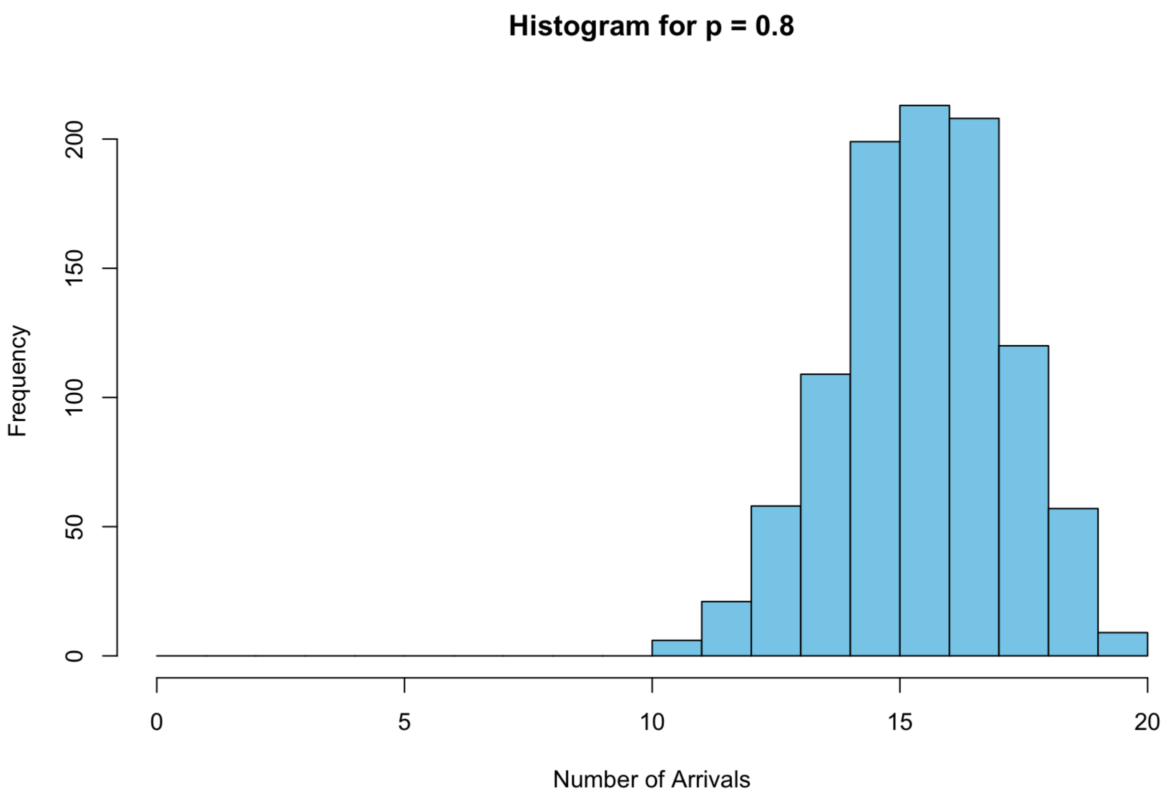
SPA: Assignment-1

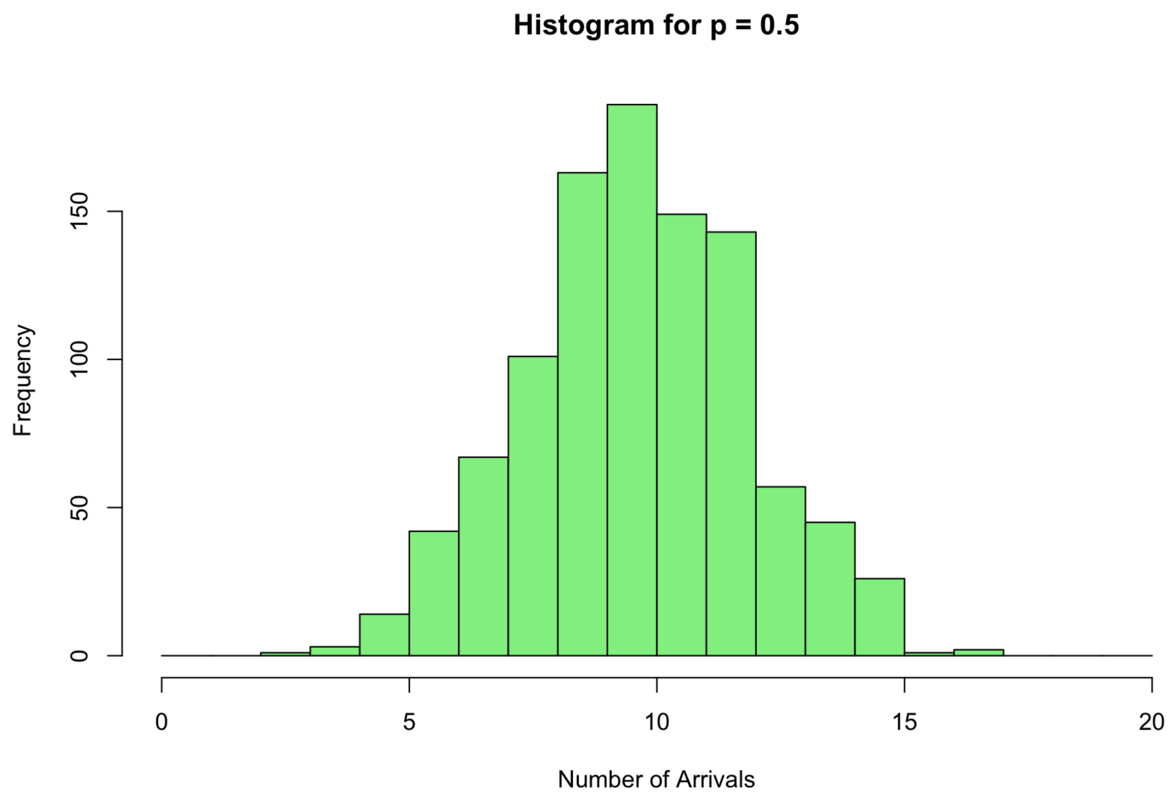
Q1)
A Bernoulli Process was simulated in which a coin was tossed 20 times. It was simulated for the values p = 0.8 and p = 0.5. The process was simulated 1000 times for both of these values.

a) p = 0.8
The histogram is predominantly skewed to the right. Most simulations resulted in more arrivals(heads) in 20 trials. This is consistent with the high probability of success('p = 0.8').



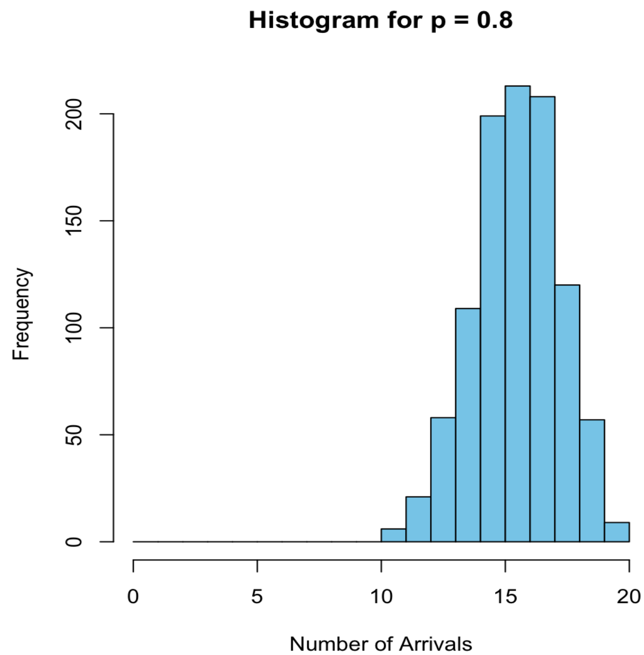
(b) p = 0.5

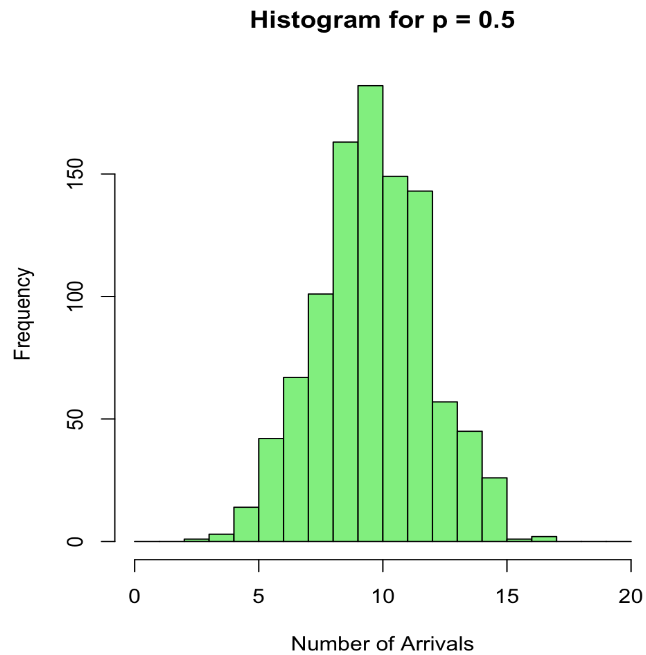
The histogram seemed to be approximately symmetric. It was centered around 10 telling us an equal likelihood for arrivals(heads) and non-arrivals(tails) in 20 trials. This outcome aligns with the given equal probability for success and failure(‘p = 0.5’).



Comparison of part (a) and part (b):
The histogram for p = 0.8 clearly showed a higher tendency toward success given that the probability was very high. Most of the simulations produced a result greater than 10 successes out of 20.

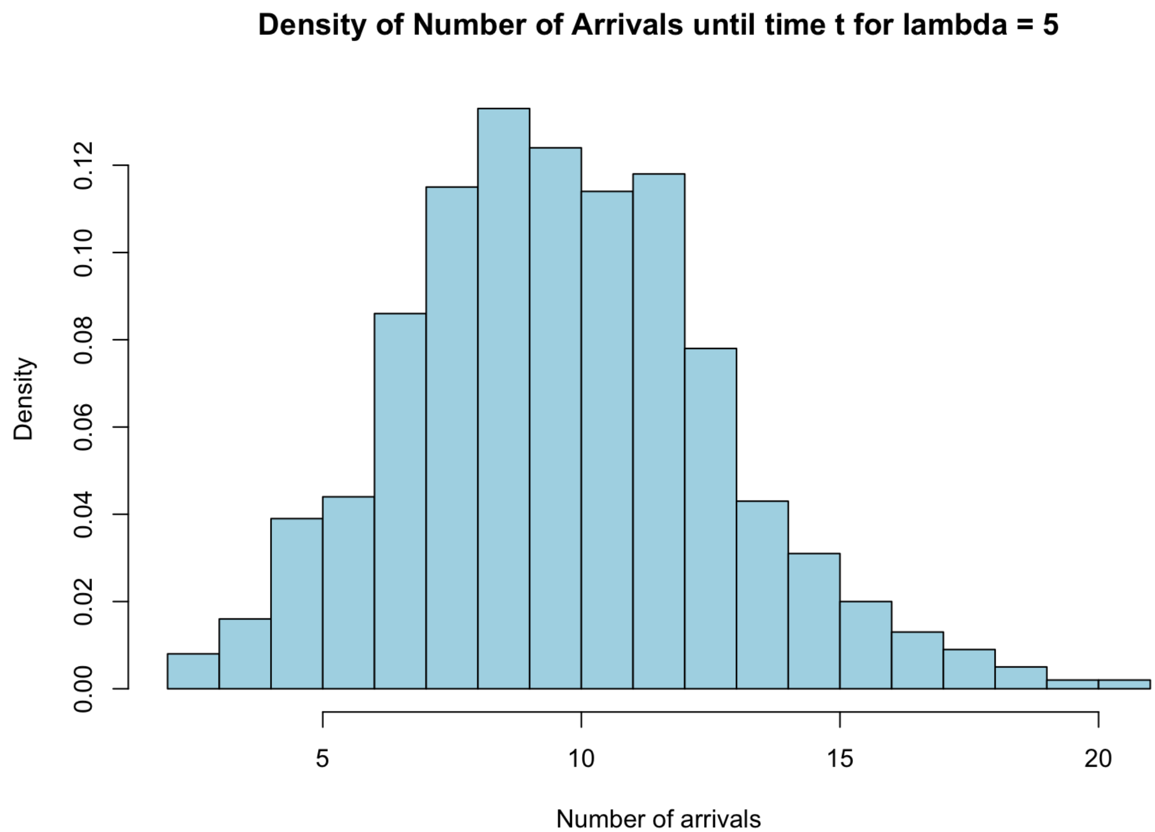
The results for p = 0.5 were more evenly distributed as the most frequent outcomes were around 10.





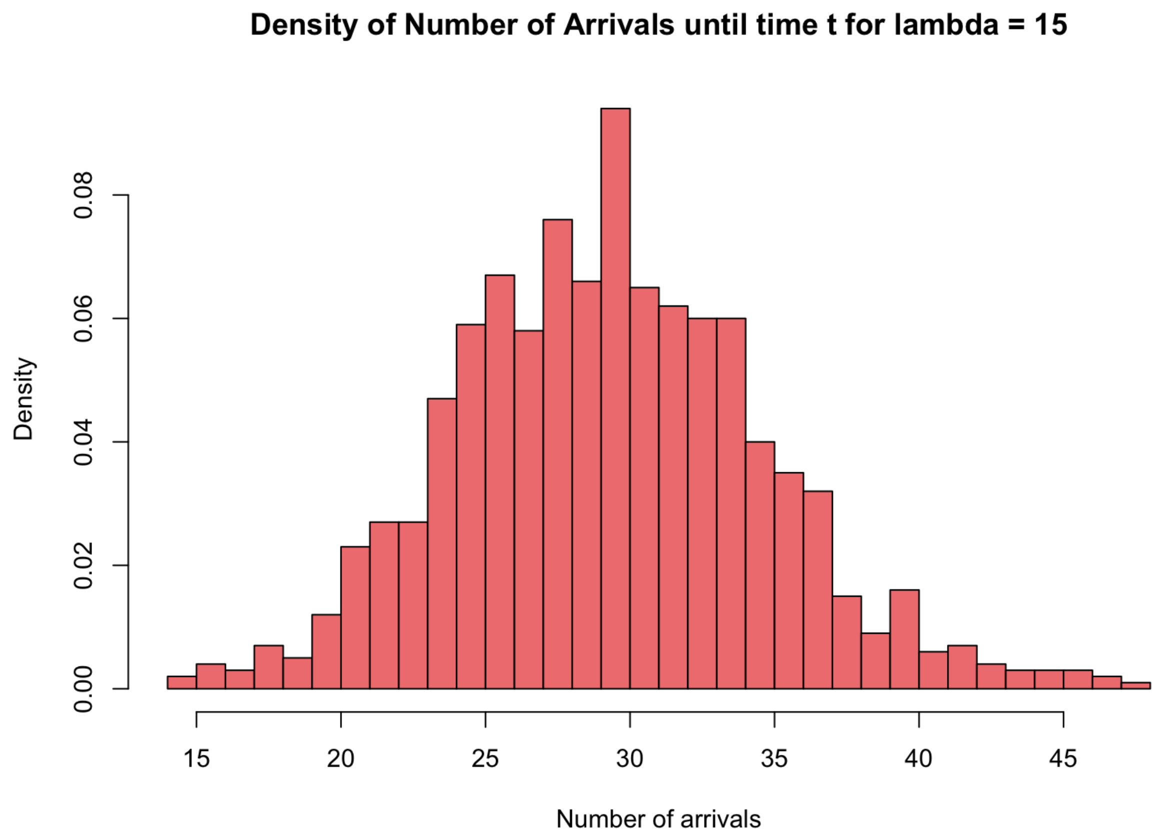
Q2)
We modeled the arrival of patients using Poisson Distribution. It assumes that the number of arrivals in non-overlapping intervals is independent and that the average rate of arrivals is constant.

(a) Lambda = 5
The number of arrivals was simulated over the time interval (0, t], where I took t = 2. The density of the histogram provided insight into the distribution of these simulated arrivals. The mean value generated seemed to be consistent which was lambda*t.

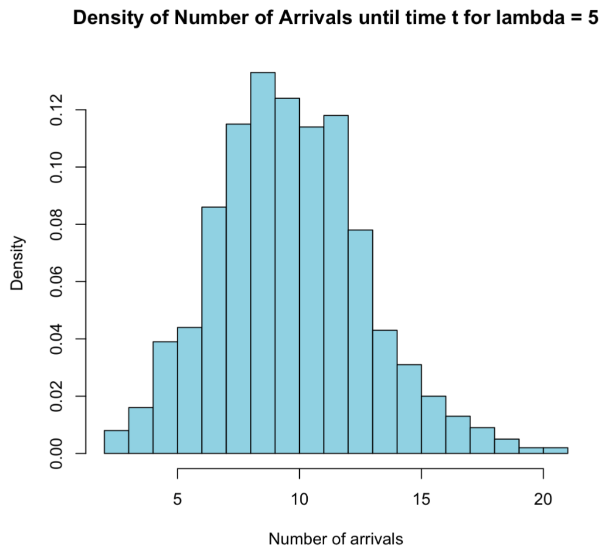


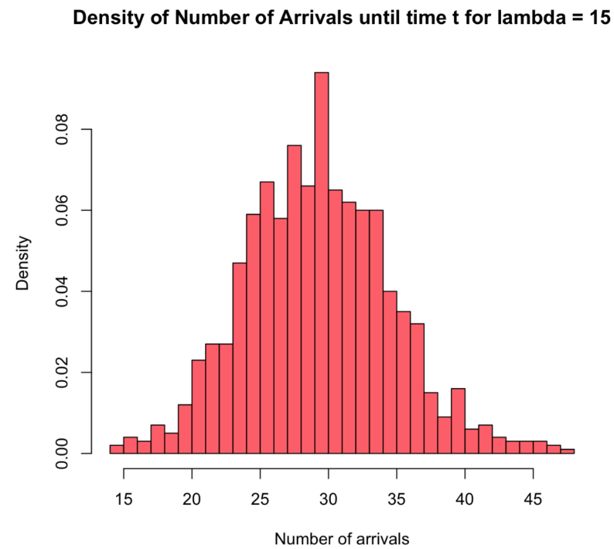
(b) Lambda = 15

There is a clear shift in distribution due to the higher number of arrivals. The mean value is consistent with the expected value.

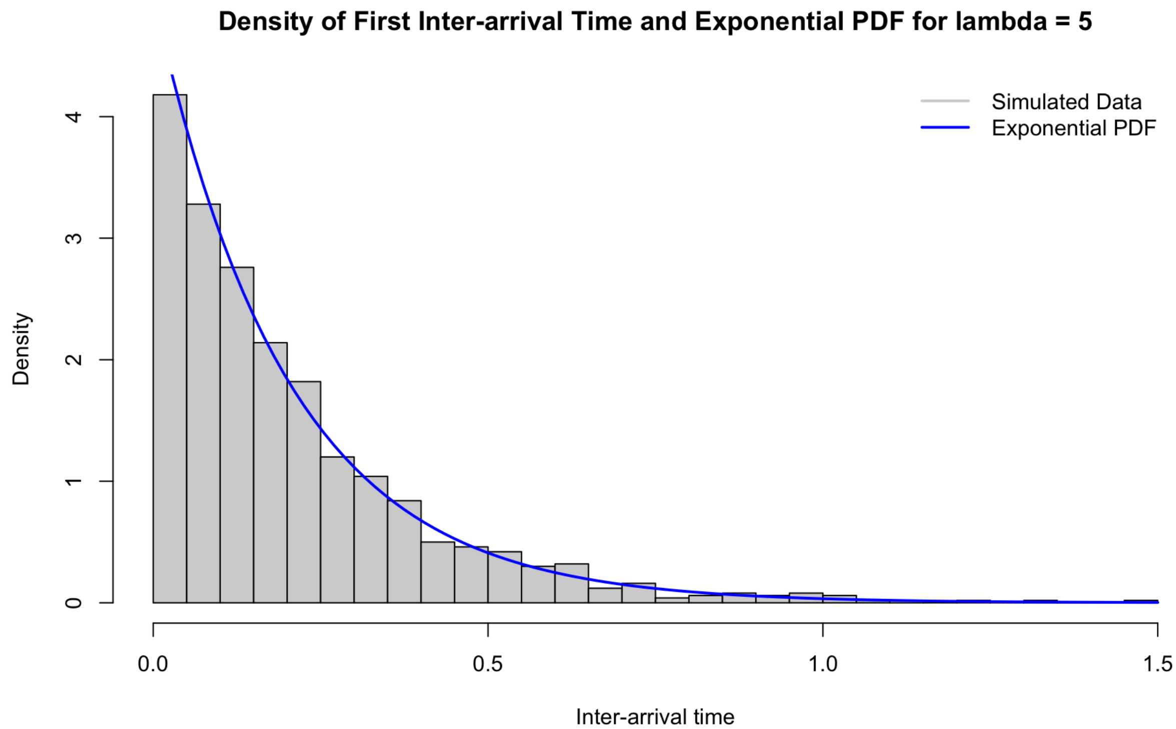


Comparison of part (a) and part (b):
The difference between the two values of lambda highlights the importance of understanding the patient arrival rate. A higher value if lambda would require more resources to manage the patients as compared to a lower value.

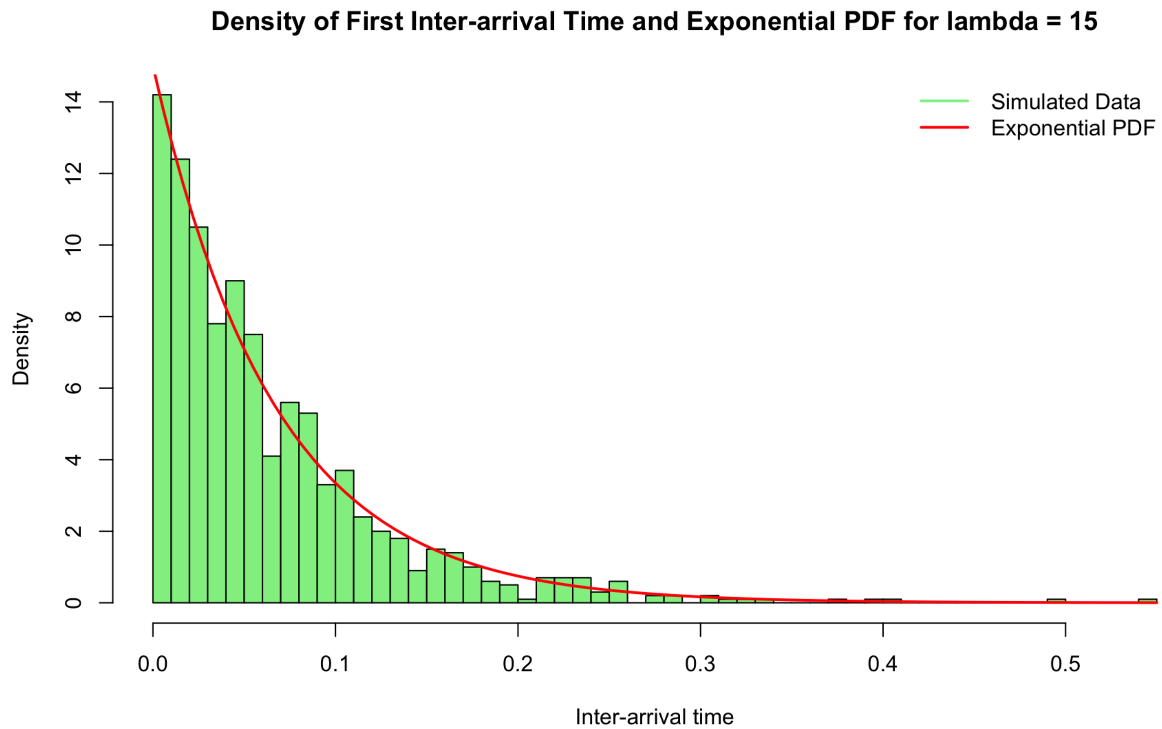




(c)
The pdf graph for lambda = 5 shows the exponential nature of the time intervals between successive patient arrivals. The shape of the distribution underscores the memoryless property of the exponential distribution.



The pdf graph for lambda = 15 indicated shorter inter-arrival times on average, which implies that patients are arriving more frequently.


Density of First Inter-arrival Time and Exponential PDF for lambda = 15
Simulated Data
Exponential PDF
Density
0
2
4
6
8
10
12
14
0.0
0.1
0.2
0.3
0.4
0.5
Inter-arrival time