Assignment 1: Simulation of M/M/1 and M/D/1 Queues

Akshit Kumar
EE14B127

This report contains the simulation results of a M/M/1 and M/D/1 queue. This report shows the relation between the average number of customers in the system (N) and the load on the system $\left(\rho = \frac{\lambda}{\mu}\right)$. For the purposes of this simulation, we fix the value of μ and vary λ. We plot the results from simulation against what we get from theory.

I. Nomenclature

λ	=	Arrival Rate of Customers/Packets
μ	=	Service Rate of Customers/Packets
ρ	=	Load on the system $\left(\rho = \frac{\lambda}{\mu}\right)$
N	=	Average number of customers/packets in the system

II. Simulation of M/M/1 Queue

For a M/M/1 queue, we know that relation between N and ρ is given by

$$N = \frac{\rho}{1-\rho}$$

In the following plot we show that the simulation results are in close agreement with the theoretical relationship between N and ρ

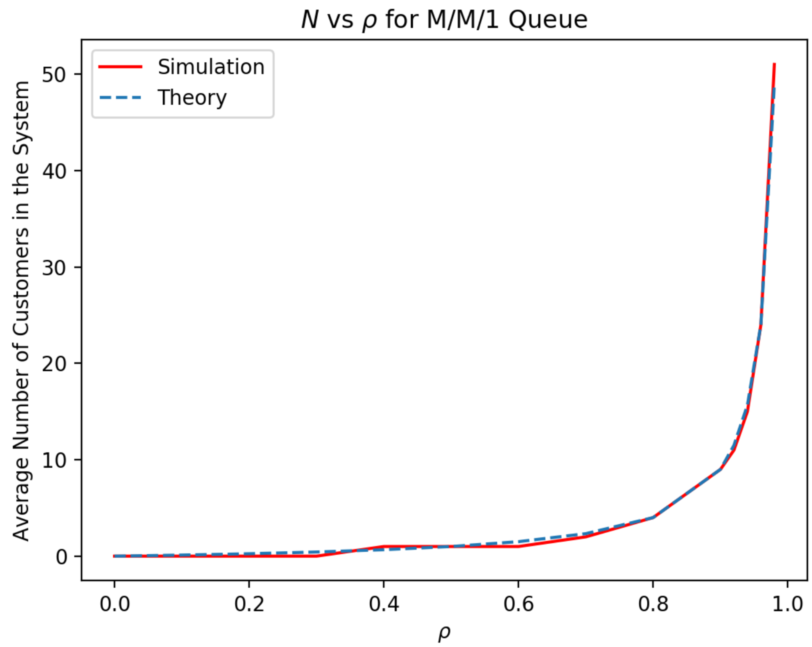

Fig. 1 Simulation Result of M/M/1 Queue

III. Simulation of M/D/1 Queue

For a M/G/1 queue, we know that relation between N and ρ is given by

$$N = \rho + \frac{\lambda^2 \bar{X^2}}{2(1-\rho)}$$

where $\bar{X^2} = E\{X^2\}$ = Second moment of Service Time
For an M/D/1 system, we have $\bar{X^2} = \frac{1}{\mu^2}$, therefore we get the following relation

$$N = \rho + \frac{\rho^2}{2(1-\rho)}$$

In the following plot we show that the simulation results are in close agreement with the theoretical relationship between N and ρ

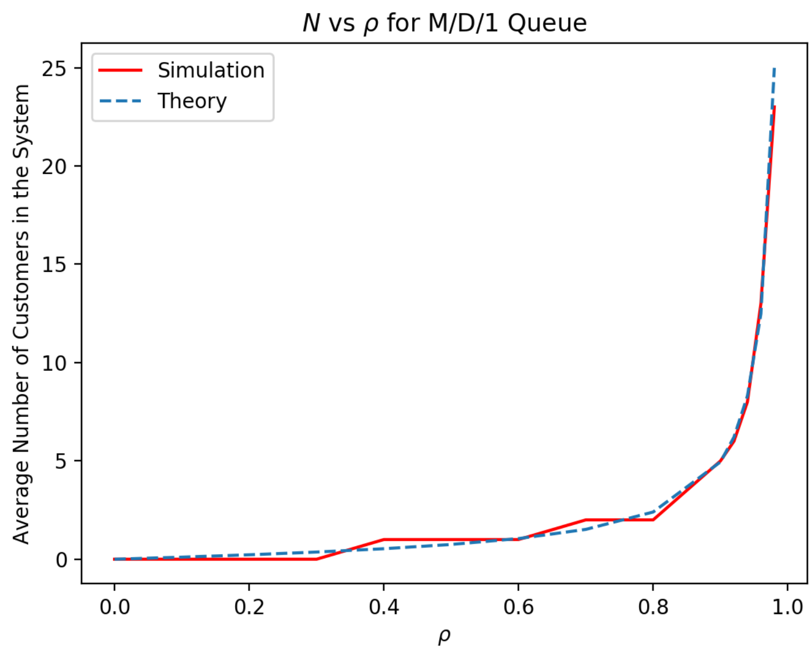

Fig. 2 Simulation Result of M/D/1 Queue