國立交通大學 95 學年度碩士班考試入學試題

：作業系統(1005)　　　　考試日期：95 年 3 月 12 日 第 3 節
系所班別：資訊學院聯招　　組別：資訊聯招　　　第 1 頁,共 3 頁
＊＊作答前請先核對試題、答案卷(試卷)與准考證之所組別與考科是否相符!

共有八題,請按題號依序作答,未按題號作答者不予計分。

1. (10%) Multi-threaded processes are supported by most modern operating systems. Please briefly describe the benefits of multithreaded programming compared to using multiple processes.

2. (15%) Three processes Pa, Pb, Pc arrive at the ready queue of a single-processor system at 0, 3, 4 (time unit). Their execution state sequences are as follows:
   - Pa: CPU burst (5 time units)→ I/O burst (5 time units)→ CPU burst (4 time units)
   - Pb: CPU burst (6 time units)
   - Pc: CPU burst (3 time units)→ I/O burst (2 time units)→ CPU burst (2 time units) →I/O burst (4 time units)→ CPU burst (3 time units)

   Assumed that there're sufficient I/O devices and processes re-enter the ready queue immediately after I/O execution.
   (a). Please draw the Gantt chart of the First-Come, First-Serve CPU scheduling algorithm.
   (b). Please draw the Gantt chart of the Round-Robin CPU scheduling algorithm (the time quantum = 4)

3. (10%) Please draw a figure or a flow chart to describe the life cycle of an interrupt-based I/O request. The figure or the flow chart needs to cover the procedures in user process, I/O subsystem and device driver in an operating system, and device controller. Also, draw a figure or a flow chart to describe the life cycle of a DMA-based I/O request. The figure or the flow chart needs to cover the procedures in user process, I/O subsystem and device driver in an operating system, DMA controller, memory, and device controller.

4. (15%) An IDE hard disk spins at 7200 RPM, has 2 megabytes internal cache, 5000 cylinders, 20 tracks per cylinder, 120 sectors per track, 512 bytes per sector, and connects to a computer via Ultra ATA/133 interface at a speed of 133 megabytes per second.
   (a). Calculate the disk size.
   (b). Estimate the sustained transfer rate of this drive in megabytes per second.
   (c). Suppose that the average seek time for the drive is 4 milliseconds. Estimate the I/Os per second and the effective transfer rate for a random-access workload that reads individual sectors scattered across the disk.

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(d). Calculate the random-access I/Os per second and transfer rate for I/O sizes of 4KB, 8KB and 16KB.

(e). If the hard disk connects to a computer via USB 1.0, 1.1 and 2.0 at speeds of 1.5, 12 and 480 Megabits per second respectively, please estimate the sustained transfer rates of this drive via different USB interfaces from a device driver point of view.

5. (a). (3%) What is a race condition?

(b). (9%) Please explain the concept of priority inversion. How to prevent it from happening? Can the problem happen with user-level thread? Why or why not?

6. (a). (7%) To handle deadlock prevention, please describe two protocols to prevent hold and wait condition (please also discuss disadvantages about the above protocols), and one protocol to prevent circular wait condition (please prove the protocol will ensure no circular-wait).

(b). (6%) A system has four processes and five allocateable resources. The current allocation and maximum needs are as follows:

	Allocation	Maximum	Available
Process A	1 0 2 1 1	1 1 2 1 3	0 0 x 1 1
Process B	2 0 1 1 0	2 2 2 1 0	
Process C	1 1 0 1 0	2 1 4 1 0	
Process D	1 1 1 1 0	1 1 2 2 1	

What is the smallest value of x for which this is a safe state?

7. (10%) Most systems allow programs to allocate more memory to its address space during execution. Data allocated in the heap segments of programs is an example of such allocated memory. What is required to support dynamic memory allocation in the following schemes:

(a). contiguous-memory allocation

(b). pure segmentation

(c). pure paging

8. (15%) An operating system uses a FIFO replacement algorithm for resident pages and a free-frame pool of recently used pages. Assume that the free-frame pool is managed using the least recently used replacement policy. Answer the following questions:

(a). If a page fault occurs and if the page does not exist in the free-frame pool, how

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is free space generated for the newly requested page?

(b). If a page fault occurs and if the page exists in the free-frame pool, how is the resident page set and the free-frame pool managed to make space for the requested page?

(c). What does the system degenerate to if the number of resident pages is set to one?

(d). What does the system degenerate to if the number of pages in the free-frame pool is zero?