CSE 567

Homework 6
Fall 2004

READ:
1. Trivedi – 8.5 (Examples 8.34 & 8.35), 9.1 - 9.4
2. Trivedi - Optional Reading: 8.6 (For those interested in solution techniques for the matrix equations that arise), 8.7(For those interested in the relationships to Petri Nets), 9.6 (For those interested in the response time distributions, not just the steady state solutions).

DUE DATE: Wednesday, Dec. 8, 2004

PROBLEMS:

PROBLEM 1: Trivedi; Problem 1, Page 446

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PROBLEM 2: M/M/2 with Heterogeneous Servers

Read Example 8.29 on Page 476 of Trevidi. Consider an arrival rate of 1.0 arrivals/unit time, one server with a service rate of 0.8 services/unit time, and one server with a service rate of 0.4 services/unit time.

2.1 Using the results at the end of the example, find the average number in the system and the average overall waiting time.

2.2 Compare the above results with a situation where the two servers are identical and each has a service rate of 0.6 services/unit time.

2.3 Compare the two results above with a situation where the two servers have been replaced with a single server with rate equal to 1.2 services/unit time.

2.4 Explain the differences in the above results.

2.5 Say that a single server operating at 0.4 services/unit time has a cost of $C_1$ and a server operating at 1.2 services/unit time has a cost of $2C_1$. Assume also that single server costs are linear between $C_1$ and $2C_1$ for other service rates between 0.4 and 1.2 services/unit time. The cost for a system with multiple servers is the sum of the individual server costs. Determine the "best" system, if the performance metric of interest is $1/[(\text{average.wait.time}) \times (\text{system.cost})]$. 
PROBLEM 3: Shortest Processing Time First - SPTF

Consider a single server system whose Poisson input stream consists of two types of customer with arrival rates $\lambda_a = 0.75$ and $\lambda_b = 1.25$. The service rate is adjusted to the customer type with $\mu_a = 1.5$ and $\mu_b = 2.5$.

3.1 Determine the mean waiting time for the average customer when the two arrival streams are aggregated into a single Poisson arrival stream.

3.2 Determine the mean waiting time by customer type, and overall mean waiting time, with "a" having priority over "b", and with "b" having priority over "a". Does this (in some sense) verify the SPTF algorithm?

PROBLEM 4: Trivedi; Problem 1, Page 567

PROBLEM 5: Trivedi; Problem 7, Page 596

Perform your calculations only using the structure as in Table 9.6. Do this for 1 and 2 CPUs and compare results.

Separate instructions will be given out concerning the project report.