

Homework 3

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Measures of Performance #2

(1) Find L , expected value of # units in system.

$$\text{arrival rate} = \lambda \text{ hr}^{-1}$$

$$\text{cost per unit} = \$ C_1 \text{ hr}^{-1}$$

$$\text{service rate} = \mu \text{ hr}^{-1}$$

$$\text{machine cost} = \$ \mu C_2 \text{ hr}^{-1}$$

$$L = \left[\frac{\lambda}{\mu - \lambda} \right] \text{ because } \mu / \lambda > 1$$

(2) Find $E(\text{cost of operation})$.

$$E(\text{cost of operation}) = \$ (L C_1 + \mu C_2) \text{ hr}^{-1}$$

$$= \left[\frac{\lambda}{\mu - \lambda} C_1 + \mu C_2 \right]$$

(3) Find μ to minimize $E(\text{cost of operation})$.

$$\frac{d}{d\mu} \left[\frac{\lambda}{\mu - \lambda} C_1 + \mu C_2 \right] = \frac{(\mu - \lambda) 0 - \lambda C_1 (1)}{(\mu - \lambda)^2} + C_2$$

$$= -\frac{\lambda C_1}{(\mu - \lambda)^2} + C_2$$

$$\text{Set } 0 \Rightarrow \frac{\lambda C_1}{(\mu - \lambda)^2} = C_2 \Rightarrow \mu - \lambda = \sqrt{\frac{\lambda C_1}{C_2}}$$

$$\mu = \left[\lambda + \sqrt{\frac{\lambda C_1}{C_2}} \right]$$