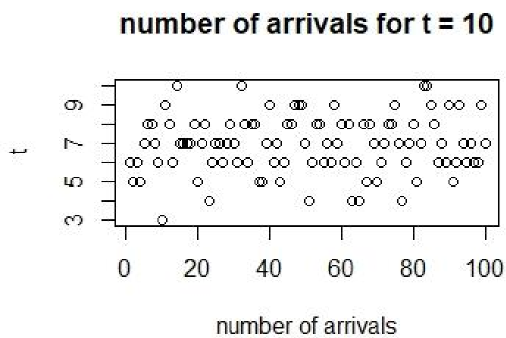
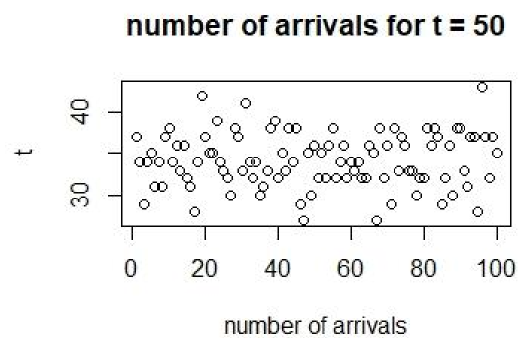
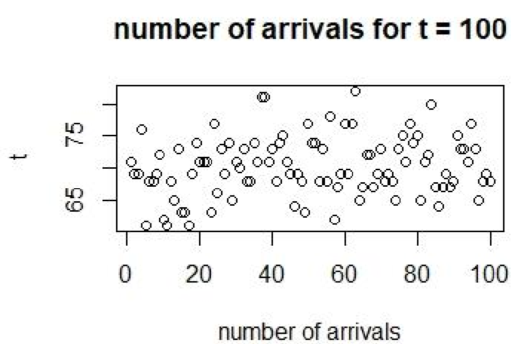
REPORT

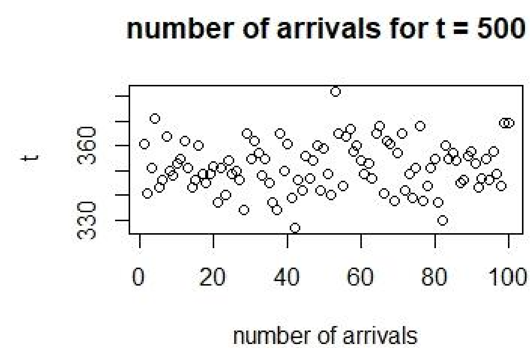
Q1) We have modelled a Bernoulli Random Process

(a) Given p = 0.7, Following 4 plots simulate the number of arrivals for t = 10,50,100,500
We have taken the number of observations N = 100
The x - axis shows number of arrivals
The y-axis displays time t

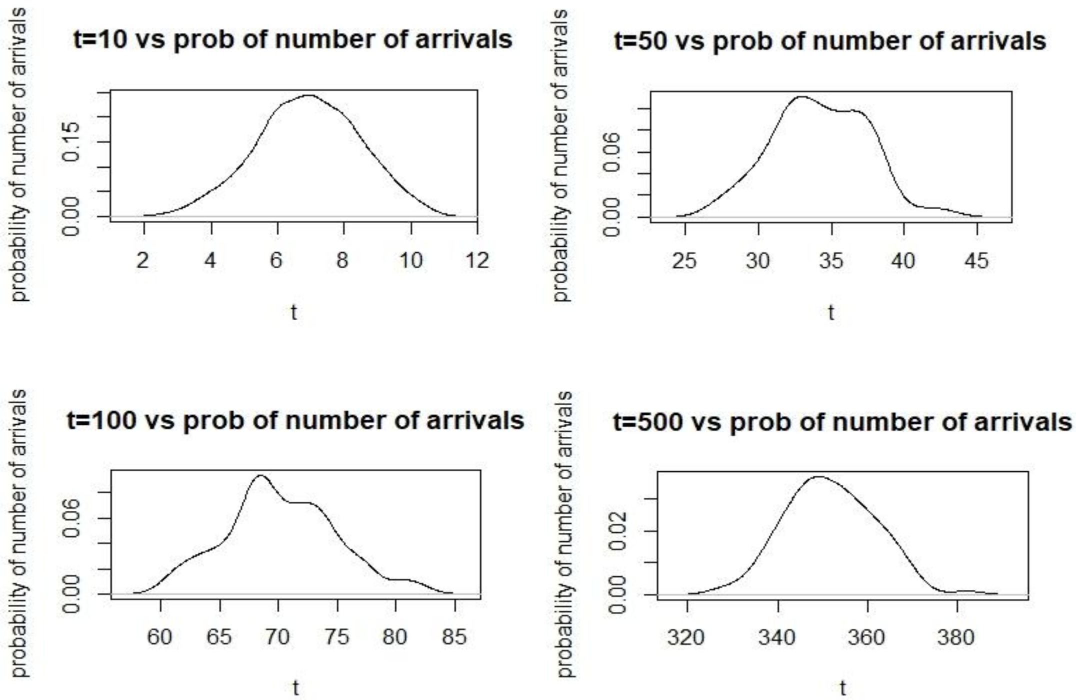




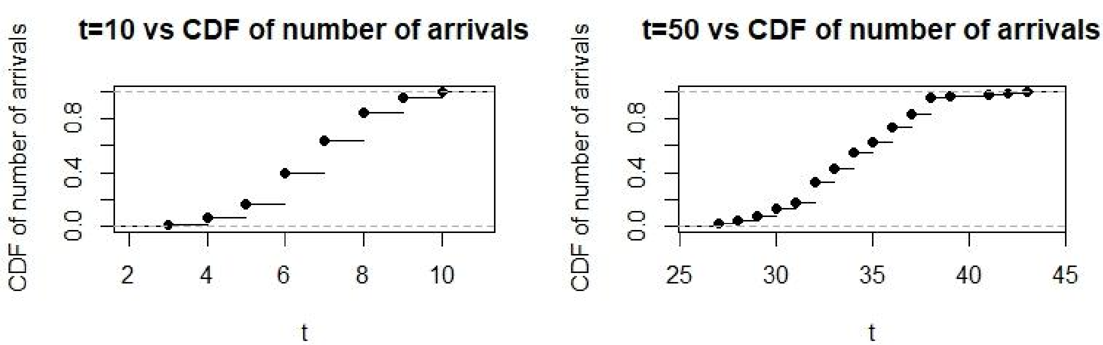


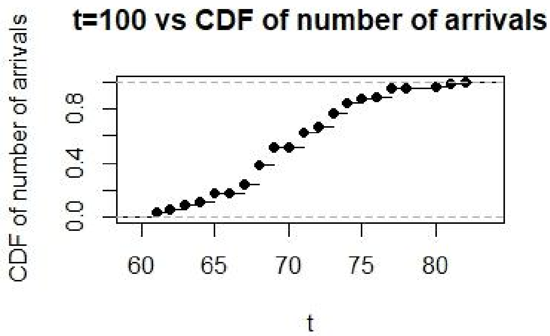


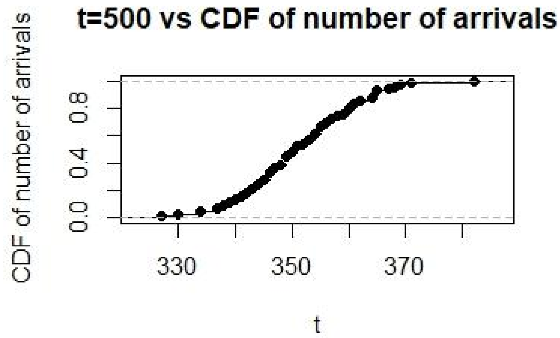
(b) plotting t versus probability of number of arrivals. Here for all 4, n = 100
Here we can see that in each plot, as t increases, probability of number of arrivals increases till μ (mean value), and peaks at expected value E(x), then decreases. Also we observe that as t increases from 10 to 500 in the 4 plots, the peak value decreases. This happens because the total area under the curve must be 1(total probability)



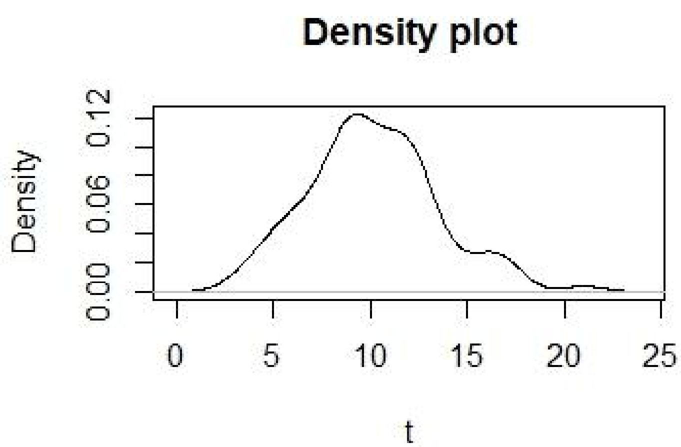
(c) Here we are plotting t versus cumulative distribution function of number of arrivals. As we can see in all 4 plots, as t increases, the plot becomes denser (density increases), reaches max value = 1; and then stays constant. Initially when t is small, we can see discrete values in the plot, but as t increases, the plot can be viewed in the same manner as an increasing continuous distribution(Fx is increasing function).



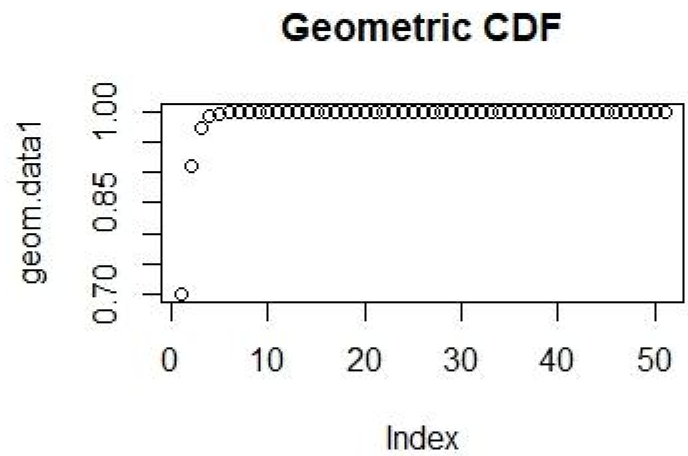




(d) Density plot with t = 100, p = 0.1. Similar behaviour is exhibited here as in part (b).

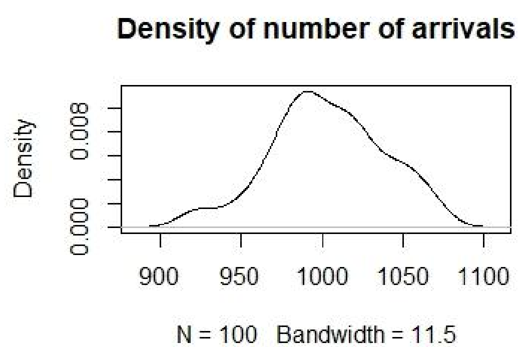


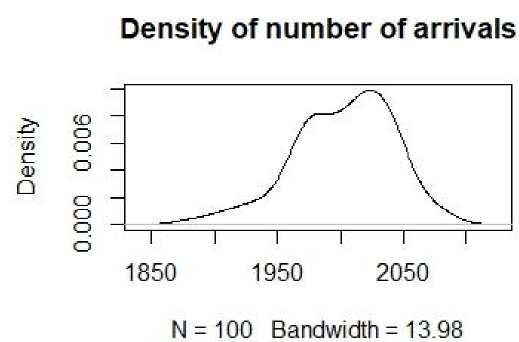
(e) Geometric CDF with p = 0.7 . Here as index value increases, the interarrival times show exponential behaviour. This happens because they are geometric in nature and geometric rvs show exponential behaviour as number of instances grow large.



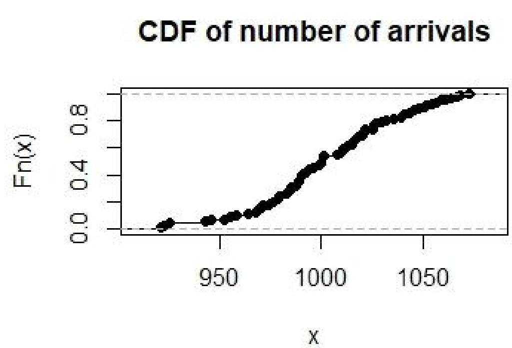
Q2)We are going to model a Poisson process. We know $f_X(x) = \lambda e^{-\lambda x}$ where rate = 20 and λ = rate*t for t = 50,100. Also, this is a renewal process(sequence of positive iids) and interarrival times follow exponential behaviour.

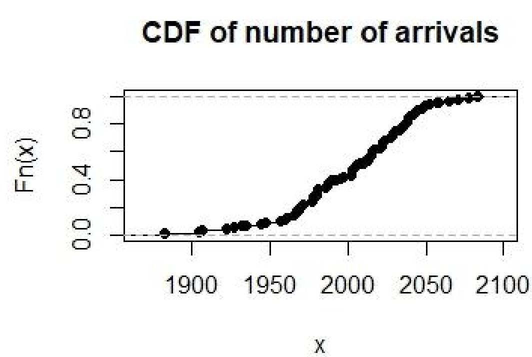
(a) The below plots show the density of number of arrivals until time t = 50(left), 100(right).





(b) Here we plot the CDF of number of arrivals until time t = 50(plot on the left), 100(plot on the right).





(c) For part (a), the peak value in both graphs depict the mean value μ. As we can see, μ decreases as t increases(from $t = 50$ to $t = 100$). Its actually a discrete function, however the lines are shown because they connect the points to chart a path, which is important in overall understanding of the graph.

For part (b), the CDF is discontinuous at the integers of λ = rate*t and flat elsewhere because poisson distributed variables take only integer values. Due to a large number of values, the plot looks continuous, but is actually a set of discrete points. So, as t increases in plot, cdf vals also increase and ultimately reach 1; after which remain constant at 1.