Introduction to QUEUEING: M/G/1

author

This Hypercard stack was prepared by:
Dennis L. Bricker,
Dept. of Industrial Engineering,
University of Iowa,
Iowa City, Iowa 52242
e-mail: dennis-bricker@uiowa.edu

M/G/1

- *Arrival process is **M**emoryless, i.e., interarrival times have Exponential distribution with mean* $1/\lambda$
- *Single server*
- *Service times are independent, identically-distributed, but not necessarily exponential. Mean service time is* $1/\mu$ *with variance* σ^2
- *Queue capacity is infinite*

M/G/1

Steadystate Characteristics

A steadystate distribution exists if $\rho = \frac{\lambda}{\mu} < 1$

i.e., if service rate exceeds the arrival rate.

$\pi_0 = 1 - \rho$ *= probability that server is idle*

$1 - \pi_0 = \rho$ *= probability that server is busy i.e., utilization of server*

There is no convenient formula for the probability of j customers in system when j > 0.

M/G/1

Steadystate Characteristics

$$L_q = \frac{\lambda^2 \sigma^2 + \rho^2}{2(1-\rho)}$$

average number of customers waiting

After calculating L_q, Little's Formula allows us to compute:

$$W_q = \frac{L_q}{\lambda}, \quad W = W_q + \frac{1}{\mu},$$

$$\& \quad L = \lambda W = L_q + \rho$$

For the M/M/1 queue, the standard deviation equals the mean service time, i.e., $\sigma = 1/\mu$

Using these formulae for the M/G/1 queueing system with $\sigma^2 = 1/\mu^2$ will give results consistent with the formulae for M/M/1.