FSM Analysis

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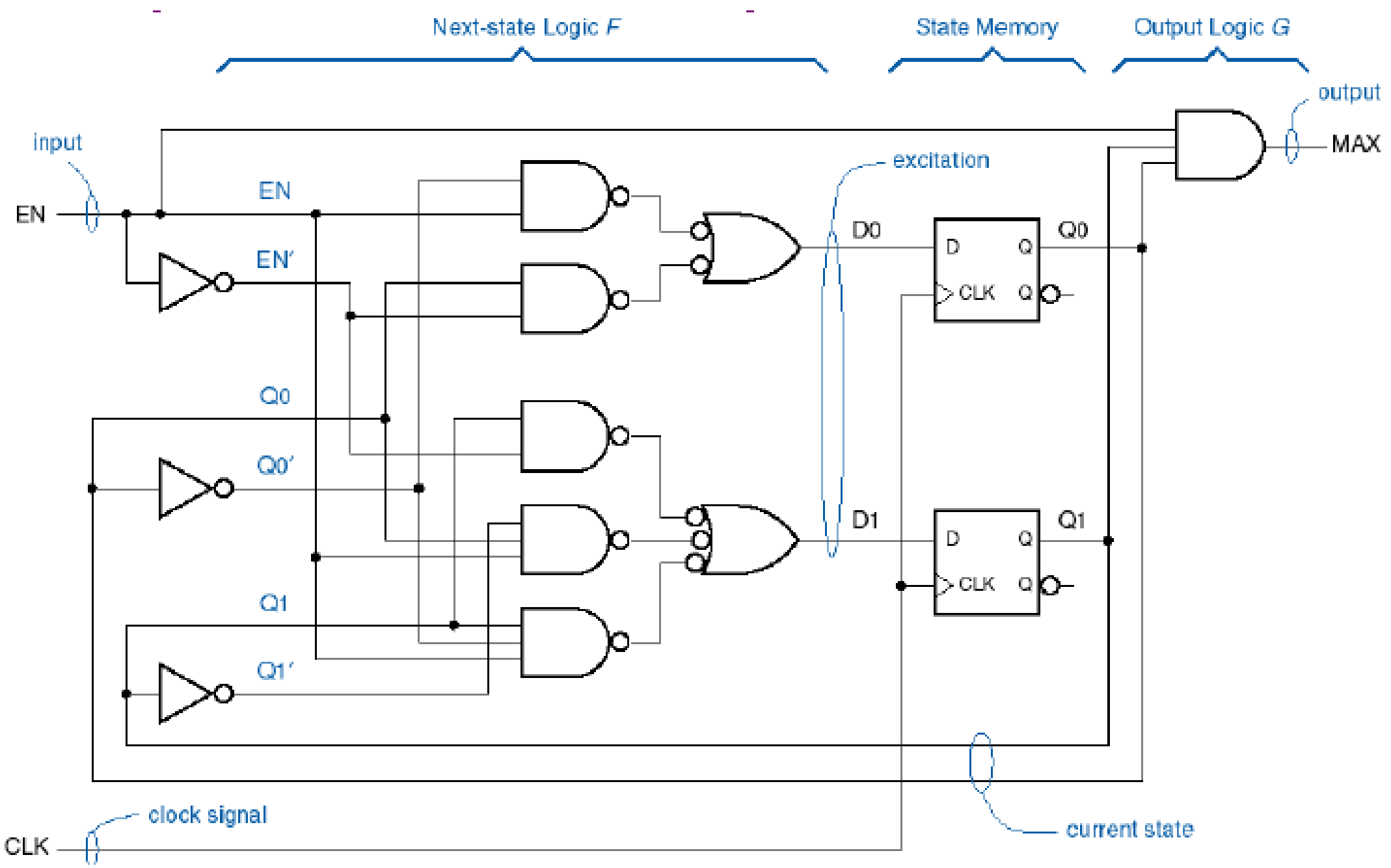
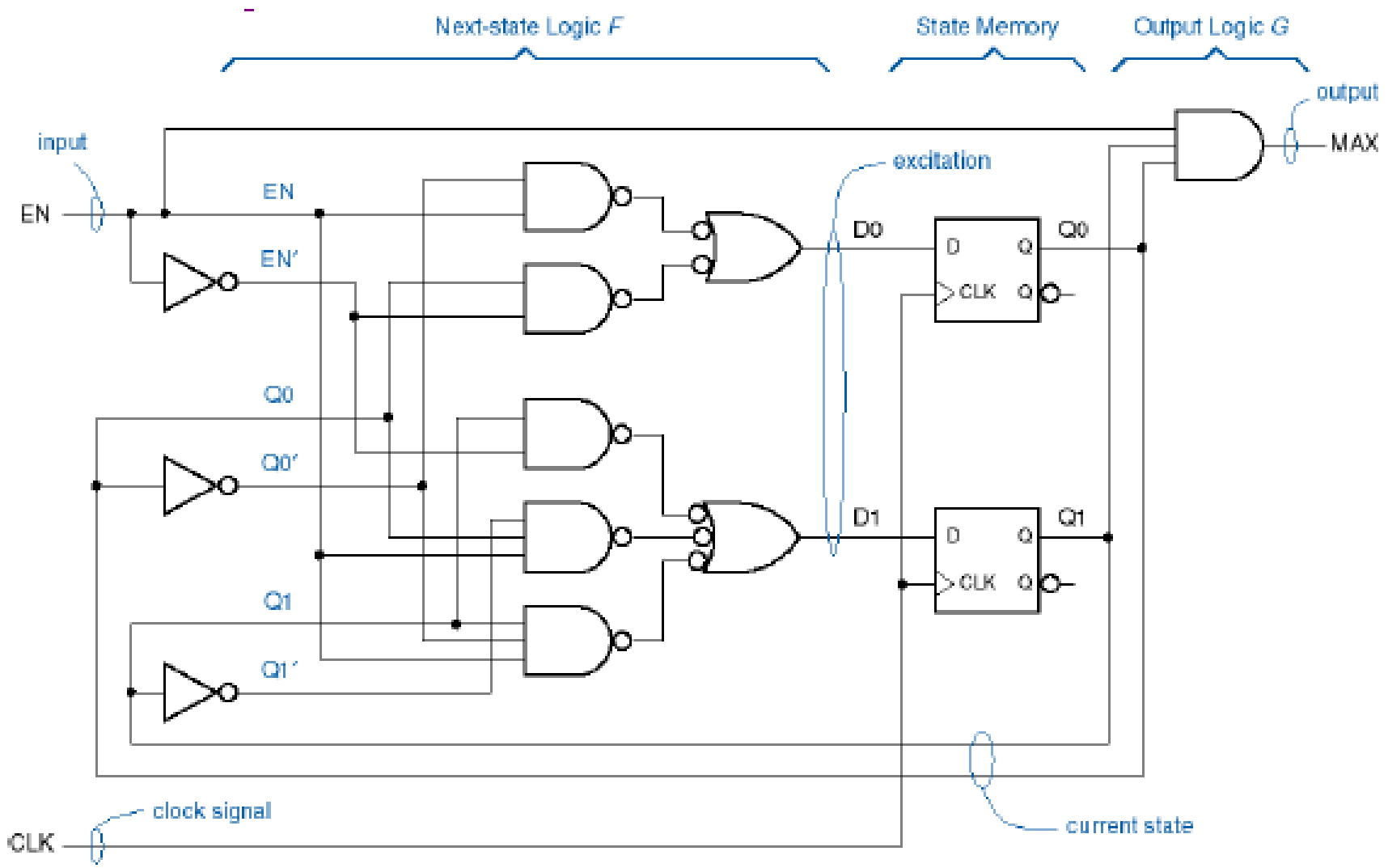

Next-state Logic F
State Memory
Output Logic G
input
EN
EN
EN′
Q0
Q0′
Q1
Q1′
excitation
D0
D1
D
Q
CLK
Q0
Q1
output
MAX
clock signal
CLK
current state



$$D0 = Q0 \cdot EN' + Q0' \cdot EN$$

$$D1 = Q1 \cdot EN' + Q1' \cdot Q0 \cdot EN + Q1 \cdot Q0' \cdot EN$$

Transition equations

- Excitation equations

$$D_0 = Q_0 \,.\, EN' + Q_0' \,.\, EN$$
$$D_1 = Q_1 \,.\, EN' + Q_1' \,.\, Q_0 \,.\, EN + Q_1 \,.\, Q_0' \,.\, EN$$

- Characteristic equations (Trivial for DFF!)

$$Q_0^+ = D_0$$
$$Q_1^+ = D_1$$

- Substitute excitation equations into characteristic equations

$$Q_0^+ = Q_0 \,.\, EN' + Q_0' \,.\, EN$$
$$Q_1^+ = Q_1 \,.\, EN' + Q_1' \,.\, Q_0 \,.\, EN + Q_1 \,.\, Q_0' \,.\, EN$$

Transition and state tables

$$Q0^* = Q0 \cdot EN' + Q0' \cdot EN$$

$$Q1^* = Q1 \cdot EN' + Q1' \cdot Q0 \cdot EN + Q1 \cdot Q0' \cdot EN$$

(transition equations)

$$MAX = Q1 \cdot Q0 \cdot EN$$ (output equation)

	EN	
Q1 Q0	0	1
00	00	01
01	01	10
10	10	11
11	11	00
	Q1* Q0*	

transition table

	EN	
S	0	1
A	A	B
B	B	C
C	C	D
D	D	A
	S*	

state table

	EN	
S	0	1
A	A, 0	B, 0
B	B, 0	C, 0
C	C, 0	D, 0
D	D, 0	A, 1
	S*, MAX	

state/output table

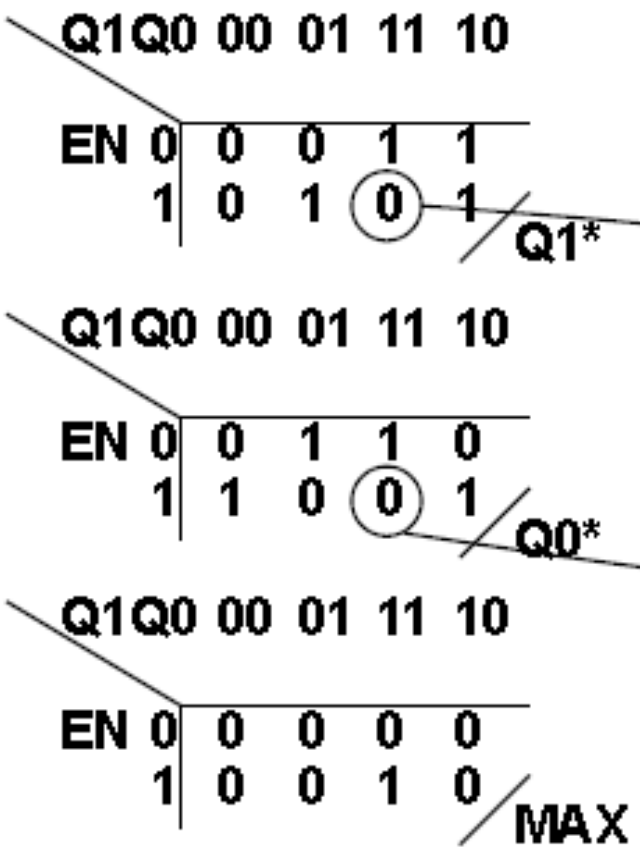
Transition and state tables (using K-map)

$$Q0^* = Q0 \cdot EN' + Q0' \cdot EN$$

$$Q1^* = Q1 \cdot EN' + Q1' \cdot Q0 \cdot EN + Q1 \cdot Q0' \cdot EN$$

$$MAX = Q1 \cdot Q0 \cdot EN$$ (output equation)

(transition equations)



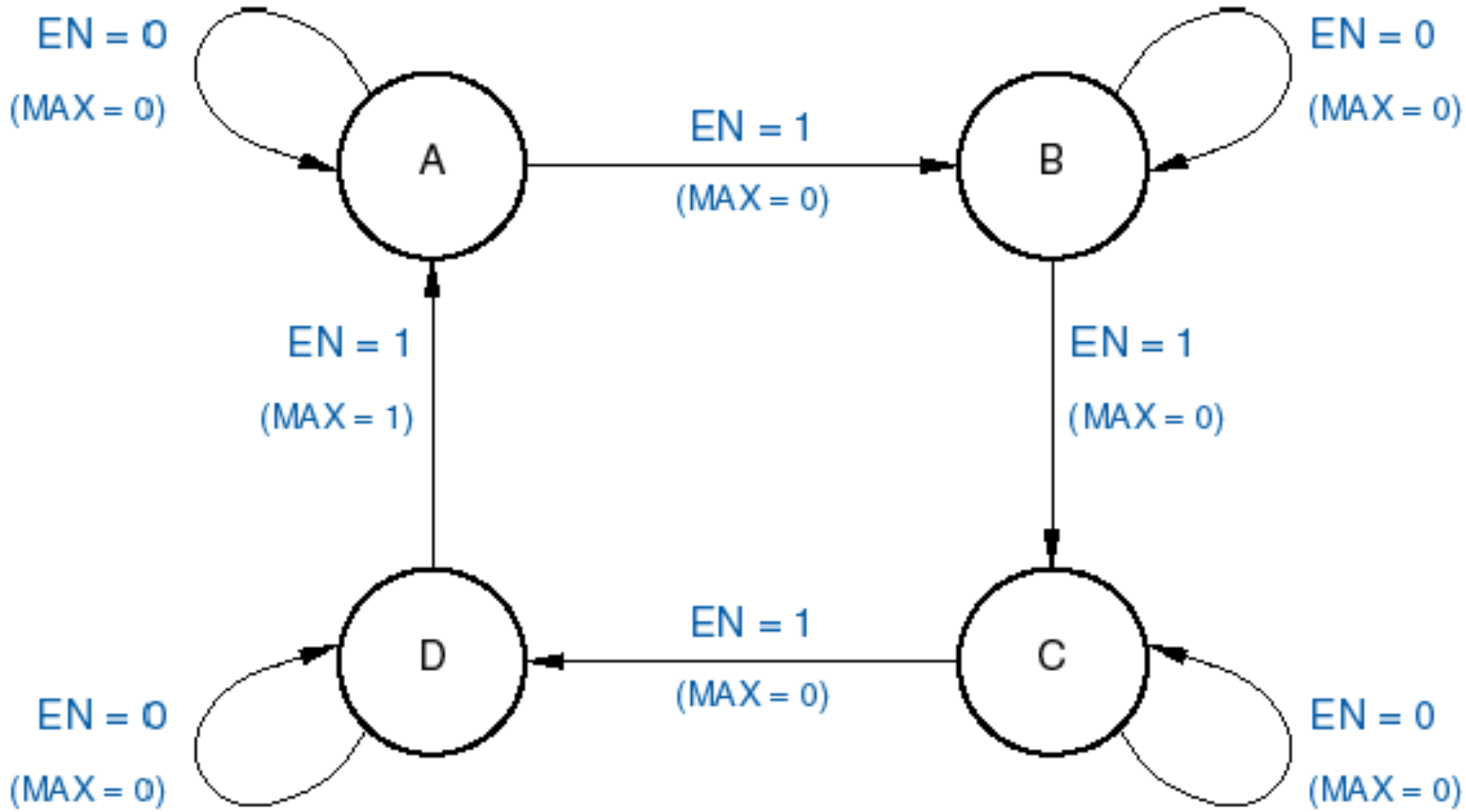
	EN	
Q1 Q0	0	1
00	00	01
01	01	10
10	10	11
11	11	00
	Q1* Q0*	

transition table

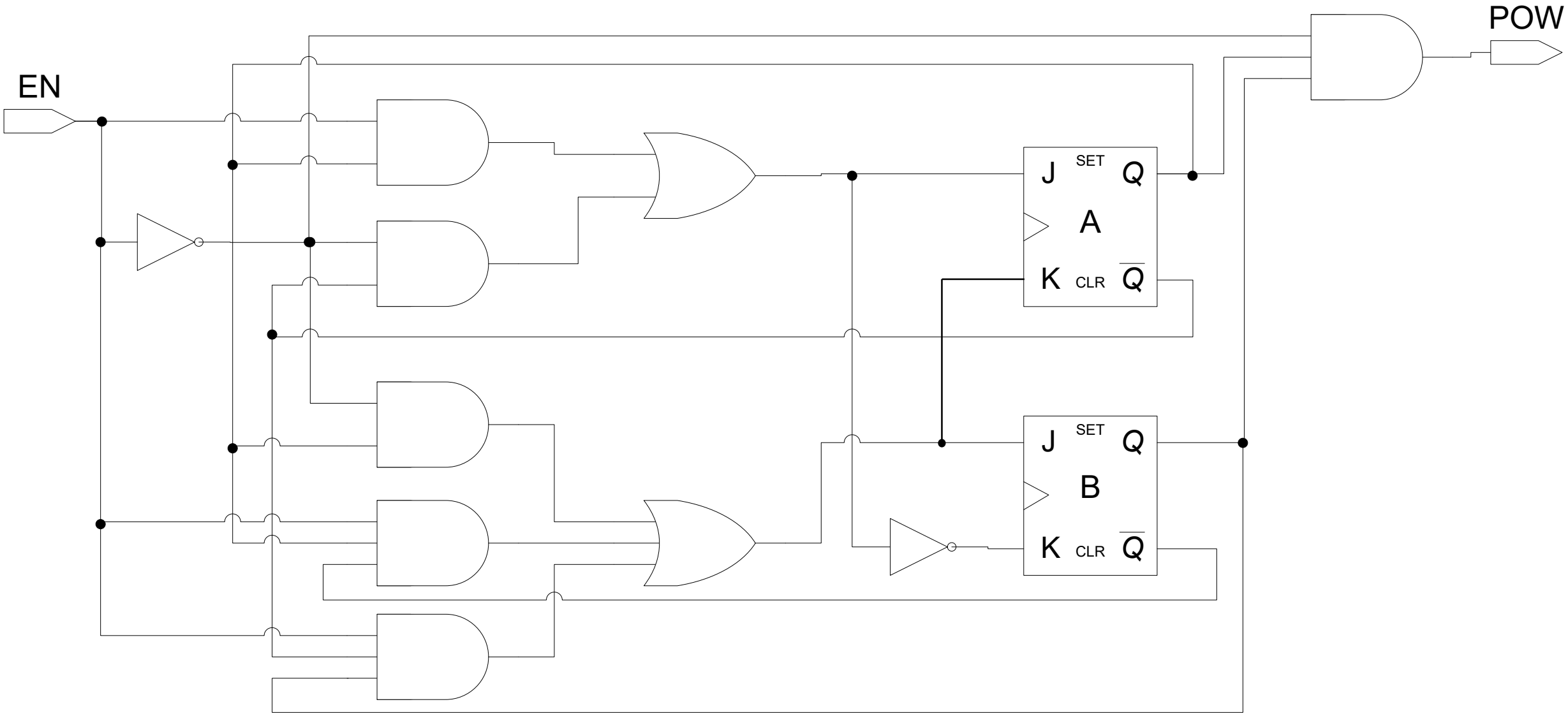
	EN	
S	0	1
A	A, 0	B, 0
B	B, 0	C, 0
C	C, 0	D, 0
D	D, 0	A, 1
	S*, MAX	

state/output table

State diagram



- Circles for states
- Arrows for transitions (note output info)


EN
POW
J
SET
Q
A
K
CLR
Q
J
SET
Q
B
K
CLR
Q

Q	$Q(t+1)$	J	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

$$Q(t+1) = J \cdot \overline{Q(t)} + \overline{K} \cdot Q(t)$$

J_A= ..... ?

K_A= ..... ?

J_B= ..... ?

K_B= ..... ?

Pow= ..... ?

PS Q(t)		In	NS Q(t+1)		J	K	J	K	Out
A	B	En	A	B	A	A	B	B	POW
0	0	0							
0	0	1							
0	1	0							
0	1	1							
1	0	0							
1	0	1							
1	1	0							
1	1	1							