Performance Evaluation of Computer Networks

Assignment #2

1. The workload of a database server is characterized by three types of transactions: Trivial, Medium, and Complex. The database server which consists of one CPU and one disk. This server is monitored for one hour and the utilization of CPU and disk are measured to be 40% and 60%. Additional metrics obtained during the observation period are shown in Table 1.

	Trivial	Medium	Complex
Number of Physical I/Os	10	20	40
Total CPU Seconds	700	450	180
Number of Transactions Completed	10500	5600	2100

Table 1. Data for exercise 1

For each workload class, find the following:
   a. Service demands at CPU and Disk.
   b. System throughput
   c. System response time
   d. Number of transactions at CPU and Disk
   e. Queue length of CPU and Disk

2. Consider a VMM (Virtual Machine Monitor) that runs three virtual machines concurrently. The VMM runs on top of a mainframe which consists of a single CPU. VM_1 runs a guest operating system that processes three workload classes: Batch (B), Interactive (I), and Transactions (TP). The TP monitor supports the execution of two classes of transactions: Query (Q) and Update (U).

   Using data collected by monitors at different layers of the system, the analyst obtains the following measurements:

   $U_{CPU,Total} = 95\%, U_{CPU,VM1} = 50\%, U_{CPU,VM2} = 25\%, U_{CPU,VM3} = 10\%,$

   $T_B = 10$ seconds , $T_I = 20$ seconds, $T_{TP} = 80$ seconds,

   $T_Q = 30$ seconds, $T_U = 40$ seconds, $\lambda_Q = 10$ tps, $\lambda_U = 4$ tps

   Find the service demands of Query and Update workload classes at CPU.

3. Consider a web server that is used to download two types of files: 1) PDF files 2) ZIP files. The web server consists of one CPU and two disks: Disk1 and Disk2. PDF files are stored on Disk1 and ZIP files are stored on Disk2. This web server is monitored for 300 seconds. During this time, 450 PDF files and 550 ZIP files are downloaded from the web server. The average elapsed time to download a PDF file and a ZIP file is 1.79 seconds and 5.45 seconds, respectively. The average size of PDF and ZIP files are 350 KB and 800 KB, respectively. The Suppose that the average CPU and Disk times (in terms of milliseconds) needed to process a file with size FILE_SIZE (in terms of KB) are obtained from the following equations:

CPU_TIME = $0.1 \times$ FILE_SIZE $- 0.02$

DISK_TIME = $0.15 \times$ FILE_SIZE $+ 0.1$

   a. Find the average concurrency level for each type of file.
   b. Find the average service demands of PDF and ZIP files at CPU, Disk1, and Disk3.
   c. Use JMT and find system throughput for PDF and ZIP files.
   d. Find utilization of CPU, Disk1, and Disk2.
   e. Find system response time for PDF and ZIP files.

Note: Solve the part (d) and (e) of exercise (3) without using JMT.