

國立中山大學資訊工程學系
104學年度第1學期博士班資格考試

科目：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.*

1. (10%) A computer has 4 GB of RAM allocated in units of 4 KB. How many KB are needed if a bit map is used to keep track of free memory?
2. (10%) A machine has 48-bit virtual addresses and 32-bit physical addresses. Pages are 4 KB. How many entries are needed for the page table?
3. (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 or less?
4. (10%) A small computer has 8 page frames, each containing a page. The page frames contain virtual pages *A, C, G, H, B, L, N*, and *D* in that order. Their respective load times were 18, 23, 5, 7, 32, 19, 3, and 8. Their reference bits are 1, 0, 1, 1, 0, 1, 1, and 1 and their modified bits are 1, 1, 1, 0, 0, 0, 1, and 1, respectively. Which page will the second chance page replacement algorithm replace?
5. A disk has 12000 cylinders, each with 10 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 μ s. Assuming that the rotational latency is 3 ms and the transfer time is 15 μ s per block, answer the following questions.
 - (a) (10%) How long does it take to read a 200 block randomly placed file?
 - (b) (10%) How long does it take to read a 200 block clustered file?
6. Given a UNIX *i*-node with ten direct blocks and three levels of indirect blocks (i.e., a single, a double, and a triple) and assuming that the sizes of a pointer and a block are, respectively, 4 bytes and 4 Kbytes, answer the following questions.
 - (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?
7. Assume a page reference string for a process with m frames (initially all empty). The page reference string has length n with p distinct page numbers occurring in it. For any page-replacement algorithms,
 - (a) (10%) What is a lower bound on the number of page faults? **Justify your answer for credit.**
 - (b) (10%) What is an upper bound on the number of page faults? **Justify your answer for credit.**