**CIS 350 – INFRASTRUCTURE TECHNOLOGIES**

**GROUP HOMEWORK #6, PART I (Chapters 9, 10 & 11)**

**Objectives: I/O Operations & Buses, Computer Peripherals Devices, PCI-Express Bus**

Group # and Names of Group Members:   
Group 9  
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Logistics

1. Get in touch with your group. (See Groups folder on Blackboard.)
2. Discuss and work all 4 problems collectively with your group via E-mail, Discussion Forum, Blackboard Collaborate Ultra, and/or MS Teams. (Do not divide the work among group members.)
3. Choose a recorder to prepare the final copy (**one per group**) and submit it via the Blackboard Assignments/Homeworks folder by the due date.
4. Be sure all group members' names are on final copy. Do **not** add names of your group members who did not participate in the assignment or whose contribution was minimal.

Worth 40 points.

**Work the following problems in the space provided below. You must show your calculations and 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.

1. What is the capacity (expressed in Megabytes and Gigabytes) of one cylinder?
2. What is the capacity (expressed in Megabytes and Gigabytes) of the entire hard disk?

You must show your calculations.

a)

- 1 sector stores 20,48 bytes.

- 2,000 sectors \* 2,048 bytes = 4,096,000 / 1024 = 4,000 KB / 1024 = 3.906 MB

- 25 platters \* 2 surfaces = 50

- 50 platters \* 3.906 MB = 195.313 MB = 195.313 / 1024 = 0.191 GB

Capacity of one cylinder is 195.313 MB or 0.191 GB

b)

5,000 \* 195.313 = 976,565 MB = 953.68 GB

Capacity of the entire hard disk is 976,565 MB or 953.68 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.

1. Compute the average rotational delay (latency time).
2. Compute the transfer time for 800 sectors.
3. 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. Express all the times in milliseconds [ms].

a)

12,000 / 60 = 200 revolutions/seconds

(1/2) \* (1/200)s = 0.0025 s = 2.5 ms

Average latency time = 2.5 ms

b)

(800 sectors) / (2,000 sectors \* 200 revolutions) = .002 s = 2 ms

Transfer time is 2 ms

c)

7 ms + 2.5 ms + 2 ms = 11.5 ms

The total disk access time is 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](https://www.dell.com/en-us/shop/dell-34-curved-gaming-monitor-s3422dwg/apd/210-AZEP/monitors-monitor-accessories).

1. How many pixels/dots per inch are displayed on this monitor?
2. How many pixels/dots per millimeter [mm] are displayed on this monitor?
3. 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 34" diagonal of the monitor for a 3,440-pixel by 1,440-pixel display.

a)

= 3729.24 pixels

3729.24 / 34 = 109.68

109.68 pixels per inch (ppi) are displayed

b)

109.68 / 25.4 = 4.32

4.32 pixels per millimeter are displayed

c)

1 / 4.32 = 0.231 mm

The size of an individual pixel is 0.231 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.

A non-motion true color image would need 3440\*1440\*3 = 14,860,800 bytes / 1024 = 14,512.5 or 14,513 KB / 1024 = 14.17 MB

A motion true color image would need 14.17MB \* 120 frames/sec = 1700.4 MB

One would need 1700.4 MB / 190 MB = 8.95 lanes

Need to round it up to 16 lanes as 1, 2, 4, 8 ,**16**, or 32 lanes are allocated at a time.

16 lanes are needed to support the monitor at full capability.