Lecture-8 | 4 Sept. 2019

Review of last lecture -

- D-flip flop (1-bit)
- Registers (more than one-bit)
- Counter (~~storage~~ Register + ~~function~~ additional function)
- Program counter (Register + additional functionality)

Today's Lecture :-

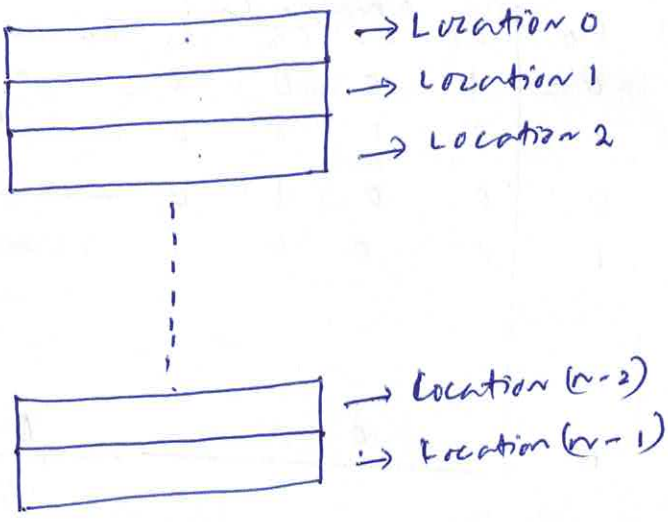
→ Memory Design :-

→ Register file :-

Memory Design :-

- Able to store the information (data or instruction)
- Able to access for read & write

Block diagram :-

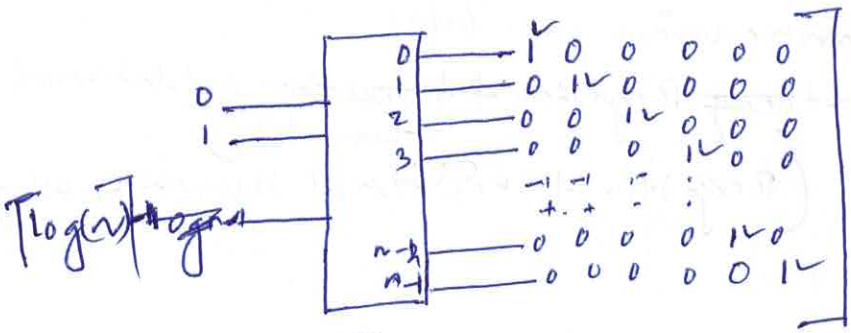


Addressing requirement :-

- Able to address Location i
- Able to store data/instruction in Location i without affecting other locations

(2)

Address Decoder :-



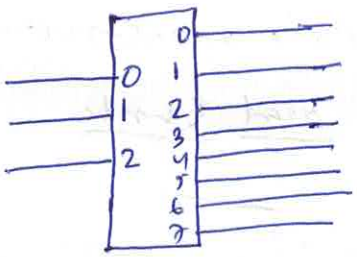
At any point of time only one location is address

K : n address decoder

$K = \lceil \log(n) \rceil$

Example : ($n = 8$)

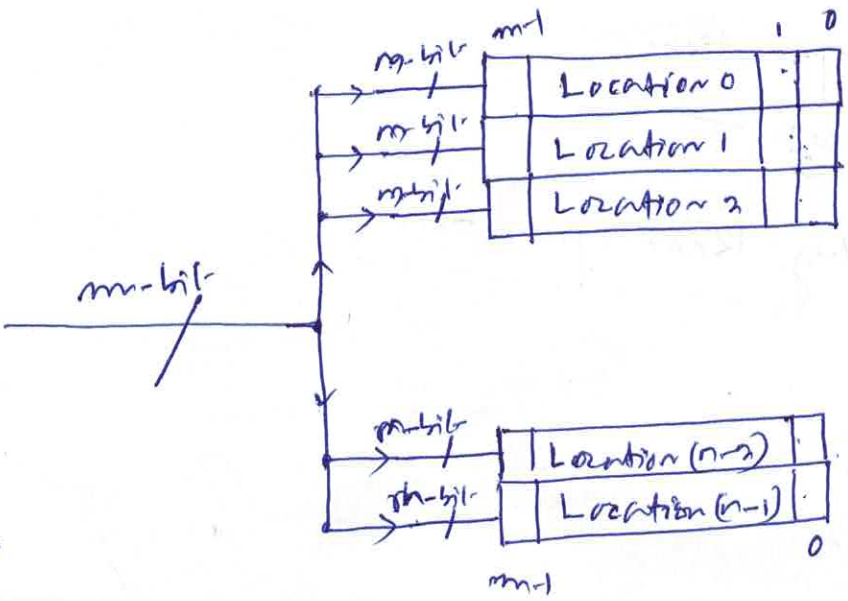
$K = \lceil \log 8 \rceil = 3$



address			enable line							
a_2	a_1	a_0	e_0	e_1	e_2	e_3	e_4	e_5	e_6	e_7
0	0	0	1	0	0	0	0	0	0	0
0	0	1	0	1	0	0				0
0	1	0	0	0	1	0				0
0	1	1	0	0	0	1				0
1	1	1		0				0		1

Read & write operation :-

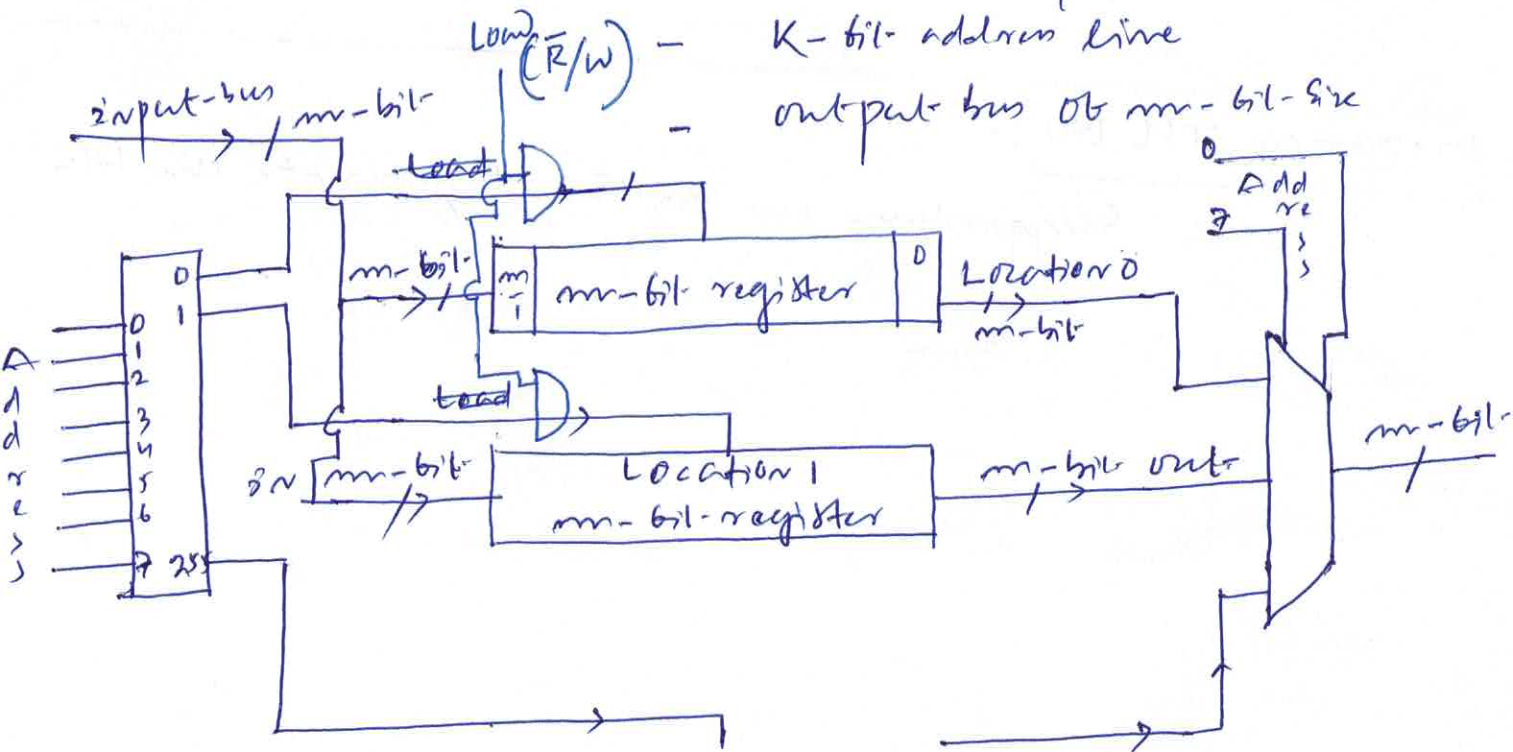
write :- ① the information to be written (input-bus)
② the Location at which it is to be written (Address bus)



Read operation & Detail Design :-

Component required :-

- ~~n-bit~~ m-bit register
- n number of registers
- ~~Data bus~~ input data bus line
- K-bit address line
- output bus of m-bit size



(4)

Design verification (Example) :-

Address – 00000010 — Location 2.

Data to be written – 0000 0110 0000 0001

operation — write operation

control signal – Load = 1

→ Similarly can verify Read operation :-

- HDL Design

- Preparing .cmp file :-

Time	Address	Input Data	Load	output
0+	0000 1000	0000 0000	1	xxxxxx
1				
1+	0 000 1000	xxxx xxxx	0	xx xxxx
2	0 0001000	xx xxxxxx	0	0000 000
2				
2+				
3				
3+				

Preparing TST file :-

Suggestion – use python to generate this file

General Memory Terminology :-

- Size of a memory :-
  - Total location × width of a location
  = n × m bit

byte = 8-bit
word = 16 bit (Intel architecture)
word = 32 bit (MIPS architecture)

double = 2 × word

1 kilo = 2^{10}
1 Mega = $2^{10} \times 2^{10}$
1 Giga = $2^{10} \times 2^{10} \times 2^{10}$
1 Tera = $2^{10} \times 2^{10} \times 2^{10} \times 2^{10}$
1 Peta = $2^{10} \times 2^{10} \times 2^{10} \times 2^{10} \times 2^{10}$

1 kilobyte = 2^{10} × byte
= 2^{10} × 8 bits

- Type of Memory -

to be used in this course..
- Read only (ROM)
- DRAM (Dynamic Random Access Memory)
- SRAM (Static RAM)
- NVM (None-Volatile Memory)
- Disk
- ——