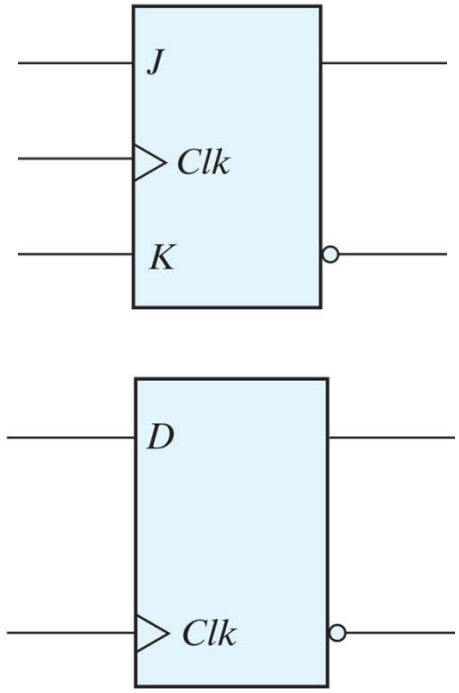
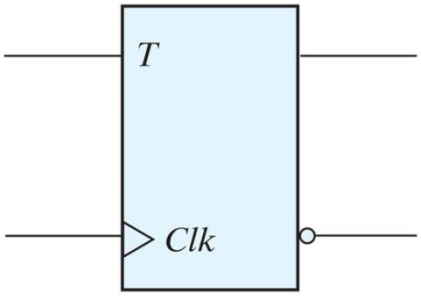
Chapter 5 – con’t

Flip-flops

- Hold their state
- 3 Basic Types
  - JK
  - D
  - T





Characteristics Tables

JK Flip-Flop

J	K	Q(t + 1)	
0	0	$Q(t)$	No change
0	1	0	Reset
1	0	1	Set
1	1	$Q'(t)$	Complement

D Flip-Flop

D	Q(t + 1)	
0	0	Reset
1	1	Set

T Flip-Flop

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

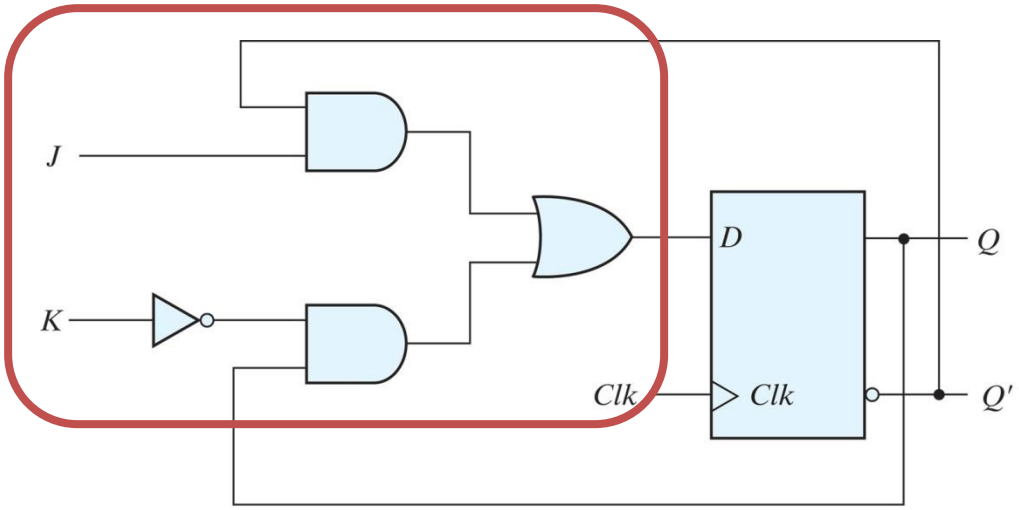
Characteristic Equations

Q(t+1) = D

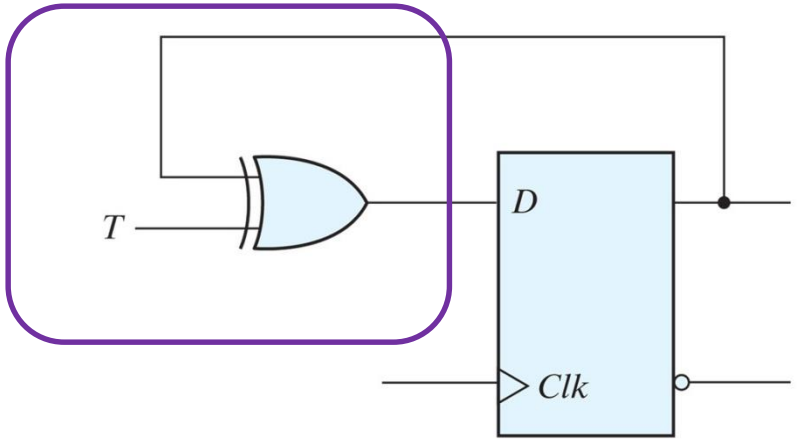
D Flip-Flop

D	$Q(t + 1)$
0	0
1	1

$$Q(t+1) = JQ' + K'Q$$

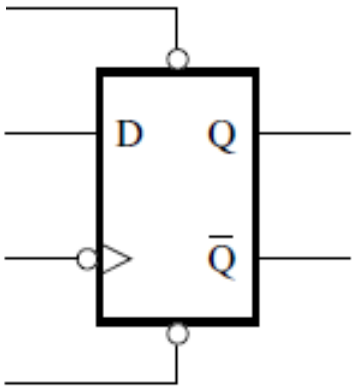


$$Q(t+1) = T \textbf{ XOR } Q$$
$$= TQ' + T'Q$$



Asynchronous Inputs

- Used to force a flip-flop to a desired state.
  - Preset or Direct Set
    - Q = 1
  - Clear or Direct Reset
    - Q = 0



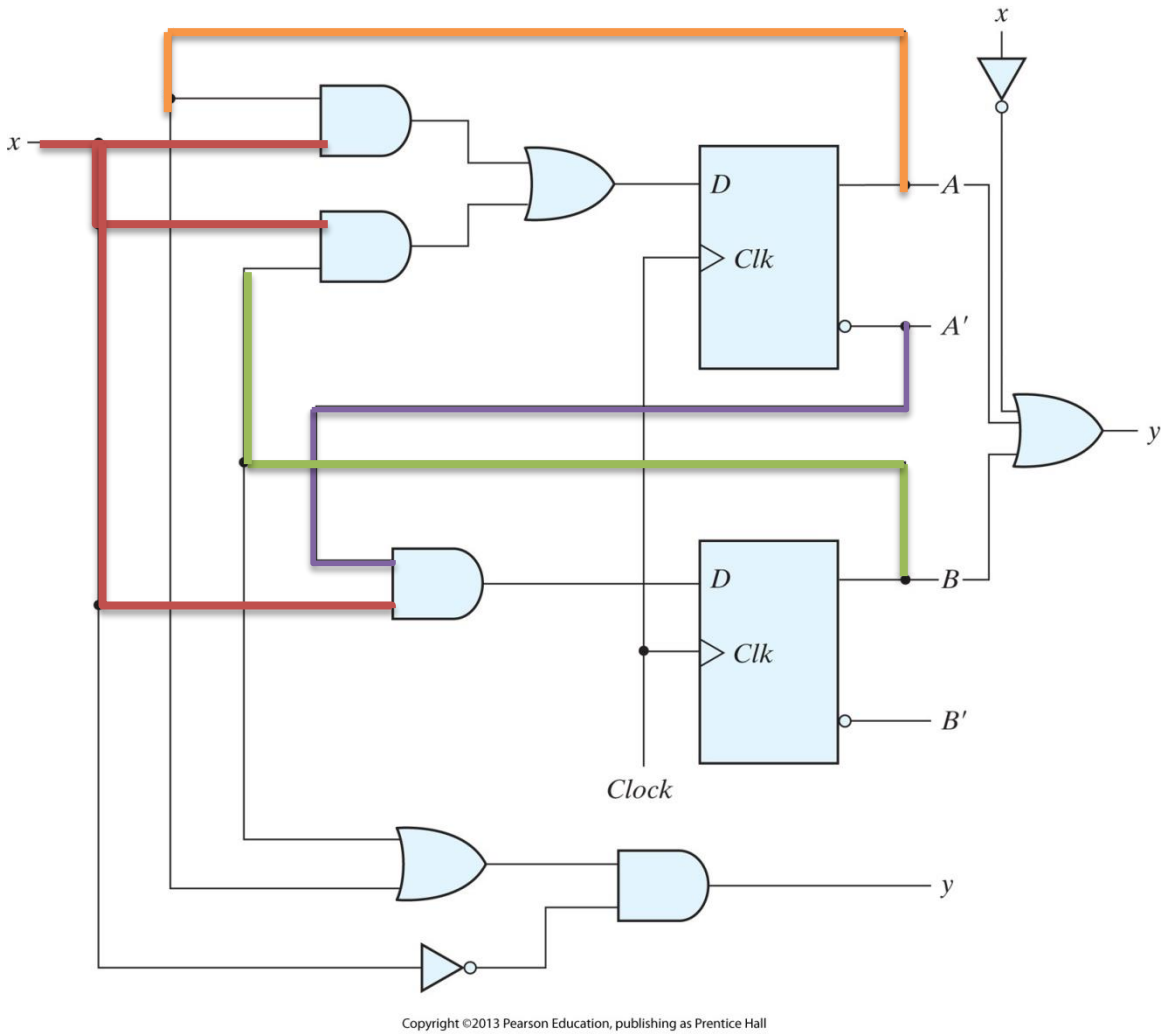
Analysis

- Analysis is about describing what a given circuit will do under certain operating conditions.
- Takes into account the inputs, the outputs, and current state of the flip-flops.
- Consists of obtaining a table/diagram

State Equations

- Algebraic description of the behavior of a circuit
- Specifies the next state as a function of the current state and inputs.

State Equations: Figure 5.15



$A(t+1) = A(t)x(t) + B(t)x(t)$

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

State Table: Figure 5.15

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

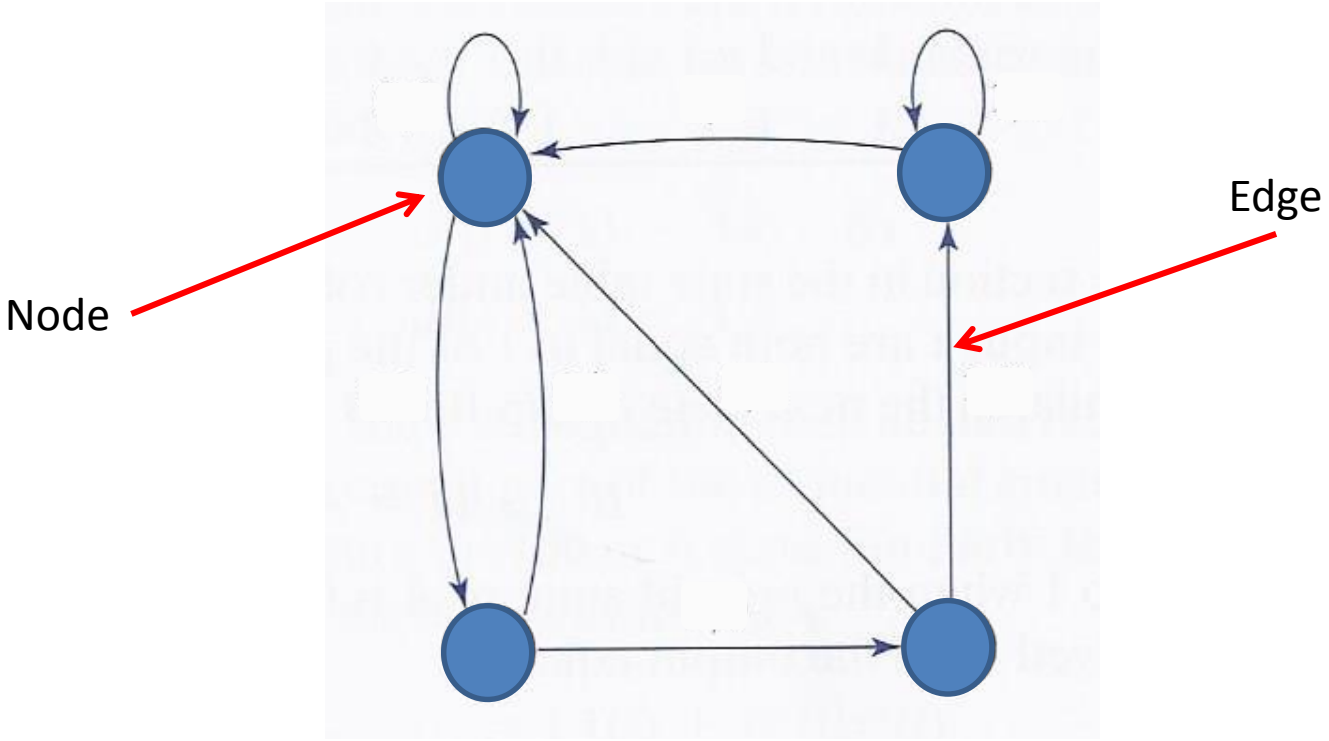
State Table: Figure 5.15

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

Present State		Next State				Output	
		$x = 0$		$x = 1$		$x = 0$	$x = 1$
A	B	A	B	A	B	y	y
0	0	0	0	0	1	0	0
0	1	0	0	1	1	1	0
1	0	0	0	1	0	1	0
1	1	0	0	1	0	1	0

A little bit about graphs

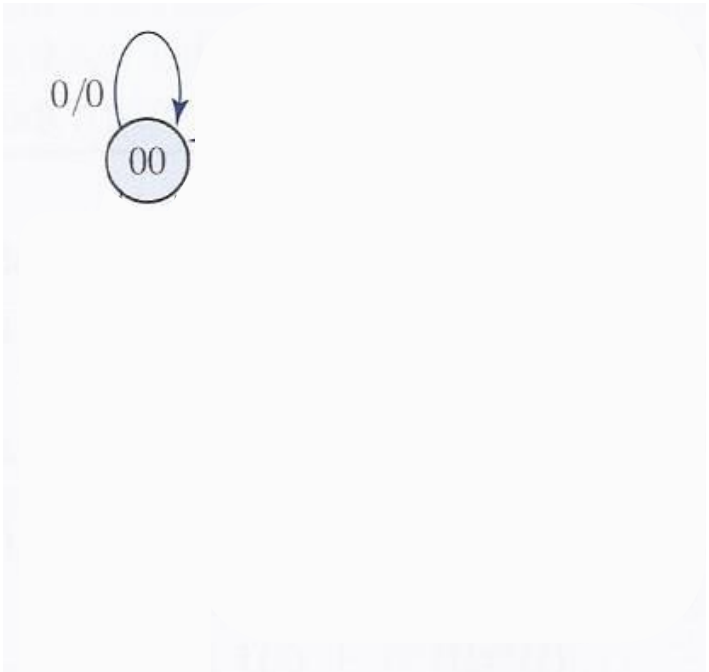
- Made of nodes and edges.



State Table

(Another form)

Present State		Next State				Output	
		$x = 0$		$x = 1$		$x = 0$	$x = 1$
A	B	A	B	A	B	y	y
0	0	0	0	0	1	0	0
0	1	0	0			1	

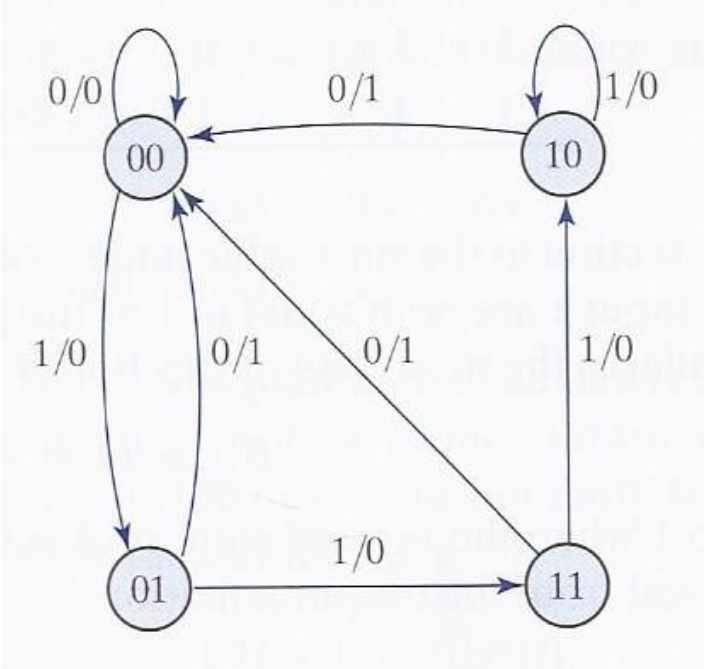


Input/Output

State Table

(Another form)

Present State		Next State				Output	
		$x = 0$		$x = 1$		$x = 0$	$x = 1$
A	B	A	B	A	B	y	y
0	0	0	0	0	1	0	0
0	1	0	0	1	1	1	0
1	0	0	0	1	0	1	0
1	1	0	0	1	0	1	0



State Diagram