

Table 5.2 State Table for the Circuit of Fig. 5.15

Present State		Input	Next State		Output
A	B	x	A	B	y
0	0	0	0	0	0
0	0	1	0	1	0
0	1	0	0	0	1
0	1	1	1	1	0
1	0	0	0	0	1
1	0	1	1	0	0
1	1	0	0	0	1
1	1	1	1	0	0

The derivation of a state table requires listing all possible binary combinations of present states and inputs. In this case, we have eight binary combinations from 000 to 111. The next-state values are then determined from the logic diagram or from the state equations. The next state of flip-flop *A* must satisfy the state equation

$$A(t + 1) = Ax + Bx$$

In words: the next state of *A* is formed by ORing (1) the result of ANDing the present state of *A* with the input (*Ax*), with (2) the result of ANDing the present state of *B* with the input (*Bx*).

The next-state section in the state table under column *A* has three 1's where the present state of *A* and input *x* are both equal to 1 or the present state of *B* and input *x* are both equal to 1. Similarly, the next state of flip-flop *B* is derived from the state equation

$$B(t + 1) = A'x$$

and is equal to 1 when the present state of *A* is 0 and input *x* is equal to 1. The output column is derived from the output equation

$$y = Ax' + Bx'$$

The state table of a sequential circuit with *D*-type flip-flops is obtained by the same procedure outlined in the previous example. In general, a sequential circuit with *m* flip-flops and *n* inputs needs 2^{m+n} rows in the state table. The binary numbers from 0 through $2^{m+n} - 1$ are listed under the present state and input columns. The next-state section has *m* columns, one for each flip-flop. The binary values for the next state are derived directly from the state equations. The output section has as many columns as there are output variables. Its binary value is derived from the circuit or from the Boolean function in the same manner as in a truth table.

It is sometimes convenient to express the state table in a slightly different form having only three sections: present state, next state, and output. The input conditions are enumerated under the next-state and output sections. The state table of [Table 5.2](#) is repeated in [Table 5.3](#) in this second form. For each present state, there are two possible next states and outputs, depending on the value of the input. One form may be preferable to the other, depending on the application.