COM S 352 Homework 1

Alec Meyer

February 5, 2021

Question 1

Interrupts are used to inform a program or proccess of an external proccess, typically a physical device controller telling the CPU that there has been an I/O operation. A Trap, However, is an interrupt triggered by software (i.e. exceptions, requests from other programs). Traps can be generated intentionally such as an exception being thrown when trying to access invalid memory or invalid arithmetic.

Question 2

The two modes of a CPU are User mode and Kernel mode. The system privlleges are increased when Kernal mode is in use because Kernal mode will allow more control over the system. Only Kernal mode can run privlleged instructions, such as clearing memory and accessing I/O devices. This dual operation will help protect the user and the system from programs not laucnhing correctly and/or being malicious. The reason to distinguish the two is to know where interrupts should be used. The system will produce interrupts in user mode then switch to Kernel mode.

Question 3

Privlleged Instructions:
Clearing memory
Turning off Interrupts
Putting the CPU in Kernel mode
Accessing I/O device
Setting value of timer

Question 4

1,000 CPU cycles per 1 μs
20 bytes every 10 μs = 20 bytes every 10,000 cycles

10,000 cycles sending
100 cycles transfering to memory
10,000 + 100 cycles = 10,100 total cycles

$$\frac{\text{100 Transfering Cycles}}{\text{10,100 Total Cycles}} = 0.99\% \approx 1\%$$

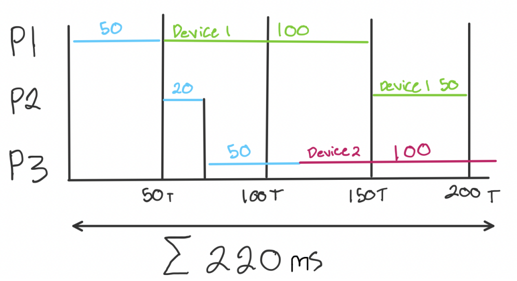
about 1% of the CPU clock cycles are used to transfer data from the controller to main memory.

Question 5

1. **Program 1**
   50ms computation
   100ms I/O
   device 1

2. **Program 2**
   20ms computation
   50ms I/O
   device 1

3. **Program 3**
   50ms computation
   100ms I/O
   device 2



Question 6

A DMA controller does not require the CPU to interviene while writing data. This allows the CPU to preform other tasks while data is being transfered. interrupt driven I/O requires the CPU's attention and also only writes one byte at a time.

Question 7

1. **Parameters in Registers**
   Simplest method, can only have as many parameters as available registers. Most operating systems do not use this method as it only allows a few parameters of a certain length at a time.

2. **Parameters in Block Memory**
   If there are more parameters than registers the extra parameters will be saved to a block or table of memory. Then the address is used as the parameter.

3. **Parameters in Stacks**
   Similar to the block memory aproach the stack approach is when you push parameters on a stack and pop them when they are to be used.