

JYOTHISHMATHI INSTITUTE OF TECHNOLOGY & SCIENCE



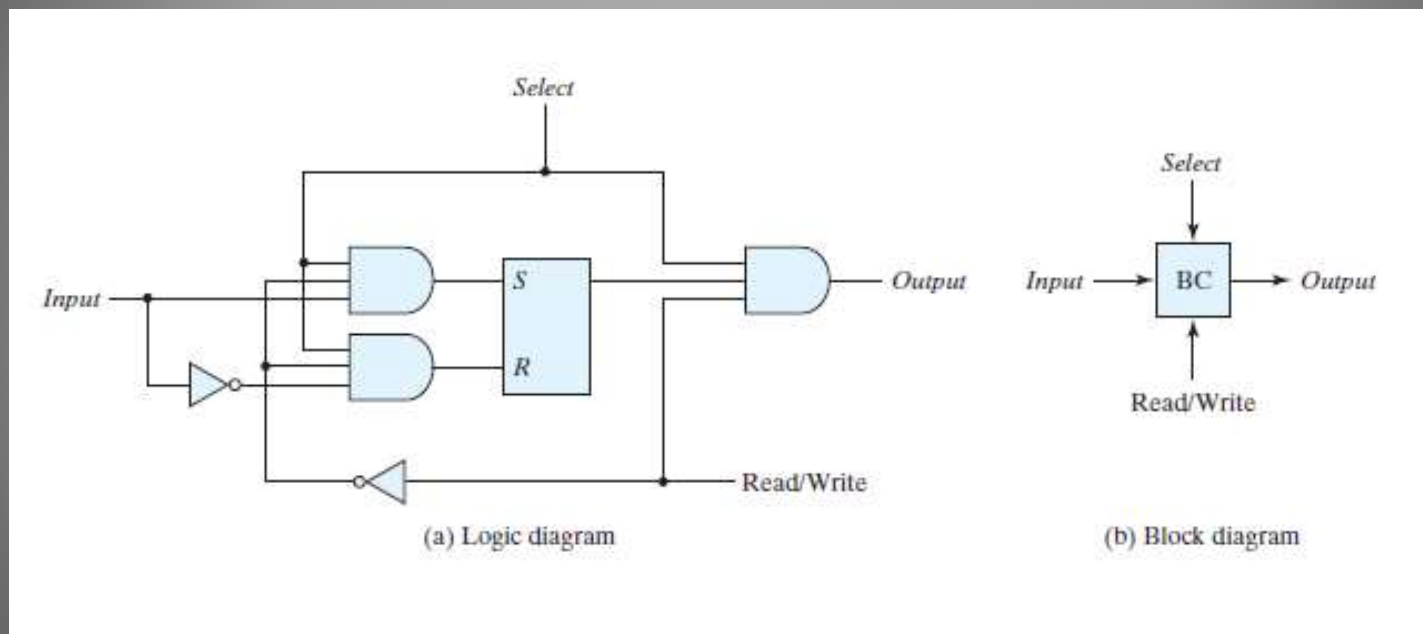
MICRO PROCESSORS & MICRO CONTROLLERS

K.RADHIKA

Department of ECE

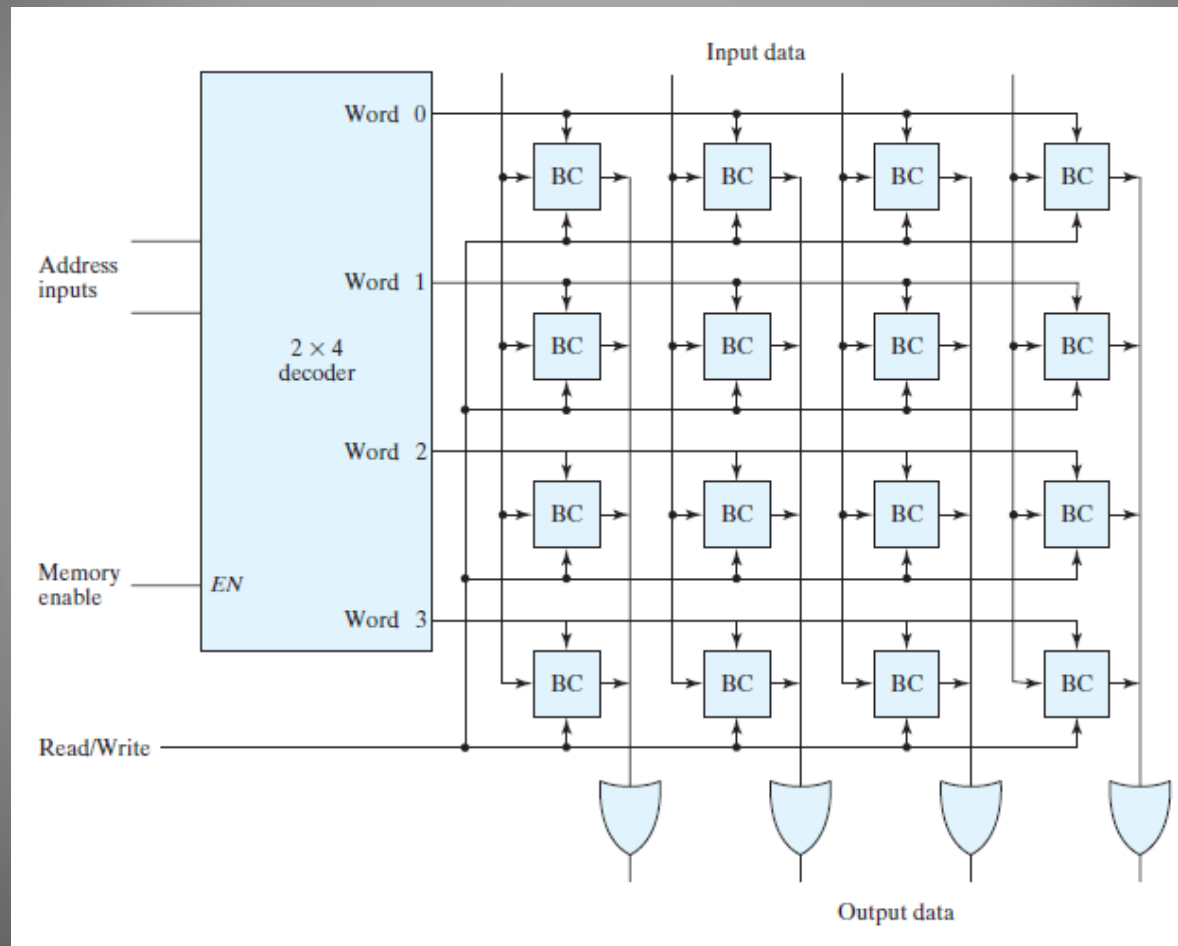
Jyothishmathi Institute of Technology

Random Access Memory



Static Random Access Memory (SRAM)

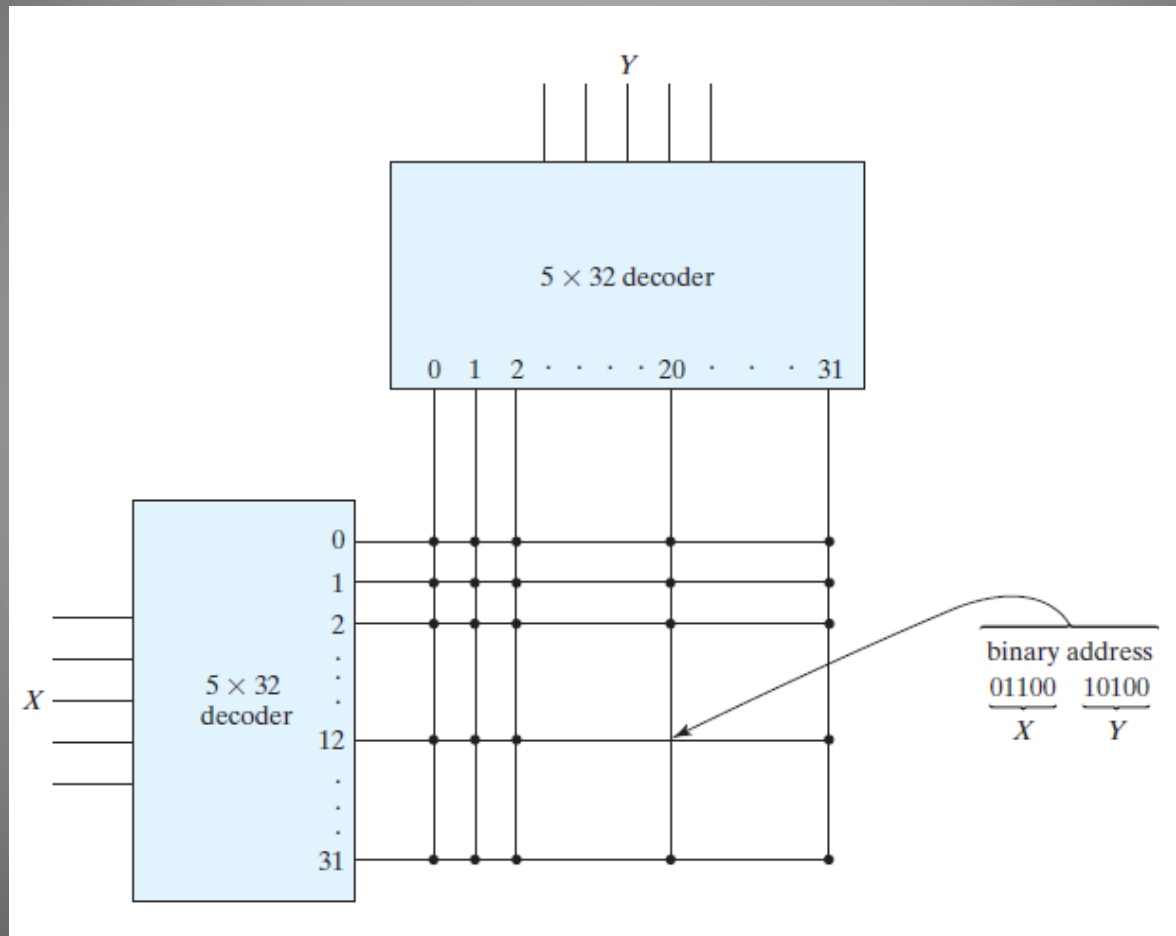
Random Access Memory



RAM: Address Decoding

- k-bit address
 - Decoder requires 2^k AND gates
 - Each AND gate has k inputs
 - For large k this becomes prohibitive.
- Use 2-dimensional decoding
 - Two decoders
 - Each decoder requires $2^{(k/2)}$ AND gates
 - Each AND gate has k/2 inputs
 - Far less combinational logic

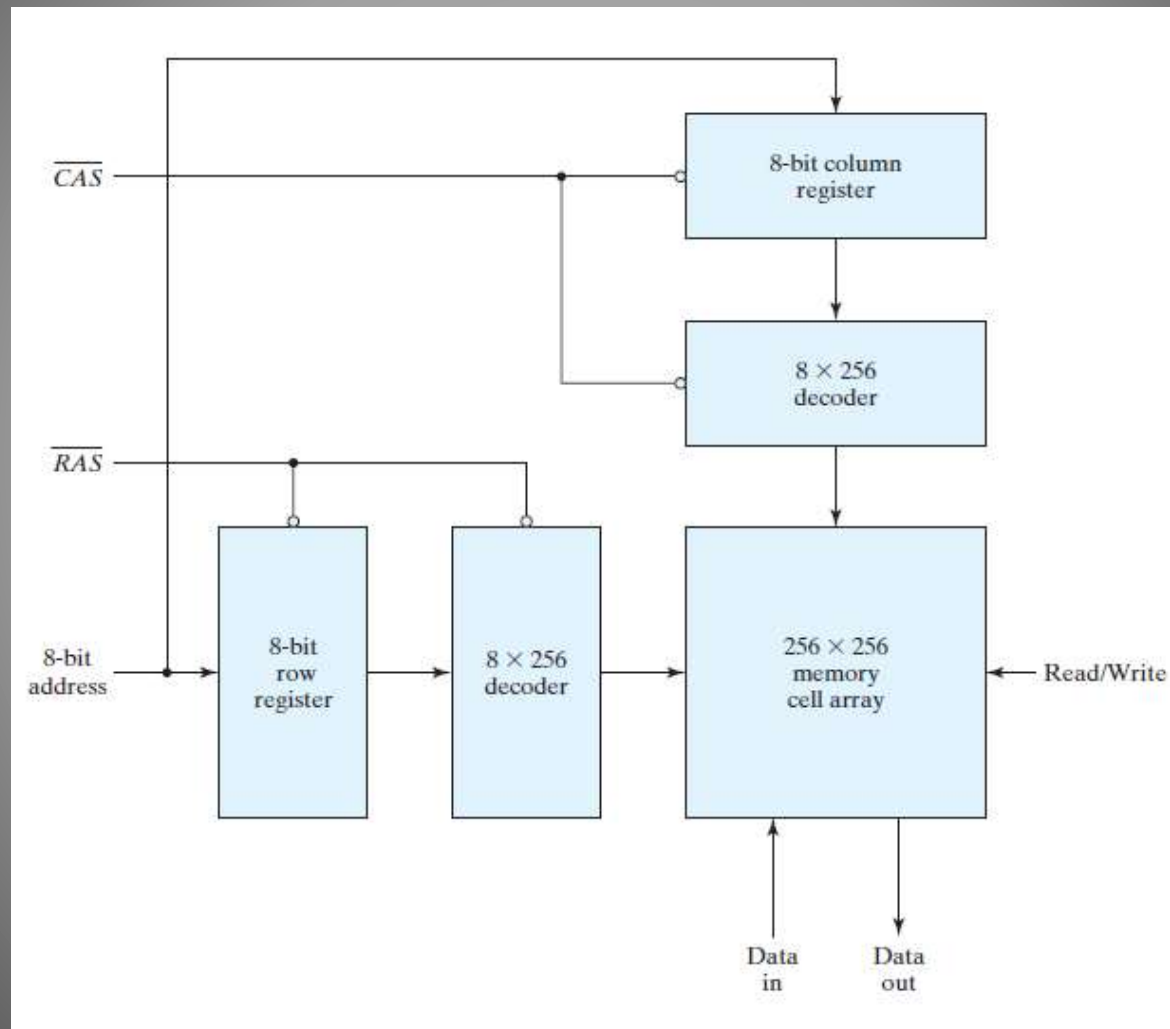
RAM: Address Decoding



RAM: Address Decoding

- The size of a chip package is often dictated by the number of input and output signals.
- For large memories, the number of address lines often becomes prohibitive.
- Use address multiplexing
 - The same address lines are used both for the row address and the column address
 - Use time multiplexing to first latch the row address and then latch the column address

RAM: Address Decoding



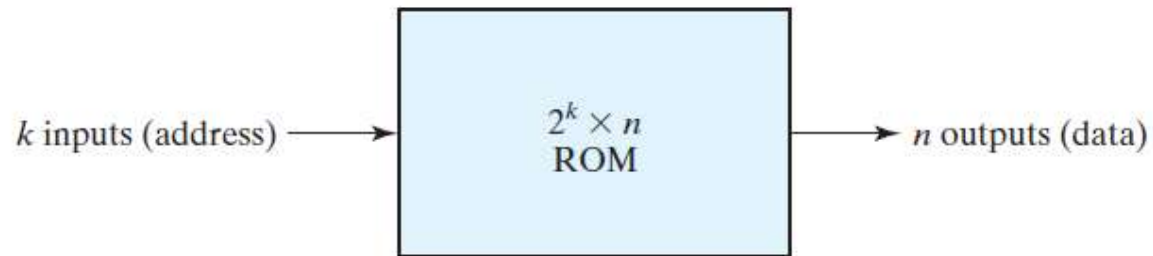
RAM Systems

- Often RAM chips are smaller than the required memory size.
- What if you need a wider memory?
 - Larger word size
- What if you need a deeper memory?
 - Greater number of memory locations

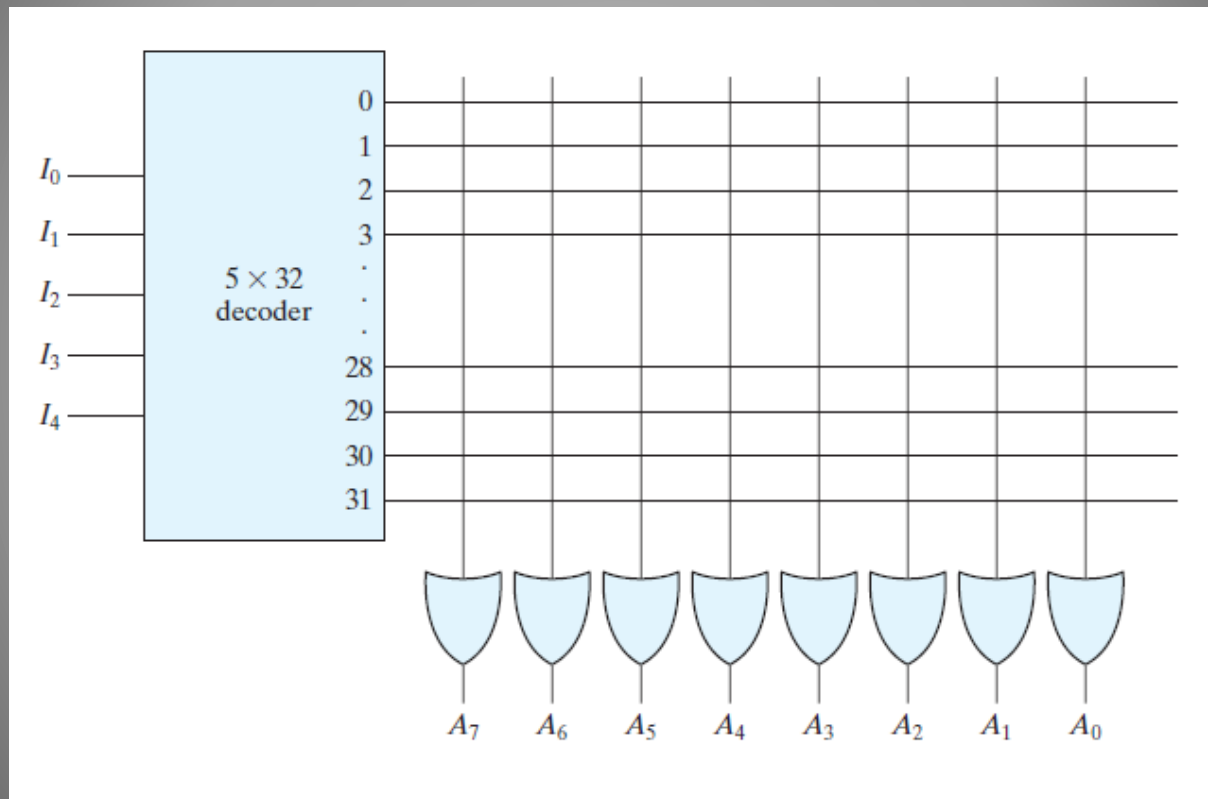
Read Only Memory

- ROM store “permanent” binary information
 - One-time programmable memory
 - Multiple-time programmable memory
- Address and Data
 - k address bits
 - n data bits
- $2^k \times n$ ROM includes
 - k-to- 2^k decoder
 - n 2^k -input OR gates

Read Only Memory



Read Only Memory

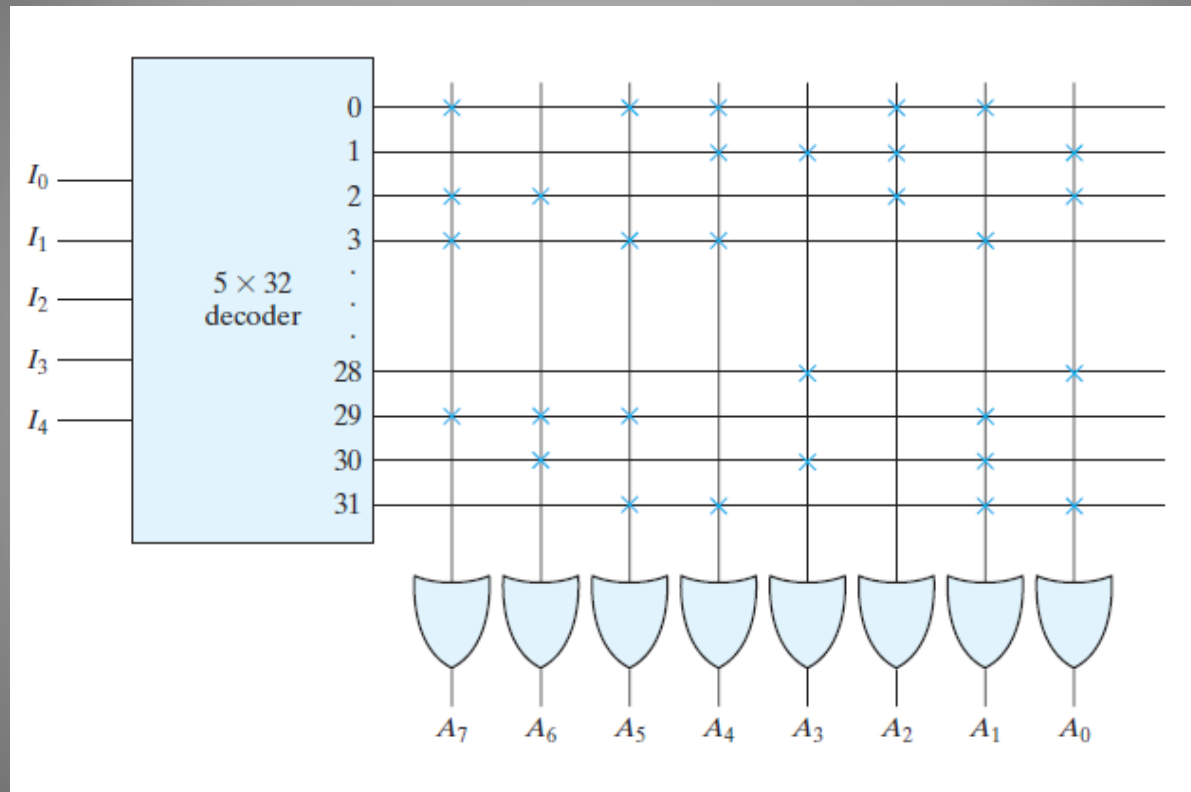


Read Only Memory

Table 7.3
ROM Truth Table (Partial)

Inputs					Outputs								
I_4	I_3	I_2	I_1	I_0	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0	
0	0	0	0	0	1	0	1	1	0	1	1	0	
0	0	0	0	1	0	0	0	1	1	1	0	1	
0	0	0	1	0	1	1	0	0	0	1	0	1	
0	0	0	1	1	1	0	1	1	0	0	1	0	
		$\vdots$						$\vdots$					
1	1	1	0	0	0	0	0	0	1	0	0	1	
1	1	1	0	1	1	1	1	0	0	0	1	0	
1	1	1	1	0	0	1	0	0	1	0	1	0	
1	1	1	1	1	0	0	1	1	0	0	1	1	

Read Only Memory



Read Only Memory

- EEPROM (E²PROM)
 - Electrically Erasable Programmable ROM
- Flash ROM
 - Similar to E²PROM
 - Has additional circuitry to selectively erase and program the memory in-circuit
 - Does not require a special programmer

Programmable Logic Devices



Programmable Logic Devices

- Programmable Logic Arrays (PLA)
 - Programmable Array Logic (PAL)
 - Simple Programmable Logic Device (SPLD)
 - Complex Programmable Logic Device (CPLD)
 - Field Programmable Gate Array (FPGA)
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