COMP9334 Revision Questions for Week 9

Question 1

Measurements were conducted on an interactive computer system and the following results were obtained:

Length of measurement interval:	1 hour
Number of completed requests:	36,000
Utilisation of CPU:	75%
Utilisation of Disk 1:	50%
Utilisation of Disk 2:	50%
Utilisation of Disk 3:	25%
Think time:	7s

You may assume that the service time is exponentially distributed.

(a) Compute the service demand on the CPU and the disks.

(b) Write a computer program to implement the MVA algorithm. The inputs to your computer program should be

- Service demand of the components
- The think time
- The maximum number of interactive users N

The output of the program should be

- System throughput when there are 1,...,N interactive users
- The system response time when there are 1,...,N interactive users

(c) Use your computer program to determine the system throughput when the number of interactive users varies from 1 to 200.

Use asymptotic analysis to determine the upper bound on system throughput when the number of interactive users from 1 to 200.

Plot both the actual throughout and the asymptotic bound on the same graph. What do you observe?

(d) Assuming that there are 70 interactive users in the system. By what factor must you speed up the CPU so that the system response time is 0.3s.

Question 2

(Note: This question is taken from Menasce, "Performance by design", Chapter 12.)

A web server has one CPU and one disk and was monitored during one hour. The utilisation of the CPU was measured at 30%. During this period, 10,800 HTTP requests were

processed. Each request requires, on average, 3 I/Os on the server's disk. The average service time at the disk is 20 ms.

You may assume that the service time is exponentially distributed.

(a) What are the service demands of an HTTP request at the CPU and at the disk.

(b) Find the throughput, $X_0(n)$, of the web server for $n = 0, 1, 2$ and 3, where n is the number of concurrent HTTP requests in execution at the web server.

(c) Assuming that the web server receives requests at a rate of $\lambda = 5$ requests per second Poisson distributed. At most three HTTP requests can be in execution at any point in time. Requests that arrive and find 3 requests being processed will be placed in a processing queue, which is assumed to have an infinite size. Find the average response time of an HTTP request. This time includes the time spent by a request in the processing queue plus the time required to process the request. (Hint: Model the problem as a Markov chain.)

You may find the following formula useful:

$$p + m(p+q) + m^2(p+2q) + m^3(p+3q) + ... = \frac{p}{1-m} + \frac{mq}{(1-m)^2} \quad (1)$$