Exercise 6 – I/O, File systems, Protection

Questions are taken from Stallings, Operating Systems Internals and Design Principles, fifth edition and Silberschatz et al., Operating System Concepts, seventh edition.

1 – Silberschatz 12.2

Suppose that a disk drive has 5000 cylinders, numbered 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 orderl, is:

$$86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130 \tag{1}$$

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

e) C-SCAN

f) C-LOOK

2 – Silberschatz 12.18

What would be the effects on cost and performance if tape storage had the same areal density as disk storage? (Areal density is the number of gigabits per square inch.)

3 – Silberschatz 11.3

Consider a file 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? Explain your answer.

b) Consider a file system similar to the one used by UNIX with indexed allocation. How many disk I/O operations might be required to read the contents of a small local file at */a/b/c*? Assume that none of the disk blocks is currently being cached.

c) Suggest a scheme to ensure that the pointer is never lost as a result of memory failure.

4 – Silberschatz 11.6

Consider a file system on a disk that has both logical and physical block sizes of 512 bytes. Assume that the information about each file is already in memory. For each of the three allocation strategies (contiguous, linked, and indexed), answer these questions:

a) How is the logical-to-physical address mapping accomplished in this system? (For the indexed allocation, assume that a file is always less than 512 blocks long.)

b If we are currently at logical block 10 (the last block accessed was block 10) and want to access logical block 4, how many physical blocks must be read from the disk?

5 – Silberschatz 13.9

UNIX coordinates the activities of the kernel I/O components by manipulating shared in-kernel data structures, whereas Windows NT uses object-oriented message passing between kernel I/O components. Discuss three pros and three cons of each approach.

6 – Silberschatz 14.2

The access-control matrix could be used to determine whether a process can switch from, say, domain A to domain B and enjoy the access privileges of domain B. Is this approach equivalent to including the access privileges of domain B in those of domain A?

7 – Silberschatz 14.3

Consider a computer system in which "computer games" can be played by students only between 22:00 to 06:00, by faculty members between 17:00 and 08:00, and by the computer center staff at all times. Suggest a scheme for implementing this policy efficiently.

8 – Silberschatz 15.3

The list of all passwords is kept within the operating system. Thus, if a user manages to read this list, password protection is no longer provided. Suggest a scheme that will avoid this problem. *Hint:* Use different internal and external representations.

9 – Silberschatz 15.6

The UNIX program COPS scans a given system for possible security holes and alerts the user to possible problems. What are two potential hazards of using such a system for security? How can these problems be limited or eliminated?