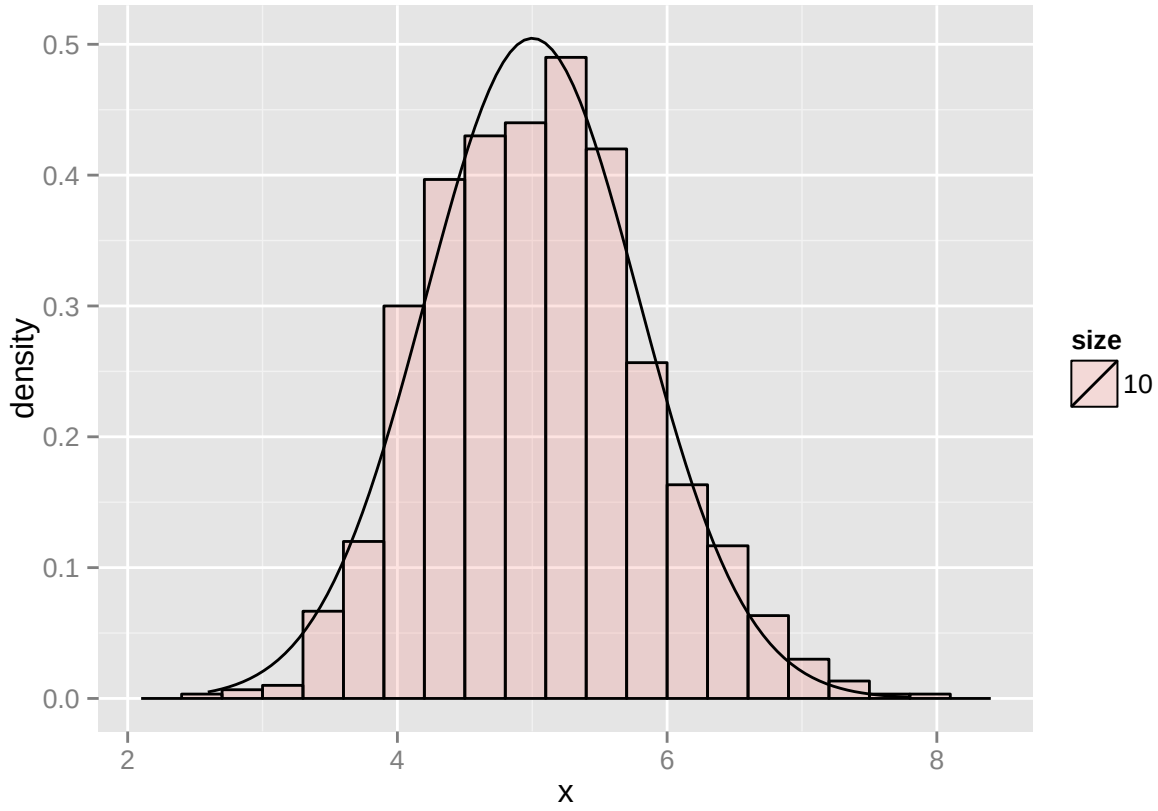
```
((1/lambda)**2)/40
```

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

3. The distribution is approximately normal

To show this I draw the graph with the normal graph:

```
library(ggplot2)
dat <- data.frame(
  x = means,
  size = factor(rep(c(10), rep(nosim)))
)
g <- ggplot(dat, aes(x = x, fill = size)) + geom_histogram(alpha = .20, binwidth=.3, colour = "black", a
 g <- g + stat_function(fun = dnorm, colour="black", arg=list(mean=1/lambda, sd=(1/lambda)/sqrt(n)))
g
```



4. Coverage of the confidence interval for 1/lambda

To calculate the coverage I use the definition:

```
mean_ = mean(means)
sd = sqrt(var(means))
mean_ + (c(1, -1)*1.96* (sd / sqrt(n)))
```

```
## [1] 5.291 4.794
```