IE 306
Systems Simulation

Spring 2020

Homework 2
Output Analysis

Çağrı ÇİFTÇİ - 2016400243

Emilcan ARICAN - 2016400231

Muhammed HALAS - 2016400228

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1 Question 1

We applied Kolmogorov-Smirnov test on the inter-arrival times. We reached following results. Since these D values are more than the $D_{0.05}$, we reject the claim of the manager.

D1=	0,64749545
D(0.05,488)=	0,0736789
Rejected.	

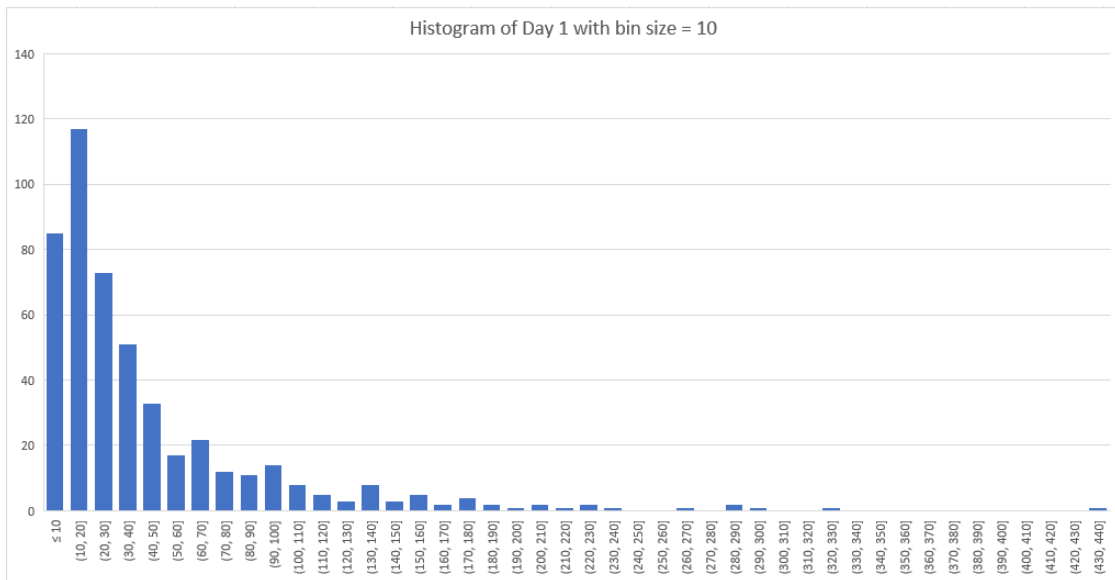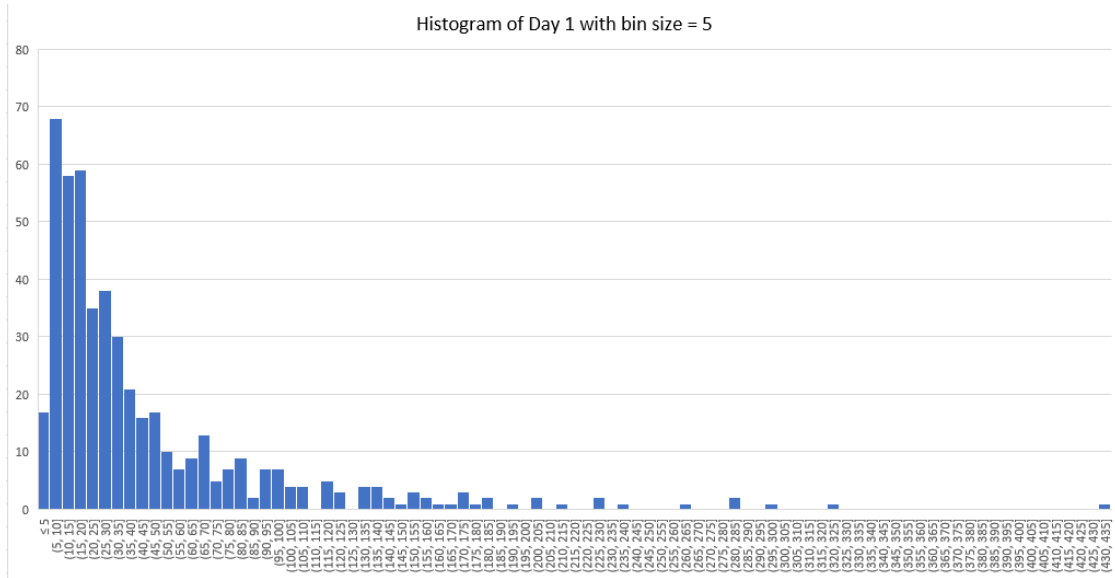| D2=	0,59732013
D(0.05,488)=	0,0736789
Rejected.	

2 Question 2

We calculated mean, standart deviation, variance, median, mode, skewness, minimum, and maximum of the given inter-arrival times. We obtained results that are in the below table.
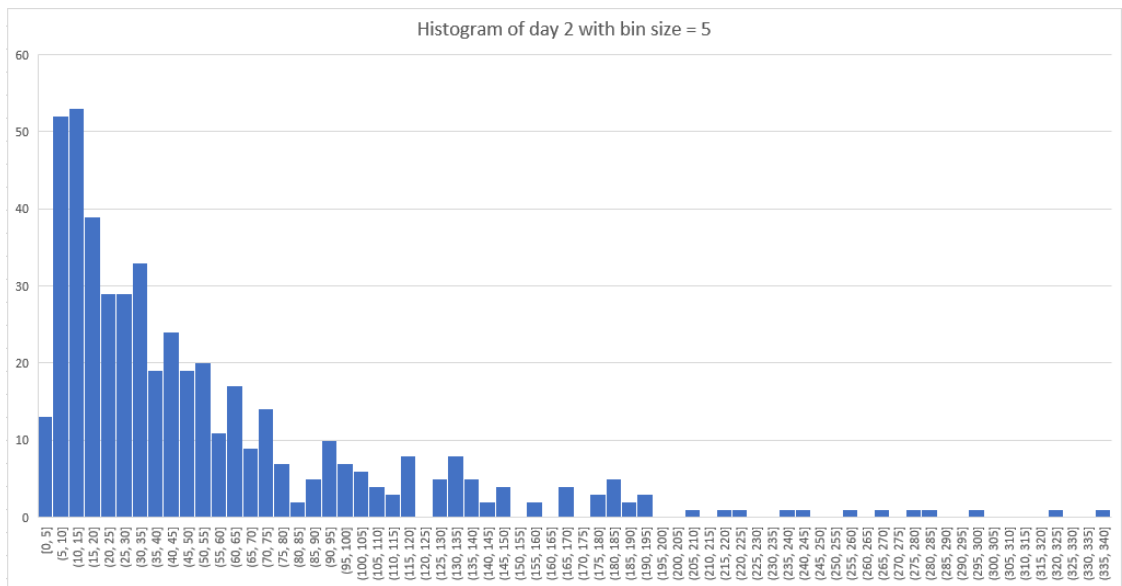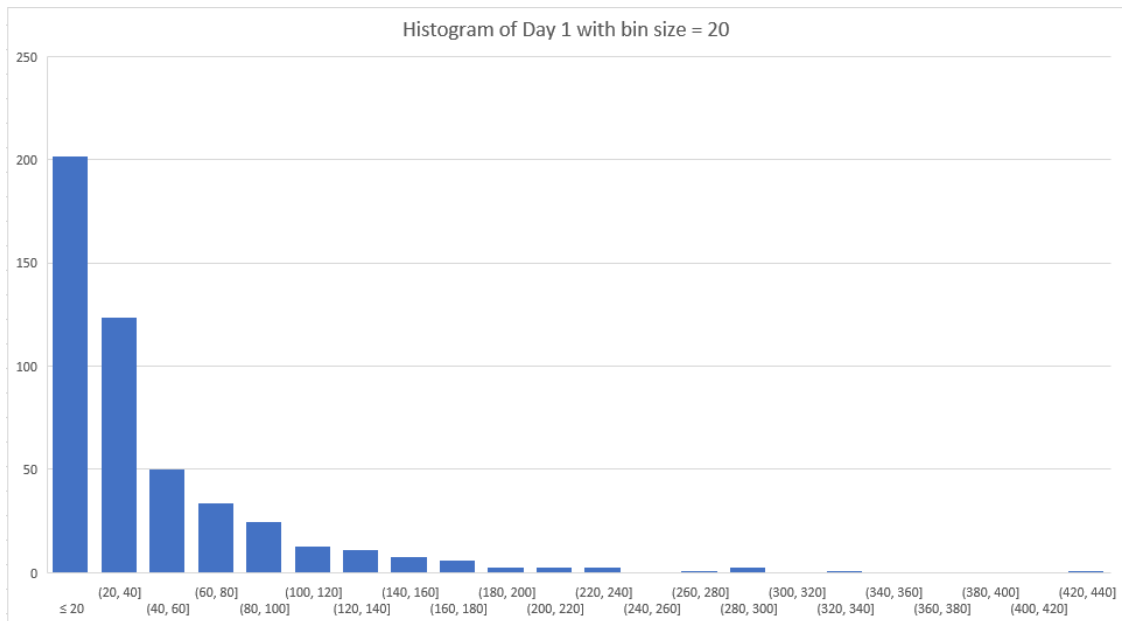
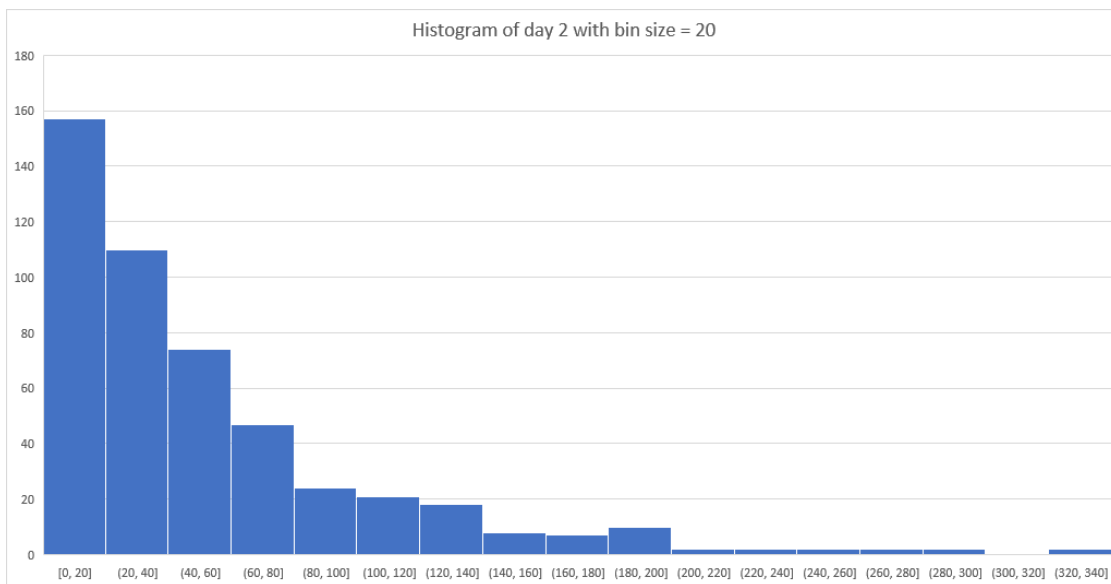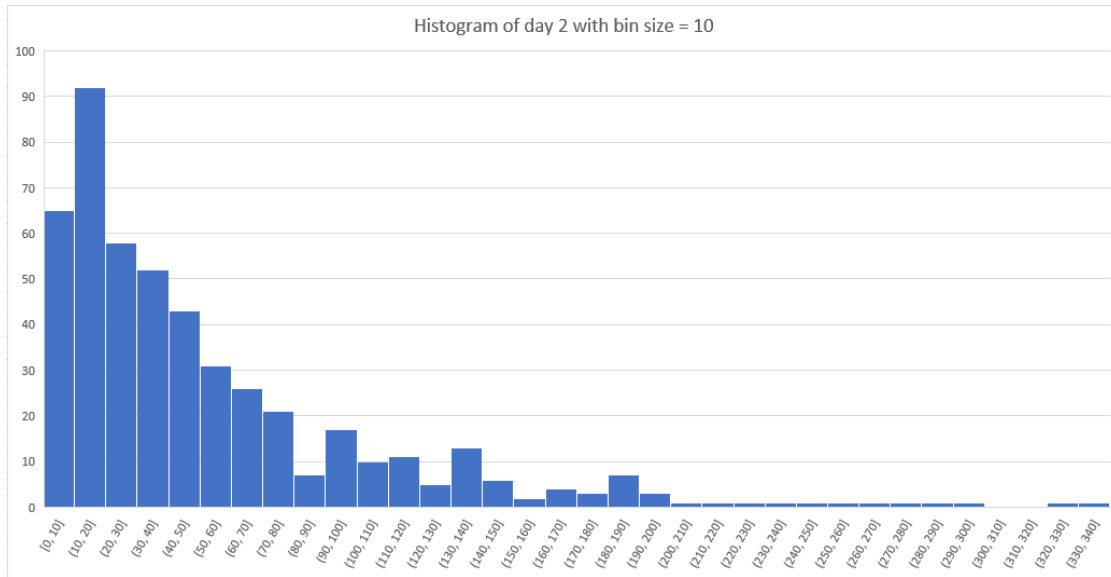| Day 1		Day 2	
Mean =	44,73235	Mean =	53,77094718
Standart Deviation =	52,75821	Standart Deviation =	55,02762254
Variance =	2783,429	Variance =	3028,039242
Median =	25,66667	Median =	34,66666667
Mode =	10,22222	Mode =	20
Skewness =	2,810706	Skewness =	2,028221104
Max =	434,4444	Max =	338,8888889
Min =	1,222222	Min =	0

3 Question 3

Since the provided data is random, it is natural to see non ideal results. So shape of the plots are similar to exponential distribution. When we increase the bin sizes, occurrences of these faults are seems to be decreased. However, if bin size is increased a lot, it makes harder to make a healthy observation.

Plots

Histogram of Day 1 with bin size = 5

Histogram of Day 1 with bin size = 10

Histogram of Day 1 with bin size = 20

Histogram of day 2 with bin size = 5

Histogram of day 2 with bin size = 10

Histogram of day 2 with bin size = 20

4   Question 4

We applied Chi-Square test at a significance level of 0.05 with 10 second intervals. We reached following results. According to Chi-Square test, day 1 does not belong to exponential distribution. On the other hand, inter-arrival times of the day 2 belongs to a exponential distribution.

The calculation of the Chi-Square statistic is as following:

$\chi^2 = \frac{(f_o - f_e)^2}{f_e}$

where f_o = the observed frequency (the observed counts in the cells)
and f_e = the expected frequency

|		
Degree of freedom =	43	
Chi-square(0.05,43) =	59,3035	
Day 1 Chi-square value =	236,13962	Rejected
Day 2 Chi-square value =	45,793951	Failed to reject

5   Question 5

We drawn QQ-plots of day 1 and day 2's inter-arrival times. When we look at these plots they both start linear. Although QQ-plot of the day 1 does not follows the linear trend after some point, QQ-plot of the day 2 remains linear. So, we can conclude that inter-arrival times of day 1 is probably not belong to exponential distribution, on the other hand inter-arrival times of day 2 probably belong to a exponential distribution.
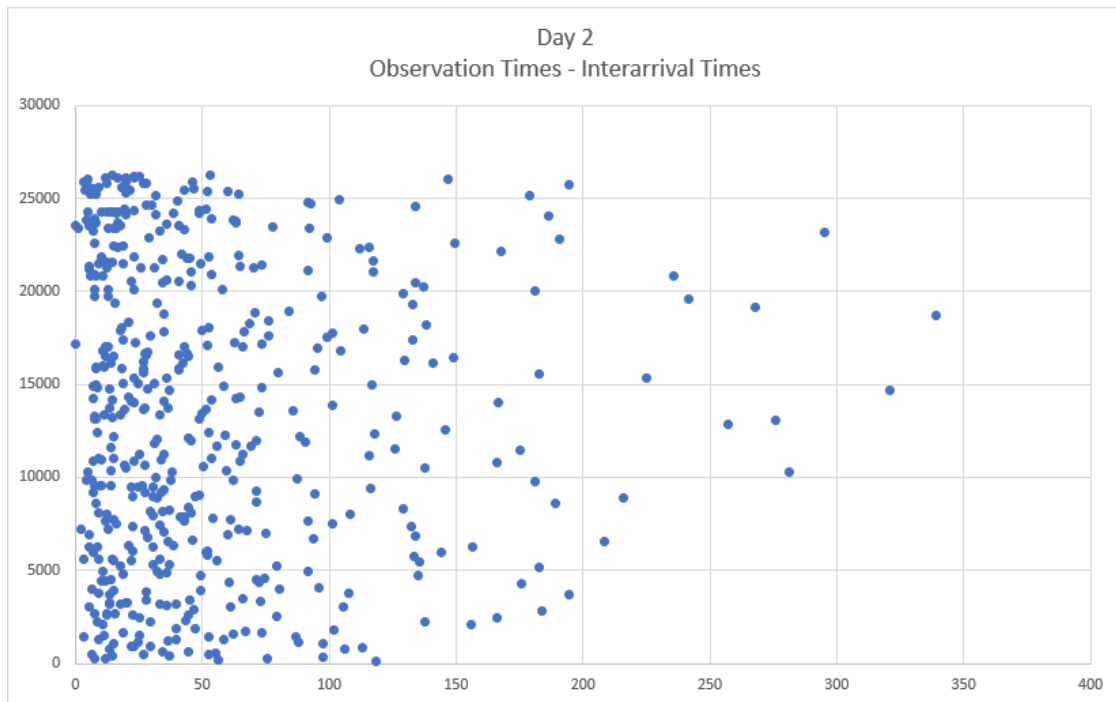
QQ-Plot Day 2
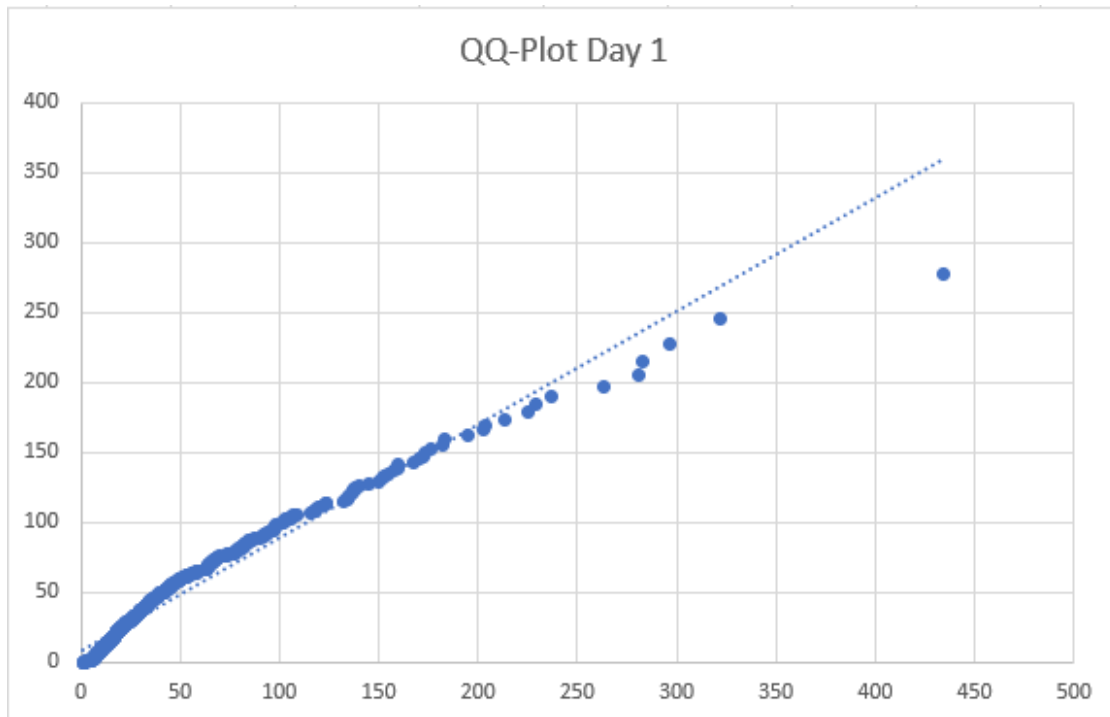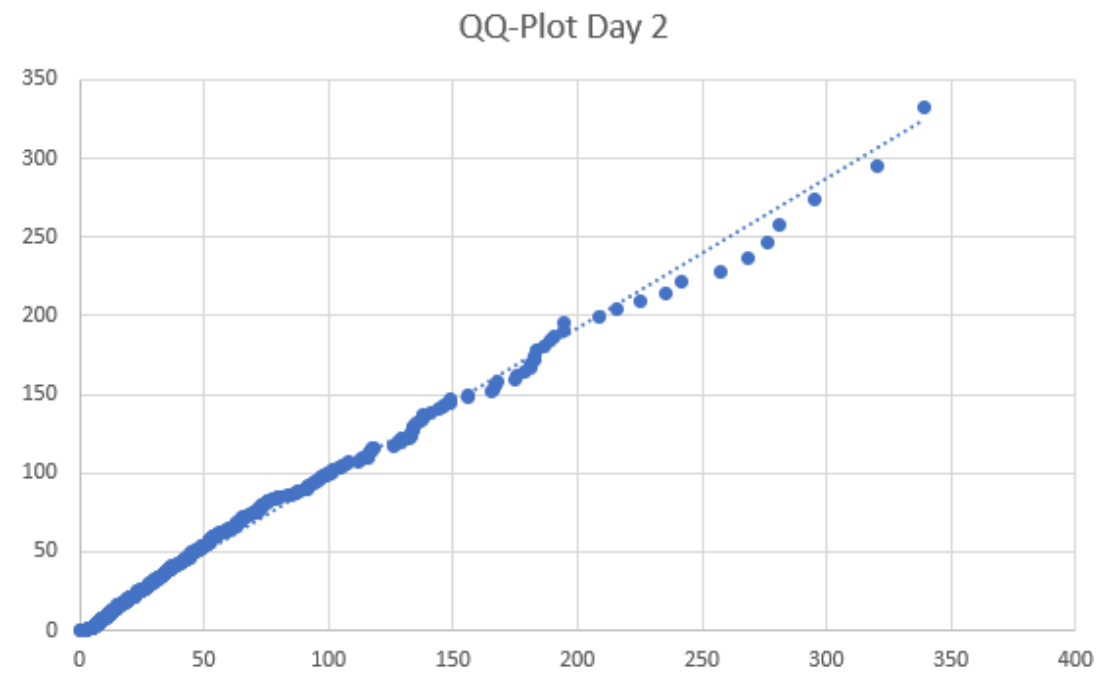
6 Question 6

Since mean and variance do not seem to change over time, we can conclude that the process is stationary.

Day 1
Observation Times - Interarrival Times

Day 2
Observation Times - Interarrival Times
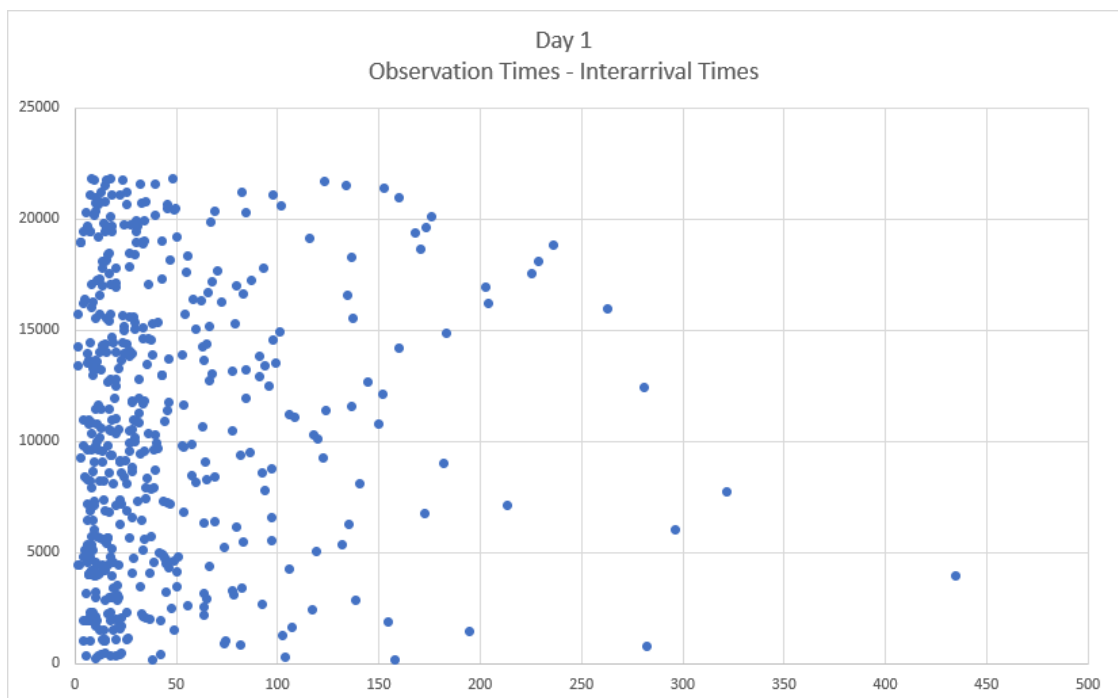
7 Question 7

Since auto-correlation values are very small, we can conclude there is no auto-correlation between inter-arrival times. They are random.

Day 1 - Lag 1

Day 1 - Lag 2

Day 2 - Lag 1

Day 2 - Lag 2