Operating Systems
Assignment 3

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Problem 3.1

(a) Fairness in the CFS refers to the distribution of the CPU bandwidth and hence if there are N processes then the each process should have $(100/N)\%$ of CPU time.

(b) When the CFS schedules a task it accumalates virtual runtime. The CFS always picks the task with the least accumulated virtual runtime (vruntime) to schedule. The CFS uses a Red Black Tree (RBT) to maintain information. By balancing the RBT when tasks are inserted into the run queue, the left most node in the RBT will always be the task with the minimum vruntime. Therefore, it can be accessed in $O(1)$. This, along with the fact that inserting and deleting tasks has time complexity $O(log\ n)$, is the reason RBTs are used in the CFS.

(c) The CFS does use time slices to determine the vruntimes of the tasks. The parameters that affect the time calculations are:

1. The *wait_runtime* variable is the accumulated time the current process spent waiting while executing.
2. The *fair_clock* variable that is used by the threads to time how long a process has run for.

(d) Priorities only affect the incrementation on virtual runtime of processes. When a task is scheduled, its vruntime is incremented accordingly by the calculated weight. This means if a process has higher priority, its vruntime will be incremented by a smaller factor thereby increasing its odds of being scheduled in future, and vice versa for lower priorities.