

Homework Assignment 2

CSC 4103 Operating Systems, Spring 2023

Name (Last, First): _____

Due Date: March 7, 2023 (Tuesday)

Instructions: Submit your solutions by the due date on Moodle. Answer all questions completely and concisely. Late submissions will be penalized at the rate of 10% per day late and no more than 3 days late.

Questions (10 points)

1. Describe the differences between process and thread. (1 point)
2. Explain the advantages and disadvantages of user threads and kernel threads. (1 point)
3. 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? (1 point)
 - a. $\alpha = 0$ and $\tau_0 = 100$ milliseconds
 - b. $\alpha = 0.99$ and $\tau_0 = 10$ milliseconds
4. Consider the following set of processes, with the length of the CPU burst time given in milliseconds: $\begin{bmatrix} P_1 \\ P_2 \\ P_3 \\ P_4 \\ P_5 \end{bmatrix}$ (3 points)

<u>Process</u>	<u>Burst Time</u>	<u>Priority</u>
P_1	2	2
P_2	1	1
P_3	8	4
P_4	4	2
P_5	5	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 that illustrate the execution of these processes using the following scheduling algorithms: FCFS, SJF, non-preemptive priority (a larger priority number implies a higher priority), and RR (quantum = 2).
 - b. What is the turnaround time of each process for each of the scheduling algorithms above?
 - c. What is the waiting time of each process for each of these scheduling algorithms?
5. Different synchronization methods have advantages and disadvantages. In the following

scenarios, describe which is a more suitable synchronization method, spinlock or semaphore. Explain the reason for your choice and why the other is not chosen. (2 points)

- a. Increment and decrement a shared 16-bit counter in memory.
- b. Write a message to the log file and use *fsync* to wait for the data written to a magnetic disk.

6. Consider the following snapshot of a system with 5 processes and 4 resource types:

	<u>Allocation</u>	<u>Max</u>	<u>Available</u>
	<i>A B C D</i>	<i>A B C D</i>	<i>A B C D</i>
P_0	0 0 1 2	0 0 1 2	1 5 2 0
P_1	1 0 0 0	1 7 5 0	
P_2	1 3 5 4	2 3 5 6	
P_3	0 6 3 2	0 6 5 2	
P_4	0 0 1 4	0 6 5 6	

Answer the following questions using the banker's algorithm: (2 points)

- a. What is the content of the matrix *Need*?
- b. Is the system in a safe state? If yes, give a sequence of processes for safe execution. If not, explain why.