Queueing Models

Standard Queueing Notation: A/B/c/N/K

* A : interarrival time distribution
* B : service-time distribution
* c : number of parallel servers
* N : system capacity
* K : size of calling population
* Common types for A/B
  + M : Markov (exponential)
  + D : Deterministic/constant (not random)
  + EK : Erlang of order k
  + G : General (arbitrary)

Long-Run Average Measures of Performance

* L : number of customers in system
* LQ : number of customers in queue
* w : time spent in system
* wq : time spent in queue
* p : server utilization

Time-Average Number in System/Queue

* Let L(t) = # of customers in system/queue at time t

Average Time Spent in System/Queue

* Let Wi be the amount of time the ith customer spent in the system

Little’s Equation

System Stability

* Arrival rate (λ) must be less than service rate (μ)
* For G/G/1//
  + Stable if λ < μ
* For G/G/c//
  + Stable if λ < μ\*c

Server Utilization

* For G/G/1//

Input Modeling

Maximum Likelihood Estimate (MLE)

* Where, X’ = sample mean and
* Exponential:
* Binomial: p’ = X’/n
* Poisson: α’ = X’
* Normal: μ’ = X’, σ’ = S

Goodness of Fit Tests

* Chi-Squared
  + Degrees of freedom = k – s – 1, where k is number of outcomes and s is number of estimated parameters
* Kolmogorov-Smirnov
  + Order all values from smallest to largest first
  + Check to see if D < Dα from table

Covariance and Correlation

* Let X and Y be random variables
* Covariance