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CPE434-01.

HOMEWORK 4.

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1. Given 6000 rpm, 1024 cylinders, 8 surfaces, 10240 sectors per track, 512 bytes per sector, minimum track to track seek time 0 ns, minimum track to track head switch time 0 ns, minimum cylinder to cylinder seek time 1 ms (one cylinder), average cylinder-to-cylinder seek time 5 ms (512 cylinders), maximum end to end (first cylinder to last cylinder) seek time 10 ms, maximum data transfer rate of disk interface 100 MB per second. What is the maximum transfer rate of this disk if you only wanted to read the first cylinder, the heads are located at the first cylinder at start-up, and the heads are at sector 0 when you issue the read command. SHOW YOUR WORK

- We need to multiply the sector size by the number of sectors per track and the rotational speed to determine the Maximum Transfer rate:

$$\begin{aligned}\text{Maximum Transfer Rate} &= (\text{Sector Size}) * (\text{Sectors per Track}) * (\text{RPM}) \\ &= (512 \text{ Bytes}) * (10240 \text{ Sectors per track}) * (6000 \text{ rpm}) \\ &= 314572800 \text{ bps} = \underline{300 \text{ MBps}}.\end{aligned}$$

2. If you wanted to store data on a disk in 512 byte blocks with the ability to detect 2 errors and correct 1 error how many extra bits would be required? Show your calculations.

To detect two errors and correct one error, we need a Hamming code with a minimum distance of 4, so that any two errors will be detected, and any single error can be corrected. The formula for the minimum distance of a Hamming code is (Minimum distance = $2^r - 1$), where r is the number of parity bits. To solve for r:

$$\text{Minimum distance} + 1 = 2^r$$

$$r = \log_2(\text{Minimum distance} + 1)$$

$$r = \log_2(4 + 1) = \log_2(5) \approx 2.322$$

Since we need a whole number of parity bits, we can use $r = 3$, in which case, the total number of bits per block will be 515 ($512 + 3$). Therefore, we need an extra 3 bits per block for error detection and correction.

3. We have a disk drive with 3000 cylinders, which are numbered 0 to 2999. The drive is currently serving a request at cylinder 93, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is: 45, 1950, 912, 1090, 130, 10, 2250, 130. 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? FCFS SSTF SCAN LOOK C-SCAN.
 - FCFS service order: 45, 1950, 912, 1090, 130, 10, 2250, 130. This will follow a first-come-first serve criteria to execute pending requests.

| FCFS | | |
|----------------|------|-------------|
| START | END | DISTANCE |
| 93 | 45 | 48 |
| 45 | 1950 | 1905 |
| 1950 | 912 | 1038 |
| 912 | 1090 | 178 |
| 1090 | 130 | 960 |
| 130 | 10 | 120 |
| 10 | 2250 | 2240 |
| 2250 | 130 | 2120 |
| TOTAL DISTANCE | | <u>8609</u> |

- SSTF service order: 93, 130, 45, 10, 912, 1090, 1950, 2250 . (Shortest Time first).

| SSTF | | |
|----------------|------|-------------|
| START | END | DISTANCE |
| 93 | 130 | 37 |
| 130 | 45 | 85 |
| 45 | 10 | 35 |
| 10 | 912 | 902 |
| 912 | 1090 | 178 |
| 1090 | 1950 | 860 |
| 1950 | 2250 | 300 |
| TOTAL DISTANCE | | <u>2397</u> |

- SCAN: Movement is going towards 0, since previous position is 125 and current position is 93, therefore we determine total distance by scanning every request moving left, and then moving right.

| SCAN | | |
|----------------|------|-------------|
| START | END | DISTANCE |
| 45 | 10 | 35 |
| 10 | 0 | 10 |
| 0 | 130 | 130 |
| 130 | 912 | 782 |
| 912 | 1090 | 178 |
| 1090 | 1950 | 860 |
| 1950 | 2250 | 300 |
| TOTAL DISTANCE | | <u>2295</u> |

- **LOOK:** Movement is going towards 0, since previous position is 125 and current position is 93, therefore we have total distance as absolute result of [(10-45) + (2250-10)].

| LOOK | | |
|----------------|------|--------------------|
| START | END | DISTANCE |
| 45 | 10 | 35 |
| 10 | 2250 | 2240 |
| | | |
| TOTAL DISTANCE | | <u><u>2275</u></u> |

- **CSCAN:** Movement is going towards 0, since previous position is 125 and current position is 93, therefore we have total distance as absolute result of [(0-45) + (93-2999)]. CSCAN mimics a “circular” movement.

| CSCAN | | |
|----------------|-----|--------------------|
| START | END | DISTANCE |
| 45 | 0 | 45 |
| 2999 | 93 | 2906 |
| | | |
| TOTAL DISTANCE | | <u><u>2951</u></u> |

4. Suppose that you are a system administrator and that there are 4000 users for your system. You would like 3950 of these people to have access to a specific file, how you would you achieve this in UNIX or Linux?

My approach would be to restrict access to the remaining 50 users, since it would be easier to set up a group of 50 rather than 3950. I would set up a group by running this command in the terminal:

`<groupadd groupname>`

Once the group is created and 50 users added (<usermod> command), I would modify the file's permissions to restrict read, write, and/or execute (r, w, x) access to the group using the following command: SOURCE

`<chmod -R fileparameters>`