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1. Problem Set

1. Which of the following scheduling algorithms could result in starvation? Explain.
   a. First-come, first-served
   b. Shortest job first
   c. Round robin
   d. Priority

The answer is (b) and (d). For (b), consider a job having large CPU burst. If the following tasks have short CPU burst, then they will have higher priority, which make the job having large CPU burst have no chance to execute. As for (d), it is similar to (b). This time, consider a task having low priority. This task won't get chance to execute unless there is no task having higher priority than it. However, since it has a low priority, it is hard to have the situation that the task is having highest priority, and thus cause the starvation.

2. Consider a system running ten I/O-bound tasks and one CPU-bound task. Assume that the I/O-bound tasks issue an I/O operation once for every millisecond of CPU computing and that each I/O operation takes 10 milliseconds to complete. Also assume that the context-switching overhead is 0.1 millisecond and that all processes are long-running tasks. Describe the CPU utilization for a round-robin scheduler when:
   a. The time quantum is 1 millisecond
   b. The time quantum is 10 milliseconds

For (a), the CPU utilization is 1 / (1 + 0.1) = 0.91 = 91%. This is calculated by (real executing time) / (executing time + context-switch)

For (b) the CPU utilization is 10*1 + 1*10 / 10*(1 + 0.1) + 1*(10 + 0.1) = 0.948 = 94.8%. This is calculated by (IO real executing + CPU real executing time) / [(IO executing time + context-switch) + (CPU executing time + context-switch)]