長庚大學110學年度第一學期 資工所博士班資格考試
科目：作業系統

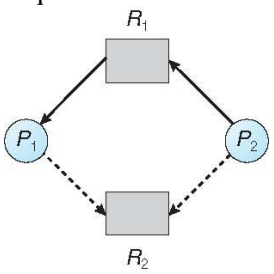
1. (16%) Let's consider the Readers and Writers Problem. We now have two mutex instances, mutex1 and mutex2. Please complete the code of writers and readers. (Hint: you should fill in all [?] with mutex1 or mutex2 in the following sample code.)

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

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

2. (10%) For the resource-allocation graph scheme, we have:
   - Claim edge $Pi \rightarrow R_j$ indicates that process P_i may request resource R_j; represented by a dashed line
   - Claim edge converts to request edge when a process requests a resource
   - Request edge converted to an assignment edge when the resource is allocated to the process
   - When a resource is released by a process, assignment edge reconverts to a claim edge

If we adopt deadlock avoidance to manage the deadlock problem, could we grant the request that P_2 request R_2 with the current situation in the following graph?

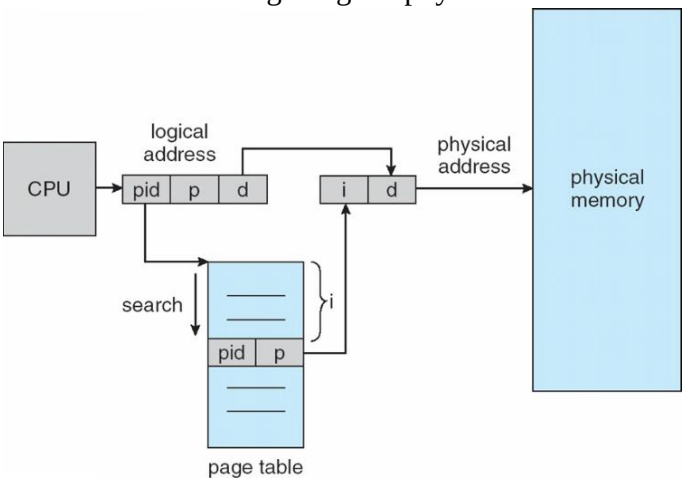


3. (14%) Consider the following processes, assume that the time unit is one millisecond.
   (1) Draw the scheduling charts for non-preemptive SJF (shortest job first) scheduling and preemptive SJF, i.e., shortest remaining time first. (8%)
   (2) Derive the average waiting time of each scheduling algorithm. (6%)

Process	Burst Time (ms)	Ready Time (ms)
P1	4	0
P2	9	1
P3	1	2
P4	1	3
P5	4	4

4. (10%) Copy-on-Write (COW) allows both parent and child processes to initially share the same pages in memory. So, please explain the details of COW.

5. (10%) For the inverted page table architecture, please briefly explain the mechanism of inverted page table architecture for getting the physical address.



6. (10%) Please explain the procedure of using a Remote Procedure Call (RPC).

7. (10%) For the thrashing in operating systems, please answer the following questions:
   (1) What is the cause of thrashing? (2%)
   (2) How does an operating system detect thrashing? (5%)
   (3) Once the system detects thrashing, what can the system do to eliminate this problem? (3%)

8. (10%) Suppose that a disk drive has 5000 cylinders, numbered from 0 to 4999. The drive is currently serving a request at cylinder 1012, and the previous request was at cylinder 1006. The queue of pending requests, in FIFO order, is 86, 1458, 913, 1800, 948, 1509, 1022, 1750, 130. Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for each of the following disk scheduling algorithms? (1) SSTF (2) SCAN

9. (10%) Please explain the difference between a program and a process.