

# exponential distribution

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*08.18.2015*

## Investigation on the exponential distribution

In this PDF the exponential distribution is investigated.

## Simulation setup

### Mean

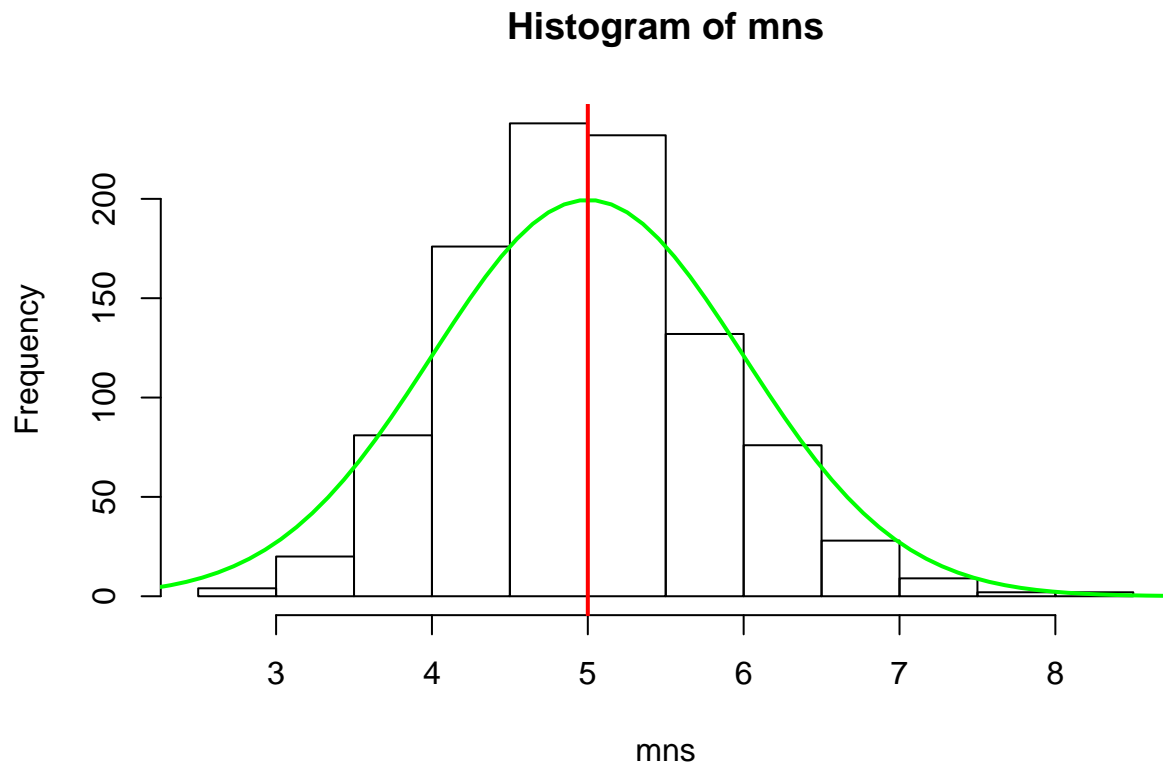
The theoretical mean of a exponential distribution is  $1/\lambda$ . With  $\lambda$  set to 0.2 the mean is:

$$\text{mean} = 1 / \lambda = 1/0.2 = \lambda^{-1} = 5$$

```
lambda = 0.2
theoretical_mean = lambda^-1
```

The sample mean is calculated by running 1000 times the mean of 40 exponential distributions.

```
mns = NULL
for (i in 1: 1000) mns = c(mns, mean(rexp(40, 0.2)))
hist(mns)
x <- seq(0, 10, length=100)
hx <- dnorm(x, mean=5)
lines(x, hx*500, col="green", lwd=2)
abline(v=5, col="red", lwd=2)
```



As we can see in the histogram the mean concentrates around the expected theoretical mean of 5.

## Variance

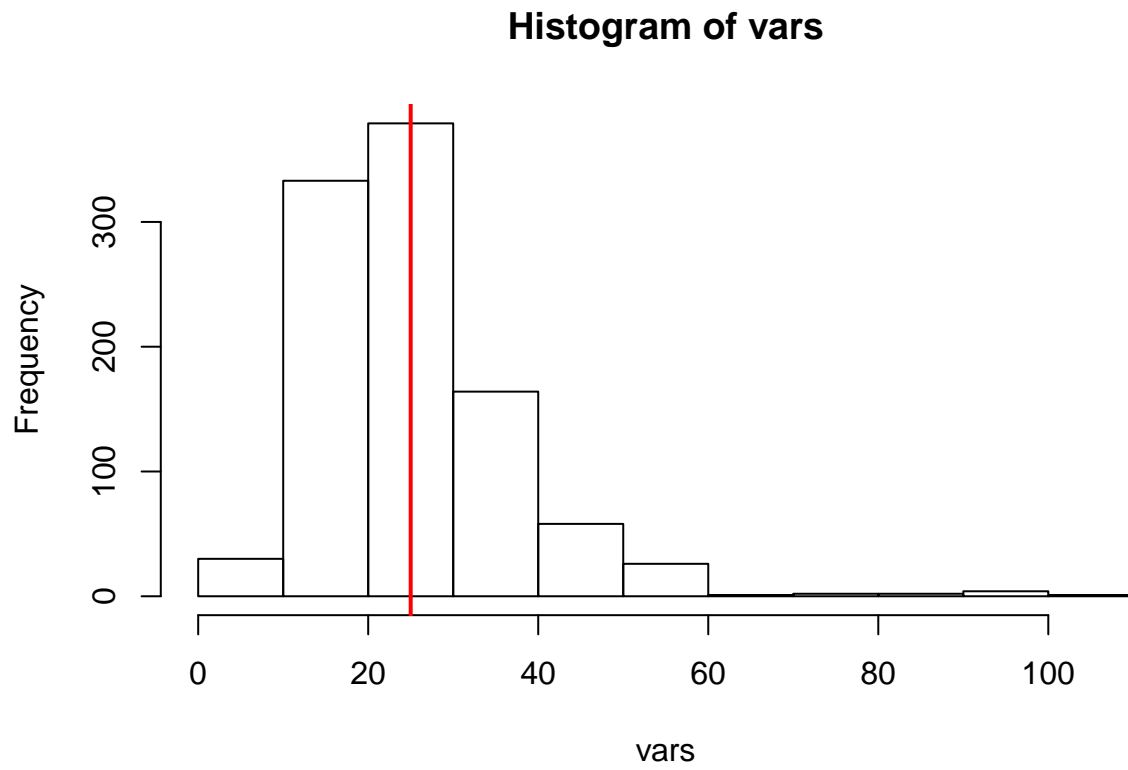
The theoretical variance of an exponential distribution is  $\lambda^{-2}$ . With  $\lambda$  set to 0.2 the variance is:

variance =  $\lambda^{-2} = 25$

```
theoretical_variance = lambda^-2
```

The sample variance is calculated by running 1000 times the variance of 40 exponential distributions.

```
vars = NULL
for (i in 1: 1000) vars = c(vars, var(rexp(40, 0.2)))
hist(vars)
abline(v=25, col="red", lwd=2)
```



As we can see in the histogram the variance concentrades around the expected theoretical variance of 25.