

Memory and Programmable Logic Devices:

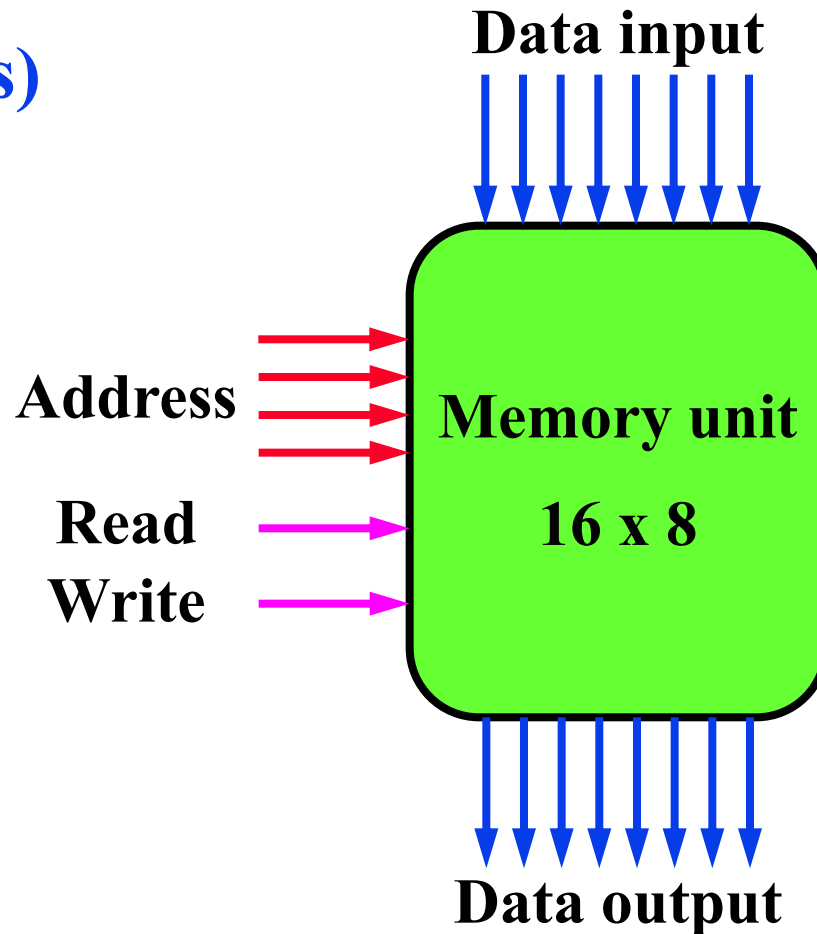
★ UNIT-3

Random-Access Memory (RAM)

★ Data Storage (Volatile)

★ Locations (Address)

★ Byte or Word



Random-Access Memory (RAM)

★ Data Storage (Volatile)

★ Locations (Address)

★ Byte or Word

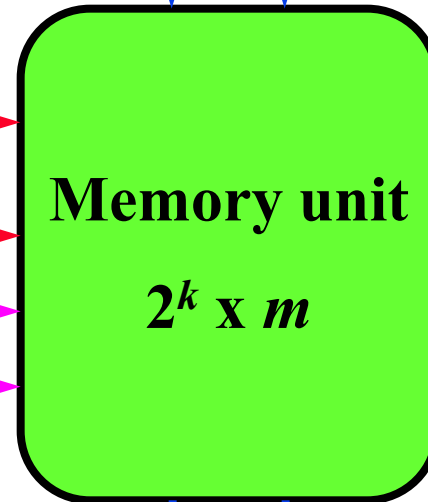
10 Address lines
→ 1024 locations
= 1 K

k Address

Read

Write

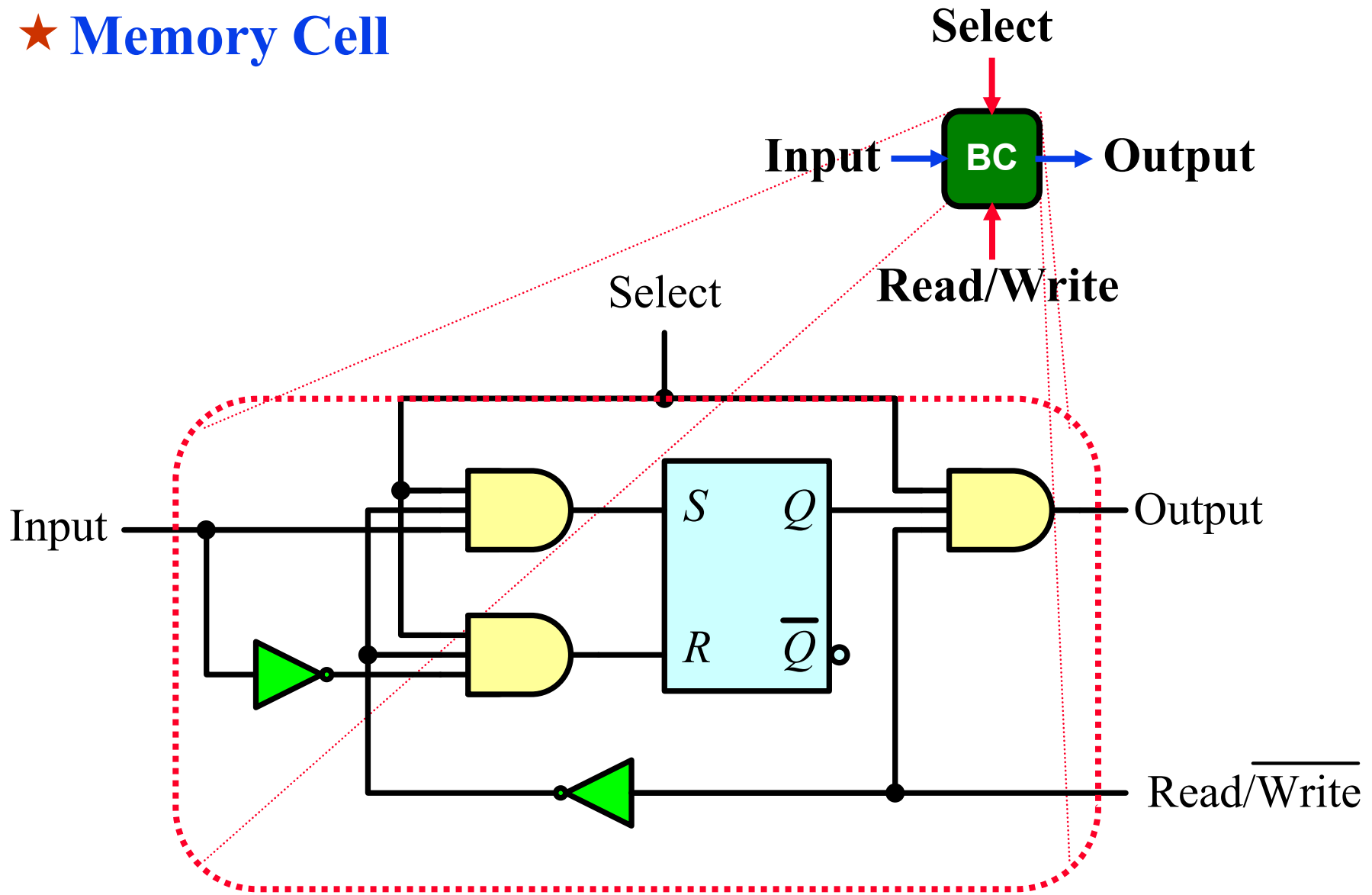
m Data input



m Data output

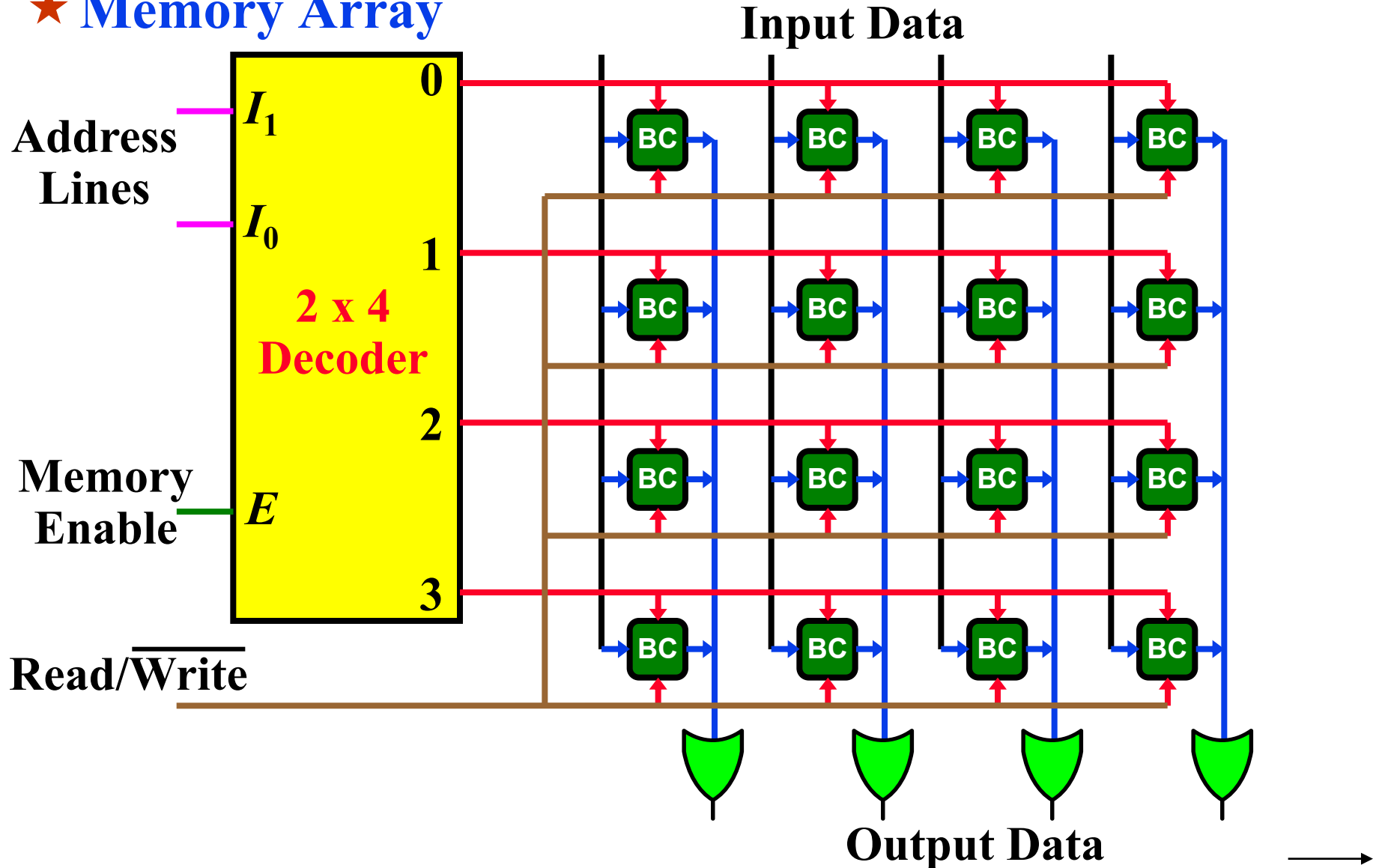
Memory Decoding

★ Memory Cell

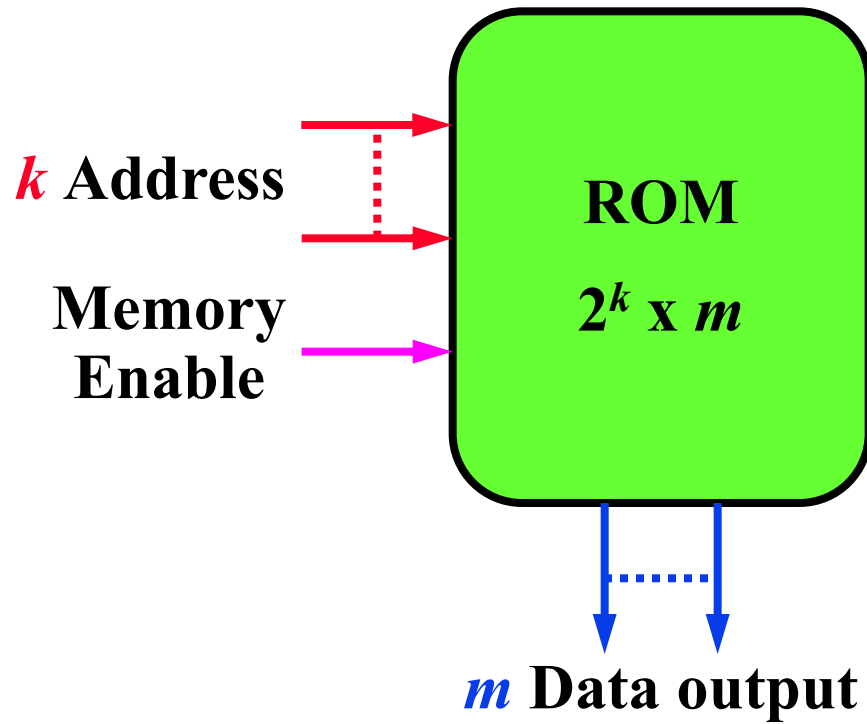


Memory Decoding

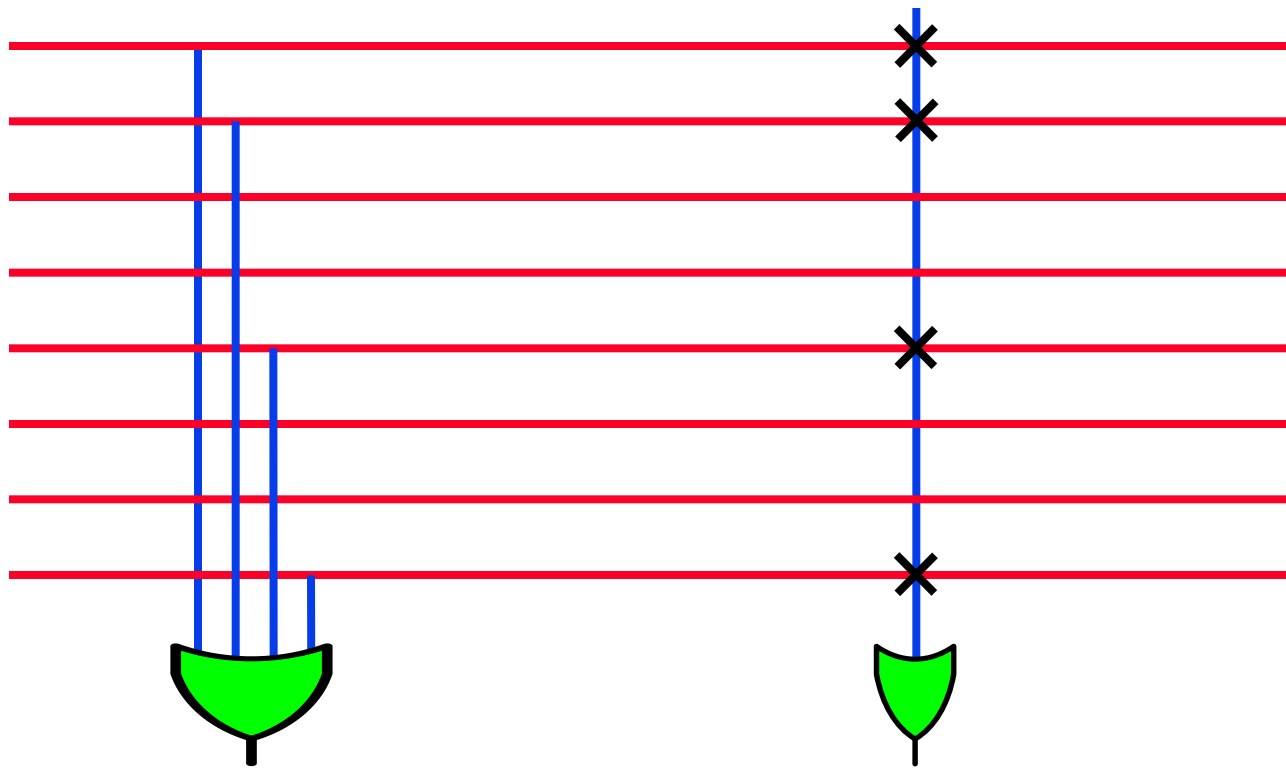
★ Memory Array



Read-Only Memory (ROM)



Read-Only Memory (ROM)



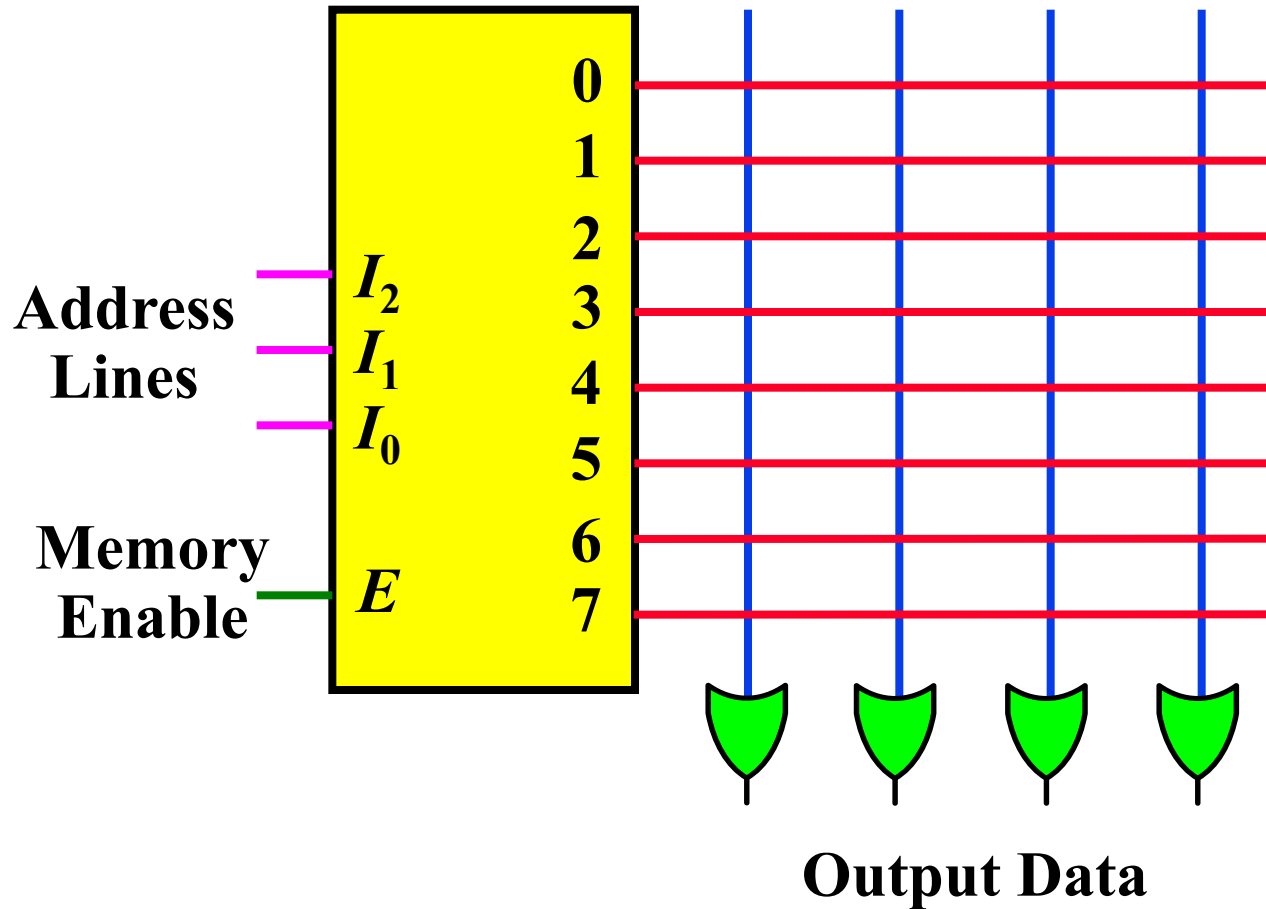
**Conventional
Symbol**

**Array Logic
Symbol**



Read-Only Memory (ROM)

★ **8 x 4 ROM** **3 x 8 Decoder**

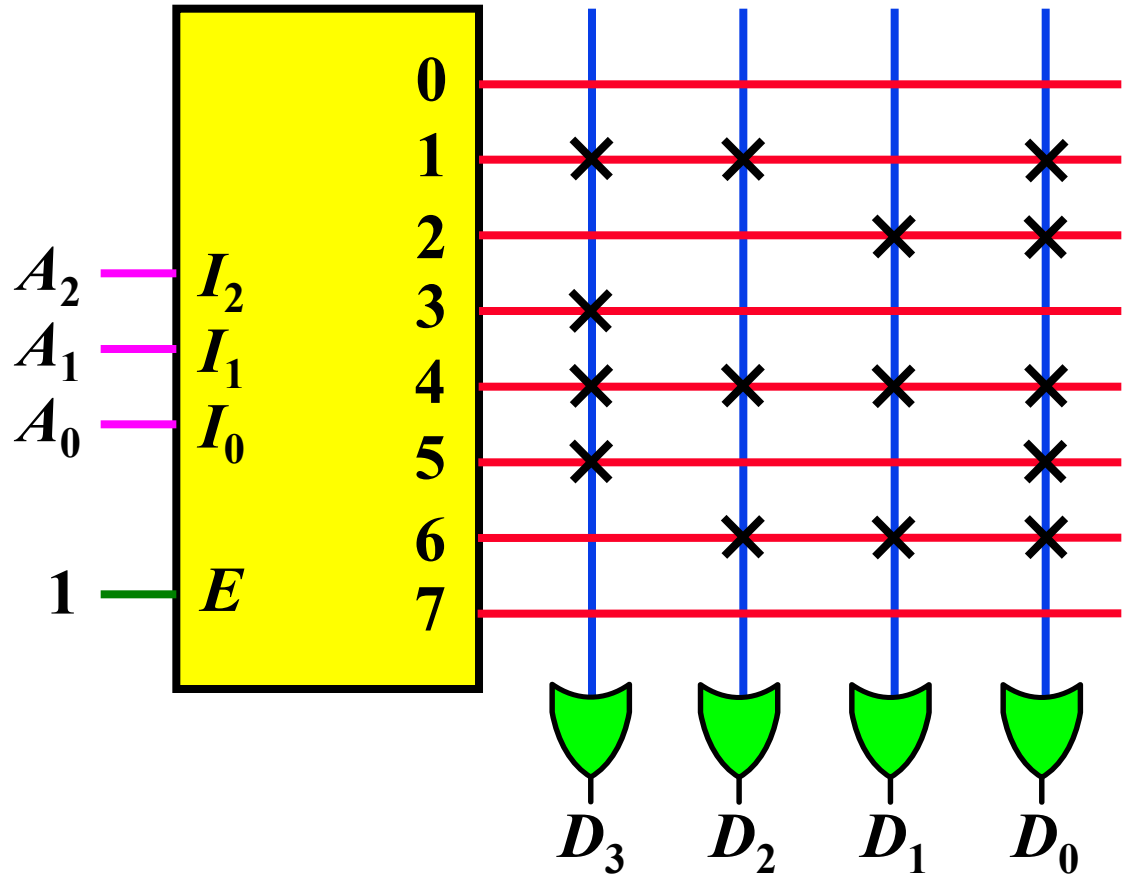


Read-Only Memory (ROM)

★ 8 x 4 ROM

Address	Data
0 0 0	0 0 0 0
0 0 1	1 1 0 1
0 1 0	0 0 1 1
0 1 1	1 0 0 0
1 0 0	1 1 1 1
1 0 1	1 0 0 1
1 1 0	0 1 1 1
1 1 1	0 0 0 0

3 x 8 Decoder



Types of ROMs

★ Mask Programmed ROM

- Programmed during manufacturing

★ Programmable Read-Only Memory (PROM)

- Blow out fuses to produce '0'

★ Erasable Programmable ROM (EPROM)

- Erase all data by *Ultra Violet* exposure

★ Electrically Erasable PROM (EEPROM)

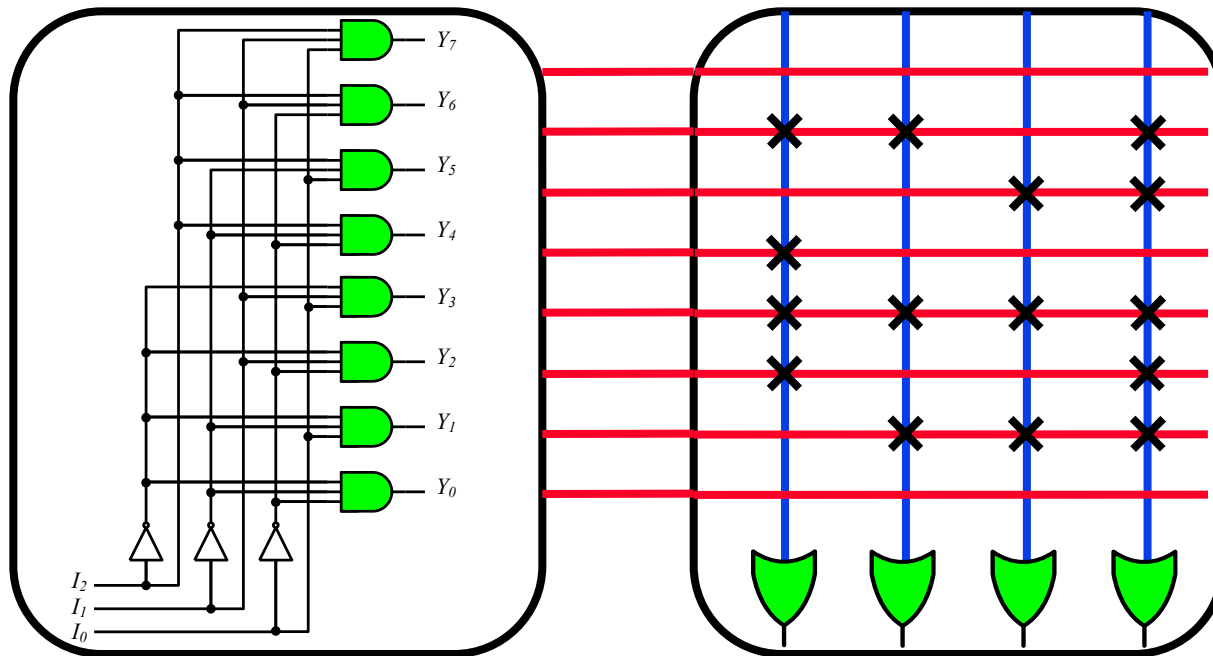
- Erase the required data using an electrical signal



Programmable Logic Device (PLD)

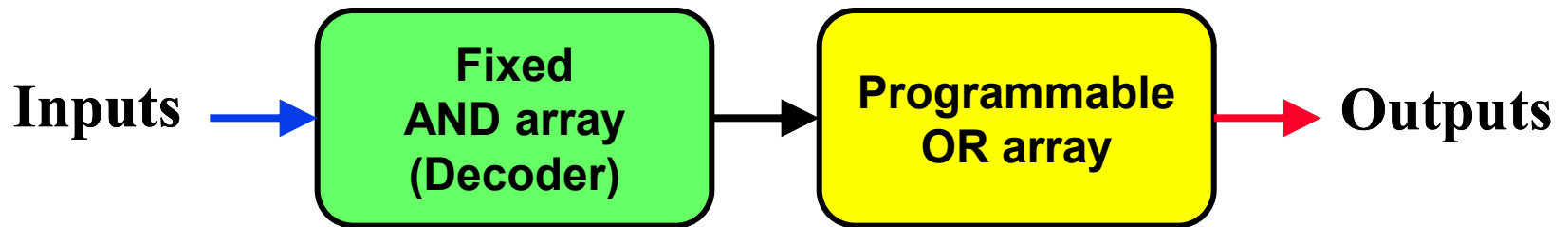
★ Boolean Functions:

- Sums-of-Products
- AND-plane followed by OR-plane

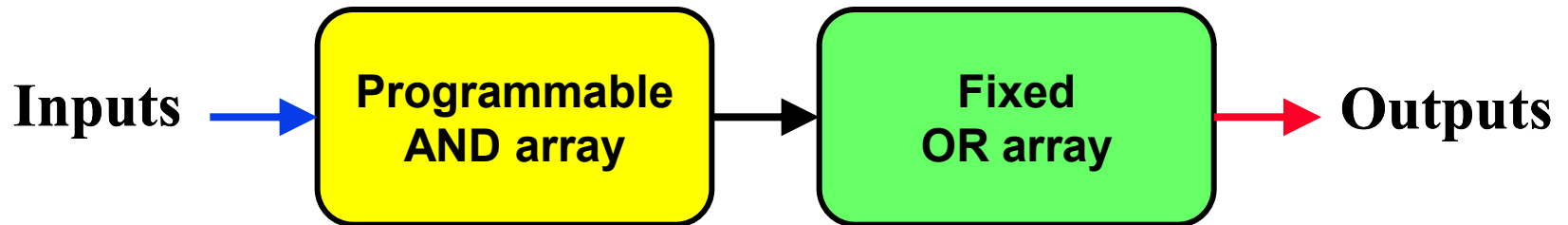


Programmable Logic Device (PLD)

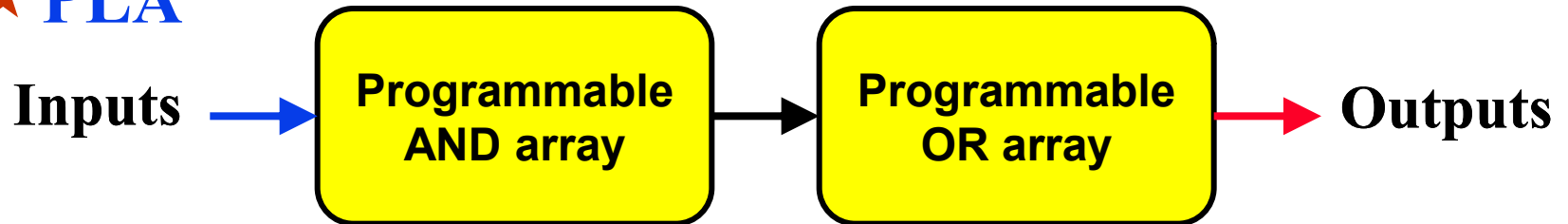
★ PROM



★ PAL



★ PLA



Programmable Array Logic (PAL)

Example

$$w(A,B,C,D) = \sum(2,12,13)$$

$$x(A,B,C,D) = \sum(7,8,9,10,11,12,13,14,15)$$

$$y(A,B,C,D) = \sum(0,2,3,4,5,6,7,8,10,11,15)$$

$$z(A,B,C,D) = \sum(1,2,8,12,13)$$

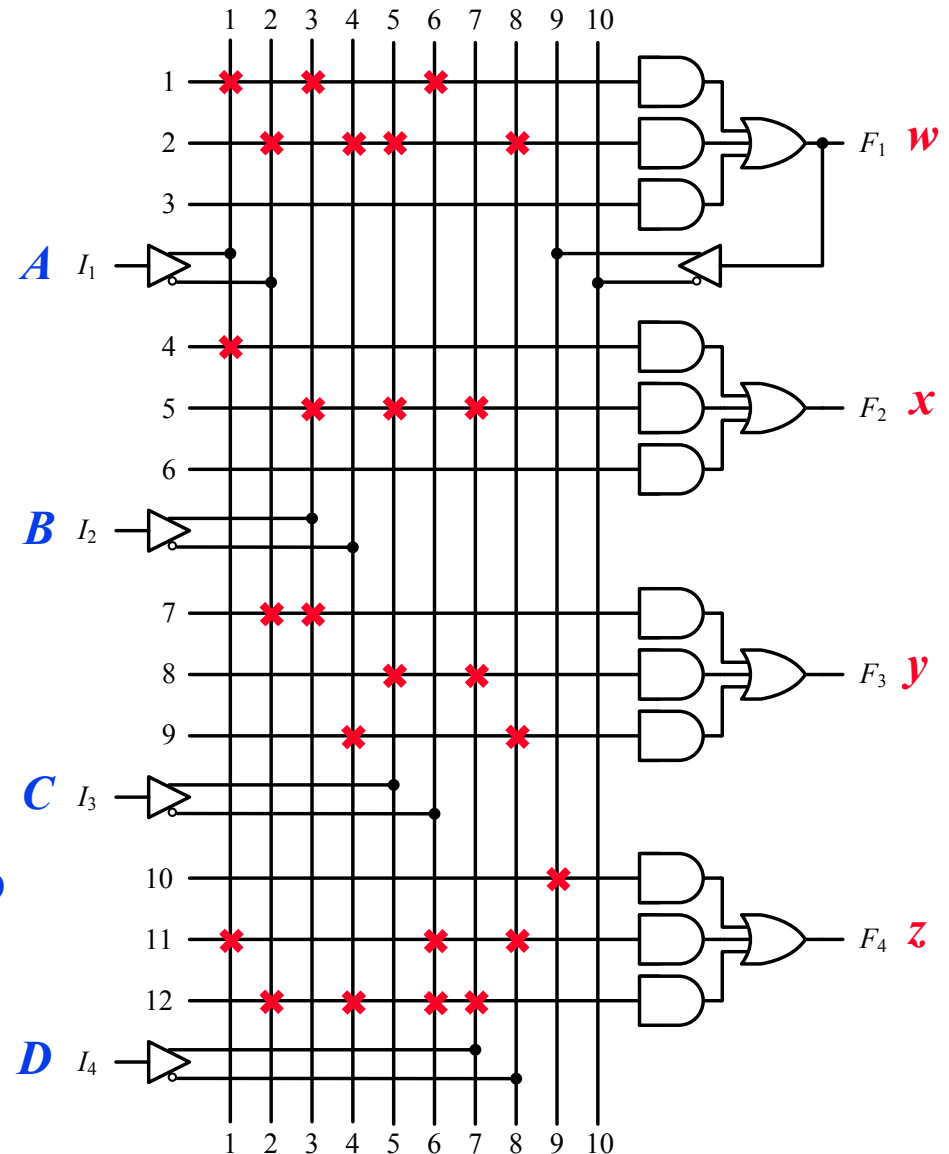
Simplify:

$$w = ABC' + A'B'CD'$$

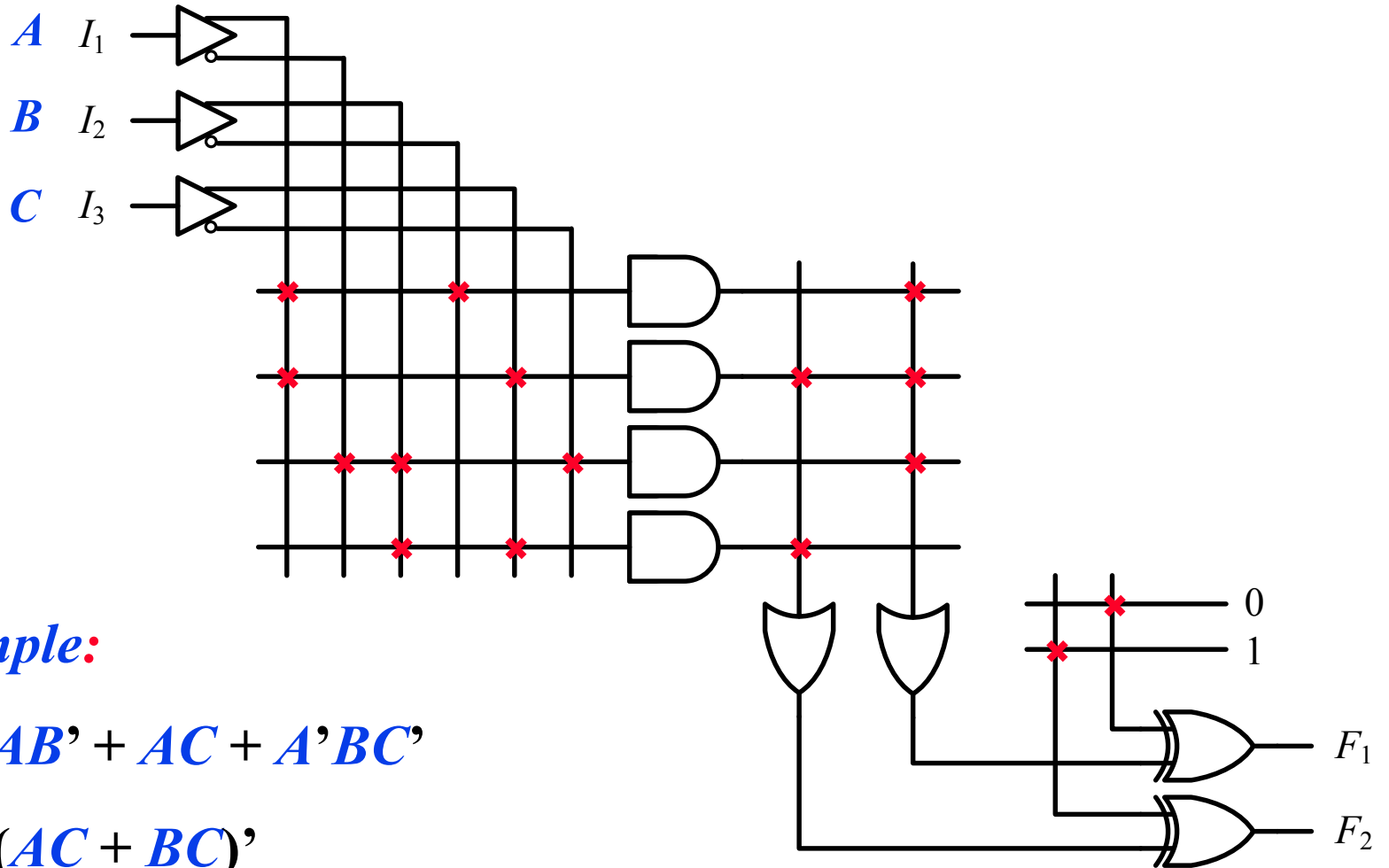
$$x = A + BCD$$

$$y = A'B + CD + B'D'$$

$$\begin{aligned} z &= ABC' + A'B'CD' + AC'D' + A'B'C'D \\ &= w + AC'D' + A'B'C'D \end{aligned}$$



Programmable Logic Array (PLA)



Sequential Programmable Logic Device

★ Basic Macrocell Logic

