國　立　清　華　大　學　命　題　紙

九十三學年度 通訊工程研究所 系（所） 組碩士班入學考試

科目 計算机系統 科號 3404 共 2 頁第 1 頁 *請在試卷【答案卷】內作答

1. (6%) Discuss three major complications that concurrent processing adds to an operating system.

2. (4%) Define the difference between preemptive and nonpreemptive scheduling in CPU scheduling.

3. (5%) Consider a paging system with the page table stored in memory.
   (a) If a memory reference takes 100 nanoseconds, how long does a paged memory reference take? Justify your answer.
   (b) If we add associative registers, and 75 percent of all page-table references are found in the associative registers, what is the effective memory reference time? Justify your answer. (Assume that finding a page-table entry in the associative registers takes zero time, if the entry is there.)

4. (5%) Consider a system where free space is kept in a free-space list.
   (a) Suppose that the pointer to the free-space list is lost. Can the system reconstruct the free-space list? Justify your answer.
   (b) Suggest a scheme to ensure that the pointer is never lost as a result of memory failure.

5. (5%) How does DMA increase system concurrency? How does it complicate hardware design?

6. (8%) Suppose that a disk drive has 5000 cylinders, numbered from 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is

   86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130

   Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for each of the following disk scheduling algorithms?
   (a) FCFS
   (b) SSTF
   (c) SCAN
   (d) LOOK

7. (8%) Describe why an application developer may choose to run an application over UDP rather than TCP.

8. (9%) Compare the differences of using multiprocessor systems and distributed systems for parallel computation in various aspects such as programming, execution, performance, applications, and etc.

9. (8%) Discuss the tradeoffs between data migration and computation migration in distributed systems.

10. (9%) Describe three approaches for mutual exclusion in distributed systems.

11. (16 points) There are six relative conditions between the values of two registers. In this problem we consider two of them. Assuming that variable `i` corresponds to register $19 and variable `j` to $20, show the MIPS code for the conditions corresponding to the following two C codes:

    (a) `if (i == j) goto L1;`

    (b) `if (i < j) goto L1;`

12. (10 points) Consider a virtual memory system with the following properties:

    - 40-bit virtual address
    - 16 KB pages
    - 36-bit physical address

    Assume that the valid, protection, dirty, and use bits take a total of 4 bits and that all the virtual pages are in use. Assume that disk addresses are not stored in the page table. What is the total size of the page table for each process on this machine?

13. (7 points) Assume that a hard disk in a computer transfers data in one-work chunks and can transfer at 2 MB/sec. Assume that no transfer can be missed. Assume that the number of clock cycles for polling operation is 100 and that the processor executes with a 50-MHz clock. Determine the fraction of CPU time consumed by the hard disk assuming that you poll often enough so that no data is ever lost.