長庚大學107學年度第二學期 電機系博士班資工領域資格考試
科目：作業系統

1. For operating systems, please define a “program” and a “process”. **(5 pts)**

2. To do Inter-Process Communication (IPC), we have two models: Shared Memory IPC and Message Passing IPC. What is the advantage of using Shared Memory IPC? **(10 pts)**

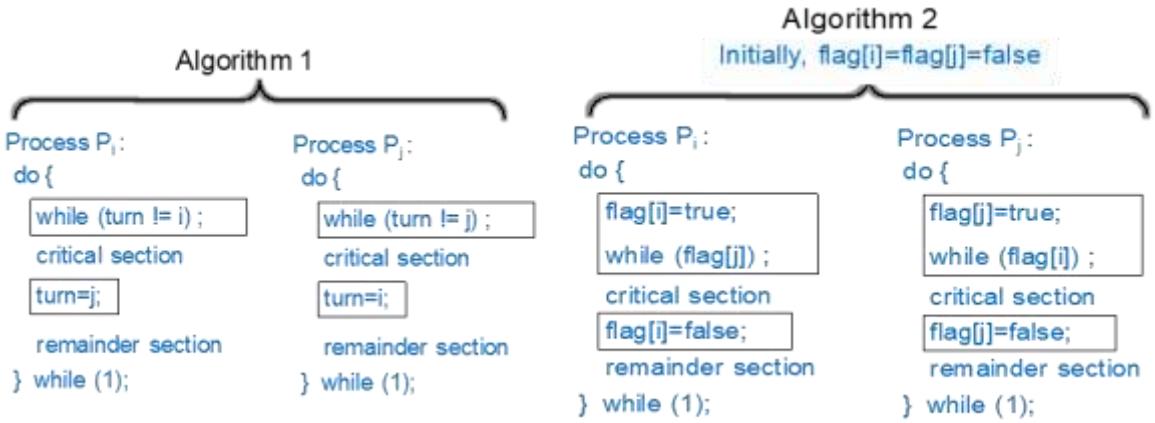
3. For the relationship between user threads and kernel threads, there are three models: Many-to-One, One-to-One, and Many-to-Many. Please explain the Many-to-One model and the One-to-One model. **(5 + 5 pts)**

4. For multiple threads of a process, please explain Thread-Local Storage (TLS). What is the difference between TLS and local variables in a thread? **(5 pts)**

5. For five processes in the ready queue, their arriving order is P_1 first, and then P_2, P_3, P_4, and P_5, and all processes are ready at time 0. The CPU burst time of each process is provided in the following table. Please draw the scheduling results and calculate the average waiting time for the First-Come First-Served (FCFS) and Shortest-Job-First (SJF) schedulers. **(5 + 5 pts)**

Process	Burst Time
P_1	10 ms
P_2	7 ms
P_3	3 ms
P_4	5 ms
P_5	1 ms

6. Let’s help Peterson to revise his algorithms for protecting the critical sections of processes P_i and P_j. Please illustrate the problems of Algorithm 1 and Algorithm 2. **(5 + 5 pts)**



7. Banker's Algorithm is a deadlock avoidance algorithm. Assume that there are 5 processes {P_0, P_1, P_2, P_3, P_4} and three types of shared resources {A, B, C} in the system, and the details are in the following table. (1) By Banker's Algorithm, is the system in a safe state? If your answer is yes, please provide a safe sequence. If your answer is no, please provide a reason. (2) Now, P_0 further has a request (2, 1 , 0) to use 2 more instances of A and 1 more instances of B. Should the request be granted? Again, provide the reason to support your answer. **(5 + 5 pts)**

	Allocation			Max			Need			Available		
	A	B	C	A	B	C	A	B	C	A	B	C
P0	0	1	0	7	5	3	7	4	3	3	3	2
P1	2	0	0	3	2	3	1	2	3			
P2	3	0	2	9	0	2	6	0	0			
P3	2	1	1	2	2	2	0	1	1			
P4	0	0	2	4	3	3	4	3	1			

8. You are asked to explain the concepts of virtual memory systems. Please answer the questions listed below.
   (a) What is virtual address? **(5 pts)**
   (b) What is physical address? **(5 pts)**
   (c) What is memory fragmentation? **(5 pts)**
   (d) What is Translation Look-aside Buffer (TLB)? **(5 pts)**

9. Please define the thrashing problem in operating systems. **(5 pts)**

10. What is the difference between asymmetric encryption and symmetric encryption? **(5 pts)**

11. There is a system with only 3 memory frames. Given a reference string of pages {4→2→0→3→0→3→5→2→0→2→3}. Please illustrate the page replacement of (a) the Least Recently Used (LRU) algorithm and (b) the optimal algorithm. You should show the memory frames and the LRU queue for the LRU algorithm. The explanation for each page replacement of the optimal algorithm should be provided. **(5 + 5 pts)**