**CIS 350 – INFRASTRUCTURE TECHNOLOGIES**

**HOMEWORK # 5**

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(You may do this homework in groups of 2 students maximum.)

**Topics**: Input/Output (Chapter 9), Computer Peripherals (Chapter 10), and Modern Computer Systems (Chapter 11)

Work the following Exercises. Attach additional pages for your answers. You answers to essay questions should be brief and capture the essence. Attempt to answer all questions as I will pick out at random only 3 questions (1 from each chapter) and grade your answers to these questions only. As a result, your overall grade for this homework will be based on the 3 graded questions only.

1. Ex. 9.4, p. 293 (under Exercises)

Consider the interrupt that occurs at the completion of a disk transfer.

1. **‘‘Who’’ is interrupting ‘‘whom’’?**

The disk controller interrupts the CPU to notify it that the transfer is complete and the data ready to use.

1. **Why is the interrupt used in this case? What would be necessary if there were**

**no interrupt capability on this computer?**

If there were no interrupt capability, the program that is using the data would have to wait long to assure that the data transfer is complete, to prevent data corruption.

**c. Describe the steps that take place after the interrupt occurs.**

At the point when the interrupt happens, it makes the CPU suspend execution of the program being executed, at that point it spares the important parameters for later come back to that program, and jumps to an interrupt on handler program. The interrupt on handler advises the program that the information is accessible for utilize. Control is then come back to the program.

1. Ex. 9.6 and 9.7 on p. 293. These 2 questions are closely related. Answer them together.

**What is an interrupt vector?**

**Interrupt Vector** is in which the address of the interrupting device is included as part of the interrupt. The vectored interrupt method is faster, but requires additional hardware to implement.

**What is polling used for? What are the disadvantages of polling? What is a better**

**way to perform the same job?**

**Polling** is a technique in which a program uses programmed I/O to send out requests to I/O devices for determining the status of the device. The device returns a message word that describes the requested information. Polling is usually used for identifying I/O device events which require attention when interrupts are not available. The CPU checks each device periodically for such events

The **disadvantage** is that polling is a continuous effort that requires dedicated resources and time from the CPU in order to perform. The CPU dedicated a portion of its time to this means that it is losing valuable time in performing more critical functions. The disadvantage of polling is that it can waste a lot of processor time because processors are so much faster than I/O devices, which makes the process slower compared to other ways.

**The better way** to perform the same job is through the interrupt process. The interrupt request process is a direct line to the CPU that the I/O devices may send interrupt requests to at any given time and then the CPU will be notified to react. This is distinct from polling because now the CPU can operate independent of continuously querying for input data and then only react when an interrupt request is sent. other ways such as allowing Input devices to send an interrupt signal when data is in cue. The CPU will then complete the specific cycle to receive the data in cue for processing. This way any input can send data when ready rather than having to wait for all other input devices ahead of it to be polled

1. Ex. 9.14, p. 293

**Describe the steps that occur when a system receives multiple interrupts.**

Multiple interrupts can be handled by assigning **priorities** to each interrupt. In general, multiple interrupts will be handled top priority first. A higher-priority interrupt will be allowed to interrupt an interrupt of lower priority, but a lower-priority interrupt will have to wait until a higher-priority interrupt is completed. This leads to a hierarchy of interrupts, in which higher-priority interrupts can interrupt other interrupts of lower priority, back and forth, eventually returning control to the original program that was running. Although this sounds complicated, this situation is actually quite common, and is fairly easy to implement. When multiple interrupts occur, the first interrupt causes a suspension of the program executing at the time, storage of that program's critical parameters, and transfer of control to the program that handles the interrupt. When a second interrupt occurs, its priority is compared to that of the original interrupt. If its priority is higher, it takes precedence, and the original interrupt program is itself suspended. Otherwise, processing of the original interrupt continues, and the new interrupt is held until the original interrupt program is complete. When the higher priority interrupt process is completed, the lower interrupt is processed. If no further interrupts occur and if no interrupt results in suspension of all CPU processing, control eventually returns to the original program, which then resumes processing. In general, multiple interrupts result in a queue of interrupt handler programs which will be executed in the order of the priorities associated with each interrupt. The top priority program in the queue executes unless it is replaced by an interrupt of even higher priority.

1. Ex. 10.2, p. 329 (under Exercises)

**What are the advantages of flash memory over hard disk storage? What are the advantages of hard disk over flash memory storage? What are the advantages of both hard disk and flash memory storage over RAM? What is the major advantage of RAM over other types of storage?**

Flash memory is non-mechanical and has no motors or other moving parts. This makes flash memory less subject to mechanical shock when the computer is moved, because there is no moving disk and head that must be moved into position to perform an operation, the flash drive has faster access to the data, especially for READ operations. Compared to flash memory, however, hard disks offer higher capacity, lower cost, and well-developed technology. The characteristics of the physics methods used for the implementation of flash memory also limit device cycle lifetimes, at least at present. Particularly for heavy-usage WRITE operations, the longevity of the hard disk is likely to exceed that of the flash memory. Both hard disk and flash memory offer non-volatility, a major advantage over RAM. RAM is cheap and fast, and is easily expanded to meet a user's requirements.

1. Ex. 10.10, p. 330

**A high-quality photographic image requires 3 bytes per pixel to produce sixteen million shades of color.**

1. **How large a video memory is required to store a 640 × 480 image during display? A 1600 × 1900 image? A 1400 × 1080 image? A 2560 × 140 image?**

640 \* 480 pixels \* 3 bytes/pixel = 921,600 bytes of video memory

1600 \* 900 pixels \* 3 bytes/pixel = 4,320,000 bytes of video memory.

1440 \* 1080 pixels \* 3 bytes/pixel = 4,665,600 bytes of video memory.

2560 \* 1440 pixels \* 3 bytes/pixel = 11,059,200 bytes of video memory.

1. **How many 1920 × 1080 non-compressed color images will fit on 4.7 GB DVD-ROM?**

The number of images on a 4.7 GB DVD-ROM.

Each image will consume 1920\*1080\*3 = 6,220,800 bytes/1024 = 6,075 KB/1024 = 5.932617

MB/1024 = 0.005794 GB

The number of images that the DVD-ROM can store is 4.7 GB/0.005794 GB = 811.2 images

1. **Ex. 10.14, p. 331**

Approach: Use the Pythagoras theorem to calculate the number of pixels on the 14" diagonal of the monitor for a 1600-pixel by 900-pixel display and then for a 1280 × 720 display. Then calculate the size of the pixel in millimeters [mm]. Note that 1"=25.4 millimeters [mm]. You can also calculate easily the number of pixels per 1 millimeter [mm]. For example, if the size of the pixel is 0.2 mm, there are 1/0.2 = 5 pixels per 1 mm.

1. Calculate the number of pixels on the main diagonal: = sqrt (9002 +16002) = 1835.8

Calculate the size of the pixel in inches: 14"/1835.8=0.007626"

Calculate the size of the pixel in millimeters [mm]: 0.007626×25.4=0.19 mm

0.26 mm pixel resolution is not quite sufficient for this display.

1. Calculate the number of pixels on the main diagonal: = sqrt (7202+12802) = 1468.6

Calculate the size of the pixel in inches: 14"/1468.8=0.009533"

Calculate the size of the pixel in millimeters [mm]: 0.009533×25.4=0.24 mm

0.26 mm pixel resolution is not quite sufficient for this display.

1. For a 1280 × 720 image, the number of dots/inch = 1280/12.17 ≈ 105.2 dots/inch. Each pixel requires 25.4/105.2 ≈ 0.24 mm. The monitor is not satisfactory for this resolution.

1. **Ex. 11.2, p. 356 (under Exercises)**

The advantage of providing multiple buses is that each bus can be optimized to meet its own requirements. for example, internal buses, PCI and PCI Express are optimized for high-speed interconnections to the CPU. on the other hand external buses, such as USB, are optimized for connection to multiple external devices at low cost with relatively high speed; SATA buses are optimized specifically for disk drives. Some buses are maintained for legacy purposes. For example, many desktop computer plug-in cards are designed to fit PCI sockets.

1. **Ex. 11.5, p. 357 (under Exercises)**

* 1920 x 1080 pixels \* 3 bytes/pixel \* 60 frames/second = 373248000
* Bytes/second = 364500 KB/second = 355.96 MB/second
* Since 355.96 MB/second < 500 MB/second, one PCI-Express lane can handle this data rate.

1. **Ex. 11.18, p. 357 (under Exercises)**

Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. However, grid computing involves coordinating and sharing computing, application, data, and storage or network resources across a dynamic and geographically dispersed organization it's is more specialized, using distributed computing power to work on a particular large-scale program application. Whereas cloud computing is intended for more general use, providing a wide variety of services. Finally, both grid computing and cloud computing rely on the availability of computing power as a resource.