Waiting lines formulas, KPP227

Waiting lines

Interarrival times

$$P_n = \frac{(\lambda T)^n}{n!} e^{-\lambda T} \quad \textit{for } n = 1,2,\ldots$$

P_n = Probability of n arrivals in T time periods
λ = Average numbers of cutomer arrivals per period

Service time distribution

$$P_{(t \leq T)} = 1 - e^{-\mu T}$$

μ = Average number of customers completing service per period
t = service time of the customer
T = target service time

Single server model

Average utilization of the system

$$\rho = \frac{\lambda}{\mu}$$

Average number of customers in the system

$$L = \frac{\lambda}{\mu - \lambda}$$

Average number of customers in the waiting line

$$L_q = \rho L = \frac{\lambda^2}{\mu(\mu - \lambda)}$$

Average time spent in the system including service

$$W = \frac{1}{\mu - \lambda}$$

Average waiting time in line

$$W_q = \rho W = \frac{\lambda}{\mu(\mu - \lambda)}$$

Probability that n customers are in the system

$$P_n = (1 - \rho)\rho^n$$

Probability that 0 customers are in the system

$$P_0 = 1 - \frac{\lambda}{\mu}$$

Probability that less than *k* customers are in the system

$$P_{n<k} = 1 - \left(\frac{\lambda}{\mu}\right)^k$$

Probability of more than *k* customers are in the system

$$P_{n>k} = \left(\frac{\lambda}{\mu}\right)^{k+1}$$