

科目：作業系統 A

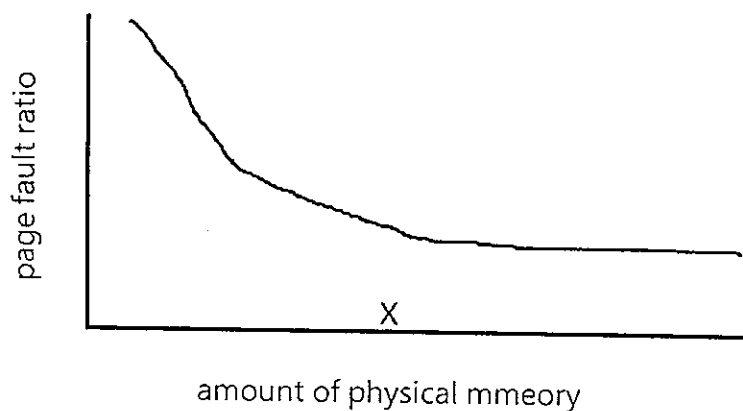
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* 請將答案依題號順序寫入答案卷

答題時字跡需工整，否則不予計分。Write your answers legibly; otherwise you will get zero score.

1. [10 pts] What is Belady's Anomaly? Demonstrate an example of it.
2. [10 pts] The figure below shows the page fault ratio of a typical system. The page fault ratio drops as the amount of physical memory increases, and the marginal gain becomes very small beyond a certain amount of memory, e.g., X in this example. Explain why.



3. [10 pts] What are the advantages (show at least two) of the multilevel page table design compared to the single-level page table design?
4. [10 pts] Consider the following design parameters: A file sever operates under a very high writing rate on random files, and the written files are very small. The sever is equipped with a very large amount of DRAM as the disk cache. The storage device is a conventional hard disk. Among the following file systems, which one is the better choice for the sever in terms of I/O performance? Why?
 - (a) FAT
 - (b) Unix File System
 - (c) NILFS2 (a log-structured file system)
5. [10 pts] Explain what is a one-way function, and how it provides data security.

◎請用深黑色鋼筆或原子筆出題

命題老師簽名：

科目：作業系統 B

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請“✓”明 ✓不可看書 可看書

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答題時字跡需工整，否則不予計分。Write your answers legibly; otherwise you will get zero score.

1. [10pts] Many of the operating system features (e.g., the user interface, file systems, etc.) can possibly be implemented in the kernel or as user-level services. Please discuss the trade-offs in the following aspects
- (a). System reliability
 - (b). System performance
 - (c). System security
 - (d). The cost of performing system updates
2. Given a system with
3 processes $P_0 \sim P_2$
3 resource types: A (9 instances), B (6 instances), and C (8 instances)
Resource allocation snapshot at time t_0 :

| | Allocation | | | Max | | | Available | | |
|-------|------------|---|---|-----|---|---|-----------|---|---|
| | A | B | C | A | B | C | A | B | C |
| P_0 | 2 | 2 | 2 | 7 | 4 | 5 | 4 | 0 | 1 |
| P_1 | 1 | 2 | 2 | 3 | 4 | 2 | | | |
| P_2 | 2 | 2 | 3 | 2 | 2 | 3 | | | |

[10pts] According to Banker's algorithm, is the system in a safe state? If yes, please give the process execution sequence that will satisfy the safety criteria. If not, please provide your reasoning.

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3. [10pts] Suppose a program consists of three threads $Thread_1$, $Thread_2$, $Thread_3$, and a shared counter, $count$ as shown below:

```
int count = 10;
Semaphore Lock = 1; //initial value is 1

Thread1(...)      Thread2(...)      Thread3(...)
{
    do something
    Lock.Wait();
    count++;
    Lock.Signal();
}
{
    do something
    Lock.Wait();
    count--;
    Lock.Signal();
}
{
    // do something
    Lock.Wait();
    printf("%d", count);
    Lock.Signal();
}
```

List all possible screen outputs of this program.

4. [10pts] Can we use spinlock to substitute the use of mutex in concurrent programming? What are the trade-offs?
5. [10pts] Compare the pros and cons of paging vs. segmentation in memory management in the following aspects:
- (a). Hardware implementation complexity
 - (b). Overhead of bookkeeping structures
 - (c). Possibility of internal fragmentation
 - (d). Possibility of external fragmentation