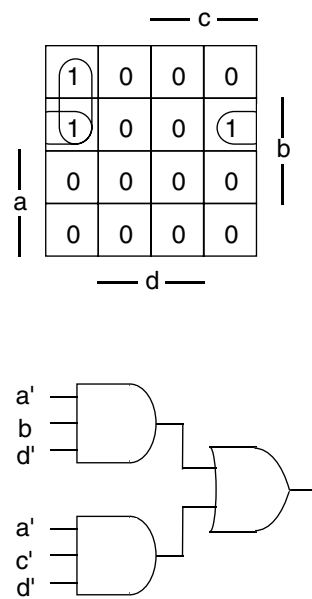


Implementing a Truth Table Using An And-Or Structure (Review)

- Given a truth table, we can use a Karnaugh map to find the minimum 2-level SOP implementation

a	b	c	d	x
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0



$$x = a'bd' + a'c'd'$$

1

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PLAs

- A 2-level *and-or* structure is replicated many times in a programmable array called a *PLA (programmable logic array)*
 - Parts of a CPU's datapath or next-state logic can be built out of PLAs
 - Small circuits can be built out of PLAs
- At the input of each gate, there's a "fuse" which can be left whole, or broken
 - So the designer can control which inputs go to each and gate, and which outputs of the and gates go to each or gate
- A PLA can be either
 - Mask programmable — customer orders a programmed PLA from the manufacturer
 - Field programmable — customer can program PLA (once)

2

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PLAs

- A 2-level *and-or* structure is replicated many times in a programmable array called a *PLA (programmable logic array)*

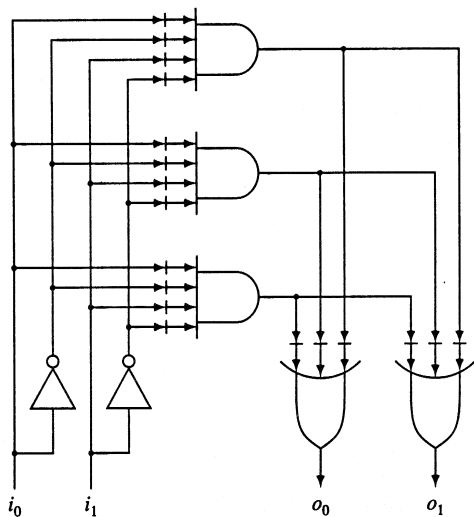


Diagram from *Computer Systems*, Maccabe, Irwin 1993

- This PLA has 2 inputs, 2 outputs, and can represent up to 3 product terms

3

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PLA Example

- This is an *abstract* diagram of a PLA with 6 inputs, 4 outputs, which can represent up to 12 product terms

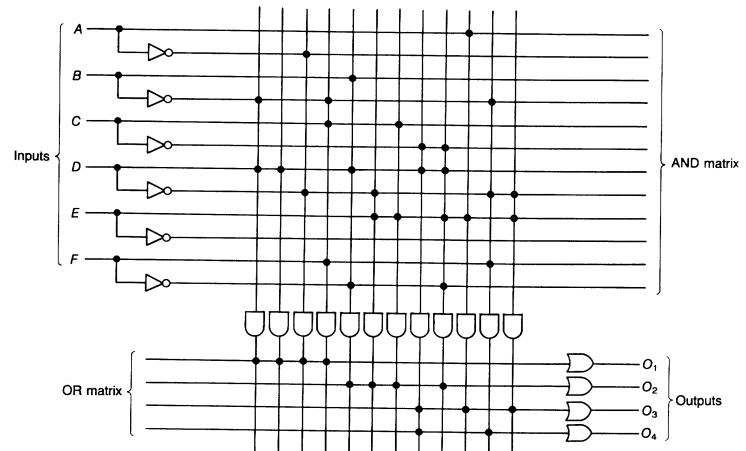


Diagram from *Digital Design*, Johnson & Karim, PWS-Kent 1987

- Try the Java KMap->PLA animation at <http://tech-www.informatik.uni-hamburg.de/applets/kvd>

4

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Programming Using Static RAMs (SRAMs)

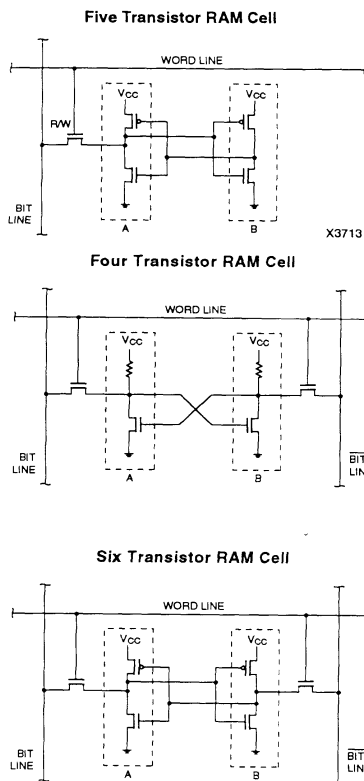


Figure from *Field-Programmable Gate Array Technology*, Trimberger, Kluwer, 1994

Programming Using Static RAMs (SRAMs) (cont.)

■ Disadvantages:

- Must load configuration from ROM, disk, etc. on power-up
- Large — requires several transistors

■ Advantages:

- Can be programmed repeatedly, in-circuit
 - Can be programmed quickly (< 1ms)
- Part has been 100% tested at factory
- Same basic process as CMOS, so quickly takes advantage of new fab processes
 - CMOS also requires less power than circuits requiring pull-up resistors

■ SRAMs can be used in FPLDs to :

- Connect inputs to cells, or even to replace the cell if it's a LUT
- Connect cells to interconnect