Id No 13943

Name Mehran Ali Shah

Subject Computer Architecture

Semester Summer 2020

Assignment 2nd

Q.1 Give answers to each of the following:

a) Discuss the concept of word, addressable units, and unit of transfer for internal memories.

Answer:

Word: The "natural" unit of organization of memory. The size of a word is typically equal to the number of bits used to represent an integer and to the instruction length.

• Addressable units: In some systems, the addressable unit is the word. However, many systems allow addressing at the byte level. In any case, 2A = N.

• Unit of transfer: For main memory, this is the number of bits read out of or written into memory at a time. The unit of transfer need not equal a word or an addressable unit.

b) How least recently used (LRU) and least frequently used (LFU) replacement algorithms are implemented for a cache memory with two-way set associative mapping?

c) How read and write operations are performed in SRAM cell?

Answer:

As we observe, that with the evolution of technology, devices are scaling down from time to time, which leads to reduction in the length of the channel of the MOSFET, giving importance to speed of operation. This paper consist of designing 6T SRAM cell, along with its READ and WRITE operations which operates at high speed consuming less power. The SRAM cell is simulated and the graphs for READ and WRITE operations and respective power results are presented. The tool used for designing of 6T SRAM cell is Tanner Tool which operates at 250nm technology and 2.5volts as supply voltage.

d) Discuss 16-Mbit DRAM (4M x 4) organization in detail.

Answer:

e) What are the reasons for DVD's greater capacity over CD?

Answer:

Digital versatile discs (DVDs) can store more information than compact discs (CDs) because they have smaller pits, placed closer together. It is the pattern of these pits burned onto a disc's surface that encodes the 1's and 0's a player translates into sound and/or images.

Q.2 Differentiate each of the following in detail:

a) EEPROM and flash memory

Answer:

The main difference between EEPROM and flash memory is that most EEPROM devices can erase any byte of memory at any time. Flash memory can only erase an entire chunk, or "sector", of memory at a time. Both EEPROM and flash are subject to the limitation that only bytes in an 'erased' state can be written, which means that if the user wants to change only one byte of flash, the entire sector must be erased and re-written. This means that flash memory can wear out faster than EEPROM.

b) Hard failure and soft error in Semiconductor memories

Answer:

Memory checks detect both hard and soft errors. The application response to these different error types should differ because hard failures are caused by the circuit itself while soft errors are caused by some external particles that destroys the data but does not degrade the circuit functionality.

c) Read and write Mechanisms for magnetic disk

Answer:

Disk read/write heads are the small parts of a disk drive which move above the disk platter and transform the platter's magnetic field into electrical current (read the disk) or, vice versa, transform electrical current into magnetic field (write the disk).

d) Parallel access and independent access RAID schemes

Answer:

In parallel access, ALL the disks are accessed at once, whereas in independent access, the disks run independently of each other.

e) HD DVD and Blu-ray DVD

Answer:

The major difference between Blu-ray/HD DVD and DVDs is capacity -- that is, both Blu-ray and HD DVD can store more information than current DVDs on the same size 12cm optical disc we're all used to. In contrast, HD DVDs can store up to 15GB on a single layer while Blu-ray can hold 25GB on one layer.

Q.3 Write note on each of the following:

a) Memory access methods

Answer:

Memory Access Methods:

Sequential Access:-

In this method, the memory is accessed in a specific linear sequential manner, like accessing in a single Linked List. The access time depends on the location of the data. Applications of this sequential memory access are magnetic tapes, magnetic disk and optical memories.

Random Access:-

In this method, any location of the memory can be accessed randomly like accessing in Array. Physical locations are independent in this access method.

Applications of this random memory access are RAM and ROM.

Direct Access:-

In this method, the particular location of the memory can be accessed directly like accessing in Array. This method is a combination of above two access methods. The access time depends on both the memory organization and characteristics of storage technology. The access is semi-random or direct. Application of thus direct memory access is magnetic hard disk, read/write header.

Associate Access:-

In this memory, a word is accessed rather than its address. This access method is a special type of random access method. Application of thus direct memory access is Cache memory. Attention reader! Don’t stop learning now. Get hold of all the important CS Theory concepts for SDE interviews with the CS Theory Course at a student-friendly price and become industry ready.

b) Principle of locality

Answer:

In computer science, locality of reference, also known as the principle of locality, is the tendency of a processor to access the same set of memory locations repetitively over a short period of time. There are two basic types of reference locality – temporal and spatial locality.

c) Possible approaches to cache coherency

Answer:

One approach is to use what is called an invalidation-based cache coherence protocol. This approach solves the cache coherence problem by ensuring that as soon as a core requests to write to a cache block, that core must invalidate (remove) the copy of the block in any other core's cache that contains the block.

d) Practical Issues peculiar to SSDs

Answer:

There are two practical issues peculiar to SSDs that are not faced by HDDs

SDD performance has a tendency to slow down as the device is used. The entire block must be read from the flash memory and placed in a RAM buffer. Before the block can be written back to flash memory, the entire block of flash memory must be erased. The entire block from the buffer is now written back to the flash memory. Flash memory becomes unusable after a certain number of writes. Techniques for prolonging life:

Front-ending the flash with a cache to delay and group write operations. Using wear-leveling algorithms that evenly distribute writes across block of cells. Bad-block management techniques. Most flash devices estimate their own remaining lifetimes so systems can anticipate failure and take preemptive action

e) CD read and write operation

Answer:

CD-RW (Compact Disc-rewritable) is a digital optical disc storage format introduced in 1997. A CD-RW compact disc (CD-RWs) can be written, read, erased, and re-written. CD-ROM drives with a "MultiRead" certification are compatible.

Q.4 Solve each of the following:

a) Suppose that the processor has access to two levels of memory.

Level-1 contains 1000 words and has an access time of 0.01 μs;

level-2 contains 100,000 words and has an access time of 0.1 μs. Assume that if a word to be accessed is in level 1, then the processor accesses it directly. If it is in level 2, then the word is first transferred to level 1 and then accessed by the processor. Suppose 95% of the memory accesses are found in level 1. Then find the average time to access a word. Also draw the general shape of the curve that covers this situation.

Answer:

b) Show the tag, Set, and word values for a two-way set-associative cache if the main memory address is 9F3A7Ch.

Answer:

c) Suppose an 8-bit data word (M) stored in memory is 10101010. Using the Hamming algorithm, determine what check bits (k) would be stored in memory with the data word.

Answer:

d) Consider a disk with an advertised average seek time of 6 ms, rotation speed of 7,200 rpm, and 512-byte sectors with 500 sectors per track. Suppose that we wish to read a file consisting of 2500 sectors for a total of 1.28 Mbytes. Estimate the total time for the transfer when:

1. The file occupies all the sectors on 5 adjacent tracks
2. The sectors are distributed randomly over the disk

Answer: