國立中山大學資訊工程學系

１０３學年度第１學期博士班資格考試　作業系統

INSTRUCTIONS: *If any question is unclear or you believe some assumptions need to be made, state your assumptions clearly at the beginning of your answer.*

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1. Assume a page reference string for a process with m frames (initially all empty). The page reference string has length p with q distinct page numbers occurring in it. For any page-replacement algorithms,

   (a) (10%) What is an upper bound on the number of page faults? **Justify your answer for credit.**

   (b) (10%) What is a lower bound on the number of page faults? **Justify your answer for credit.**

2. Given an i-node with ten direct blocks and four levels of indirect blocks and assuming that the sizes of a pointer and a block are, respectively, 8 bytes and 8 Kbytes,

   (a) (10%) What would be the size of the smallest file allowed in bytes?

   (b) (10%) What would be the size of the largest file allowed in bytes?

3. (20%) A disk has 10000 cylinders, each with 16 tracks of 512 blocks. A seek takes 1 ms per cylinder moved. If no attempt is made to put the blocks of a file close to each other, two blocks that are logically consecutive (i.e., follow one another in the file) will require an average seek, which takes 6 ms. If, however, the operating system makes an attempt to cluster related blocks, the mean interblock distance can be reduced to 2 cylinders and the seek time reduced to 200 μs. How long does it take to read a 200 block file in both cases, if the rotational latency is 10 ms and the transfer time is 20 μs per block?

4. (10%) A computer whose processes have 1024 pages in their address spaces keeps its page tables in memory. The overhead required for reading a word from the page table is 600 nsec. To reduce this overhead, the computer has a TLB, which holds 32 (page, frame) pairs and can do a lookup in 100 nsec. What hit rate is needed to reduce the mean overhead to 200 nsec?

5. (10%) A machine has 48-bit virtual addresses and 32-bit physical addresses. Pages are 8 KB. How many entries are needed for the page table?

6. (10%) Consider the interprocess-communication scheme where mailboxes are used. Suppose a process P wants to wait for two messages, one from mailbox A and one from mailbox B. What sequence of `send` and `receive` should it execute so that the messages can be received in any order?

7. (10%) Explain what are returned by the `fork` system call on Unix and its variants on success?