長庚大學108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. When Monolithic Kernel is compared with Microkernel, please provide one advantage and one disadvantage of Monolithic Kernel. **(10 pts)**

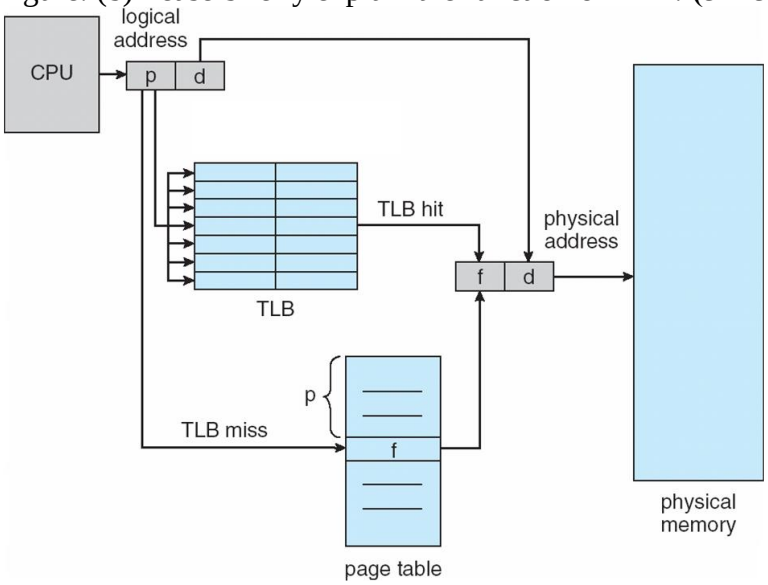
2. Consider a system consisting of ten instances of the same resource that are shared by eight processes, and each process has to use at most two instances during its execution. Please show that the system is deadlock-free. **(10 pts)**

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. Please define the thrashing problem in operating systems. **(10 pts)**

5. There is a system with only 3 memory frames. Given a reference string of pages {5→7→0→3→0→3→5→7→0→7→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)**

6. The following figure shows the paging hardware with TLB. (a)Please define p, d, and f in the figure. (b)Please briefly explain the function of TLB. **(5 + 5 pts)**



7. For the memory management in operating systems, please explain the following terminology:
   (a) External fragmentation **(5 pts)**
   (b) Internal fragmentation **(5 pts)**

8. 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. (a) 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. (b) Now, P_0 further has a request (1, 1 , 0) to use 1 more instance of A and 1 more instance 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	1	0	1	2	4	3	1	4	2			
P2	3	0	2	9	0	2	6	0	0			
P3	0	1	1	0	2	2	0	1	1			
P4	2	1	1	6	4	2	4	3	1			

9. Let's consider the Readers and Writers Problem. We now have two mutex instances, $mutex_1$ and $mutex_2$. Please complete the code of writers and readers. (Hint: you should fill in all [?] with $mutex_1$ or mutex2 in the following sample code.) **(10 pts)**

Writer:

```
wait( ? );
… writing … ;
signal( ? );
```

Reader:

```
wait( ? );
readcount++;
if (readcount == 1) {wait( ? );}
signal( ? );
… reading … ;
wait( ? );
readcount--;
if (readcount== 0) {signal( ? );}
signal( ? );
```

10. For process scheduling, please define the (a) Shortest-Job-First Scheduling and the (b) First-Come First-Served Scheduling. **(5 + 5 pts)**