Ch: 6: Memory Organization

* Explain Main Memory with its Hierarchy.

The Main Memory is the fundamental storage unit in a computer system.

It is associatively large and quick memory and saves programs and information during computer operations.

There are two types of Main Memory:

1) RAM 2) ROM

1 RAM: RAM is stands for Random Access Memory.

There are two types of RAM

(i) Static RAM: Stores a bit of data using the state of a six transistor memory cell.

(ii) Dynamic RAM: Stores a bit data using a pair of transistor and capacitor.

2 ROM: ROM stands for Read only Memory.

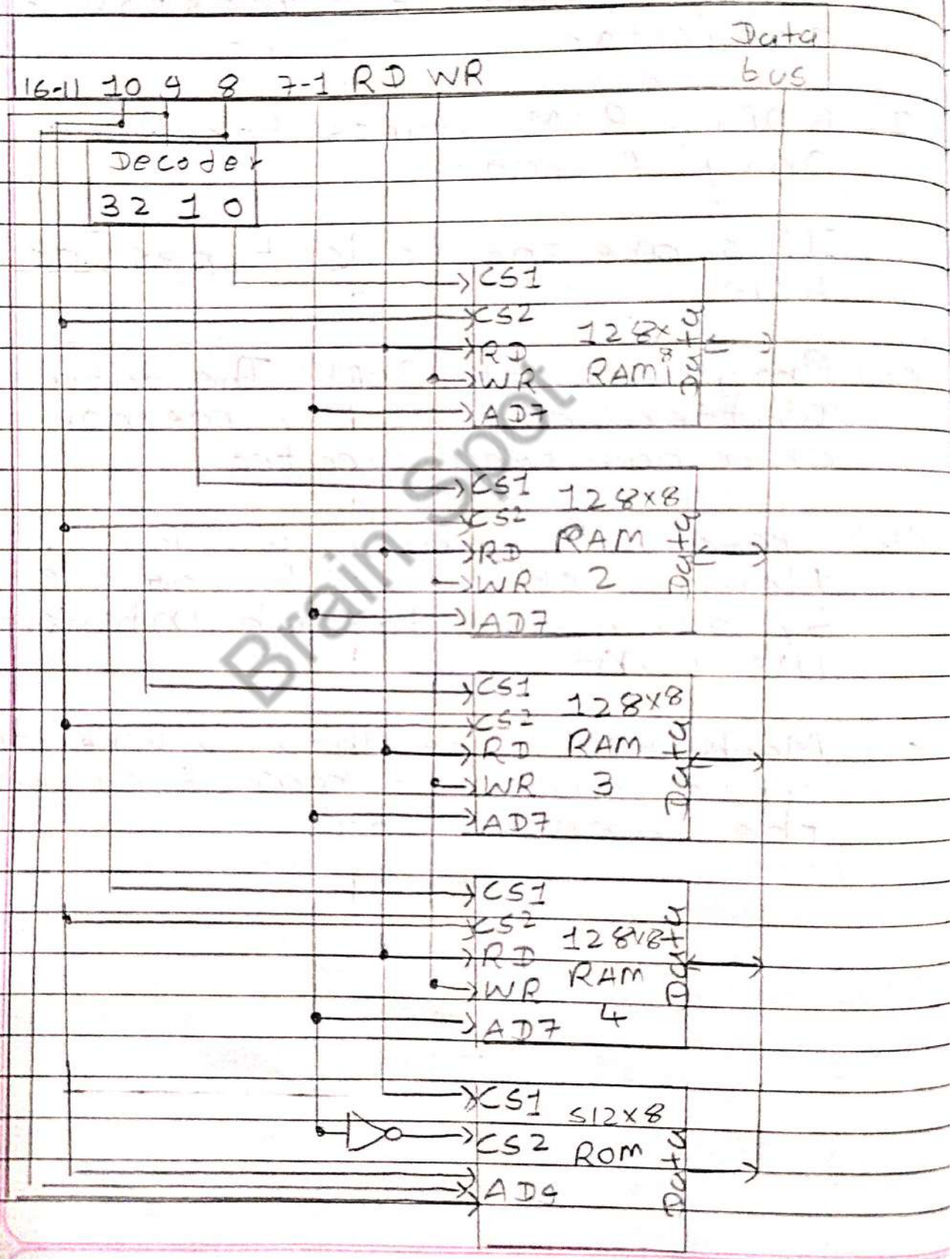
This are the basic types of ROM.

(i) Programmable ROM: The data is written after the memory chip has been created.

(ii) Erasable Programmable ROM: Memory chip can be erased by exponsing to high intensity UV light.

(iii) Mask ROM: The data is written at a time of manufacturing the memory chip.

=> Hirarchy of Memory:



* Explain Difference of Main Memory.

Or

* Explain Difference of RAM and ROM.

	RAM	ROM
1	RAM stands for Random Access Memory.	ROM stands for Read Only Memory.
2	RAM data is volatile.	ROM data is non-volatile.
3	RAM data can be read or modified.	ROM data is read only.
4	RAM speed is quite high.	ROM speed is slower than RAM.
5	RAM Memory is Large and high capacity.	ROM is generally small and low capacity.
6	RAM is costly.	ROM is cheap.
7	RAM is Temporary storage.	ROM is Pemenent storage

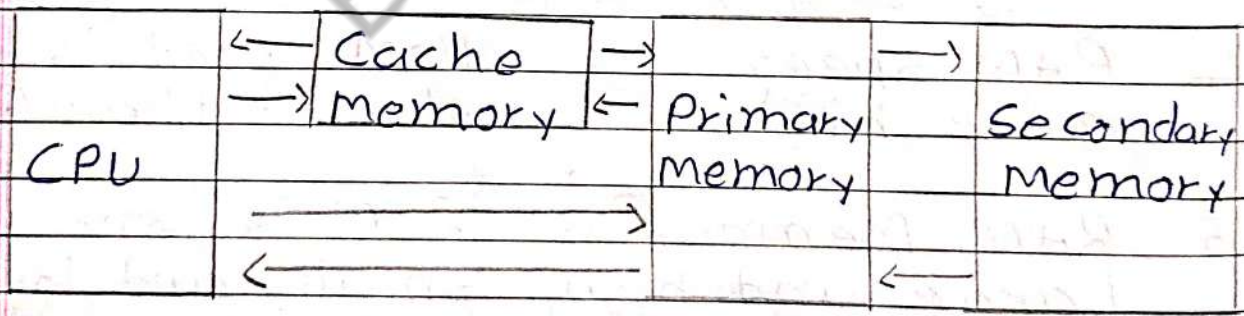
* Explain Cache memory with its Mapping.

=> Cache Memory is a special very high-speed memory.

~~Cha~~
Cache Memory is costiler than main memory or Disk Memory.

It holds frequently requested data and instruction so they are immediately available to CPU when needed.

Cache memory is used to reduce the average time to access data from the main memory.



There are Three Cache Mapping Method.

1) Direct Mapping

2) Associative Mapping

3) Set-Associative Mapping.

1 Direct Mapping:

Direct Mapping method assign each memory block to a specific line in the cache.

Every ~~bole~~ block can place at a specific line in cache.

For Cache $i = j$ modulo m line number

Where, j = Block number
m = line number.

Using this Formula, we can place every block in the cache memory line.

Ex.

$B_0 B_4$	0
$B_1 B_5$	1
$B_2 B_6$	2
$B_3 B_7$	3

Cache Memory

$W_0 W_1 W_2 W_3$	B_0
$W_4 W_5 W_6 W_7$	B_1
$W_8 W_9 W_{10} W_{11}$	B_2
- - - -	B_3
- - - -	B_4
- - - -	⋮
- - - -	⋮
- - - -	⋮
- - - -	B_{31}

Main Memory.

Here, Main memory contain 128 words and cache memory contain 16 words.

In Main Memory every block and Cache Memory every line contain 4 words.

For Direct Mapping,

For Block 9 (B9)

$i = j \text{ modulo } m$
$= 0 \text{ modulo } 4$
$i = 0$

So Block 0 can place at Line 0.

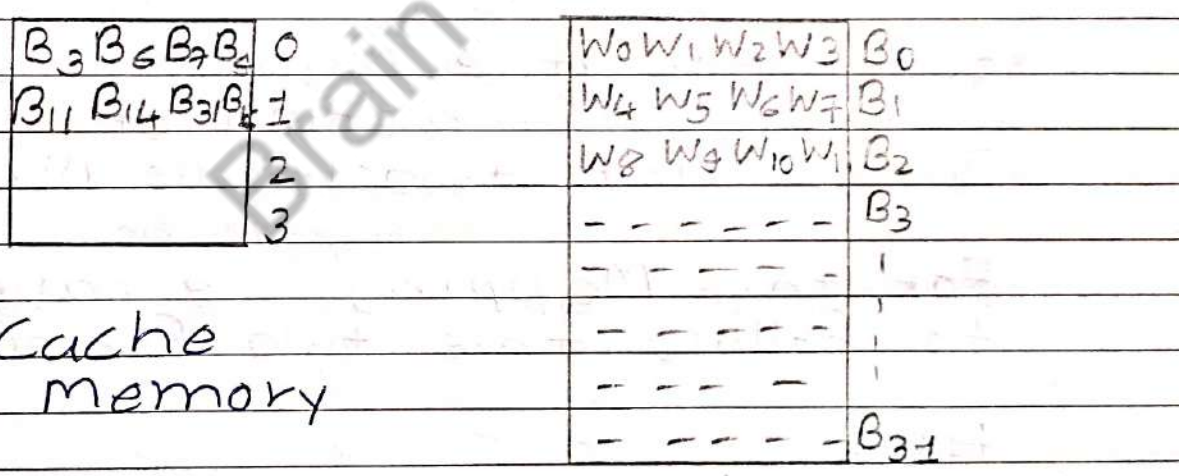
2 Associative Mapping:

In Associative Mapping, we can place any block at any cache memory line.

There are no fixed cache memory line for place the block.

This mapping method, remove the disadvantage of associative Memory.

Ex.



Here, Main Memory contain 128 words and cache memory contain 16 words.

For Associative Mapping,

We can place any block at any line in cache memory.

We can place Block 3, 6, 7, and 9 in Line 0 in cache memory.

3 Set Associative Mapping:

Set Associative Mapping is also called k-way Associative Mapping.

Set Associative Mapping is a ~~typ~~ combinaction of Direct and Associative Mapping.

For this Mapping, we have to follow this two formula.

Here

$$i = \frac{\text{No. of lines}}{k}$$

Here, we have to divided number of cache line into the given k-way.

After that we have to divided cache Memory according to value of i.

After that we have to follow Direct Mapping.

~~K modulo~~

$i = j \text{ modulo } m$

Whena we get i value than we also get cache memory one section.

In this section, we can place Block into the line.

Ex.

B_1	0
B_0	1
B_3	2
B_2	3

Cache Memory

$W_0 W_1 W_2 W_3$	B_0
$W_4 W_5 W_6 W_7$	B_1
- - - - -	B_2
- - - - - -	B_3
- - - - -	:
- - - - - -	:
- - - - - -	B_{31}

Main Memory

Here, number of line = 4 and
K - way = 2.

So,

$$i = \frac{\text{No. of line}}{K} = \frac{4}{2}$$

$$\therefore \quad i = 2.$$

We have to divided cache memory into two part.

After that,

For Placing Block,

$$i = j \text{ modulo } m$$
$$= 0 \text{ modulo } 4$$
$$= 0.$$

We can place Block Zero at the First part of Cache memory.

We can place Block Zero either line 0 or line 1 of cache memory.

* Explain Auxiliary Memory:

=> Auxiliary Memory is known as the lowest cost, highest capacity and slowest-access storage in a computer system.

Ex. Magnetic Disks or Magnetic Tapes.

- Magnetic Disks:

A Magnetic Disk is a type of memory constructed using a circular plate of metal or plastic coated magnetized material.

Both sides of the Magnetic Disk are used to carry out read or write operation.

On Magnetic Disk there are number of trackes are spots.

On Number of trackes, there are number of sector on a Magnetic Disk.

- Magnetic Tape:

The Magnetic Tape is construct using a plastic strip coated with a magnetic recording medium.

Magnetic Tape is a storage medium that allows data achiving, collection.