Performance Evaluation of Computer Networks
Assignment #7

1. Consider a mail server with one processor and one disk. Measurement data shows that the service time of requests at the CPU has large coefficient of variation and it is necessary to include high service time variability at the CPU in the model. Assume that the following input parameters were obtained through measurements:
   $CV_{CPU} = 4, N = 100, D_{CPU} = 180\ ms, D_{disk} = 160\ ms, P_L = 0.1, P_S = 0.9$
   Find system throughput and system response time using two techniques:
   a. Modeling the CPU as an exponential service center
   b. Modeling the CPU as a service center with high service time variability and using the MVA-based decomposition approach

   Note: Use JMT to find system throughput and system response time

2. A database server has one processor and one disk. The requests arrive at the database server with $\lambda = 2$ tps. Let the service demands at CPU and disk be $D_{CPU} = 100\ ms, D_{Disk} = 250\ ms$, respectively. Suppose that the server has admission control mechanism that allows maximum three transactions be processed in the system, concurrently.
   a. What is the average number of transactions executing in the system?
   b. What is the average number of transactions waiting for execution in the system?
   c. What is the average number of transactions in the system?
   d. What is the system throughput?
   e. What is the system response time?

3. Consider a system that consists of one CPU and one disk. The workload of the system is described by four distinct classes of transactions: class1, class2, class3, and class 4. The priority, service demand, and the number of customers of each workload class are shown in Table 1.
   a. Suppose that the CPU scheduling policy is FCFS or PS. What are the system throughput and system response time?
   b. Suppose that the CPU scheduling policy is priority-based scheduling. What are the system throughput and system response time?

Class	Priority	$D_{CPu,r}$ (Sec)	$D_{Disk,r}$ (Sec)	N
1	1	0.08	0.12	1
2	1	0.12	0.1	2
3	2	0.05	0.08	2
4	3	0.1	0.05	1

Table 1. Data for exercise 3

Note: Use JMT to find system throughput and CPU and disk utilizations

4. The software and hardware queuing network of a system is shown in Figure 1. Service demands are given in Table 2. Find the parameters listed in Table 3 for two different cases:
   Case 1: The SQN is modeled as a closed QN with N = 3.
   Case 2: The SQN is modeled as an open class with $\lambda = 2$ tps.

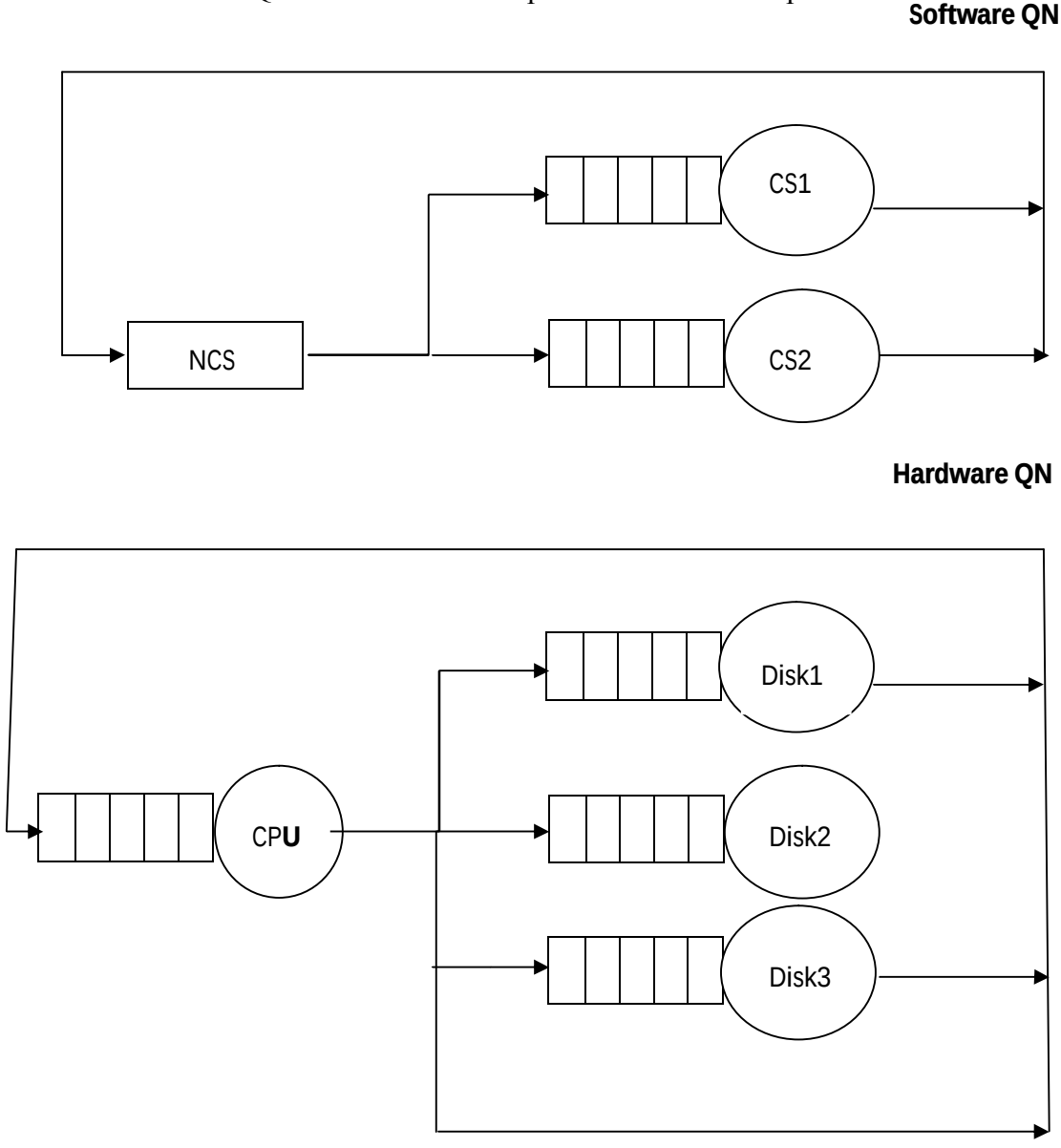

Figure 1. Software and Hardware QN of the system

	Software Modules		
Device	NCS	CS1	CS2
CPU	0.15	0.04	0.07
Disk1	0.08	0.03	0.04
Disk2	0.06	0.02	0
Disk3	0.09	0	0.06

Table 2. Service demands (in Sec) for exercise (4)

					Modified SQN Demands		
Iteration	N^h	N^s	B	R	NCS	CS1	CS2
0							
1							
2							

Table 3.