Operating Systems

Problem Set 3

1. Consider the exponential average formula to predict the length of the next CPU burst. What are the implications of assigning the following values to the parameters used by the algorithm?
    a. $\alpha = 0$, and $\tau_0 = 100$ msec
    b. $\alpha = 0.99$, and $\tau_0 = 10$ msec

2. Consider the following set of processes, with all times specified in milliseconds.

Process	P1	P2	P3	P4	P5
Arrival Time	0	2	4	6	7
Burst Time	4	1	8	4	2

    a. Draw four Gantt charts that illustrate the execution of these processes using the following scheduling algorithms: FCFS, SJF, pre-emptive SJF, and RR (with time quantum = 2).
    b. Compute the average turnaround time and average waiting time for all the cases.

3. Explain the differences in how much the following scheduling algorithms discriminate in favour of short processes:
    a. FCFS
    b. RR
    c. Multi-level feedback queue

4. Consider a preemptive priority scheduling algorithm based on dynamically changing priorities. Larger priority numbers imply higher priority. When a process is waiting for the CPU (in the ready queue), its priority changes at a rate α. When it is running, its priority changes at a rate β. All processes are given a priority of 0 when they enter the ready queue. The parameters α and β can be set to give many different scheduling algorithms.
    a. What is the algorithm that results from $\beta > \alpha > 0$?
    b. What is the algorithm that results from $\alpha > \beta > 0$?

5. An OS implements the Highest Response Ration scheduling policy as follows. Every t seconds, response ratios of all processes are computed. This is followed by scheduling, which selects the process with the highest response ratio. Comment on the performance and overhead of the scheduling policy for large and small values of t.

6. A program contains a single loop that executes 50 times. The loop contains a computation that lasts 50 msec followed by an I/O operation that consumes 200 msec. This program is executed in a time-sharing system with 9 other identical programs. All programs start their execution at the same time. The scheduling overhead of the OS is 3 msec. Compute the response time in the first and subsequent iterations if
    a. The time slice is 50 msec.
    b. The time slice is 20 msec.