長庚大學113學年度第二學期作業系統實務期中測驗(總分108) <<請依題號順序作答,跳號作答不予計分,跳號作答不予計分,跳號作答不予計分>>>

系級: 姓名: 學號:

- (8%) For the total cost of a product line, we have to consider the Non-Recurring Engineering (NRE) cost and the unit cost. (a) Please define the NRE cost and the unit cost. (b) Now, you are a project manager developing a product with an extremely large number of copies. Which one between the NRE cost and the unit cost is more important for reducing the total cost? You must provide some reason to support your answer.
- Answer: (a) NRE cost: the one-time monetary cost of designing the system. Unit cost: the monetary cost of manufacturing each copy of the system.

(b) Reducing the unit cost is more important. Since the number of copies of the product is big, the cost of the copies could be much higher than the NRE cost.

2. (8%) Please refer to the following figure. There are already some tables of opened files for processes. Why do we need the System Open File Table?



Answer: The system open file table maintains the information of each opened file in the operating system, e.g., the number processes using the file, read/write synchronization and protection issues.

- 3. (8%) Directory designs are an important issue in file systems. (a) What is the difference between Tree-Structured Directories and Acyclic-Graph Directories? (b) What is the difference between Acyclic-Graph Directories and General-Graph Directories?
- Answer: (a) Based on a tree structure, Acyclic-Graph Directories further allows the sharing of files without having any cycle in the directory structure.(b) General-Graph Directories further allows the links to make some cycles.
- 4. (12%) (a) How many i-nodes will be used if we create a file and create 3 hard links to the file? (b) How many i-nodes will be used if we create a file and create 3 symbolic links to the file? (c) For the following figure, can we access /usr/joe/foo after removing /usr/sue/bar? The reasons have to be provided to support your answer for each question.



Answer: (a) 1 i-node. Creating the file uses an i-node, and the 3 hard links share the i-node.
(b) 4 i-nodes. Creating the file uses an i-node, and the 3 symbolic links use another 3 i-nodes.
(c) Yes, the symbolic link is removed, but the original file still exists.

- (8%) There are three basic methods of file allocation, i.e., Contiguous Allocation, Linked Allocation, and Indexed Allocation. (a) Please answer that the FAT file system is developed on which type of allocation? (b) How does FAT do to reduce the cost of random reads and writes?
- Answer: (a) Basically, FAT is a kind of linked allocation.(b) FAT separates the pointers of linked lists and the data in two different areas. The pointers are collected in the file allocation table for quickly finding out all pointers of a linked list.
- 6. (8%) For free space manage management of file systems, please explain (a) the Linked List approach with the Grouping method and (b) the Linked List approach with the Counting method.
- Answer: (a) The first free block keep the address of the next n-1 free blocks and a pointer to next block that contains free-block-pointers (like this one).(b) The first block of a sequence of free blocks will keep the number of the free blocks in the sequence and the pointer to the first block of the next sequence of free blocks.
- 7. (8%) Considering the disk scheduling, let a disk drive consist of 100 cylinders, from cylinder 0 to cylinder 99. Assume that the read-write head is now at cylinder 20 and moving toward cylinder 99. Now, there are multiple read/write requests (to be served) in the disk I/O queue, and no more request will arrive. The queued requests are at the following cylinders: 2, 15, 16, 21, 25, 68, 74, 89. Please illustrate the scheduling results of (a) the SSTF scheduling and (b) the C-LOOK scheduling.
- Answer: SSTF: 21, 25, 16, 15, 2, 68, 74, 89 C-LOOK: 21, 25, 68, 74, 89, 2, 15, 16
- 8. (12%) Please explain (a) RAID 1. Assume we use two hard disk drives to run a RAID 1, where for each disk, the mean time to failure is 10,000 hours, and the mean time to repair is 100 hours. (b) Please derive the mean time to data loss. (c) What is the difference between RAID 4 and RAID 5? Answer: (a) Mirroring or shadowing keeps duplicate of each disk
 - (d) Mintofing of shadowing keeps dupneate of each disk
 (b) Mean time to failure of any of the two disks: 10,000/2 = 5,000
 The possibility for another disk to fail within the 100 hours: 100/10,000 = 1/100
 Mean time to data loss is 5,000 / (1/100) = 500,000 hours
 (c) RAID 4 keeps the parity in one hard disk drives, and RAID 5 distributes the parity to all hard disk drives so as to balance the workload of parity writes
- 9. (12%) Please carefully define the concepts of (a) Buffering, (b) Caching, and (c) Spooling.
- Answer: (a) Buffering: Buffering is to store data in some intermediate devices, such as DRAM, while the data are transferring between devices. It can be used to cope with some problems of the device speed mismatch and the device transfer size mismatch.
 (b) Cashing: A casha is a ration of fast memory that holds carries of data. The difference

(b) Caching: A cache is a region of fast memory that holds copies of data. The difference between a buffer and a cache is that a buffer may hold the only existing copy of a data item, whereas a cache, by definition, holds a copy on faster storage of an item that resides elsewhere.(c) Spooling: A spool is a buffer that holds multiple outputs for a device, such as a printer, that cannot accept interleaved data streams.

- 10. (8%) To implement the access matrix for system protection, there are four methods: global tables, access lists for objects, capability lists for domains, and lock-key schemes. Please explain the implementations of (a) the capability list for domains and (b) the lock-key approach.
- Answer: (a) Capability list for domain is a list of objects together with operations allows on them.
 (b) Each object has a list of unique bit patterns, called locks. Each domain consists of a list of unique bit patterns called keys. A process in a domain can access an object if the domain has a key that matches one of the locks

- 11. (8%) There are several security violation methods. Please explain (a) Man-in-the-middle attack and (b) Session hijacking.
- Answer: (a) Man-in-the-middle attack: An intruder sits in data flow, masquerading as sender to receiver and vice versa

(b) Session hijacking: An intruder intercepts an already-established session to bypass authentication

- 12. (8%) Assume that there are a public key K_e and a private key K_d, where K_e and K_d are a pair. E() and D() are the encryption and decryption functions, respectively. E(K_e, X) is the encryption result of any data X by using function E() with the key K_e, and D(K_d, Y) is the decryption result of any ciphertext Y by using function D() with the key K_d. Now, let Emily have key K_e, and David have key K_d.
 - (a) If Emily wants to send private data Q to David, what should they do?
 - (b) If David wants to prove that he is David (i.e., having the private key K_d) to Emily, what should they do?
- Answer: (a) 1. Emily sends the encryption result $E(K_e, Q)$ to David.
 - 2. David then gets the decryption result $D(K_d, E(K_e, Q)) \rightarrow Q$.
 - (b) 1. Emily sends the encryption result E(K_e, P) to David.
 - 2. David then gets the decryption result $D(K_d, E(K_e, P)) \rightarrow P$.
 - 3. David sends the result P back to Emily to prove that David has the private key.