

University of Colorado at Boulder
Department of Electrical and Computer Engineering
ECEN 2120 – Computers as Components

Quiz III

March 2008

STUDENT ID

- TIME ALLOWED = 50 minutes
- THIS IS A CLOSED BOOK EXAM
- NO CALCULATOR IS ALLOWED

Q1	Q2

TOTAL	
-------	--

Q1 Short answer (40pts)

1). (10pts) Please briefly explain memory-mapped I/O.

Check the slides

2). (10pts) Please briefly compare polling vs. interrupt based communication transaction methods.

Check the slides

3). (10pts) Please briefly explain advantages and disadvantages of asynchronous and synchronous communication methods.

Check the slides

4). (10pts) Please briefly explain direct memory access (DMA).

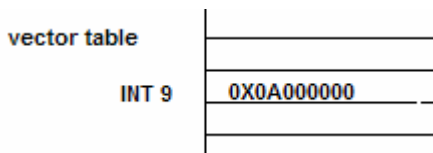
Check the slides

Q2 (60pts) You are in charge of designing the next generation portable video device, which contains an Intel Silverthorne mobile processor plus 4GB main memory. This device uses USB 3.0 (memory address 0xFF000000) as the I/O interface with 4.8Gb/s data rate. You decide to use DMA to handle data communication between the USB interface and main memory. The DMA controller used in this portable device follows the standard DMA transaction we discussed in the class -- The USB interface issues an interrupt to the DMA controller, which in turn generates an interrupt (interrupt #9) to the processor. When the processor receives an interrupt from the DMA controller, it invokes an interrupt handler (starting at memory address 0xA000000) to initialize the DMA controller. The DMA controller contains three 32-bit registers:

Reg1 (memory address 0xF0000000): contains the base address of the destination area (store data to).
 Reg2 (memory address 0xF0000010): contains the base address of the source area (read data from).
 Reg3 (memory address 0xF0000020): total amount of data through each DMA transaction (number of bytes).

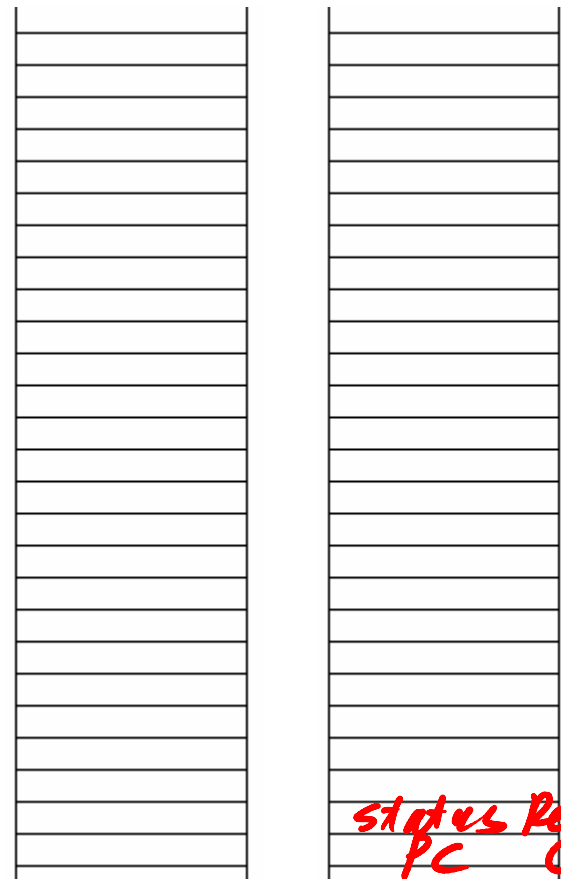
In the main memory, the data received from the USB will be stored at starting address of 0x10000000. In addition, we assume each DMA transaction transfers 4KB data.

- 1). Please implement the interrupt handler used to initialize the DMA controller.
- 2). Please describe the stack content during run-time DMA interrupt handling.
- 3). Please describe a complete DMA transaction in detail.



```

Move.l #0x10000000, 0xF0000000
Move.l #0xFF000000, 0xF0000010
Move.l #0x1000, 0xF0000020
Move.l #0x1, 0x10000000
RET
  
```



User stack

supervisor stack