Read-Only Memory

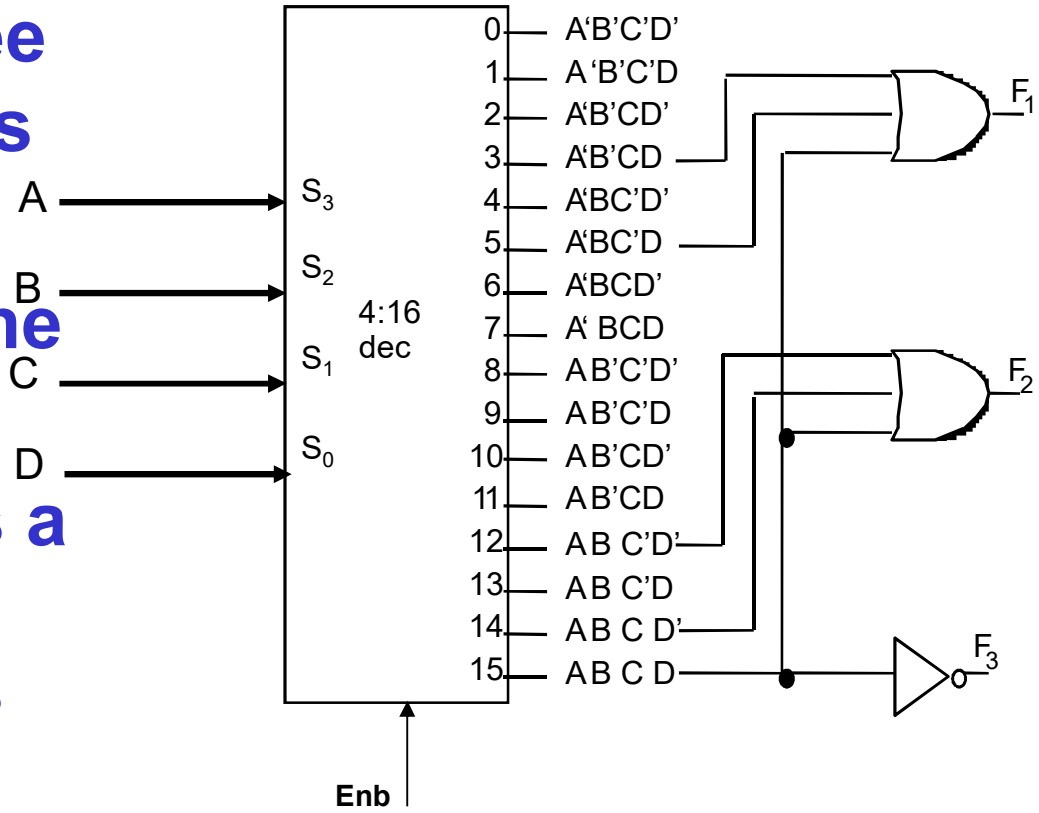
ROM

ROM

- **Can be used:**
  - to implement any arbitrary combinational circuit
  - as a memory
- **Consists of:**
  - an n-to-2^n decoder that produces ALL minterms
  - a set of programmable OR gates that produce SoP's
- **Is usually described in terms of:**
  - size of its decoder output (number of memory rows)
  - number of OR gates (memory width)
  - i.e., 2^n x w, e.g., 8x4, 1024x8, etc.

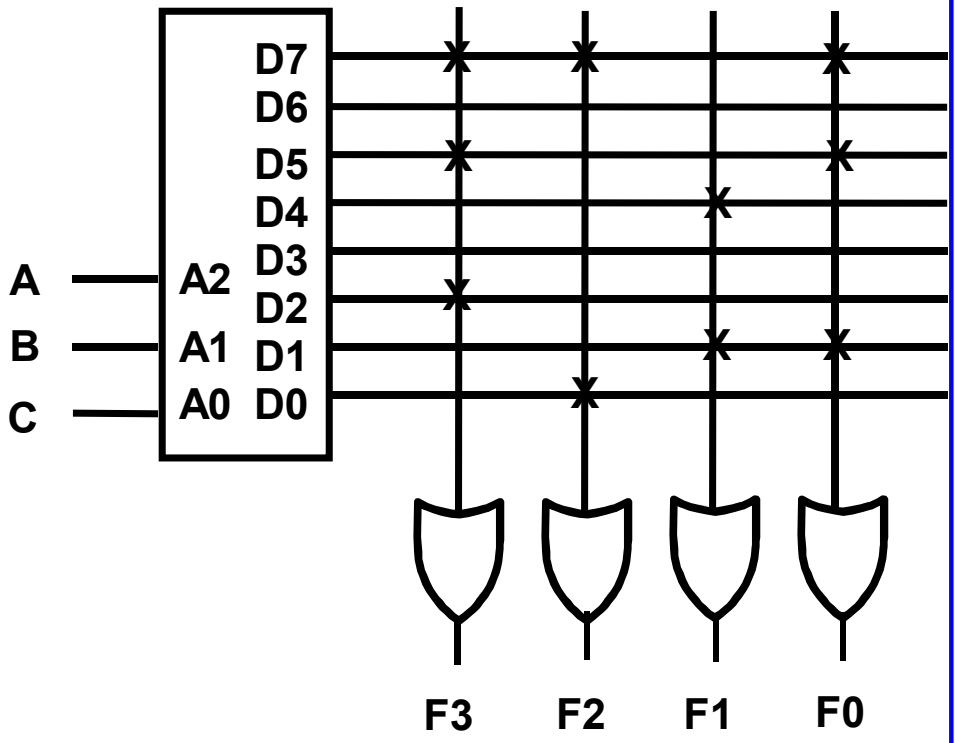
ROM: Example 1

- A 4-to-16 decoder
- Three OR gates
- Implemented three Boolean functions
- Has an “enable” input to control the output
- Can be viewed as a 16 x 3 memory
- Memory content?

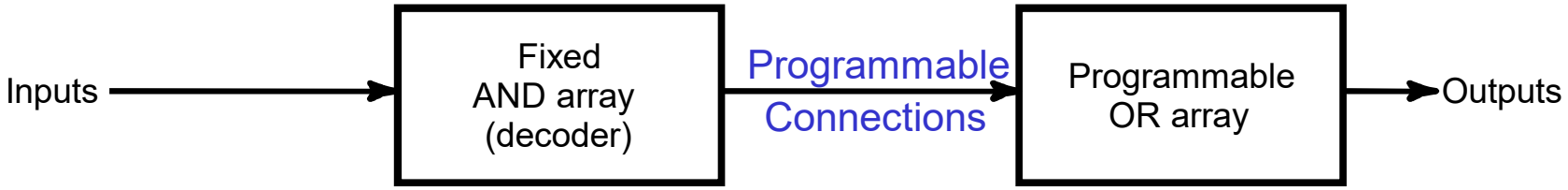


ROM: Example 2

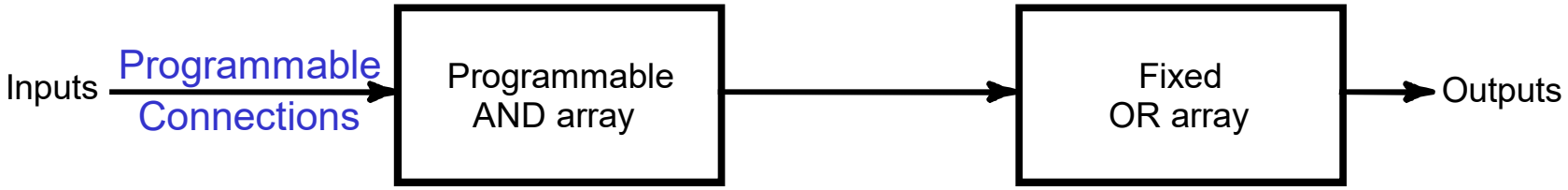
- A 3-to-8 decoder
- Four OR gates
- Can implement four Boolean functions
- Can be viewed as a 8 x 4 memory
- No “enable” input
- Memory content?



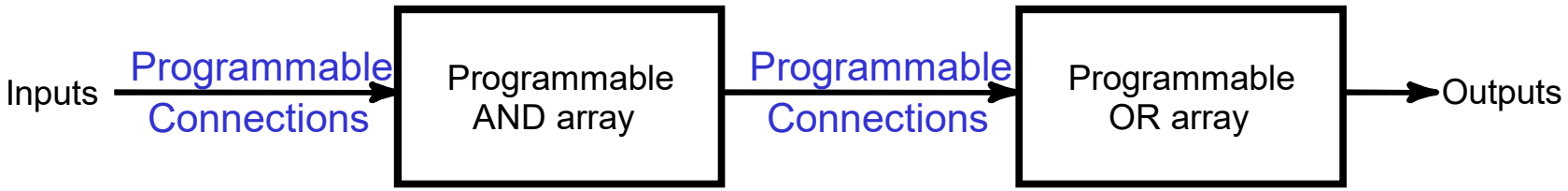
ROM vs. PLA/PAL



(a) Programmable read-only memory (PROM)



(b) Programmable array logic (PAL) device



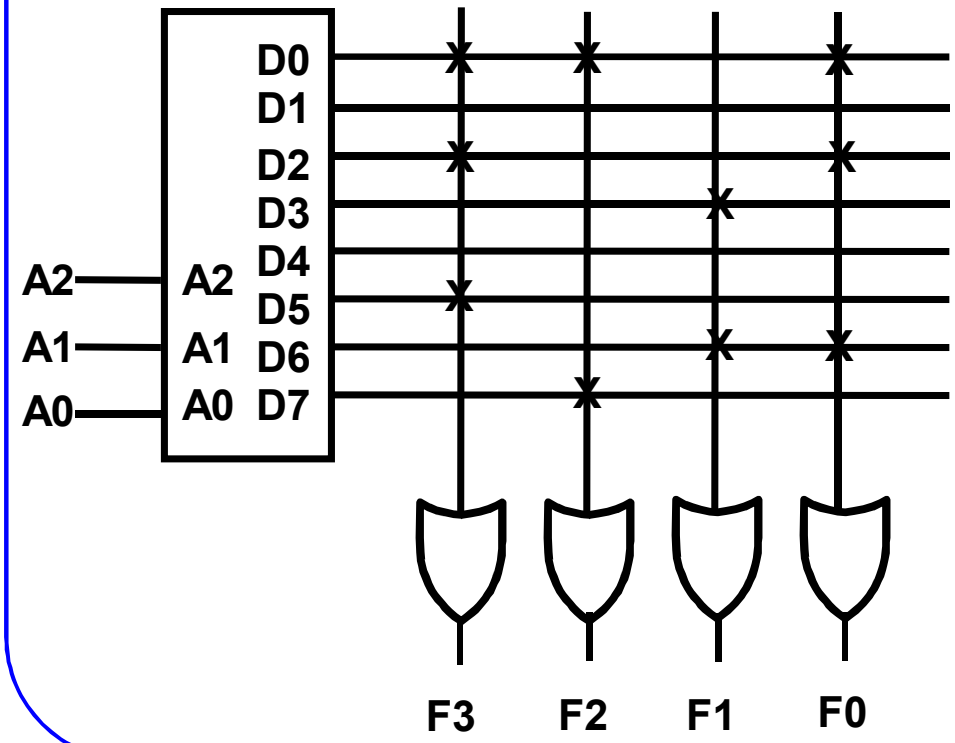
(c) Programmable logic array (PLA) device

ROM as a Memory

- **ROM's can be viewed as memory with the inputs as address lines, and outputs as the stored data**
- **Usually have:**
  - N input lines,
  - M output lines,
  - Provide 2^N x M bits of memory

ROM as Memory (Example)

- Read Example: For input $(A_2,A_1,A_0) = 011$, output is $(F_3,F_2,F_1,F_0) = 0010$.
- What are functions F_3, F_2 , F_1 and F_0 in terms of (A_2, A_1, A_0)?



Address — 8x4 ROM

A[2:0] →

Address				
0	1	1	0	1
1	0	0	0	0
2	1	0	0	1
3	0	0	1	0
4	0	0	0	0
5	1	0	0	0
6	0	0	1	1
7	0	1	0	0

→ F[3:0]

(Memories)

- **Volatile:**
  - Random Access Memory (RAM):
    - SRAM: "static"
    - DRAM: "dynamic"
- **Non-Volatile:**
  - ROM
  - PROM
  - EPROM
  - EEPROM
  - FLASH memory: similar to EEPROM with programmer integrated on chip