

CS501 Advanced Computer Architecture

Final Term Examination - August 2004

Time Allowed: 150 Minutes

Please read the following instructions carefully before attempting any of the questions:

1. Attempt all questions. Marks are written with each question.
2. Do not ask any questions about the contents of this examination from anyone.
 - a. If you think that there is something wrong with any of the questions, attempt it to the best of your understanding.
 - b. If you believe that some essential piece of information is missing, make an appropriate assumption and use it to solve the problem.
 - c. Write all steps, missing steps may lead to deduction of marks.

Total Marks: 100

Total Questions: 9

Question No. 1

Marks : 15

Consider a hard disk that rotates at 6000 rpm. The seek time to move the head between adjacent tracks is 1 ms. There are 64 sectors per track stored in linear order. Assume that the read/write head is initially at the start of sector 1 on track 7.

- (a) How long will it take to transfer sector 1 on track 7 to sector 1 on track 9?
(b) How long will it take to transfer all the sectors on track 12 to corresponding sectors on track 13?

Question No. 2

Marks : 10

Briefly describe five important features of RISC machines.

Question No. 3

Marks : 15

What will be the logic levels on the external FALCON-A buses when each of the given FALCON-A instruction is executing on the processor? Complete the table given. All numbers are in the hexadecimal number system, unless noted otherwise. Assume that all memory content is properly aligned, i.e. memory addresses start at address divisible by 2.

This table contains a partial memory map showing the addresses and the corresponding data values.

Memory Address	Memory Content
1000h	12h
1001h	34h
1002h	14h
1003h	24h
1004h	56h
1005h	36h
1006h	46h
1007h	16h

The next table shows the register map showing the contents of all the CPU registers. Another important thing to note is that memory storage is big-endian.

Register Name	Register Content
R1	1000h
R2	ABCDh
R3	0FFAh
R4	5678h

FALCON-A Instruction	Address Bus <15...0>	Data Bus <15...0>	MR	MW	RTL equivalent
load r4, [r1+4]					
store r2, [r3+8]					

Question No. 4

Marks : 15

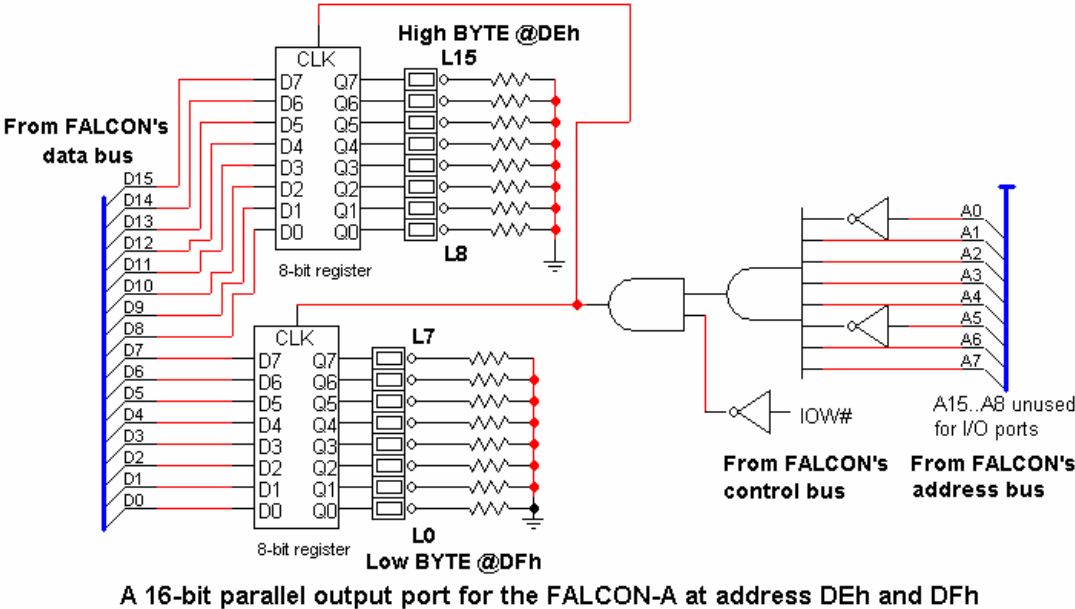
- (a) Drawing a timing diagram, briefly explain the sequence of steps that take place during a synchronous transfer between a master device and a slave device.
(b) List one advantage and one disadvantage of DMA ?

Question No. 5

Marks : 15

Given a 16-bit parallel output port attached with the FALCON-A CPU as shown in the figure below. The port is mapped onto address DEh of the FALCON-A's I/O space. Sixteen LED branches are used to display the data being received from the FALCON-A's data bus. Every LED branch is wired in such a way that when a 1 appears on the particular data bus bit, it turns the LED on; a 0 turns it off.

- (a) Which LEDs will be ON when the instruction
out r7, 222
executes on the CPU? Assume r7 contains ABCDh. Briefly explain your answer.



- (b) Identify the changes needed to map the above output port at address A0h and A1h of the FALCON-A's I/O space (instead of DEh and DFh)

Question No. 6

Marks : 15

Consider a DRAM with 2048 rows and a refresh time of 20ms.

- (a) Find the frequency of row refresh operations.
(b) What fraction of the DRAM's time is spent on refreshing if each refresh takes 100ns.

Question No. 7

Marks : 15

Assume a network with a bandwidth of 1500Mbps/sec. It has a sending overhead of 80μsec and a receiving overhead of 100μsec. Assume two machines connected together. It is required to send a 15,000 byte message from one machine to the other (including header), and the message format allows 15,00 bytes in a single message. Calculate the total latency to send the message from one machine to another assuming they are 20m apart (as in a SAN). Next, perform the same calculation but assume the machines are 700m apart (as in a LAN). Finally, assume they are 1000Km apart (as in a WAN).

Assume that signals propagate at 66% of the speed of light in a conductor, and that the speed of light is 300,000Km/sec.