Tutorial #04

6.6 Consider a disk that rotates at 3600 rpm. The seek time to move the head between adjacent tracks is 2 ms. There are 32 sectors per track, which are stored in linear order from sector 0 through sector 31.The head sees the sectors in ascending order. Assume the read/write head is positioned at the start of sector 1 on track 8. There is a main memory buffer large enough to hold an entire track. Data is transferred between disk locations by reading from the source track into the main memory buffer and then writing the date from the buffer to the target track.

a. How long will it take to transfer sector 1 on track 8 to sector 1 on track 9?

b. How long will it take to transfer all the sectors of track 8 to the corresponding sectors of track 9?

Solution

[1] t = transfer data from sector 1/track 8 to buffer + rotate disk + rotate data from buffer to sector 1 track 9

$$t = \frac{60}{32 * 3600} + 16 * 10^{-3} + \frac{60}{32 * 3600}$$

[2]

$$t = \frac{2 * 60}{3600} + 2 * 10^{-3} + 12 * 10^{-3}$$

$\frac{2 * 60}{3600}$ → to transfer data

$2 * 10^{-3}$ → seek

$12 * 10^{-3}$ → to stop at sector [1] again

Track 8 → buffer → Track 9

[4 points] Consider a 4-drive, 500GB-per-drive RAID array. What is the available data storage capacity for each of the RAID levels: 0, 1, 5, and 6?

RAID		storage capacity for data
RAID [0]	4*500	2000 GB
RAID [1]	2*500	1000 GB
RAID [5]	(4-1)*500	1500 GB
RAID [6]	(4-2)*500	1000

[4 points] A RAID array is to be built using a number of 200 GB disk drives. The target data storage capacity of the array is 1000 GB. For each of the following design goals, determine which RAID level should be the best choice and how many disk drives are needed to construct the array in each case.

(a) To minimize the cost.
(b) To maximize the i/o transfer rate.
(c) To maximize the data availability (*i.e.*, sustain multiple simultaneous disk failures)

solution

[a] to minimize cost

choose RAID #0

# of disk drives ≡ 5

[b] Maximum I/o transfer rate

RAID #3

# of disk drives = [6]

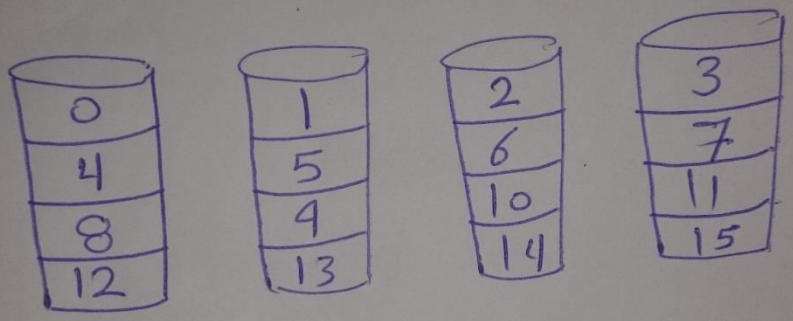
[c] Maximize data availability

RAID #6 [N = 7]

[4 points] Four disks are configured as a RAID level 3 where strips are 16-bit long. Stripe #*i* contains four strips: strip #4*i*, strip #4*i*+1, strip #4*i*+2, and strip #4*i*+3. Calculate the hexadecimal values for strip #5 and strip #8 given the following information:

Strip #	0	1	2	3	4	5	6	7	8	9	10	11
Hexadecimal Value	...	...	215F	1357	FFFF	?	0000	7B21	?	0F0F	32D7	FFFF

Solution



strip#5 = FFFF ⊕ 0000 ⊕ 7B21

≡ **84DE**

strip#8 = 0F0F ⊕ 32D7 ⊕ FFFF

≡ **C227**