

國立臺北科技大學九十九學年度碩士班招生考試

系所組別：2310 資訊工程系碩士班甲組

第一節 作業系統 試題

第一頁 共二頁

注意事項：

1. 本試題共十三題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. A "multiple readers - single writer" problem is a readers-writers problem in which multiple readers can read the shared data at the same time; however, only one single writer can access the data at one time. Below is a partial implementation of this problem. The program is described by the comments. Please fill the blanks to complete the program. (12% ; (a)8%、(b)2%、(c) 2%)

```
/*
This is an implementation of the multiple readers - single writer problem.
wait(semaphore *) and signal(semaphore *) are semaphore operations.
read_data() and write_data(), defined elsewhere, are functions to read and write
the shared data, respectively.
*/

semaphore mutex_A, mutex_B; /* Both semaphores are initialized to 1. */
int read_count; /* initialized to 0 */

/* The Reader Process */
void reader_process () {
    while (1) {
        /* prepare to read the shared data */
        wait (mutex_A);
        readcount++;
        if (readcount == 1) wait (mutex_B);
        signal (mutex_A)

        /* read the data */
        read_data();

        /* finish reading */
        (a)
    }
}
```

```
/* The Reader Process */
void writer_process () {
    while (1) {
        /* prepare to write the shared data */
        (b)

        /* write the data */
        write_data();

        /* finish writing */
        (c)
    }
}
```

2. Consider the Banker's algorithm. Below shows the system snapshots of a system with three processes P_1 through P_3 and two resource types A and B,

	<u>Allocation</u>	<u>Max</u>	<u>Available</u>
	A B	A B	A B
P_1	0 1	1 2	1 3
P_2	2 0	4 2	
P_3	3 2	5 3	

Please answer the following questions. (a) Is this algorithm a deadlock prevention algorithm, a deadlock avoidance algorithm, or a deadlock detection algorithm? (b) In this algorithm, which of the four deadlock conditions is ensured to not happen by dynamically examining the resource-allocation state? (c) What is the initial content of the matrix *Need*? (d) What are the initial contents of the *Work* and *Finish* vectors of the safety algorithm? (e) Is the system in a safe state? Please explain.

(12% ; (a) 、(b) 、(c) 、(e)2% for each , (d)4%)

3. Suppose we have a disk with 512 cylinders, and the disk is currently at cylinder 110 (and has previously just processed a request for cylinder 100) and the disk queue contains read/write requests for sectors on cylinders 84, 302, 103, 96. How far (or, how many movements) must the head travel to satisfy the requests in the queue for the (a) FCFS, (b) SSTF, (c) SCAN, and (d) C-LOOK scheduling algorithms, respectively?

(12% ; 3% for each)

注意：背面尚有試題

4. The following statements are descriptions about the file management. However, two of them are incorrect. Please identify and correct these two statements. (6%)
- (a) The inode in UNIX is a variation of the indexed allocation method.
 - (b) A unified buffer cache uses the same page cache to cache both memory-mapped pages and ordinary file system I/O.
 - (c) The contiguous allocation algorithm suffers from the problems of internal fragmentation and size declaration.
 - (d) One of the advantages of the structured file systems is that if the file system crashes, all remaining transactions in the log do not need to be performed again.
5. What are the detriments of microkernel? (3%)
6. Suppose you are writing a program which needs to process more than one I/O events. For example, the program needs to get input data from the keyboard and a socket port at the same time. List two methods to solve this problem. (6%)
7. Answer the following questions regarding process scheduling.
- (1) Describe the differences among short-term, medium-term, and long-term scheduling. (6%)
- (2) Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:

Process	Arrival Time	Burst Time
P1	0	8
P2	1	4
P3	2	9
P4	3	5

The processes are assumed to arrive at the ready queue at the times shown, and need the indicated burst times, answer the questions using the following scheduling algorithms: preemptive shortest-job-first (SJF), and first-come first-served (FCFS) scheduling. (8%)

- (a) What is the turnaround time of each process for each of the scheduling algorithms? (4%)
- (b) What is the waiting time of each process for each of the scheduling algorithms? (4%)

8. Among the following descriptions about multithreading, please indicate whether each statement is true or false. If a statement is incorrect, please correct it. (8%)
- (a) Multithreaded programs can always provide better performance than a single-threaded solution. (2%)
 - (b) A multithreaded program using multiple user-level threads achieves better performance on a multiprocessor system than on a single-processor system. (2%)
 - (c) Linux does not distinguish between processes and threads. (2%)
 - (d) A multithreaded program using multiple kernel threads can provide better performance than a single-threaded program on a single-processor system. (2%)
9. Assume we have a demand-paged memory. The page table is held in registers. It takes 8 milliseconds to service a page fault if an empty page is available. Memory access time is 200 nanoseconds. What is the maximum acceptable page-fault rate if we want performance degradation (of effective access time) to be less than 10 percent? (4%)
10. Among the following statements about memory management, please indicate whether each statement is true or false. If a statement is incorrect, please correct it. (8%)
- (a) Pure paging avoids the problem of external fragmentation. (2%)
 - (b) Pure segmentation requires more memory overhead than pure paging to maintain the address translation structures. (2%)
 - (c) Pure segmentation has the problem of internal fragmentation. (2%)
 - (d) Both pure paging and pure segmentation have the ability to share code across processes. (2%)
11. Consider the following page reference string:
- 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6.
- How many page faults would occur for the following page-replacement algorithms assuming a memory with four page frames? Please show the process of page replacement in details. (Note: Remember that all frames are initially empty, so your first unique pages will cost one fault each.) (8%)
- (a) LRU (Least-Recently Used) (4%)
 - (b) Optimal (4%)
12. What is the difference between location-transparent and location-independent DFS (distributed file system)? (3%)
13. What is the most important characteristic of a real-time system? What are the differences between hard and soft real-time systems? (4%)