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: Dalton, Charles, Daniel, Anthony

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 50 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 30 platters. The data is recorded on both surfaces of each platter. Each surface has 4,000 tracks. A track contains 2,500 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) Bytes : 2 * 4,000 * 2,500 * 2,048 = **40,960,000,000bytes**

Capacity of one cylinder (MB) : (40,960,000,000bytes)/ 2^20= **39,062.5 MB**

Capacity of one cylinder (GB) : (40,960,000,000bytes)/ 2^30= **38.147 GB**

B) bytes: 2 * 4,000 * 2,500 * 2,048 * 30 = **1,228,800,000,000 bytes**

Capacity of one cylinder (MB) : (**1,228,800,000,000) / 2^20 = 1,171,875 MB**

Capacity of one cylinder (GB) :(**1,228,800,000,000) / 2^30 = 1,144.41GB**

Exercise 2. The hard disk from Exercise 1 above has the average seek time of 5 milliseconds [ms]. The disk revolves with the speed of 15,000 revolutions per minute.

(a) Compute the average rotational delay (latency time).

- Average rotational delay = (1 / (2 * 15000)) * 60 * 1000 milliseconds
- (1 / 30000) * 60 * 1000 milliseconds
- Average rotational delay = **0.002 milliseconds**

(b) Compute the transfer time for 1000 sectors.

- Transfer time = (1000 / 15000) * 60 * 1000
- Transfer time = **400 milliseconds**

(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 1000 sectors. Express all the times in milliseconds [ms].

- Total disk access time = 5 ms + .002 ms + 400 ms
- Total disk access time = **405.002 milliseconds**

Exercise 3. A high-definition 25-inch Dell G2524H monitor has the resolution 1,920 × 1,080 pixels. You can see the monitor at the following link. Dell 25 inch Gaming Monitor (G2524H) - Computer Monitors | Dell USA

(a) How many pixels/dots per inch are displayed on this monitor?

given that D = 25 inches, H = 1920 pixels, and v = 1080 pixels:

$25^2 = 1920^2 + 1080^2$

625 = 4852800

Square root 4852800/625

Then square the answer 7764.48

PPI = 88.11 or 88 pixels per inch

(b) How many pixels/dots per millimeter [mm] are displayed on this monitor?

88 * 1/25.4

PPMM = 3.46 pixels per milimeter

(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 25-inch diagonal of the monitor for a 1,920-pixel by 1,080-pixel display.

Pixel size in mm = 1/ppmm

= 1/34.6

Pixel size in mm = 0.29 mm

Exercise 4. Assume that a PCI-Express bus consists of 32 lanes. Each lane is capable of a maximum data rate of 200 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 1,920 × 1,080 true color (3 bytes per pixel) progressive scan monitor with a refresh rate of 150 frames per second. How many lanes will this video card require to support the monitor at full capability? You must show your calculations.

Data Rate = 1920 x 1080 x 3 x 150

Data Rate = 933 120 000 bytes per second

Converting to megabyte:

Data rate = 933120000/1024*1024 = 889.89 MBps or 890 MBps

Lanes required = 890 MBps/200 MBps per lane

Lanes required = 4.5 lanes

Since we issue lanes 1, 2, 4 8, 16, or 32 lanes at a time, we will need to issue 8 lanes to the video card.