

科目：作業系統 A

日期：106 年 7 月 27 日 第 1 頁 共 1 頁

請“✓”明      ✓不可看書      可看書

\* 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%) Consider a computer system that has cache memory, main memory (RAM) and disk, and an operating system that uses virtual memory. It takes 2 nsec to access a word from the cache, 10 nsec to access a word from the RAM, and 10 ms to access a word from the disk. If the cache hit rate is 95% and main memory hit rate (after a cache miss) is 99%, what is the average time to access a word?
2. (5%) Consider a multiprogrammed system with degree of 5 (i.e., five programs in memory at the same time). Assume that each process spends 40% of its time waiting for I/O. What will be the CPU utilization?
3. (5%) Multiple jobs can run in parallel and finish faster than if they had run sequentially. Suppose that two jobs, each needing 20 minutes of CPU time, start simultaneously. How long if they run in parallel? Assume 50% I/O wait.
4. (5%) Consider the following piece of C code:  

```
void main( ) {  
    fork( );  
    fork( );  
    exit( );  
}
```

How many processes are created upon execution of this program
5. (5%) Round-robin schedulers normally maintain a list of all runnable processes, with each process occurring exactly once in the list. What would happen if a process occurred twice in the list? Can you think of any reason for allowing this?
6. (10%) Measurements of a certain system have shown that the average process runs for a time  $T$  before blocking on I/O. A process switch requires a time  $S$ , which is effectively wasted (overhead). For round-robin scheduling with quantum  $Q$ , give a formula for the CPU efficiency for each of the following:  
(a)  $Q = \infty$   
(b)  $Q > T$   
(c)  $S < Q < T$   
(d)  $Q = S$   
(e)  $Q$  nearly 0
7. (10%) If FIFO page replacement is used with four page frames and eight pages, how many page faults will occur with the reference string 0172327103 if the four frames are initially empty? Now repeat this problem for LRU.

◎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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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 thrashing? How might it be detected? How might one recover from it once detected?
2. Please answer the following questions regarding the comparison among three file system allocation methods: *index-based allocation*, *linked allocation*, and *extent-based allocation*. You have to justify your answers by giving the reasons.
  - (a) (5 pts) For reading a random location in a big file, which of the three allocation methods is the least efficient choice?
  - (b) (5 pts) If you are to design a file system for an append-only medium, such as DVD+R or BD-R discs, which of the three file allocation methods is the best choice if you want *high-throughput sequential access* (e.g. for streaming a video from the disc) and *efficient space utilization* when storing many files in the filesystem?
3. (10 pts) What is the main reason for an operating system to support non-blocking operations on Input/Output devices? How are they synchronized with the program performing the I/O?
4. (10 pts) Explain the advantages and disadvantages of interrupt-driven I/O and polling-based I/O respectively.
5. (10 pts) If we want to minimize the impact of software bugs and vulnerabilities in the OS itself, would it be better to go with a microkernel or a monolithic kernel? Explain your reasons clearly.

◎請用深黑色鋼筆或原子筆出題

命題老師簽名：