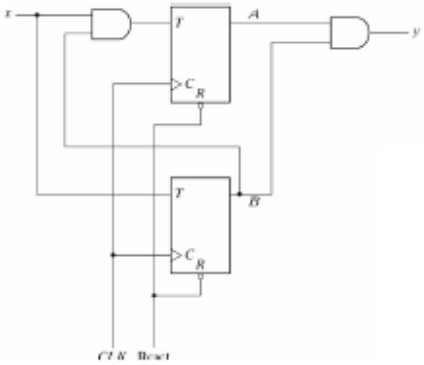
ANALYSIS WITH *T* FLIP-FLOPS

As with *JK* flip-flops, the next state values can be obtained either by using the Characteristic table.

T Flip-Flop

T	$Q(t+1)$	
0	$Q(t)$	No change
1	$Q'(t)$	Complement

$$Q(t+1) = T \oplus Q = T'Q + TQ'$$



Consider the following sequential circuit or by the characteristic equation:

$Q\,(t+1) = T$ X-OR $Q = T'Q + TQ'$

It can be described algebraically by two input equations and an output equation:

$$T_A = Bx$$

$$T_B = x$$

$$y = AB$$

The state table for this circuit is listed below.

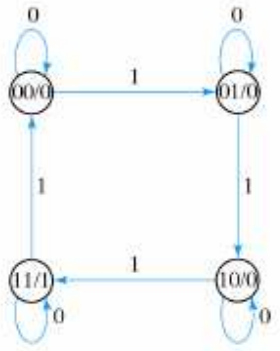
Present State		Input	Next State		Output
A	*B*	*x*	*A*	*B*	*y*
0	0	0	0	0	0
0	0	1	0	1	0
0	1	0	0	1	0
0	1	1	1	0	0
1	0	0	1	0	0
1	0	1	1	1	0
1	1	0	1	1	1
1	1	1	0	0	1

The values for *y* are obtained from the output equation. The values for the next state can be derived from the state equations by substituting T_A and T_B in the characteristic equations, yielding:

$$A(t+1) = (Bx)'A + (Bx)A' = AB' + Ax' + A'Bx$$

$$B(t+1) = x \oplus B$$

The state diagram for the circuit is shown below.



As long as input *x* is equal to 1, the circuit behaves as a binary counter with a sequence of states 00,01, 10, 11, and back to 00.When *x* = 0, the circuit remains in the same state. Output *y* is equal to 1 when the present state is 11.The output depends on the present state only and is independent of the input. The two values inside each circle separated by a slash are for the present state and output.