CS471: Operating System Concepts
Module 8: Homework #8
Solution
Points: 20

Question 1 [Points 8] 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, 3681

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

FCFS: 2150→ 2069→ 1212→ 2296 → 2800 → 544 → 1618 → 356 → 1523 → 4965 → 3681 = 81+857+1084+504+2256+1074+1262+1167+3442+1284 = 13011

SSTF: 2150→ 2069→ 2296 → 2800 → 3681 → 4965 → 1618 → 1523 → 1212→544 → 356 = 81+227+504+881+1284+3347+95+311+668+188 = 7586

SCAN: 2150→ 2296→ 2800→ 3681→ 4965→ 4999→ 2069→ 1618→ 1523→ 1212→ 544→ 356 = 2849+4643=7492

LOOK: 2150→ 2296→ 2800→ 3681→ 4965→ 2069→ 1618→ 1523→ 1212→ 544→ 356 = 2815+4609=7424

Question 2 [Points 4] Suppose that a disk drive rotates at 7200 RPM. It has an average seek time of 3 milliseconds. If its transfer rate is 10 Mbps, determine the average time it takes for a 10K byte request to be transferred from the time the disk starts the seek? From this, determine its throughput.

Ans: Seek time = 3 milliseconds; transfer time = 10K*8/10M sec = 8 milliseconds (Here, rate is in bps and data is in bytes; so we need to first convert data to bits)
Total time=11 milliseconds
Throughput = 10*8Kbits/11 milliseconds=7.272K bits/milliseconds = 7272 Kbits/sec = 7.1Mbps

Question 3 [Points 4] 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 continuous blocks of data

Ans:
A. Here, one block of data writing involves---1 data block write, 3 data block read (to compute parity of 4 blocks), and 1 parity block write. So 5 blocks are accessed.

B. Suppose 4 continuous data blocks have one block parity; The remaining 3 data blocks and the next block together will have another parity block.

We will have 7 data block writes, 2 parity block write, and 1 data block read. This is a total of 10 block accesses.

Question 4 [Points 4] The reliability of a hard-disk drive is typically described in terms of a quantity called mean time between failures (MTBF). Although this quantity is called a "time," the MTBF actually is measured in drive-hours per failure. If a system contains 1,000 disk drives, each of which has a 750,000-hour MTBF, which of the following best describes how often a drive failure will occur in that disk farm: once per thousand years, once per century, once per decade, once per year, once per month, once per week, once per day, once per hour, once per minute, or once per second?

Ans: MTBF of one disk = 750,000 hours
So MTBF of 1000 disks = 750000/1000 = 750 hours = 31.25 days or approximately 1 month.

So we can expect one failure per month.