

COMP SCI/SFWR ENG 4/6E03 — Solutions to Test 2

1. This can be modelled as a birth-death process with $\lambda_0 = \lambda_1 = \lambda_2 = \lambda_3 = 10$ and $\mu_1 = 4$, $\mu_2 = 8$, $\mu_3 = 12$ and $\mu_4 = 16$. We then get,

$$p_0 = \frac{1}{1 + 10/4 + 100/32 + 1000/384 + 10000/6144} = 0.0921.$$

So, the utilization of the server is $1 - p_0 = 0.9079$ and the probability that an arriving job cannot enter the system is $p_4 = 10000p_0/6144 = 0.1499$.

2. (a) F
 (b) F
 (c) F
 (d) F
 (e) T
3. We have that $V_{cpu} = 1$, $V_{io} = 0.95$ (this is of course only one possibility). Solving for G in the closed network formula, we have

$$G = (0.02)^2 + (0.95)^2(0.04)^2 + (0.02)(0.95)(0.04) = 0.002604.$$

The utilization of the CPU is then

$$1 - P(0, 2) = 1 - \frac{(0.95)^2(0.04)^2}{G} = .445.$$

4. For the original system, which is an M/M/1, we have $\lambda = 3$, $\mu = 24/7$ and thus the mean number in system is 7. The total cost per hour is $7.50 + (7)(0.50) = 11.00$.

For the new system, $1/\mu = 5/24$, which gives a mean number in system of $15/9$, and a total cost of 8.33, if the operating costs remain at 7.50.

Thus, an increase of 2.67 could be tolerated.