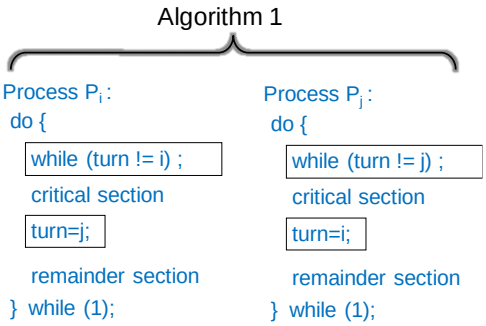
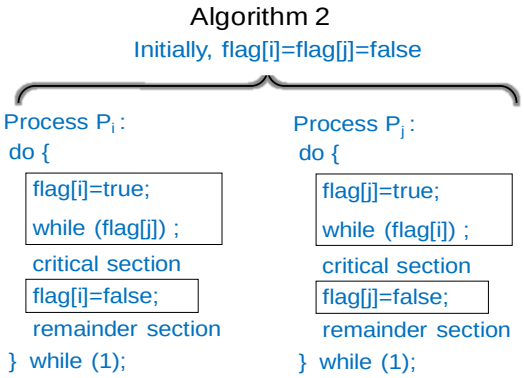
長庚大學111學年度第一學期 資工所博士班資格考試
科目：作業系統

1. (12%) Assume that you are an OS genius and helping Peterson to revise his algorithms for protecting the critical sections of processes P_i and P_j. (1) Please illustrate the problems of Algorithm 1 and Algorithm 2. (6%) (2) Please provide Algorithm 3 which can properly manage the critical sections of P_i and P_j, and make sure that Algorithm 3 can meet the requirements of Mutual Exclusion, Progress, and Bounded Waiting. (6%)





2. (12%) Consider the following processes, assume that the time unit is one millisecond.
(1) Draw the scheduling charts for non-preemptive SJF (shortest job first) scheduling and preemptive SJF, i.e., shortest remaining time first. (6%)
(2) Derive the average waiting time of each scheduling algorithm. (6%)

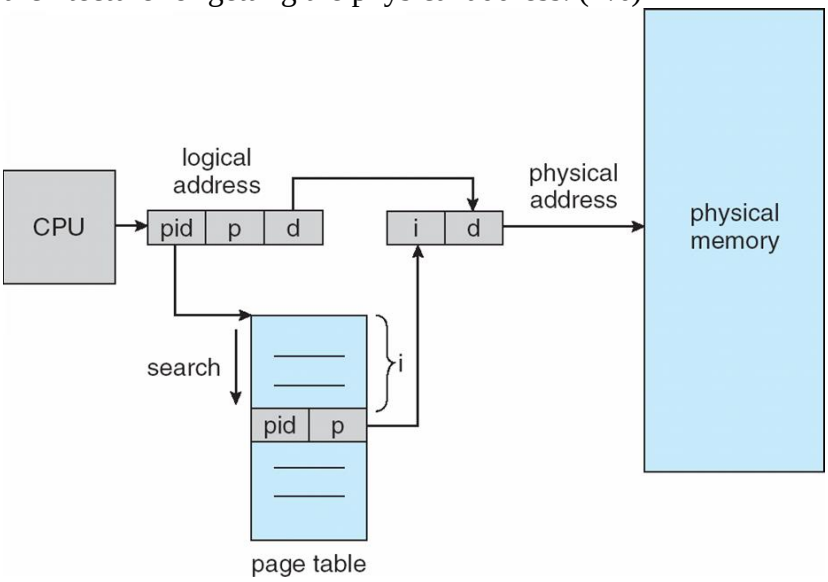
Process	Burst Time (ms)	Ready Time (ms)
P1	2	0
P2	7	1
P3	5	2
P4	1	3
P5	3	4

3. (12%) (1) Please explain the difference between a program and a process. (6%) (2) Please explain the difference between a process and a thread by describing the advantage of multi-threading compared to multi-process programming. (6%)

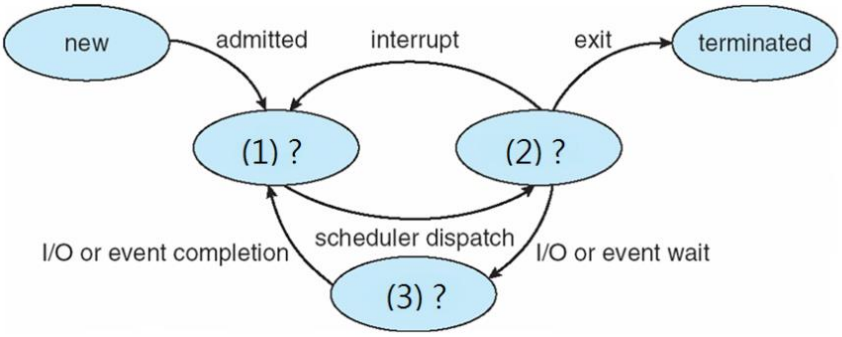
4. (12%) Banker's Algorithm is a deadlock avoidance algorithm. Assume there are 5 processes {P_0, P_1, P_2, P_3, P_4} and three types of shared resources {A, B, C} in the system, and the details are in the following table. (1) By Banker's Algorithm, is the system in a safe state? If your answer is yes, please provide a safe sequence. If your answer is no, please provide the reason. (6%) (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. (6%)

	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			

5. (12%) For the inverted page table architecture, please define the (1) pid, (2) p, (3) d, and (4) i of the following figure. (2% for each) (5) Please briefly explain the mechanism of inverted page table architecture for getting the physical address. (4%)



6. (12%) The possible states of a process are ready, running, and waiting. Please indicate the states of (1), (2), and (3) of the following figure. (4% for each)



7. (12%) There is system with only 3 memory frames. Given a reference string of pages {7→0→0→2→0→3→0→4→1→3→7}. Please illustrate the page replacement of (1) the LRU (least recently used) algorithm (6%) and (2) the optimal algorithm. You should show the memory frames and the queue for the LRU algorithm. (6%) The explanation for each page replacement of the optimal algorithm should be provided.

8. (8%) For operating systems, please define (1) Multiprogramming (4%) and (2) Time Sharing. (4%)

9. (8%) For the scheduling of operating systems, we have the long-term scheduler (or job scheduler) and the short-term scheduler (or CPU scheduler). Please explain (1) the long-term scheduler (4%) and (2) the short-term scheduler. (4%)