CIS 350 – INFRASTRUCTURE TECHNOLOGIES
HOMEWORK #5, PART I (Chapters 9, 10 & 11) – 40 points

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(2 students maximum)

Part I. Work the following problems in the space provided below. You must show your calculations. Points will be deducted if you do not. (Each exercise 1 through 4 is worth 10 points for the total of 40 points). You must put your answers on these sheets.

Exercise 1

A hard disk contains 25 platters. The data is recorded on both surfaces of each platter. Each surface has 5,000 tracks. A track contains 2,000 sectors and each sector stores 2,048 bytes.

(a) What is the capacity (expressed in Megabytes and Gigabytes) of one cylinder?
(b) What is the capacity (expressed in Megabytes and Gigabytes) of the entire hard disk?

You must show your calculations.

(a) One sector: 2048 bytes

The track capacity: 2000 sectors * 2048 bytes = 4096000 bytes = 4000 KB = 3.91 mb

The number of surfaces: 25 * 2 = 50

Capacity of one cylinder: 3.91MB * 50 = 195.31 MB = 0.19 GB

(b) Capacity of the entire disk: 195.31 MB * 5000 tracks = 976550 MB = 953.66 GB

Exercise 2

The hard disk from Exercise 1 above has the average seek time of 7 milliseconds [ms]. The disk revolves with the speed of 12,000 revolutions per minute.

(a) Compute the average rotational delay (latency time).
(b) Compute the transfer time for 800 sectors.
(c) Compute the total disk access time which is the sum of the three times: the average seek time, the average rotational delay (latency time), and the transfer time for 800 sectors.

You must show your calculations. Express all the times in milliseconds [ms].

(a) 12000 revolution/min = 200 revolution/sec
Average rotation delay : ½ * 1/200 revolution/sec = 0.0025 s = 2.5 ms

(b) Transfer time for 800 sectors: 800/(2000tracks*200revolution/sec) = 0.002 s = 2 ms

(c) Total disk access time for 800 sectors: 7ms + 2.5ms + 2ms = 11.5 ms

Exercise 3

A 3,440-pixel × 1,440-pixel display is generated on a high-definition 34-inch Dell S3422DWG monitor You can see the monitor at the following link: Dell 34 WQHD Curved Gaming Monitor – S3422DWG | Dell USA.

(a) How many pixels/dots per inch are displayed on this monitor?
(b) How many pixels/dots per millimeter [mm] are displayed on this monitor?
(c) What is the size of an individual pixel in [mm]?

Note that 1"=25.4 mm. Approach: Use the Pythagoras theorem to calculate the number of pixels on the 16" diagonal of the monitor for a 3,440-pixel by 1,440-pixel display.

(a) The number of pixels on the main diagonal: sqrt($3440^2 + 1440^2$) = 3729
The number of pixels per inch: 3729/34" = 109.68

(b) The number of pixels per millimeter: 3729/ (34"*25.4) = 4.31

(c) The size of one individual pixel is: 1/ 4.31 = 0.23 mm

Exercise 4

Assume that a PCI-Express bus consists of 32 lanes. Each lane is capable of a maximum data rate of 190 MB per second. Lanes are allocated to a device 1, 2, 4, 8, 16, or 32 lanes at a time. Assume that the PCI-Express bus is connected to a high definition video card that is supporting a 3,440 × 1,440 true color (3 bytes per pixel) progressive scan monitor with a refresh rate of 120 frames per second. How many lanes will this video card require to support the monitor at full capability? You must show your calculations.

Size of a non-motion image: 3440 * 1440 * 3 bytes = 14860800 bytes = 14512.5 KB = 14.17 MB

A motion of true color image needs 14.17MB* 120 frames/sec = 1700.4 MB

This video requires 1700.4MB/190MB = 8.95 lands

Need to round up to **16** lanes.