Homework 11

Problem 1

Suppose we have a hard disk with:

4KB sector size

547 sectors per track in average

31887 tracks per surface

2 surfaces per platter

14 platters per disk

(1) What is the capacity of disk in GB? Please use the unit conversion 1KB=1024B and similar conversions on MB and GB.

(2) The vendor claims it to be a 2TB hard disk. If you didn't make anything wrong in the first sub-problem, the actual capacity is smaller than the claimed one.

a) Why could there be such a difference?

b) How much percentage of capacity is lost between the actual one and the claim one?

Problem 2

Suppose we have a hard disk in 7200 RPM, 500 sectors per track in average. Sector size is 4KB. Assume the average seek time is 9ms.

(1) How much milliseconds (ms) does it cost in accessing one block of data on average?

(2) How much milliseconds does it cost in accessing data stored on 20 continuous sectors in the same track?

(3) Reading many small files one by one will have larger latency than reading one larger file, even if they have the same total size in bytes. Please briefly explain the reason by considering the different data placements on disk for the two cases.

Problem 3

In the following table, let r be the number of rows in a DRAM array, c the number of columns, b_r the number of bits needed to address the rows, and b_c the number of bits needed to address the columns. For each of the following DRAMs, determine these values to minimize $\max(b_r, b_c)$, the maximum number of bits needed to address the rows or columns of the array. (You can refer to Figure 6.5 to see the organization of DRAM.)

Organization	r	c	b_r	b_c	$\max(b_r, b_c)$
16 (supercells) × 1 (chips)					
16 × 4					
128 × 8					
512 × 4					
1024 × 4					