

## 操作系统作业 3

要求：独立完成，严禁抄袭，按时提交。

提交截止日期：5.14（周日）18:00。

提交方式：提交 PDF 版本，PDF 命名规则为学号\_姓名\_作业 3，比如  
PB210110000\_张三\_作业 3.pdf。

1. What is race condition and how to address it?
2. List all the three requirements of the entry and exit implementation when solving the critical-section problem.
3. For Peterson's solution, prove that it satisfies the three requirements of a solution for the critical section problem. Analyze whether strict alternation satisfies all the requirements.
4. What is deadlock? List the four requirements of deadlock.

5. Consider the following snapshot of a system:

	<u>Allocation</u>	<u>Max</u>
	A B C D	A B C D
$T_0$	1 2 0 2	4 3 1 6
$T_1$	0 1 1 2	2 4 2 4
$T_2$	1 2 4 0	3 6 5 1
$T_3$	1 2 0 1	2 6 2 3
$T_4$	1 0 0 1	3 1 1 2

Using the banker's algorithm, determine whether or not each of the following states is unsafe. If the state is safe, illustrate the order in which the threads may complete. Otherwise, illustrate why the state is unsafe.

- Available = (2, 2, 2, 3)
- Available = (4, 4, 1, 1)
- Available = (3, 0, 1, 4)
- Available = (1, 5, 2, 2)

6. What is semaphore? Explain the functionalities of semaphores.

7. Please use semaphore to provide a deadlock-free solution to address the dining philosopher problem.

8. Consider the following set of processes, with the length of the CPU burst time given in milliseconds:

<u>Process</u>	<u>Burst Time</u>	<u>Priority</u>
$P_1$	10	3
$P_2$	1	1
$P_3$	2	3
$P_4$	1	4
$P_5$	5	2

The processes are assumed to have arrived in the order  $P_1, P_2, P_3, P_4, P_5$ , all at time 0.

- Draw four Gantt charts that illustrate the execution of these processes using the following scheduling algorithms: FCFS, SJF (nonpreemptive), nonpreemptive priority (a smaller priority number implies a higher priority), and RR (quantum = 1).
- What is the turnaround time of each process for each of the scheduling algorithms in part a)?
- What is the waiting time of each process for each of these scheduling algorithms?
- Which of the algorithms results in the minimum average waiting time (over all processes)?
- Illustrate the pros and cons of the algorithms: FCFS, SJF, priority scheduling and RR.

9. Illustrate the key ideas of rate-monotonic scheduling and earliest-deadline-first scheduling. Give an example to illustrate under what circumstances rate-monotonic scheduling is inferior to earliest-deadline-first scheduling in meeting the deadlines associated with processes?