COMP9334 Solution to Revision Questions for Week 5B (Question 1 only)

Note that the solution for Question 2 is a in a separate file.

Question 1

(a) The system throughput = Number of completed jobs / measurement time = 36,000/3,600 = 10 jobs per second.

Since service demand = utilisation of the device / system throughput.

The service demands for the CPU, Disk 1, Disk 2 and Disk 3 are respectively, 0.0750, 0.0500, 0.0500 and 0.0250 second.

(b) A sample program is given in *mva_sc.m*.

Note that the MVA algorithm given in the lecture assumes that the think time is zero. Think time can be taken into account by adding a pure delay element. if there is not think time, the system throughput is given by the number of users divided by the system response time (which is basically Little's Law). When there is think time, the system throughput should instead be given by the number of users divided by the sum of the system response time and think time (which is again Little's Law).

(c) The results are plotted in figure 1. We observe that the upper bound that we have derived in Week 2 is indeed correct. It is indeed an upper bound. Moreover, the upper bound seems to be quite accurate.

Remark: It is important to note that the upper bound from operational analysis was derived without making any assumption on the probability distribution of the service time. In other words, the bounds hold even if the probability distribution of service time is not exponential. However, for MVA to apply, the service time has to be exponentially distributed.

(d) If we speed up the CPU by f times, then the new service demand for the CPU will be $\frac{0.075}{f}$. We vary f from 1 to 2 and for each value of f, we compute the new response time using MVA. By plotting how the response time varies with f, we can find the required scaling factor.

The plot of response time is in Figure 2. From the figure, we see that the speed up factor required is about 1.65.

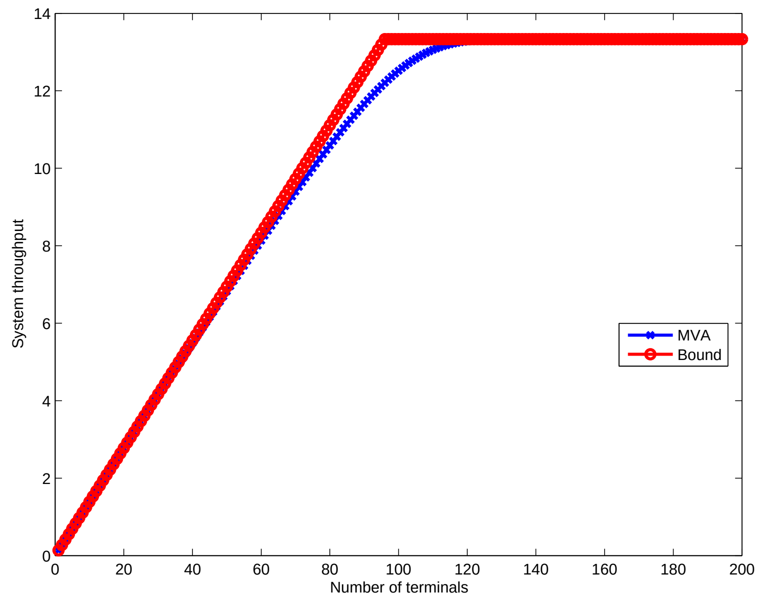

Figure 1: Throughput: MVA versus asymptotic bound.

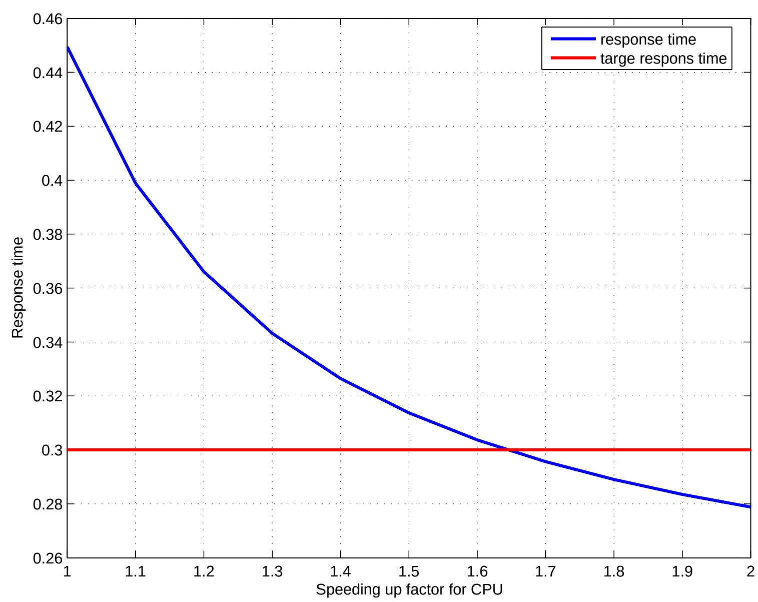

Figure 2: Response time.