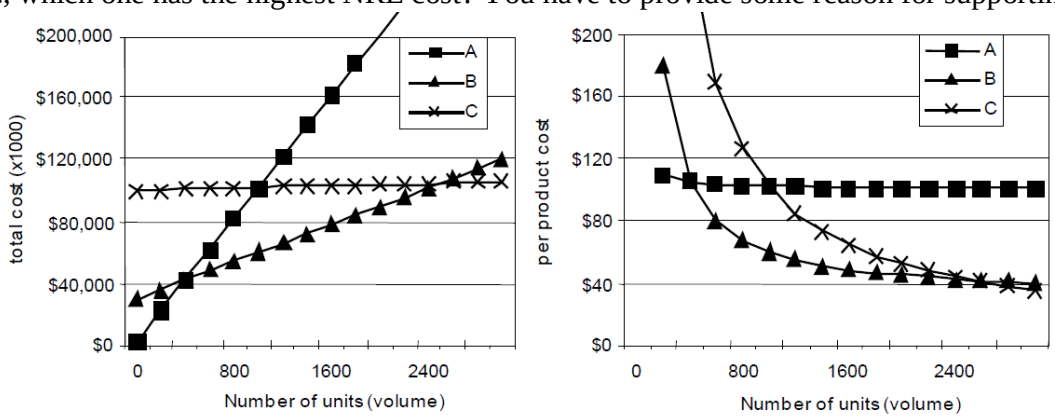
長庚大學108學年度第二學期作業系統實務期中測驗(總分109)

<<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:

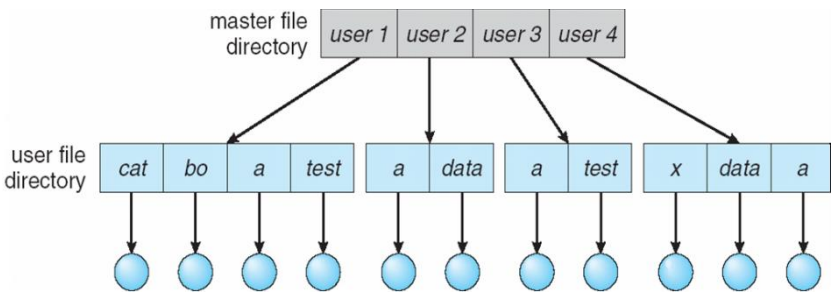
1. (10%) Please refer to the following figure. We have Technologies A, B and C for making a kind of products. (a) Please define Non-Recurring Engineering (NRE) cost. (b) Among Technologies A, B and C, which one has the highest NRE cost? You have to provide some reason for supporting your answer.



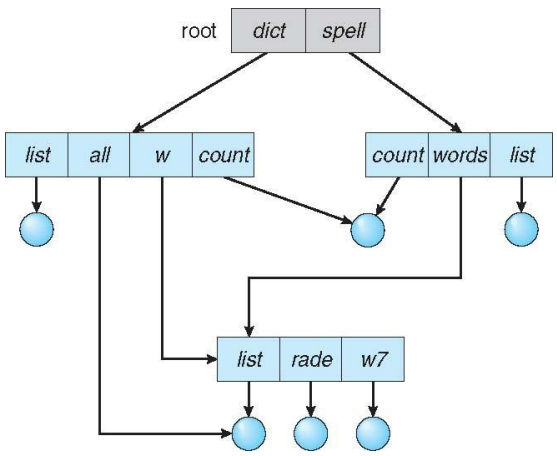
Answer: (a) NRE cost: the one-time monetary cost of designing/developing the system.
(b) Technology C. When the number of units is small, the total cost is mainly made by the NRE cost, and Technology C has the highest total cost.

2. (10%) For the directory design in file system, please define (a) the Two-Level Directory design and (b) the Acyclic-Graph Directory design.

Answer: (a) Two-Level Directory: There are two levels of directories. A master file directory can consist of multiple user file directories and files, and a user file directory can consist of multiple files.

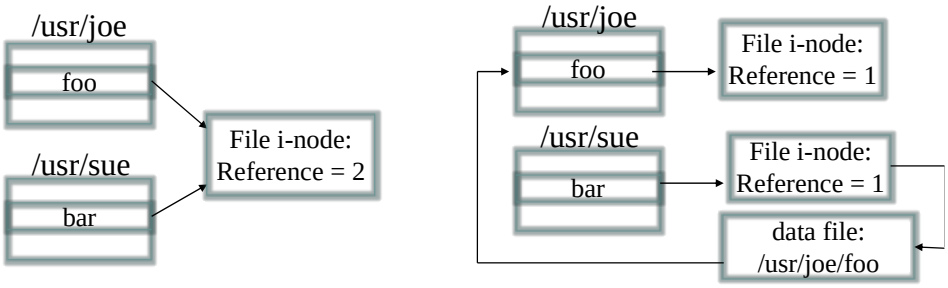


(b) Acyclic-Graph Directory: Based on a tree structure, this design further allows the sharing of files without having any cycle in the directory structure.



3. (10%) (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? The reasons have to be provided to support your answers.

Hints: the pictures of a hard link and a soft link



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.

4. (10%) When we want to put a file into a hard drive, we have to develop allocation methods to assign each part of the file to some block of the hard drive. Let's consider Linked Allocation, and Indexed Allocation. (a) If the size of the file is very small, which one can more efficiently use the disk space. You must provide some reason to support your answer. (b) If the size of the file is very large, after the file is stored in the disk, which one can provide better performance for random reads. You must provide some reason to support your answer.

Answer: (a) Link allocation is better because indexed allocation needs at least an extra index node to keep the index table.
(b) Indexed allocation is better because after the index table is loaded, it can directly find out the data block of any random read.

5. (10%) Please provide the definitions of (1) Network-Attached Storage (NAS) and (2) Storage-Area Network (SAN).

Answer: (a) NAS is storage made available over a network rather than over a local connection
(b) SAN is a private network using storage protocols rather than networking protocol connecting servers and storage units

6. (12%) Considering the disk scheduling, let a disk drive consist of 200 cylinders, from cylinder 0 to cylinder 199. Assume that the read-write head is now at cylinder 20 and moving toward cylinder 199. 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, 147, 189. Please illustrate the scheduling results of (a) the SSTF scheduling, (b) the LOOK scheduling, and (c) the C-LOOK scheduling.

Answer: SSTF: 21, 25, 16, 15, 2, 68, 147, 189
LOOK: 21, 25, 68, 147, 189, 16, 15, 2
C-LOOK: 21, 25, 68, 147, 189, 2. 15, 16

7. (9%) Please explain (a) RAID 0 and (b) RAID 1. (c) RAID 1+0 is another useful type of RAID. Please explain it as weel.

Answer: (a) Data striping to partition a file onto multiple disks for improving the read/write throughput.
(b) Mirroring or shadowing keeps duplicate of each disk to improve the reliability.
(c) Do mirroring for each disk, and then do data striping on all mirrors (couples of mirrored disks).

8. (9%) Please carefully explain 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) 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.

9. (9%) For system protection, to implement the access matrix, we have several different approaches. Please explain (a) Access list for objects, (b) Capability list for domains, and (c) Lock-key approach.

Answer: (a) Access list for objects: For each object, keep a linked list to describe the privilege of each domain for using this object.
(b) Capability list for domains: For each domain, keep a linked list to describe the privilege of this domain for using each object.
(c) Lock-key approach: Each object has a list of unique bit patterns, called locks. Each domain has 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.

10. (10%) 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: Intruder sits in data flow, masquerading as sender to receiver and vice versa
(b) Session hijacking: Intercept an already-established session to bypass authentication

11. (10%) 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(key, data) and D(key, ciphertext) are the encryption and decryption functions, respectively. E(K_e, X) is the encryption result of any data X by using function E() with key K_e, and D(K_d, Y) is the decryption result of any ciphertext Y by using function D() with key K_d. Now, let Emilly have key K_e, and David have key K_d. If Emilly want to send some private data Q to David. It is very easy. Emilly just needs to encrypt the data as E(K_e, Q) and send it to David. David can then run the decryption function D(K_d, E(K_e, Q)) to get the data Q. Let's further consider symmetric encryption/decryption technique. We also denote the symmetric encryption and decryption functions by E(key, data) and D(key, ciphertext), respectively. Now, if David want to send some private data R to Emilly, what should they do? (Hint: First, Emily has to creates a symmetric key, and let the symmetric key be Z.)

Answer: 1. Emily creates a key Z
2. Emily sends E(K_e, Z) to David
3. David calls D(K_d, E(K_e, Z)) to get key Z
4. David sends E(Z, R) to Emily
5. Emily calls D(Z, E(Z, R)) to get data R