Computer Modeling HW1

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1. M/M/1 queueing system by simulation and analysis

environment

- traffic intensity = 0.01, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 0.95
  - μ = 1.0, λ = 0.01, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 0.95
- simulation time [10000, 100000]
- simutated 10 times, averaged result

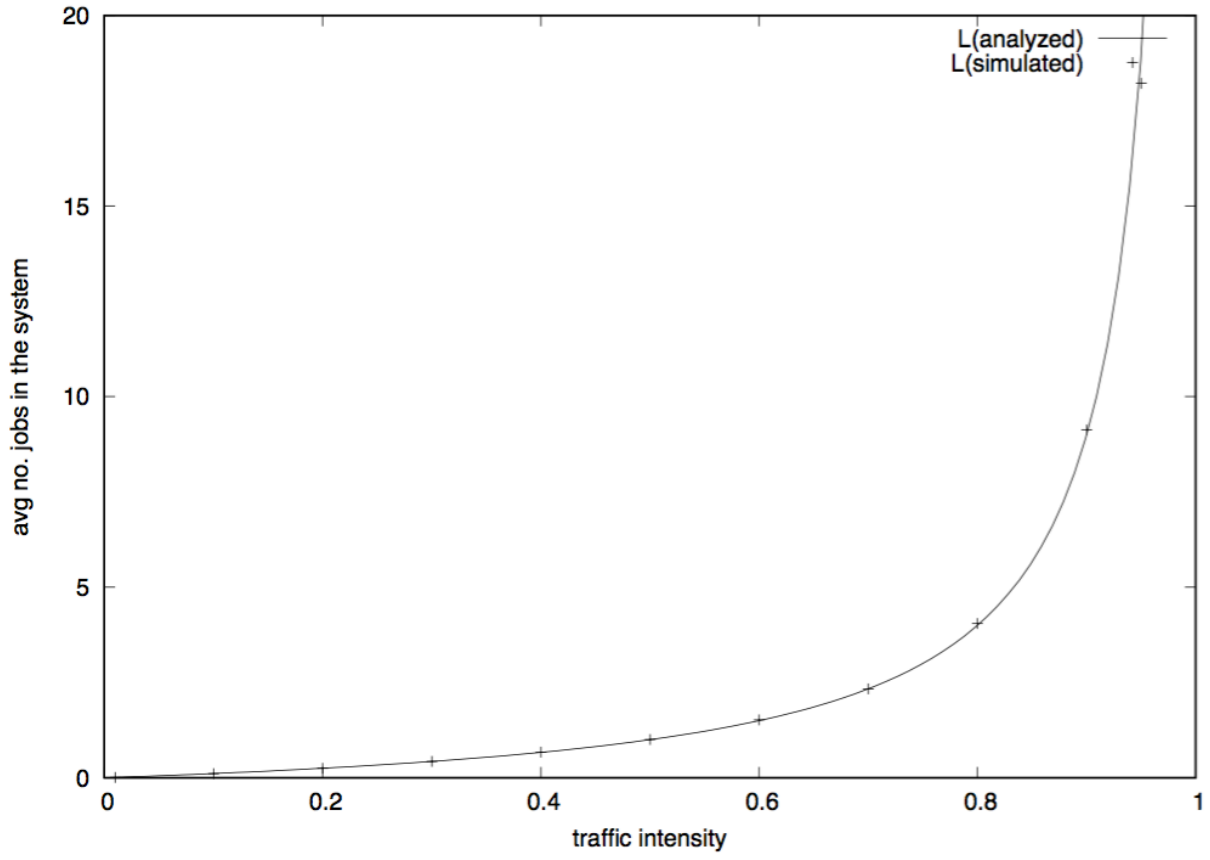
1.1 traffic load (0-0.95) vs average # of jobs in the system

Analysis

$$L = E(N) = \sum_{n=0}^{\infty} n(1-\rho)\rho^n = \frac{\rho}{1-\rho} \text{ (see geometric dist.)}$$

Simulation & Analysis

Simulated values and analyzed result are as below. Simulated values correspond with analayzed result.



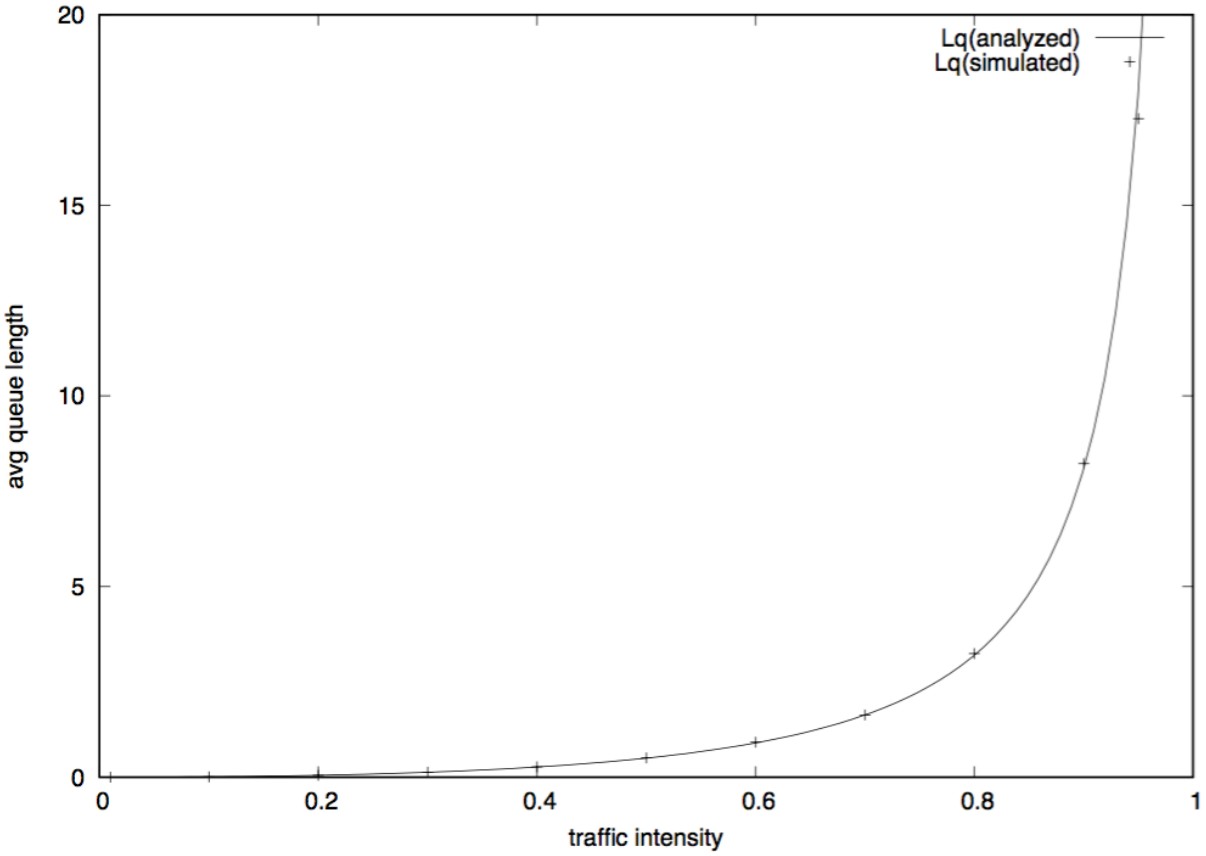
1.2 traffic load (0-0.95) vs average queue length

Analysis

$$L_q = \lambda W_q = \lambda \frac{\rho W_s}{1-\rho} = \frac{\rho^2}{1-\rho}$$

Simulation & Analysis

Simulated values and analyzed result are as below. Simulated values correspond with analayzed result.



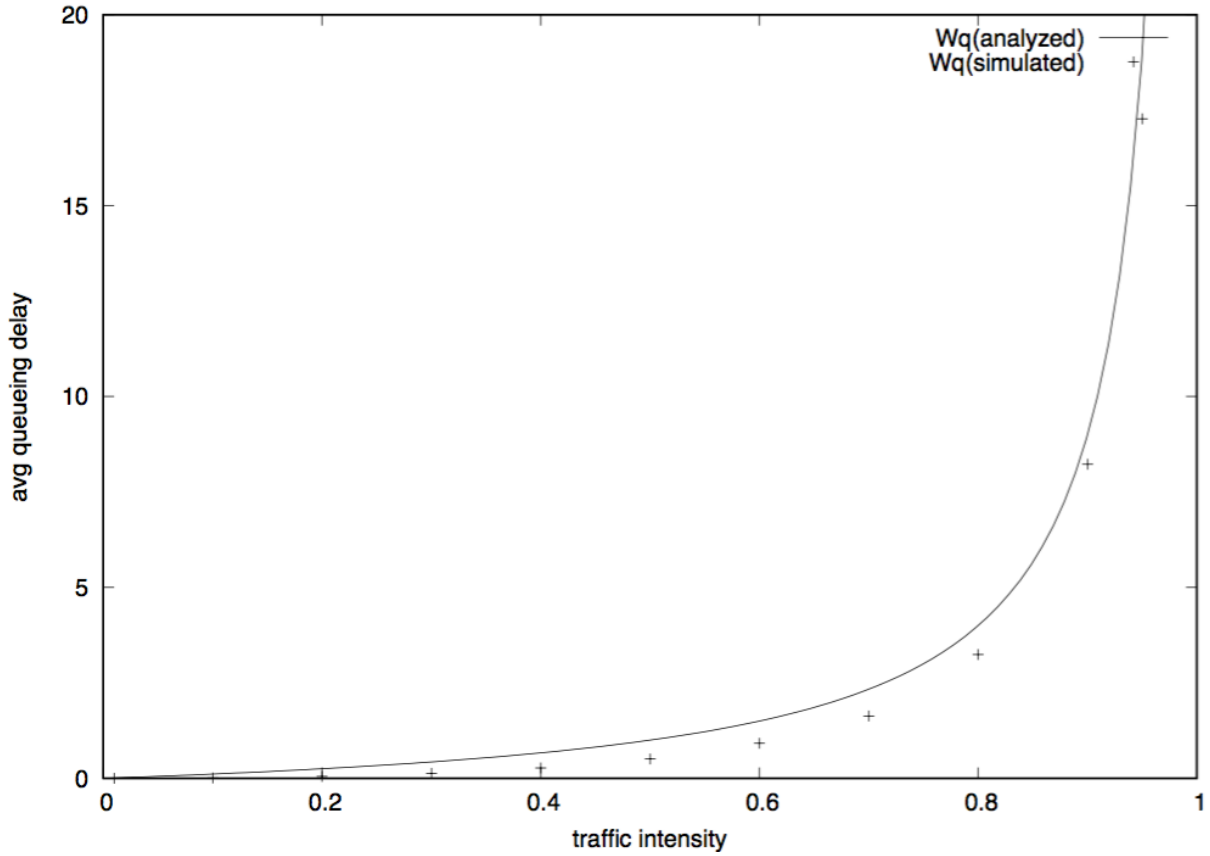
1.3 traffic load (0-0.95) vs average queueing delay for each job

Analysis

$$W_q = W - W_s = \frac{W_s}{1-\rho} - W_s = \frac{\rho W_s}{1-\rho}$$

Simulation & Analysis

Simulated result and analyzed result are as below. The shape of simulated values corresponds with analayzed result.



2. simulating the system with a traffic load 1.0 and 1.5

In simulation result with ρ=1.0 and ρ=1.5, L and W showed exponential growth as the time goes by. It menas the system does not working. To make system work, ρ should be less than 1.0. Therefore, λ should be less than μ.