Homework Assignment #4

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Homework #4

- Chap.11: 11.7, 11.8
- Chap.12: 12.3, 12.9, 12.10
- Programming problems:
  - Chap.11: 11.13*
  - Chap.12: 12.16*
- Note: Each student must complete all programming problems on your own
- Due: two weeks (Jun. 12, 2023)

- Chap.11
  - 11.7: 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 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?

- 11.8: Consider a file system that uses inodes to represent files
- Disk blocks are 8KB in size, and a pointer to a disk block requires 4 bytes
- This file system has 12 direct disk blocks, as well as single, double, and triple indirect disk blocks
- What is the maximum size of a file that can be stored in this file system?

- Chap.12
  - 12.3: Suppose that a disk drive has 5,000 cylinders, numbered 0 to 4,999.
  - The drive is currently serving a request at cylinder 2,150, and the previous request was at cylinder 1,805.
  - The queue of pending requests, in FIFO order, is 2,069, 1,212, 2,296, 2,800, 544, 1,618, 356, 1,523, 4,965, 3,681

- 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
  (e) C-SCAN

- 12.9: Consider a RAID level 5 organization comprising five disks, with the parity for sets of four blocks on four disks stored on the fifth disk.
  - How many blocks are accessed in order to perform the following?
    (a) A write of one block of data.
    (b) A write of seven contiguous blocks of data.

- 12.10: Compare the throughput achieved by a RAID level 5 organization with that achieved by a RAID level 1 organization.
  - (a) Read operations on single blocks.
  - (b) Read operations on multiple contiguous blocks.

Programming Problems for Chap.11

- 11.13*: This exercise examines the relationship between files and inodes on a UNIX or Linux system. You can complete this exercise on the Linux virtual machine that is provided with this text.
- (1) In the source code available with this text, open file1.txt and examine its contents. Next, obtain the inode number of this file with the command:
  ls –li file1.txt
  Create a hard link between file1.txt and file2.txt:
  ln file1.txt file2.txt
  What are the inode values of file1.txt and file2.txt? Are they the same or different? Do the two files have the same or different contents?

- (2) Next, edit file2.txt and change its contents. Examine the contents of file1.txt. Are the contents of file1.txt and file2.txt the same or different? Next, remove file1.txt. Does file2.txt still exist as well? Check what system call is used for removing file2.txt by the following command: *strace rm file2.txt*.
- (3) Create a soft link to file3.txt by the following command: *ln –s file3.txt file4.txt*
  Are the inode numbers of file3.txt and file4.txt the same, or is each unique?
  Next, edit the contents of file4.txt. Have the contents of file3.txt been altered as well? Last, delete file3.txt. Explain what happens when you attempt to edit file4.txt.

Programming Problem for Chap.12

- 12.16*: Write a program that implements the following disk-scheduling algorithms:
  (a) FCFS
  (b) SSTF
  (c) SCAN
  (d) C-SCAN
  Your program will be passed the initial position of the disk head (as a parameter on the command line) and report the total amount of head movement required by each algorithm.

Any Questions or Comments?