

## Computer Science Problem of the Month

October 2007

*The job scheduler is one of the central components of a modern operating system. When programs are trying to access a resource, the job scheduler decides which one will be able to use the resource first, second, third, etc. The problem of finding an optimal schedule is a challenging one, partly because there are several different ways to define "the best schedule". One metric that is commonly used is the sum of completion times. The smaller we can make this sum, the better.*

For instance, suppose we had three jobs to schedule on one CPU. **Job 1** takes 30 seconds. **Job 2** takes 90 seconds. **Job 3** takes 15 seconds. If the sum of completion times is our metric, the optimal schedule is:

On CPU 1:

At time 0: Job 3

At time 15: Job 1

At time 45: Job 2

Since the completion times are 15s for Job 3, plus 45 seconds for Job 1, plus 135 seconds for Job 2, the sum of completion times is 3 minutes and 15 seconds. Any other permutation will result in a slightly larger sum (try it and see!).

We can schedule jobs on more than one processor. To evaluate a multiple-CPU schedule, we find the sum of completion times for the jobs scheduled on each CPU and average these results together.

The table below describes completion times for six programs that must be run on a computer with two CPUs. Find an optimal schedule (there is more than one) for this two-CPU system using the averaged sum of completion times. You should assume that jobs run until they are completed and that while two jobs can run simultaneously on different CPUs, a job cannot be split between CPUs.

<b>Job</b>	<b>Run Time</b>
Job 1	50s
Job 2	60s
Job 3	20s
Job 4	140s
Job 5	10s
Job 6	70s

*This problem also appears at <http://narnia.homeunix.com/~robert/potm.html>*

**Solutions:** While this problem does not count for Cults, I will give a dollar to the first Longwood student who submits a correct solution. Solutions should be e-mailed to [marmorsteinrm@longwood.edu](mailto:marmorsteinrm@longwood.edu) (don't forget to include your name in the e-mail).