CS433 Written Homework 3

(50 points) All question numbers refer to exercises in the textbook (10th edition). Make sure you use the right textbook and answer the right questions. Students must finish written questions individually. Type your answers and necessary steps clearly.

1. **(5 points) 5.11** Of these two types of programs:

   a. I/O-bound

   b. CPU-bound

   which is more likely to have voluntary context switches, and which is more likely to have nonvoluntary context switches? Explain your answer.

2. **(10 points) 5.12.** Discuss how the following pairs of scheduling criteria conflict in certain settings.

   a. CPU utilization (efficiency) and response time
   b. Average turnaround time and maximum waiting time
   c. I/O device utilization and CPU utilization

3. (5 points) 5.15. Consider the exponential average formula used 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 $\tau_0 = 100$ *milliseconds*
   b. $\alpha = 0.99$ and $\tau_0 = 10$ *milliseconds*

4. (10 points) 5.17. Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:

Process	Burst Time	Priority
*P*1	5	4
*P*2	3	1
*P*3	1	2
*P*4	7	2
*P*5	4	3

The processes are assumed to have arrived in the order *P*1, *P*2, *P*3, *P*4, *P*5, all at time 0.

a. Draw four Gantt charts illustrating the execution of these processes using FCFS, SJF, a non-preemptive priority (a larger priority number implies a higher priority), and RR (quantum = 2) scheduling.
b. What is the turnaround time of each process for each of the scheduling algorithms in part a?
c. What is the waiting time of each process for each of the scheduling algorithms in part a?
d. Which of the schedules in part a results in the minimal average waiting time (over all processes)?

5. (10 points) 5.18 The following processes are being scheduled using a preemptive, round-robin scheduling algorithm.

Process	*Priority*	*Burst*	*Arrival*
P1	8	15	0
P2	3	20	0
P3	4	20	20
P4	4	20	25
P5	5	5	45
P6	5	15	55

Each process is assigned a numerical priority, with a higher number indicating a higher relative priority. The scheduler will execute the highest-priority process. For processes with the same priority, a round-robin scheduler will be used with a time quantum of 10 units. If a process is preempted by a higher-priority process, the preempted process is placed at the end of the queue.

a. Show the scheduling order of the processes using a Gantt chart.
b. What is the turnaround time for each process?
c. What is the waiting time for each process?

6. (5 points) 5.20 Which of the following scheduling algorithms could result in starvation?

a. First-come, first-served
b. Shortest job first
c. Round robin
d. Priority

7. (5 points) 5.25 Explain how the following scheduling algorithms discriminate either in favor of or against short processes: a. FCFS b. RR c. Multilevel feedback queues.