

COMP9334 Revision Questions for Week 5B

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 $1, \dots, N$ interactive users
 - The system response time when there are $1, \dots, N$ 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 throughput 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:

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