

國立臺灣科技大學  
九十四學年度碩士班招生考試試題

系所組別：資訊工程系碩士班  
科 目：作業系統

總分 100 分。

1. Two processes,  $A$  and  $B$ , each need three records, 1, 2, and 3, in a database. If  $A$  asks for them in the order 1, 2, 3, and  $B$  asks for them in the order 3, 2, 1, then deadlock is possible. Consider using two-phase locking. (a) Will the possibility of deadlock be eliminated by using two-phase locking? (b) Does it have any other undesirable characteristics? Explain why. (10%)
2. Suppose that a computer can read or write a memory word of 4 bytes in 8 nsec. Also suppose that when an interrupt occurs, all 64 CPU registers, plus the program status word and program counter, are pushed onto the stack. What is the maximum number of interrupts per second this machine can process? (10%)
3. A typical printed page of text contains 50 lines of 80 characters each. Imagine that a certain printer can print 12 pages per minute and that the time to write a character to the printer's output register can be ignored. If you run this printer using interrupt-driven I/O and each character printed requires an interrupt that takes 50 microsec to service, what percentage of the CPU time does the interrupt overhead cost? (10%)
4. The reliability of a hard-disk drive is typically described in terms of a quantity called mean time between failures (MTBF), which is actually measured in drive-hours per failure.
  - (a) If a system contains 100 disk drives, each of which has an 800,000-hour MTBF, which of the following best describes how often a drive failure will occur in that disk farm: once per thousand years, once per century, once per decade, once per year, once per month, once per week, once per day, once per hour, once per minute, or once per second?
  - (b) The manufacturer guarantees a 2-million-hour MTBF for a certain model of disk drive. What can you conclude about the number of years for which one of these drives is under warranty? (10%)

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- 5(a). Message-passing is often used in inter-processes communication. Messages may be sent in blocking or non-blocking modes. Similarly, messages may be received in one of the two modes. Which combination of sending and receiving modes is a rendezvous? (5%)
- 5(b). A benefit of multi-threading is that context-switching among the threads of a process is more time saving. Why this benefit can be obtained from a multi-threaded process? (5%)
6. During the course of execution, a process may create several new processes via create-process system calls such as *fork()* and *exec()*. The created processes are called children processes whereas the original one is called the parent. For efficient utilization of resources, the operating system will try to free the resources occupied by a dead process immediately.
- (a) In some circumstances, a child process is found to be dead but its resources (e.g. occupied main memory) cannot be freed immediately, i.e. a so called zombie process. Why a dead process may become a zombie process? (4%)
- (b) When a process generates a hardware trap, it will be forced to terminate no matter it is a parent or child process. Give two possible types of hardware traps that may be generated. (6%)
7. If a priority-scheduling algorithm is used for CPU scheduling, some low-priority processes may be left in waiting indefinitely for the CPU, i.e. starvation. More detailed, in a heavily loaded computer system, a steady stream of high-priority processes can prevent a low-priority process from ever getting the CPU. Finally, one of two things will happen. Either the process will eventually be run, or the computer system will crash and lose all unfinished low-priority processes.
- (a) Process aging is a solution to this problem of starvation. What is the technique of process aging? (5%)
- (b) Priority-scheduling is often used to implement soft real-time functionality, i.e. giving a real-time process the highest priority. However, the dispatch latency and response time of a real-time process can still not be guaranteed. What is the key cause? (5%)

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8. From what given below, pick up the memory management technologies that may be implemented even without operation system support. (8%)
  - a) paging
  - b) demand paging
  - c) multilevel queue scheduling
  - d) swapping
  - e) mirroring
  - f) overlay
  - g) dynamical loading
  - h) dynamical linking
9. The following steps describe part of a scenario how demand paging MMU operates to handling page-fault trap. Reorder them in the correct sequence and give your answer in step numbers like "a, b, c, d, e, f". (12%)
  - a) TLB miss happened.
  - b) Look up the frame table and found a free frame.
  - c) Make sure it's a valid reference, so don't trap OS for terminating process.
  - d) Schedule a disk read operation.
  - e) Reload the trapped instruction into registers.
  - f) Update process control block and page table.
10. Link is an effective approach to construct acyclic-graph directory structure from tree structure base. Explain the difference between symbolic link and non-symbolic link (hard link): (10%)
  - a) Do they have their own inodes in UNIX/Linux implementation?
  - b) When they are deleted, will the linked files erased too?
  - c) Which one of them suffers dangling pointer problem? How a dangling point happens?

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