COMP 7500/7506 Advanced Operating Systems
Homework 1: CPU Scheduling Algorithms

Points Possible: **100**
Submission via **Canvas**

This is an individual assignment; no collaboration among students. Students shouldn't share any homework solution with any other student. Collaborations among students in any form will be treated as a serious violation of the University's academic integrity code.

Learning Objectives:

- To understand CPU scheduling
- To describe various CPU scheduling algorithms
- To study evaluation criteria for CPU scheduling algorithms

Questions:

1. [30 points] Discuss how the following pairs of scheduling criteria conflict in certain settings.

1.1 [15 points] CPU utilization and response time
1.2. [15 points] Average turnaround time and maximum waiting time

2. [40 points] Consider the following set of processes, with the length of the CPU burst time given in milliseconds. The processes are assumed to have arrived in the order P1, P2, P3, P4, P5, all at time 0.

Process	Burst Time	Priority
P_1	2	2
P_2	1	1
P_3	8	4
P_4	4	2
P_5	5	3

2.1 [10 points] Draw four Gantt charts that illustrate the execution of these processes using the following scheduling algorithms: FCFS, SJF, nonpreemptive priority (a larger priority number implies a higher priority), and RR (quantum = 2).

2.2 [10 points] What is the turnaround time of each process for each of the scheduling algorithms in Question 2.1?

2.3 [10 points] What is the waiting time of each process for each of these scheduling algorithms?

2.4 [10 points] Which of the algorithms results in the minimum average waiting time (over all processes)?

3. [15 points] Which of the following scheduling algorithms could result in starvation? Why?
(1) First-come, first-served
(2) Shortest job first
(3) Round robin
(4) Priority

4. [15 points] 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, but not running), its priority changes at a rate `a`; when it is running, its priority changes at a rate `b`. All processes are given a priority of 0 when they enter the ready queue. The parameters `a` and `b` can be set to give many different scheduling algorithms. What is the algorithm that results from `b` > `a` > 0? Please justify your answer.

Submission:

- Submit your solution as a PDF file named as ““hw1.pdf” through Canvas

Late Submission Penalty:

- Ten percent (10%) penalty per day for late submission. For example, an assignment submitted after the deadline but up to 1 day (24 hours) late can achieve a maximum of 90% of points allocated for the assignment. An assignment submitted after the deadline but up to 2 days (48 hours) late can achieve a maximum of 80% of points allocated for the assignment.
- Assignment submitted more than 3 days (72 hours) after the deadline will not be graded.

Rebuttal period:

- You will be given a period of one week (i.e., 7 days) to read and respond to the comments and grades of your homework or project assignment. The TA may use this opportunity to address any concern and question you have. The TA also may ask for additional information from you regarding your homework or project.