IN3200/IN4200 Exercise Set 6

Exercise 1

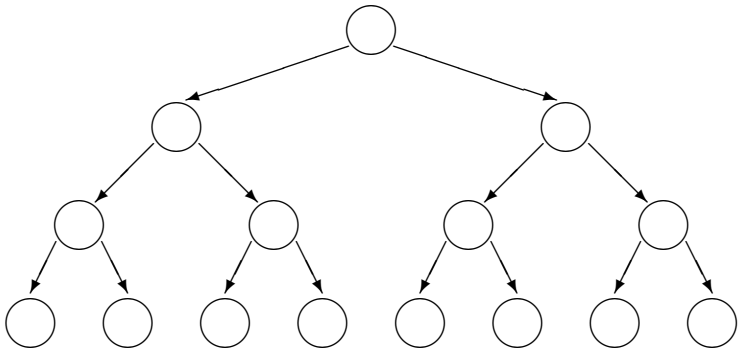
There are n equal-sized independent tasks and p equal workers. Suppose n is not divisible by p. How to divide the n tasks among the p workers in a fair way?

Exercise 2

There are in total 20 independent tasks. These tasks however require different time usages. More specifically, task No. 1 requires one hour's of a worker, task No. 2 requires two hours, task No. 3 requires three hours, and so on. (We assume that it is not possible to let two or more workers collaborate on one task for a faster execution.) If there are two equal workers, how many hours at least do they need to finish all the 20 tasks?

What if there are three equal workers?

Exercise 3



The above figure shows 15 tasks, each taking 10 minutes to be carried out by one worker. (Using more workers on the same task won't save any time.) Each arrow in the above figure means that the task being pointed cannot start before the pointing task has finished. What will be the shortest time for 4 equal workers to finish all the 15 tasks? Repeat the same question for the case of 3 equal workers.

Exercise 4

Suppose there is a 2D rectangular uniform mesh, which has M points in the x-direction and N points in the y-direction. Please describe in detail how to carry out a checkerboard block decomposition of the mesh into $S \times T$ blocks, as evenly as possible. Note that M may not be divisible by S, and N may not be divisible by T.

Exercise 5

If the work assigned to p processors is denoted respectively by W_1, W_2, ..., W_p, we can then define the *load imbalance factor* as

$$\frac{\max_i(W_i) - \min_i(W_i)}{\min_i(W_i)}$$

Suppose a 100×100 matrix is partitioned into $p = S \times T$ rectangular blocks, as evenly as possible. What will the load imbalance factor be, respectively, for the following three processor grids: 8×1, 4×2, and 3×3?