Performance Evaluation of Computer Networks

Assignment #1

1. A computer system is monitored for 1.5 hours. During this time, 21600 transactions are completed and 129600 I/O operations are executed on a certain disk that is 60% utilized.
    a. What is the average number of I/O operations per transaction on this disk?
    b. What is the average service time per transaction on this disk?

2. An interactive system has 50 terminals and the user's think time is 5 seconds. This system is monitored for one hour and the utilization of a certain disk is measured to be 70%. The average service time of transactions at the disk is 20 ms. Each user transaction makes, on average, 6 I/O operations on the disk.
    a. What is the system response time?
    b. How many users are waiting for a response from the system?
    c. How many users are in the think state?

3. A computer system has one CPU and two disks: Disk1 and Disk2. This system is monitored for one hour and utilization of the CPU and of Disk1 are measured to be 30% and 70%, respectively. Each transaction makes 5 I/O operations to Disk1 and 8 to Disk2. The average service time of transactions at Disk1 and Disk2 are 20ms and 10ms, respectively.
    a. Find the system throughput.
    b. Find the utilization of Disk2.
    c. Find the average service demand of transactions at CPU, Disk1, and Disk2.
    d. Find system response time.
    e. Find queue length of CPU, Disk1, and Disk2.
    f. Find the maximum throughput and minimum response time of the system.
    g. Suppose that the bottleneck resource is replaced with one that is 70% faster. What is the percentage change of system response time?
    h. Assume that a new disk equivalent to the existing disks is being added to the system and I/O activity is balanced on them. What is the percentage change of the system response time?

4. Consider an interactive system consisting of one CPU and two disks. The system is monitored for one hours and the utilization of Disk1 is measured to be 60%. Suppose that the system has 60 terminals and the average think time of users is 6 seconds. Each user interaction makes 5 I/O requests to Disk1 and 6 to Disk2. The average service times of user interactions at CPU, Disk1 and Disk2 are 5ms, 20ms and 15ms, respectively. The number of requests at the CPU, Disk1, and Disk2 are 0.8, 1.8, and 1.4, respectively.

a. Find the system throughput.
b. Find the throughput of CPU, Disk1, and Disk2.
c. Find the utilization of CPU and Disk2.
d. Find the system response time.
e. Find queue length of each resource.
f. Find waiting time of each request.
g. Find Number of users that are awaiting a response from the system.
h. Find the Number of users that want to submit their request to the system.
i. Find the maximum throughput and minimum response time of the system.