CSc 841 Computer Performance Evaluation **Dr. Jozo Dujmović**
HOMEWORK: Mean Value Analysis

1. Computer system shown in Fig. 1 has one processor ($S_p = 3ms$) and 4 disk units ($S_d = 10ms$). The number of jobs is 8. An average transaction generates 40 visits to disk units. Compute the throughput X (transactions per second), server utilizations U, queue lengths Q, and the system response time R in two cases: (a) when the load is balanced and each disk receives 25% of disk traffic, and (b) when the load is not balanced and the traffic to individual disks is distributed nonuniformly: 40%, 30%, 20%, 10%. To solve this problem you may develop a program that implements the MVA method.

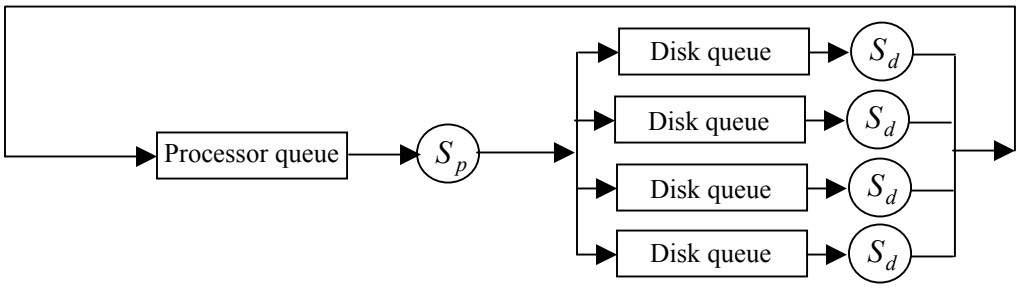

Figure 1

2. The system from problem 1.a that has the balanced workload can be approximated as shown in Fig. 2. This model is an approximation because disks are not equivalent parallel servers; unlike processors, each disk should have its own queue. However, this approximation is suitable for using the simple exponential birth-death model. Use the birth-death model to compute the same performance indicators as in the MVA case (problem 1.a). Compare and discuss the results. Evaluate the quality of the approximate model from Fig. 2.

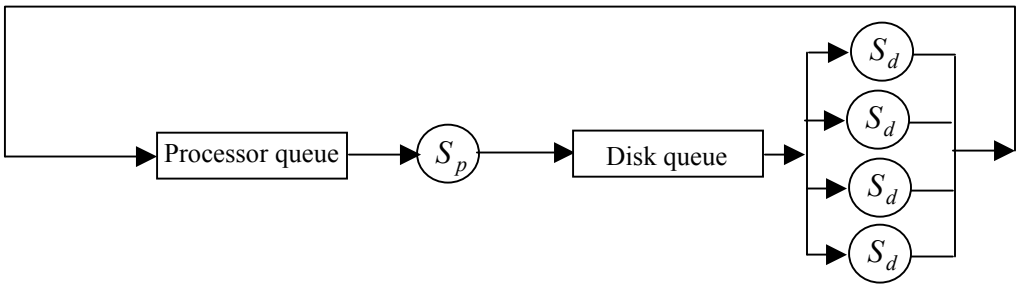

Figure 2

3. The system described in problem 1 is now serving N workstations/terminals that have the average think time Z=5 seconds (Fig. 3). Compute the critical number of workstations N* for the cases of balanced and non-balanced disk traffic. For these two cases show the resource utilization curves U(N), the system throughput curve , and the response time curve R(N), for $0 < N < 2N^*$. To solve this problem you should develop a program that implements the MVA method.

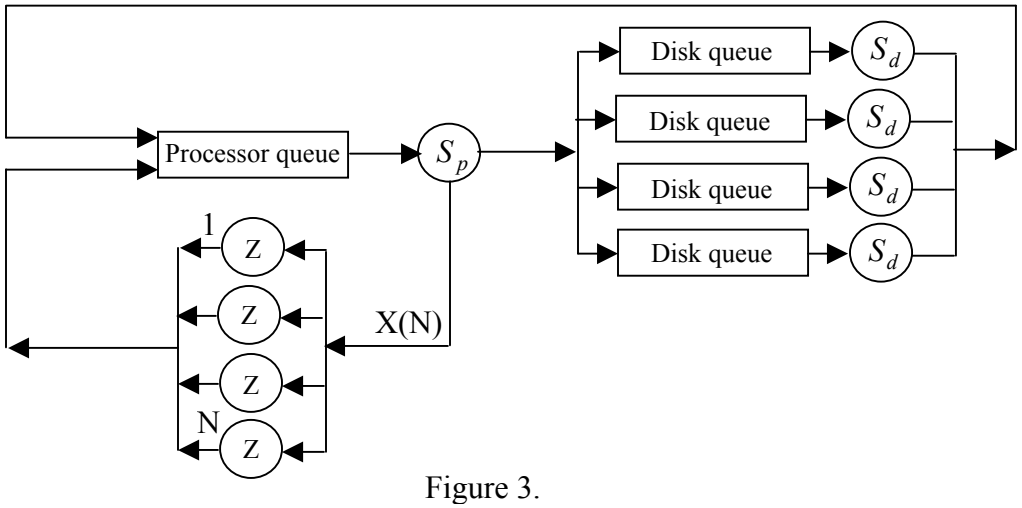

Figure 3.

4. The system from Fig. 1 is now modified and has two processors as shown in Fig. 4. The workload and all other parameters remain unchanged, as specified in problem 1.a and 1.b. Analyze the performance indicators of this system using a load dependent MVA model. Compare the results with the case that has only one processor (problems 1.a and 1.b).

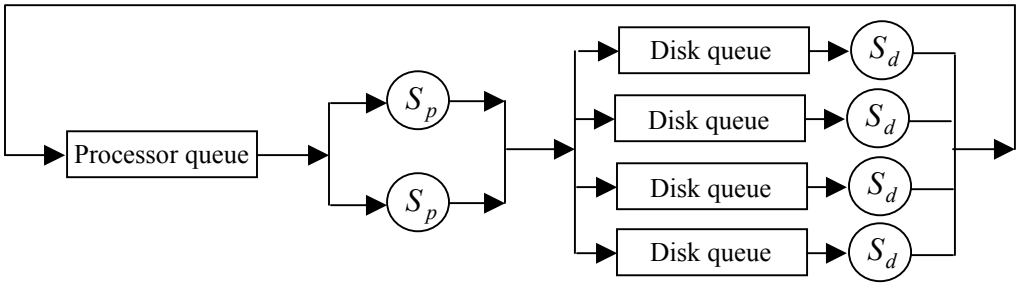

Figure 4