

❖ Memory Design

RAM is made up of memory cells arranged in a grid of rows and columns. Each cell stores a bit of data, represented as either 0 or 1.

✓ Types of RAM:

- **SRAM (Static RAM):** Uses flip-flops to store data, providing faster access but at a higher cost and power consumption.
- **DRAM (Dynamic RAM):** Stores data in capacitors, which need to be refreshed periodically. It's slower than SRAM but more cost-effective and has higher density.

Addressing: Each memory cell in RAM is accessed using a unique address. The address lines select the row and column to read or write data.

✓ Design Considerations:

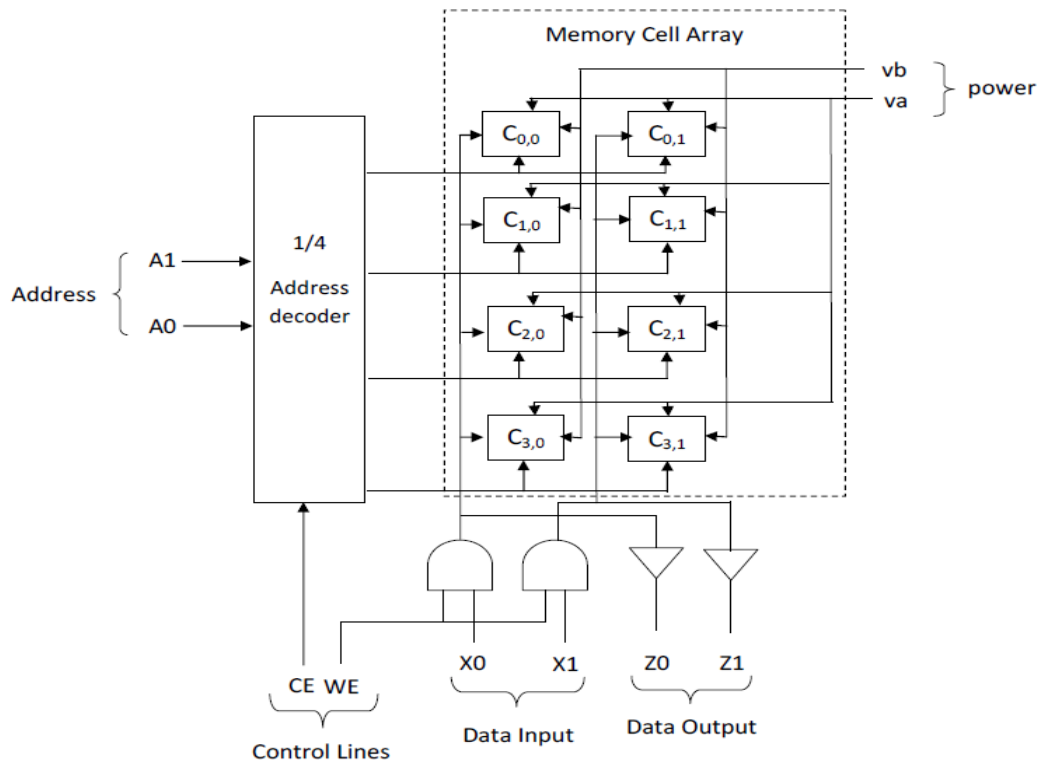
- **Size and Capacity:** Determined by the number of rows and columns. For example, designing a 512x8 RAM from 128x8 RAM involves using multiple chips and a decoder to manage the increased address space.
- **Speed:** Influenced by the type of RAM and the design of the memory cells and access circuitry.
- **Power Consumption:** Important for battery-operated devices, with SRAM generally consuming more power than DRAM.

❖ **Designing $M \times N$ memory with $D \times W$ chips, where M and D are the *Address Space*, while N and W are used for *Data*.**

Note: Always $M > D$, and $N > W$.

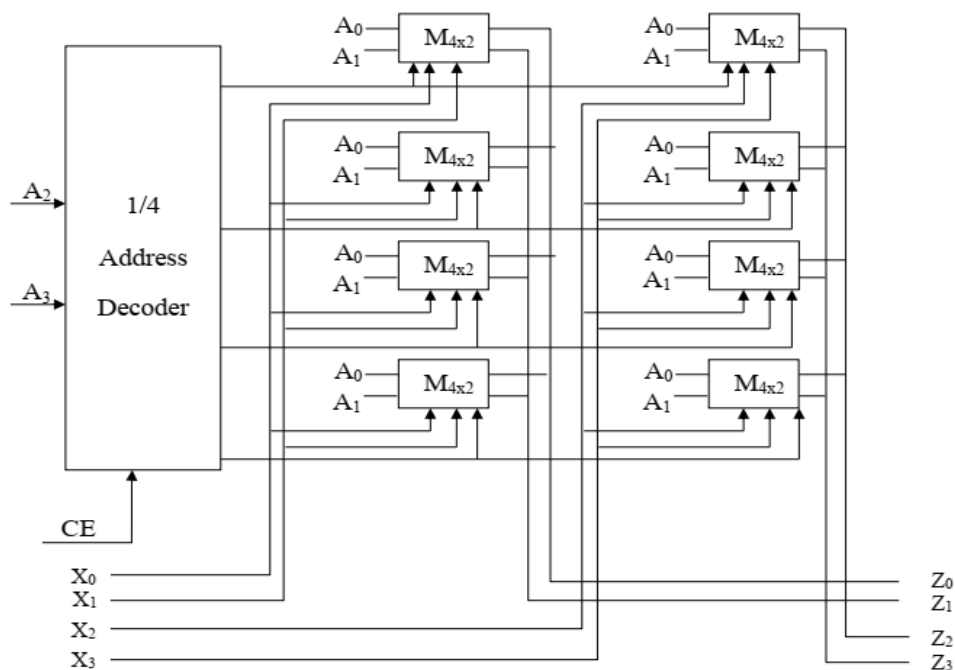
There are three basic steps in memory designing:

1. Find the Number of rows = M/D
2. Find the Number of columns = N/W
3. Find the Number of chips = $M/D \times N/W$



The internal structure for the 4*2-bit RAM

Example: Design a 16*4-bit memory using 4*2-bit ICs.



Computer Science Dept. / 2nd year 1st Course (2024-2025)

Microprocessor

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HW:

1. Design 64kb*8bit Memory using 8k*8bit RAM ICs.
2. Design 64kb*8bit Memory using 8k*4bit RAM ICs.

For Discussion: To design a 64M x 32 memory,
what we could use ??