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APPENDIX

APPENDIX A

Derivation of Equation (3.1)

There are c microprocessors in the multiple-microprocessor system. Assuming that the data transaction arrival rate is distributed according to Poisson distribution with mean λ and the processing time for each microprocessor is exponential distribution with mean μ_i, $i = 1, 2, 3, \ldots, c$.

Considering the mean service rate of this system, if there are more than c transactions in the system, all the c microprocessors are busy and each is processing at a mean of μ_i, $i = 1, 2, \ldots, c$ and the mean system output rate is thus $\mu_1 + \mu_2 + \ldots + \mu_c$. When they are fewer than c transactions in the system, only n of c servers are busy and the mean service rate of the system can be derived as follows.

n = 1: upon entry into the system, the transaction will be proceeded to any microprocessor with equal probability. It will then speed an exponentially distributed interval of time in microprocessor i whose mean is $1/\mu_i$. After that interval the transaction departs and only then a new transaction is allowed to enter the processing facility.

It is clear from the description that the processing time p.d.f. will be given by

$$b(x) = \frac{1}{c}\mu_1 e^{-\mu_1 x} + \frac{1}{c}\mu_2 e^{-\mu_2 x} + \ldots\ldots + \frac{1}{c}\mu_c e^{-\mu_c x}$$

x = microprocessor processing time

Taking the Lapace transform, and set s = 0, we get the expectation of processing time $\bar{x}$

$$\bar{x} = \frac{1}{c}\left[\sum_{i=1}^{c} \frac{1}{\mu_i}\right]$$

The mean processing rate becomes

$$\mu = 1 \Big/ \frac{1}{c}\left[\sum_{i=1}^{c} \frac{1}{\mu_i}\right]$$

$$\mu = \frac{c}{\sum\limits_{i=1}^{c} \frac{1}{\mu_i}}$$

The flow balance equation is as follows:

$$n=1\ ; \quad \frac{c}{\sum\limits_{i=1}^{c} (\frac{1}{\mu_i})}\, p_1 = \lambda p_0$$

$$p_1 = \left(\lambda \Big/ \frac{c}{\sum\limits_{i=1}^{c} (\frac{1}{\mu_i})}\right) p_0$$

$$p_1 = \delta p_0 \qquad \text{where } \delta = \lambda \Big/ \frac{c}{\sum\limits_{i=1}^{c} \frac{1}{\mu_i}}$$

$n = c$

$$\sum_{i=1}^{c} \mu_i\, p_c + p_{c-2} = [\lambda + (c-1)\frac{\lambda}{\delta}]\, p_{c-1}$$

$$p_c = \frac{\delta^{c-1}}{(c-1)!}\, \rho\, p_o$$

$n = c+1$

$$\sum_{i=1}^{c} \mu_i\, p_{c+1} + \lambda p_{c-1} = (\lambda + \sum_{i=1}^{c} \mu_i)\, p_c$$

$$p_{c+1} = \frac{\delta^{c-1}}{(c-1)!}\, \rho^2\, p_o$$

$$P_n = \begin{cases} \dfrac{1}{n!}\, \delta^n\, p_o & 1 < n < c \\ \dfrac{\delta^{c-1} \rho^{n-(c-1)}}{(c-1)!}\, P_O & c \leq n \end{cases} \qquad (3.1)$$

AUTOBIOGRAPHY

Mr. Borworn Papasratorn was born in Bangkok on July 28, 1957. He received M.Eng (EE) in Communication Engineering from the Department of Electrical Engineering, Chulalongkorn University in 1984.

During 1980 and 1985, he was with the Department of Aviation, Thailand, as an electronic engineer. His responsibility included design, installation and maintenance of the air navigation aided equipments. At present, he is a lecturer in the Department of Computer Engineering, King Mongkut's Institute of Technology Thonburi.

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