

Name

Sauad ur Rehman

ID

15031

Dept

Bs (cs) 4th semester

Subject

Computer Architecture

Assignment

Final Term

Submitted To Sir M. Amin

Date

26/6/2020

①

Q1 Give answer to each of the following ?

(a) Discuss the concept of word addressable unit and unit of transfer for internal memory.

Ans → Word → The natural unit of organization of memory.

The size of a word is typically equal ~~of a word~~ to the number of bit used to represent an integer and to the instruction length.

Unfortunately there are many exceptions

For example the CRAY 90 has a 64 bit integer representation. The

Intel x86 architecture has a wide

2

variety of instruction length expressed  
as multiple of bytes and a word  
size of 32 bits.

Addressable Unit is

In some systems the addressable  
unit is the word. However many systems  
allow addressable at the byte level.

In any case the relationship  
between the length in bits  $A$  of an address  
and the number  $N$  of

addressable units is  $N = 2^{A/8}$

Unit of Transfer is

For main memory this is the  
number of bits read out of or  
written into memory at a time.

3

The unit of transfer need not equal a word or an addressable unit for external memory data are often transferred in much larger units than a word and these are referred to as blocks.

(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?

Ans (LRU) least recently used is easily implemented by two-way set associative mapping. Each line

include a USE bit. when a line is referred its use bit is set to 1 and use bit of the other line is not set to 0. when a block is to

(4)

Be read into the set the line

whose use bit is 0 is used. Because

we are assuming that more recently used memory locations are more likely to be referred. LRU should give the best hit ratio.

(LFU) Least Frequently Used is

LFU could be implemented by associating a counter with each line. A technique

not based on usage (i.e. not LRU, LFU, FIFO or some variant) is to pick a time at random from among the candidate lines. Simulation studies

have shown that random replacement provides only slightly inferior

performance to an algorithm based on usage.

5

Name

Sauwal ar Rehman

ID

15031

Dept.

Bs (C) 4<sup>th</sup> semester

Subject

Computer architecture

Q1  
5 Give answer to each of the following ?

Q How read and write operation are performed in SRAM cell?

Ans  
5 as Read operation is

In SRAM for any operation to be performed, the word line should be high to perform read operation initially.

write operation is consider the memory

bit consists of  $Q_2=0$  and

$Q_2=1$ .

(6)

(d)

Discuss 16-Mbit DRAM (4Mx4) organization in detail.

Ans is 16-Mbit DRAM is

In this case 4 bits are read or written at a time. Logically the memory array is organized as four square array of 2048 by 2048 elements. Various physical arrangements must be possible. In any case the elements of the array are connected by both horizontal lines connect by both horizontal to the select terminal of each cell in a row each vertical lines connect to the Data in/serve terminal of each cell in a column.

Because only 4 bits are read/written to this DRAM, there must be multiple DRAM connected to the memory controller to read/write

a word of data to the bus.

(7)

(c) what are the reasons for DVD's greater data capacity over CD?

Ans: The DVD's greater capacity is due to three differences from CDs.

(1) Bits are packed more closely on a DVD. The spacing b/w loops of a spiral on a CD is 1.6  $\mu\text{m}$  and the minimum distance b/w pits along the spiral is 0.834  $\mu\text{m}$ .

(2) The DVD employs a second layer of pits and lands on top of the first layer. A dual layer on top of the reflective layer and by adjusting focus the lasers in DVD drives can read each layer separately.

(3) The DVD-ROM can be two sided whereas data is recorded on only one side of a CD. This brings total capacity up to 17GB.



(8)

Q2

Differentiate each of the following in detail.

(a) EEPROM and flash memory.

Ans to EEPROM is Electrically Erasable Programmable Read Only Memory (EEPROM) is a read-only memory that can be written into at any time without erasing previous contents. Only the byte or bytes addressed are updated. The write operation takes considerably longer than the read operation. EEPROM is more expensive than EPROM and also is less dense supporting fewer bits per chip.

Flash Memory is Flash memory is intermediate b/w EEPROM and EPROM in both cost and functionality. Like EPROM flash memory erases on electrical erasing technology. An entire flash memory can be erased in one or a few seconds, which is much faster than EPROM. Flash memory does not provide byte-level erasure.

(b) Hard failure and soft error in semiconductor memories?

Ans as Hard failure is

A hard failure is a permanent physical defect so that the memory cell or cells affected cannot reliably store data but become stuck at 0 or 1 or switch erratically b/w 0 and 1. Hard error can be caused by harsh environment abuse, manufacture using defects and wear.

Soft error is A soft error

is a random nondestructive event that alters the contents of one

or more memory cells without damaging the memory. Soft error can

be caused by power supply problems

or alpha particles. Both hard and soft error are clearly undesirable.

Q) Read and write mechanisms for magnetic disk?

Ans) Magnetic Disk

Read Mechanisms

The traditional read mechanism exploits

the fact that a magnetic field moving relative to a coil produces an electrical current in the coil when

the surface of the disk rotates under the head it generates a current of the same polarity as one already recorded.

Write Mechanisms

The write mechanism exploits the fact that electricity flowing through a coil produces a magnetic field. Electric poles the resulting magnetic

patterns are recorded on the surface below with different patterns for positive and negative currents.

(d) Parallel access and independent access RAID schemes.

Ans: All member disks are participate in the execution of every I/O request. Typically the spindle of the individual drives are synchronized so that each disk head is in some position on each disk at any given time.

Independent Access

Each member disk operates independently so that separate I/O requests can be satisfied in parallel.

17

(e) Hdd DVD and Blu-ray DVD.

Ans of Hdd DVD is

The Hdd DVD scheme can store 15 GB on a single layer on a single side.

- Hdd DVD player have been much cheaper than Blu-ray machine.
- It delivers sharp resolution.
- It is cheaper than Blue-ray.

Blu-ray DVD is

Blu-ray discs have more storage space and more advance protection against piracy.

- It also delivers sharp resolution.
- Blu ray has 25GB capacity

and is more expensive than Hdd DVD.

Q3 write note on each of the following ?

(a) Memory access Method ..

Ans Sequential access is Memory is organized into unit of called record access must be stored addressing information is used to separate record and used in the retrieval process.

A shared read write mechanism is used this must be moved from its current location to desired location passing and receiving each individual record. Tape unit are sequential access.

Random access is The Time to access a given location is independent of the sequence of prior access and is constant. Thus any location can be selected at random and directly addressed and accessed. Main memory and some cache systems are random access.

Direct access is As with sequential

access direct access involves a shared word mechanism. However individual blocks or records have a unique address based on physical location. Access time is variable. Disk units are direct access.

Associative access is This is

random access type of memory that each involves one to make a comparison of desired bit location within a word for a specified

match and to do this for all word simultaneously. Thus a word is retrieved based on a portion of its content rather than its address. Core memory may employ

associative access.

Q6) Principle of locality ?

Ans is Principle of locality is

The principle of locality states that data in the vicinity of a referenced word are likely to be referenced in the near future.

Q7) Possible approaches to cache coherency ?

Ans is Possible approaches to cache coherency include the following:

Bus watching with write through.

Each cache controller monitors the address lines to detect write operation to memory by other bus master.



Hardware Transparency is Additional hardware is used to ensure that all updates to main memory via cache are reflected in all caches. They if one processor modifies a word in its cache this update is written to main memory.

Non-cacheable Memory is only a portion of main memory

is shared by more than is designated as processor and there is such a system all access to shared memory are cache misses because the shared memory is never copied into cache

(17)

(b) Practical ~~and~~ issue peculiar

to SSDs ?

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

\* SSD 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 unusable after a certain number of writes.

• Techniques for prolonging life.

• Flash erasing the flash with a cycle

cause to delay and group writer operations.

• using wear leveling that evenly distribute writer across block of cells.

• Bad = block management techniques.

• Most flash devices estimate their own remaining life times so systems can anticipate and failure take preemptive action.

(e) CD read and write operation?

Ans of Read operation of information is

retrieved from a CD or CD-ROM by a low powered laser housed in an optical disk player or drive unit. The laser shines through the clear polycarbonate while a motor spins the disk past it. The beginning or end of pit represents a 1 when

no change in elevation occurs

between intervals a 0 is recorded.

write operation or Recall that on a magnetic disk information is recorded in concentric tracks with the simplest constant angular velocity (CAV) system the number of bits per track is constant.

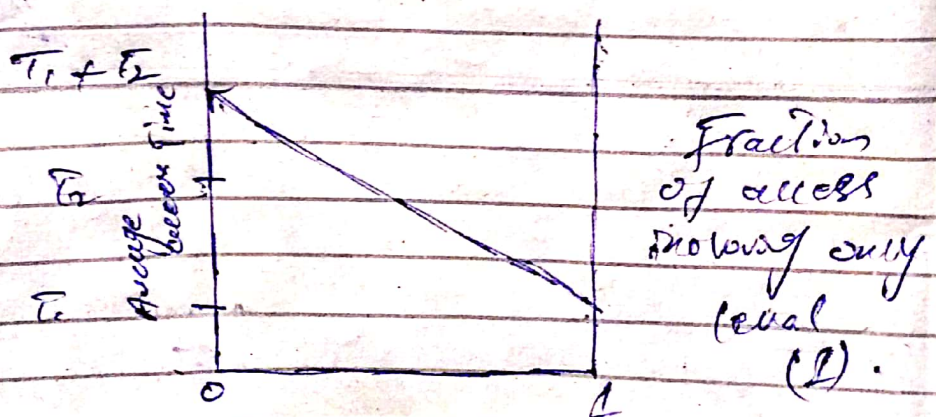
Q4 is solve each of the following

(a)

Ans is In example 95% of the memory access are found in level 0. Then the average time to access a word can be expressed as:

$$(0.95)(0.01 \mu s) + (0.05)(0.01 \mu s + 0.1 \mu s) = 0.0095 + 0.0055 = 0.015 \mu s$$

The average time is much closer to 0.01  $\mu s$  than to 0.1  $\mu s$  as desired.



(b)

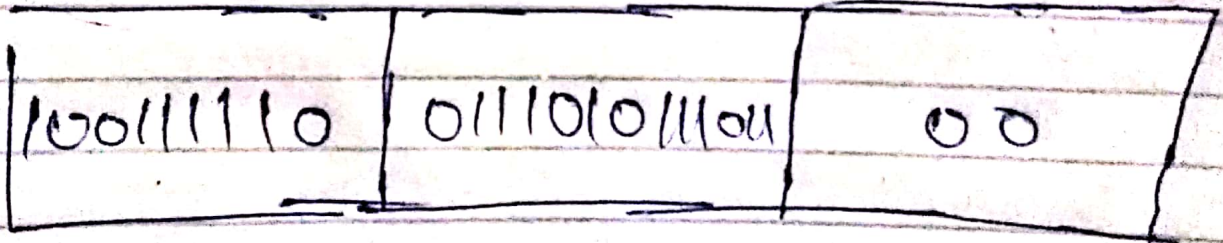
(2)

Ans is Main memory address

2 9F3A7ch

1001111001110101101100

Tag                      set                      word



← 9 bits →      ← 13 bits →      ← 2 bits

Q

Ans  
5.

$$M=8$$

$$2^4 - 1 = 8 + 1$$

$$2^4 - 1 = 4 + 8$$

$$15 > 12$$

1	2	3	4	5	6	7	8	9	10	11	12
1	0	1	1	1	0	0	1	0	0	1	0

The check bits are in a bit number  
 1, 2, 4, 8 check bit 8 calculated  
 by value in bit number.  
 9, 10, 11 and 12.

check bit 9 calculated by values  
 in bit number 5, 6, 7 and 12

check bit 2 calculated by  
 values in bit number  
 3, 6, 7, 10 and 11.

check bit 1 calculated by values  
 in bit number 3, 5, 7, 9, 10 and  
 11

The check bits are 1011.

23

(D)

Ans to

7200 revolution in 60 sec  
1 revolution in  $60/7200$

1 revolution in 6ms

1 revolution = covering one entire track  
500 sectors

500 sector = 6ms

1 sector = 8 microseconds

Now there are 2 different things

1) 2500 sectors so time =  $2500 \times 8 \mu s$

= 20ms

2) 1.28 MB = 1342177.28 bytes

OR 2621.144 sectors

2622 sectors = 20.976ms

Total Time

case

case (1)  $4 + 2 + 20 = 26ms$

case (2)  $4 + 2 + 20.976 = 26.976ms$