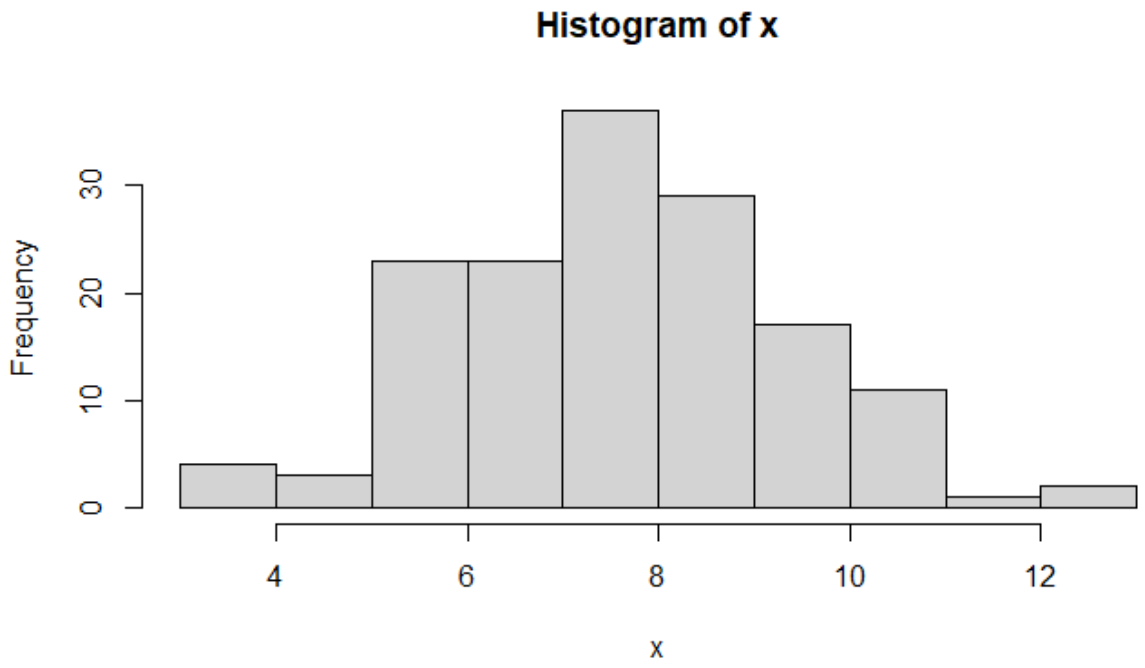
Results

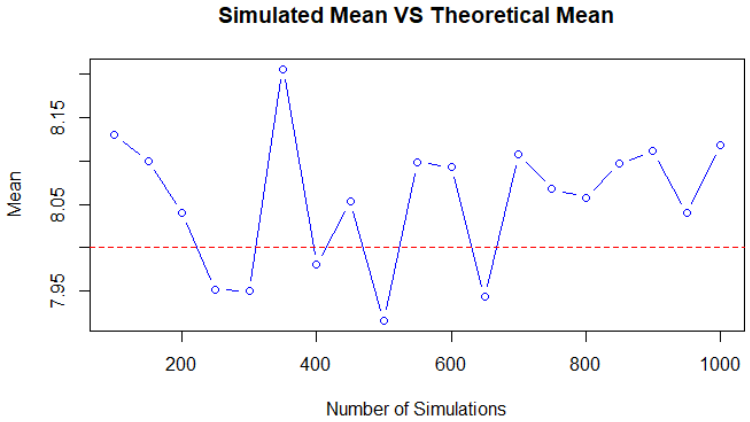
1-1)Using rhyper we can stimulate the hypergeometric distribution and generate 150 values:

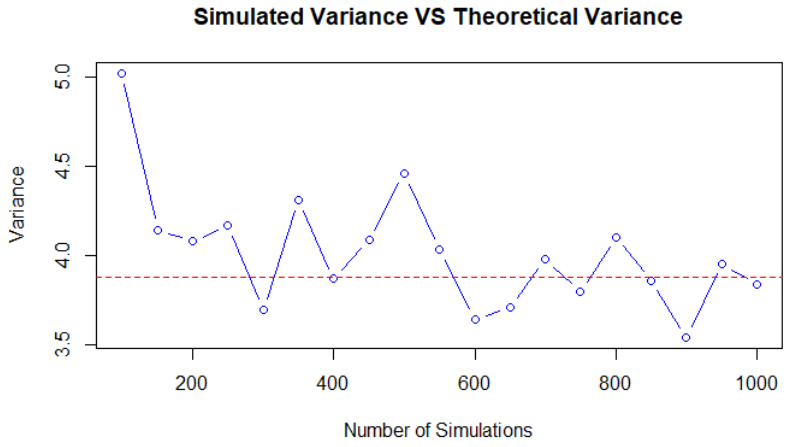


1-2&3)We calculate mean and variance of our distribution witch is independent to the number of simulations using these formulas:

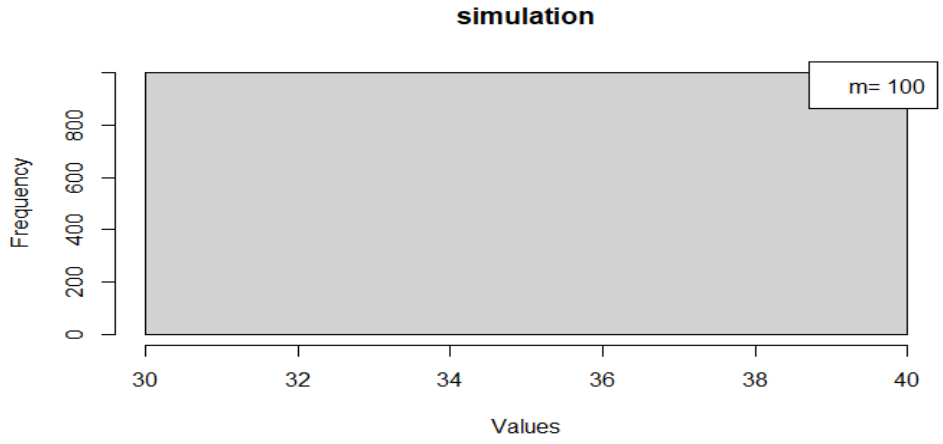
$$\mu = k\left(\frac{K}{N}\right)$$

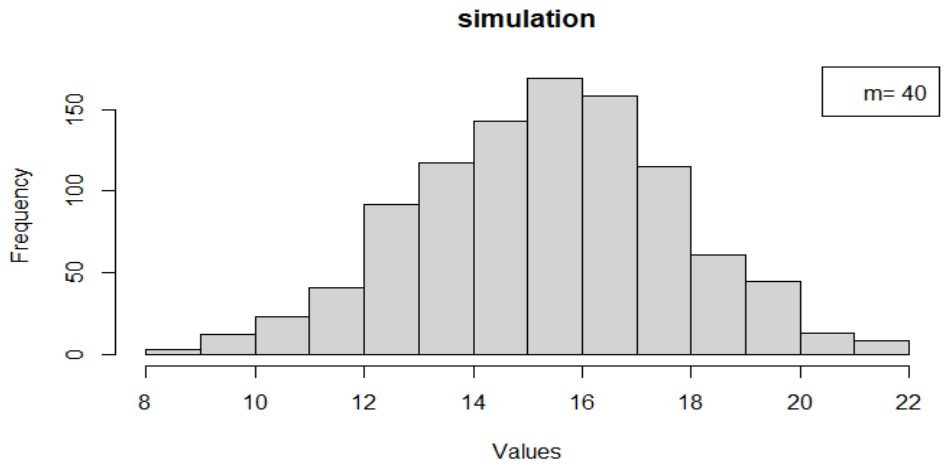
$$\sigma^2 = kpq\left(\frac{N-k}{N-1}\right)$$

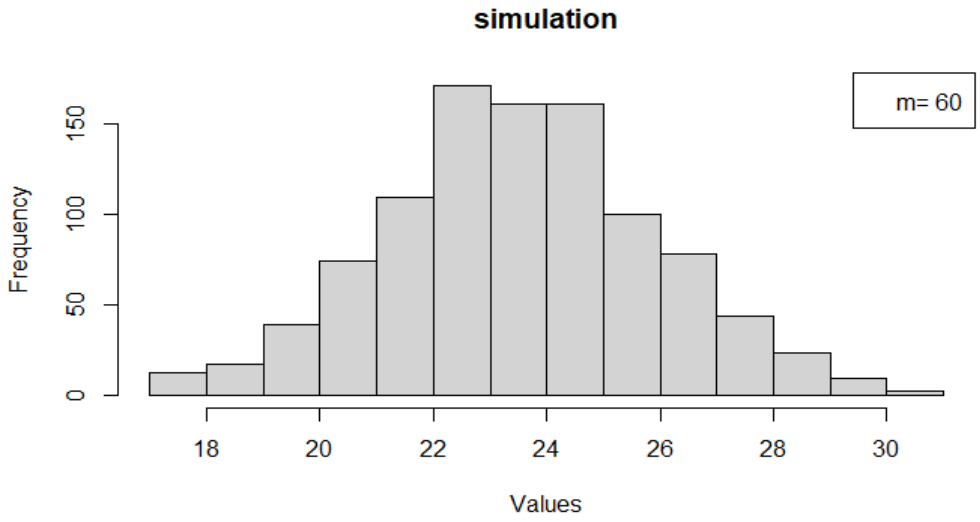


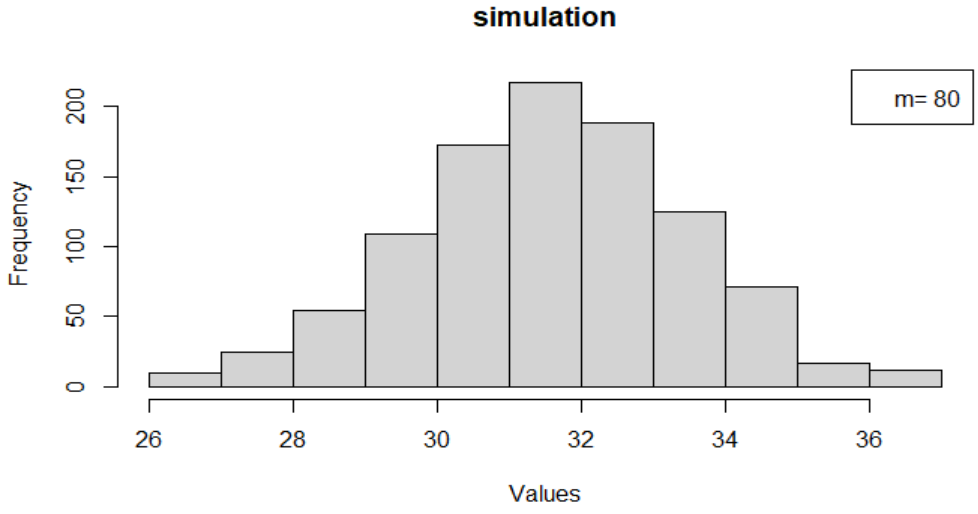


1-4)Just like part 1, we calculate distribution values using rhyper for different m values:






simulation
m= 60
Frequency
0
50
100
150
18
20
22
24
26
28
30
Values

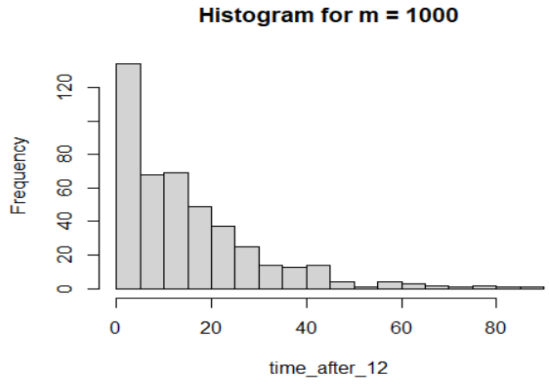

simulation
m= 80
Frequency
0
50
100
150
200
26
28
30
32
34
36
Values

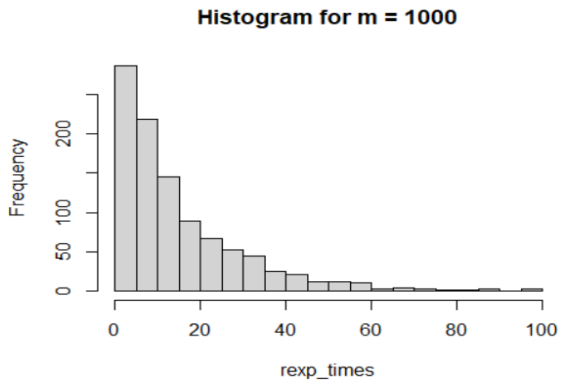
1-5)

3-1&2&3) Using rexp() we can generate values from exponential distribution, comparing arrival times after 12 minutes and all the arrival times for different sample sizes in m=(1000,10000,100000) :

Mean time greater than 12 min for m= 1000 : 15.20351

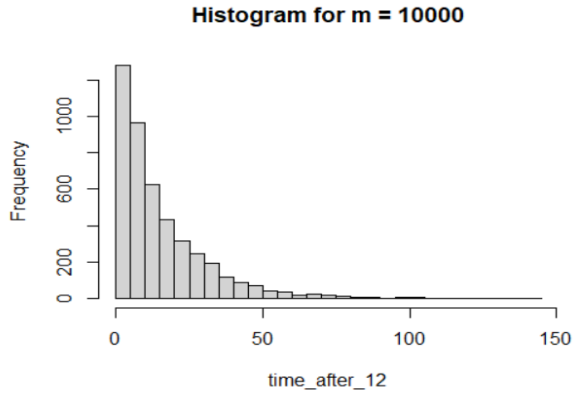
Mean time for m= 1000 : 14.9261

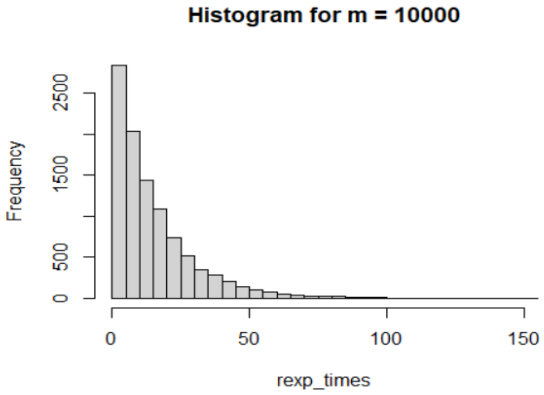




Mean time greater than 12 min for m= 10000 : 14.91234

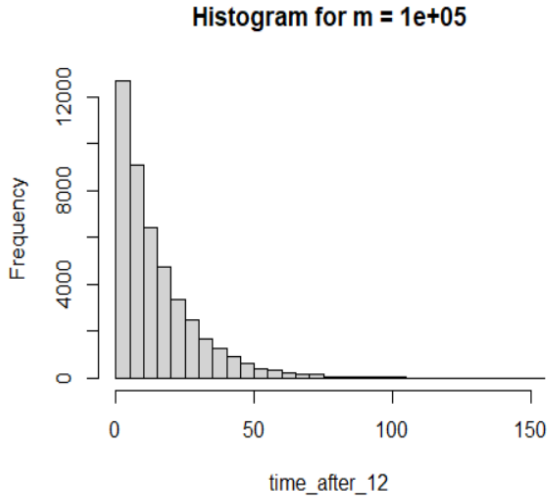
Mean time for m= 10000 : 14.9381

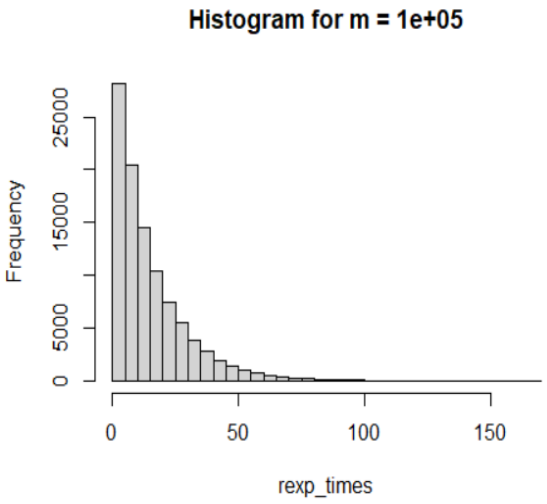




Mean time greater than 12 min for m= 1e+05 : 15.07485

Mean time for m= 1e+05 : 15.03293





Because the sample sizes are too big there's not a lot of difference between the times, you can see the difference better on smaller sample size like m=100.

3-4)Based on the means and the histographs we can see the memorylessness property of exponential function.

The means are close and the distributions are the same as we can see.

4-1)using runif we can simulate a uniform distribution.

4-2)log(x) in R calculates the natural logarithm of variable x (ln(X)) so we can simply write y as -2*log(x).

4-3)PDF Y:

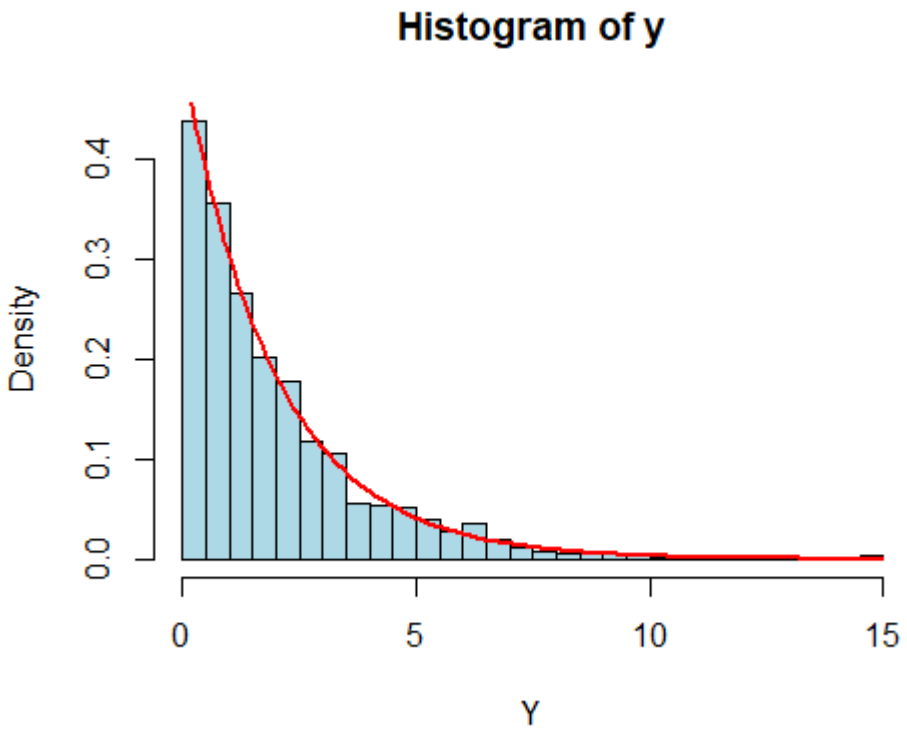
$$x = e^{-\frac{y}{2}}$$

$$f_y(Y) = f_x(X)\left|\frac{dX}{dy}\right|$$

$$f_y(Y) = \frac{1}{2}e^{-y/2}$$

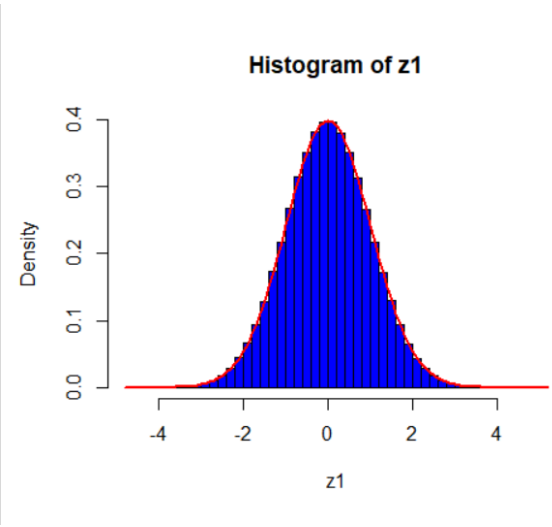
So Y is exponential distribution with lambda=(0.5).

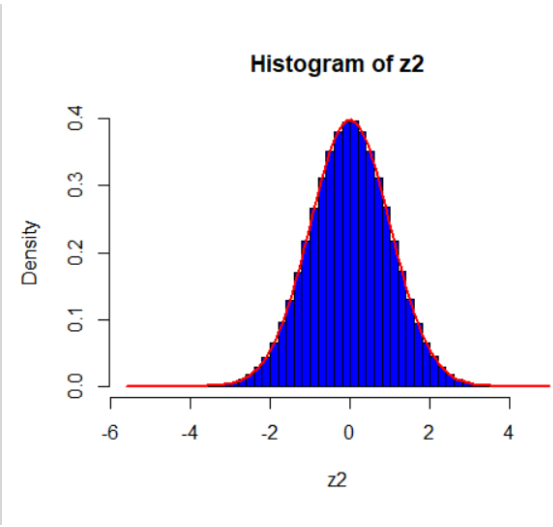
The red line is the theory values and the histography Is the simulated pdf from 1000 values:



4-4&5)Just like part 1 and 2 we use runif() to generate values and use the functions to assign values to new variables z1 , z2 .

4-6)we can use the relation given to calculate the theoretical pdf of z1 and z2 and the histographs:


Histogram of z1
Density
0.0
0.1
0.2
0.3
0.4
-4
-2
0
2
4
z1


Histogram of z2
Density
0.0
0.1
0.2
0.3
0.4
-6
-4
-2
0
2
4
z2