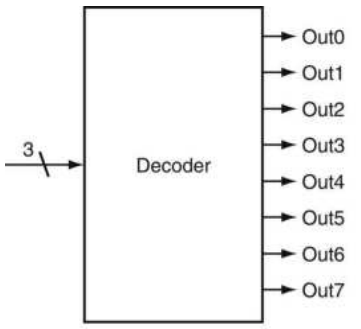
an array of logic blocks.

Decoders

One logic block that we will use in building larger components is a **decoder**. The most common type of decoder has an n-bit input and 2^n outputs, where only one output is asserted for each input combination. This decoder translates the n-bit input into a signal that corresponds to the binary value of the n-bit input. The outputs are thus usually numbered, say, Out0, Out1, …, Out2^n −1. If the value of the input is i, then Out$i$ will be true and all other outputs will be false. Figure A.3.1 shows a 3-bit decoder and the truth table. This decoder is called a *3-to-8 decoder* since there are three inputs and eight (2^3) outputs. There is also a logic element called an *encoder* that performs the inverse function of a decoder, taking 2^n inputs and producing an n-bit output.

decoder

A logic block that has an n-bit input and $2n$ outputs, where only one output is asserted for each input combination.



a. A 3-bit decoder

Inputs			Outputs							
12	11	10	Out7	Out6	Out5	Out4	Out3	Out2	Out1	Out0
0	0	0	0	0	0	0	0	0	0	1
0	0	1	0	0	0	0	0	0	1	0
0	1	0	0	0	0	0	0	1	0	0
0	1	1	0	0	0	0	1	0	0	0
1	0	0	0	0	0	1	0	0	0	0
1	0	1	0	0	1	0	0	0	0	0
1	1	0	0	1	0	0	0	0	0	0
1	1	1	1	0	0	0	0	0	0	0

b. The truth table for a 3-bit decoder

FIGURE A.3.1 A 3-bit decoder has three inputs, called 12, 11, and 10, and 2^3 = 8 outputs, called Out0 to Out7.

Only the output corresponding to the binary value of the input is true, as shown in the truth table. The label 3 on the input to the decoder says that the input signal is 3 bits wide.