<<< Exam #1 solution >>> -- Fall, 1999

1. winner/loser tree

In winner tree, each node stores the winner of its two children.
When the next match is to be played again between its two children,
you have to find the loser of the previous match. Thus, some time
is wasted.

In loser tree, the loser is stored instead at each node, so
the search is avoided, thus resulting a better performance in practice.

2. external sorting (phase 1)

The run length of simple scheme = m/3
The run length of loser tree scheme = 2k = 2(m - 4b)

2(m - 4b) > m/3.
b < 5m/24

Therefore, 0 < b < 5m/24

3. external sorting (phase 2)

(a) For optimal 4-way merging, we need one dummy run with size 0.

step 1) merge 4 runs with size 0, 500, 800, and 1000
to produce a run with run length 2300.

step 2) merge the run from step 1) and the rest 3 runs.
the resulting run has length 6000 records.

(b)

For step 1),
IO time = 2300/100 * 1 * 2 = 46 (sec)
CPU time = 2300/100 * 1 = 23 (sec)

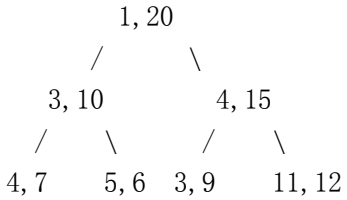
For step 2),
IO time = 6000/100 * 1 * 2 = 120 (sec)

CPU time = 6000/100 * 1 = 60 (sec)

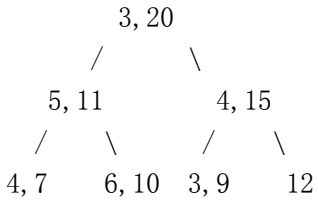
So, the merging takes 46 + 23 + 120 + 60 = 249 (sec).

4. interval tree

(a) insert 20



(b) delete min from (a)



5. leftist tree