0907432 Computer Design (Fall 2013)
<u>Quiz 2 (Make up)</u>

رقم الشعبة: 1   الرقم التسلسلي: الاسم:

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<u>Instructions</u>: Time **15** minutes. Open book and notes exam. No electronics. Please answer all problems in the space provided and limit your answer to the space provided. **No questions are allowed**.

<*Good Luck*>

Q1. Assume that you have 4-KB direct-mapped cache that has 16-byte blocks. In which block the address 1235678_{16} will be mapped to?

[2 marks]

      <Block offset>   **= lg_2 Block size = lg_2 16 = 4 bits**

      Number of blocks   **= Cache size / Block size = 4 KB / 16 B**

                               = 2^{12} / 2^4 = 2^8 = 256 blocks

      <cache Index>   **= lg_2 Number of blocks = lg_2 2^8 = 8 bits**

      Therefore the four least significant bits are the Block offset and the next 8 bits are the Index.

      1235$678_{16}$

      This address will be mapped to block 67_{16}

Q2. What are the cache design alternatives for handling store misses?

[2 marks]

    1) **<u>Allocate</u> the missed block in the cache, i.e., bring the block from the memory to the cache then store to it.**

    2) **<u>No Allocate</u>, i.e., don't bring the block from the memory to the cache, store directory to the memory.**

Q3. Assume that you have a 2-processor system that uses a snoopy cache coherence protocol. What happens when Processor 0 attempts to store to a location that is cached in Processor 0 and 1?

[2 marks]

- **Processor 0 first sends on the bus a write miss request.**
- **When Processor 1 snoops this request, it invalidates the block that has this location from its cache.**
- **When Processor 0 receives acknowledgment to its request, it stores to this location.**

Q4. For a 15,000-revolution/min hard disk, what is its maximum transfer rate if its storage density is 2 MB per cylinder?

[2 marks]

Rotational speed   **= RPM / (60 sec/min)**

                                 = 15,000 revolution/min / 60 sec/min = 250 revolution/sec

In one revolution, can read one cylinder

Transfer rate   **= Rotational speed * Storage density**

                                 = 250 revolution/sec * 2 MB/revolution

                                 = 500 MB/sec

Q5. For a RAID 4 storage system that has a total of 7 disks, how many disk read and write operations are required to update one data block on this storage system?

[2 marks]

Two reads: Need to read the old data block and parity.
Two writes: To update the data block and parity.