



1. Basic combinational building blocks

2. Logic for arithmetic

Common combinational circuits: encoders, decoders, multiplexers, adders, Arithmetic Logic Unit

(printed together, separate sets of slides online)

Karnaugh Maps: find (minimal) sums of products



A	B	C	D	F(A, B, C, D)
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

		gray code			
		order →			
		00	01	11	10
AB	00	0	0	0	0
	01	0	0	0	1
	11	1	1	0	1
	10	1	1	1	1

- Cover exactly the 1s by drawing a (minimum) number of maximally sized rectangles whose dimensions (in cells) are powers of 2. (They may overlap or wrap around!)
- For each rectangle, make a *product* of the inputs (or complements) that are 1 for all cells in the rectangle. (*minterms*)
- Take the *sum* of these products.

Voting again with Karnaugh Maps



A	B	C	M
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

Decoders

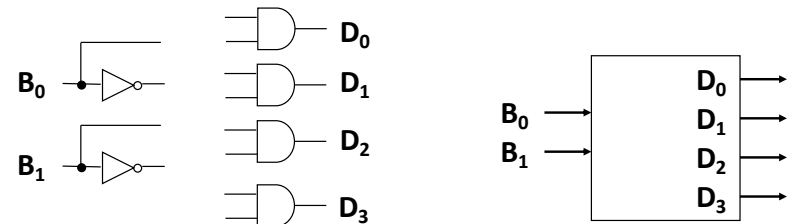


Decodes input number, asserts corresponding output.

n -bit input (an unsigned number)

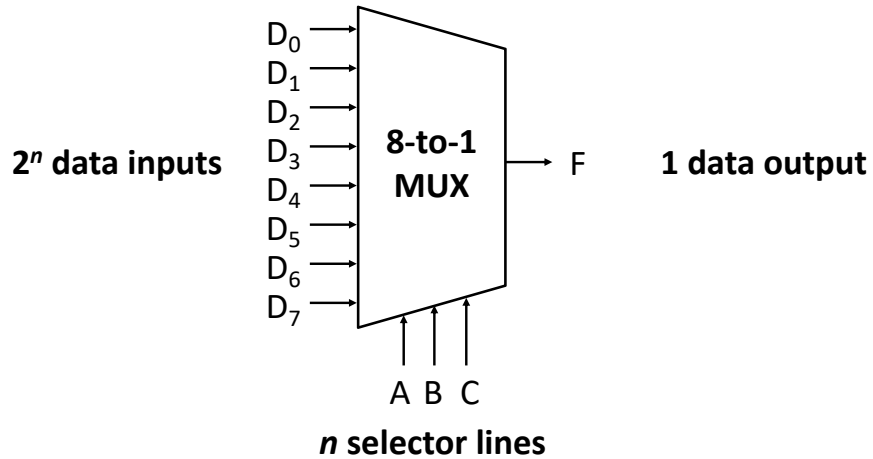
2^n outputs

Built with code detectors.



Multiplexers

Select one of several inputs as output.



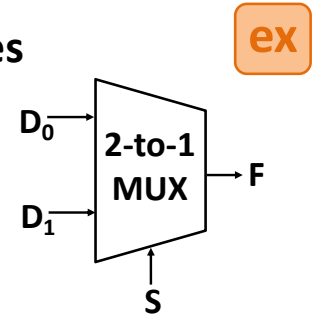
Build a 2-to-1 MUX from gates

If $S=0$, then $F=D_0$.

If $S=1$, then $F=D_1$.

1. Construct the truth table.

2. Build the circuit.



MUX + voltage source = truth table

