Report for PA of Statistical Inference

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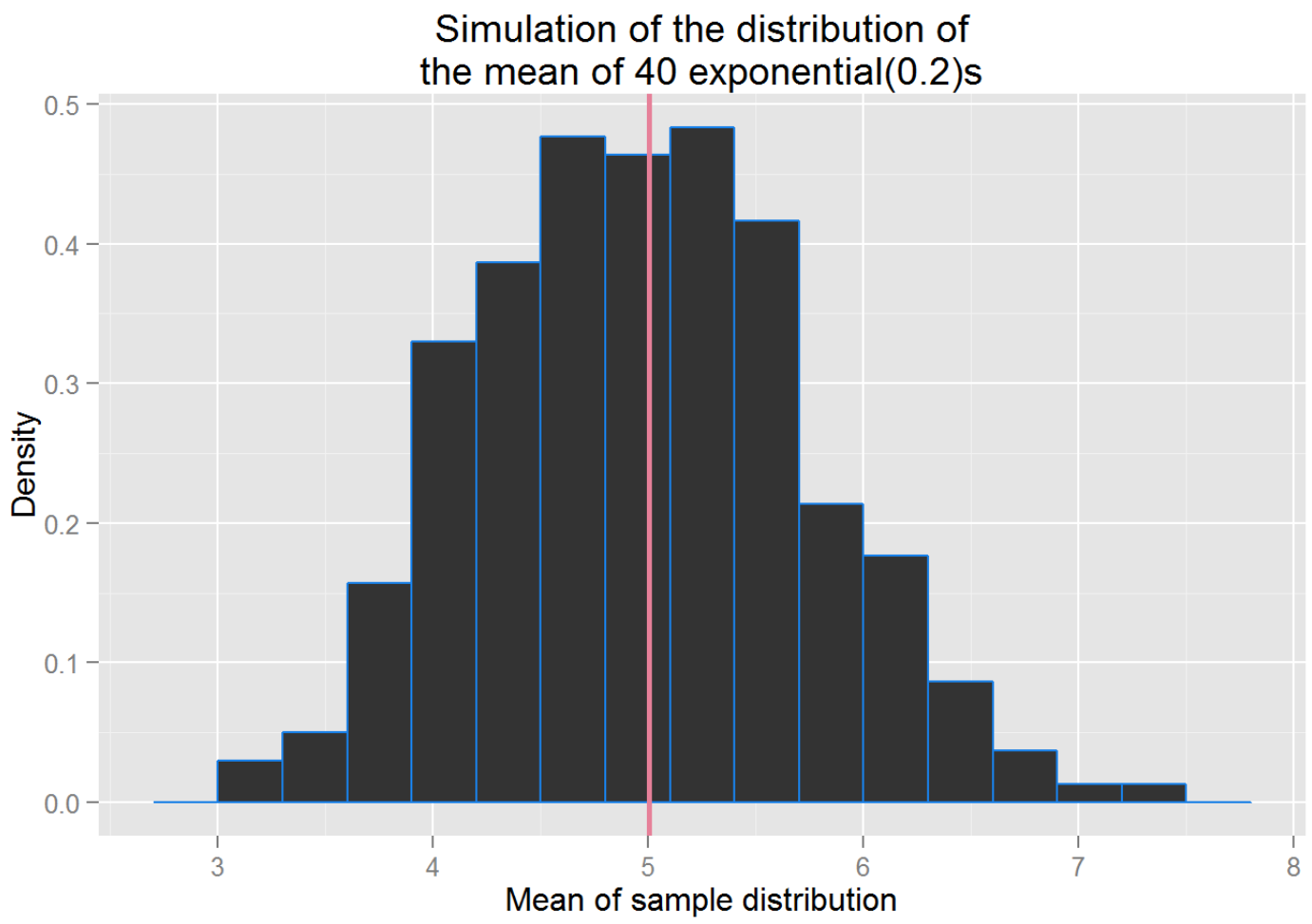
This report illustrate properties of the distribution of the mean of 40 exponentials with lamda equal 0.2. It will show how the sample mean, variance different from theoretical mean, varianace and prove that the distribution of the mean approximately normal.

Part 1: Simulate the exponential distribution

1. How sample mean differ from theoretical mean

As the plot below, the simulation mean is 4.9723191 different from theoretical mean is 5 (pink line)



As you can see in the plot above, the distribution of the mean of 40 exponential(0.2)s centered at theoretical center (pink line)

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

The simulation standard deviation is

```
simulationSd <- sd(meanOfExpDist)
print(simulationSd)
```

```
## [1] 0.7602225
```

while theoretical standard deviation is

```
populationSd <- 1 / lamda
theoreticalSd <- populationSd / sqrt(sampleSize)
print(theoreticalSd)
```

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

The simulation variance is

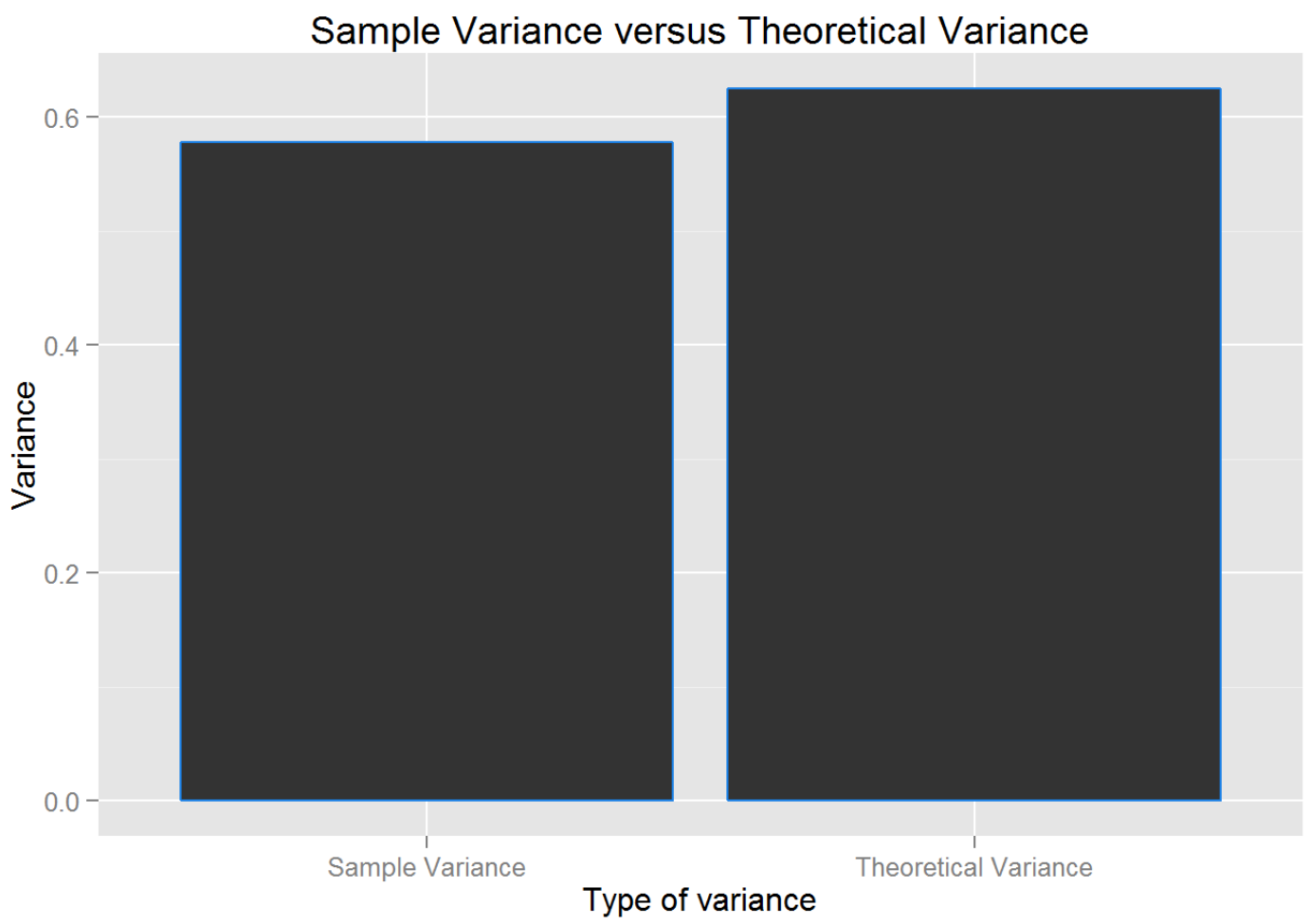
```
simulationVar <- var(meanOfExpDist)
print(simulationVar)
```

```
## [1] 0.5779383
```

while theoretical variance is

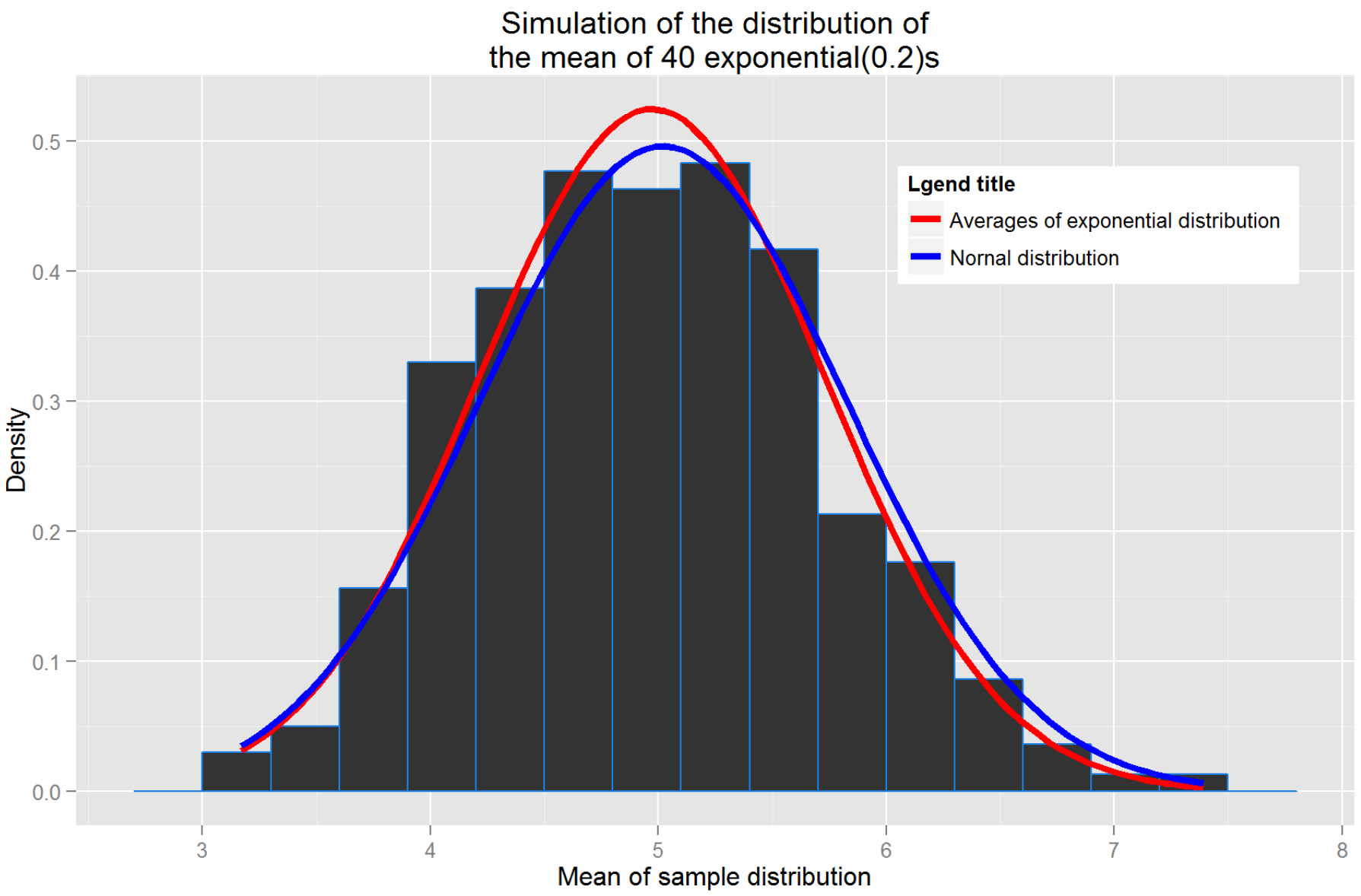
```
populationVariance <- (1/lamda^2)
theoreticalVariance <- populationVariance / sampleSize
print(theoreticalVariance)
```

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

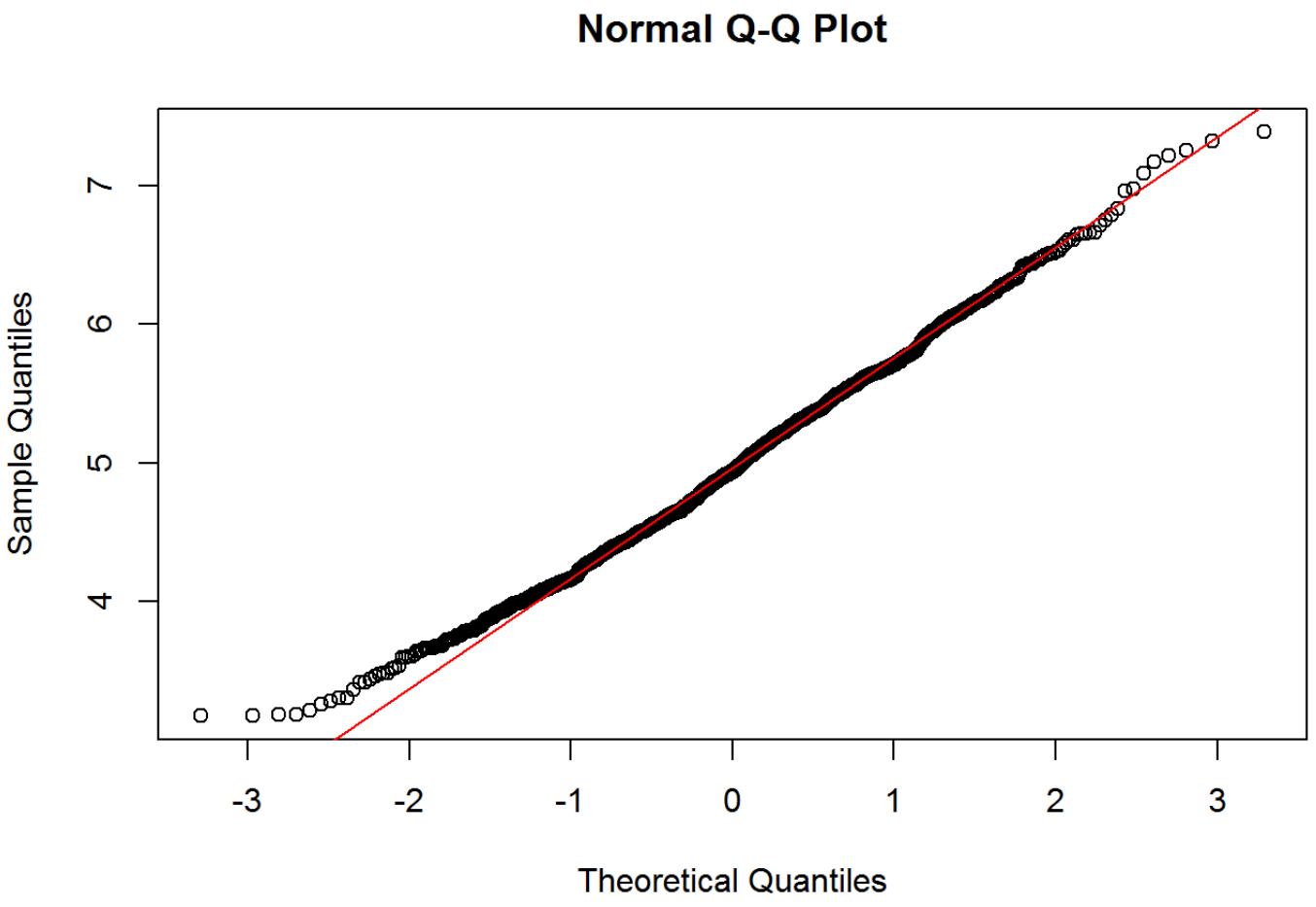


As you can see in above plot, the sample variance is less than theoretical variance. These values are different, because sample variance is variance of the distribution of averages of exponential distribution which is different from theoretical variance of exponential distribution.

3. The distribution of averages of exponential distribution is approximately normal



As you can see in the plota above, the curve of averages of exponential distribution very close to normal distribution. It mean the averages of exponential distribution is approximately normal. For more info, you can take a look to QQ plot below, the values of averages of exponential distribution approaches from left and right to center value at quantile 0.


Normal Q-Q Plot
Sample Quantiles
Theoretical Quantiles
4
5
6
7
-3
-2
-1
0
1
2
3