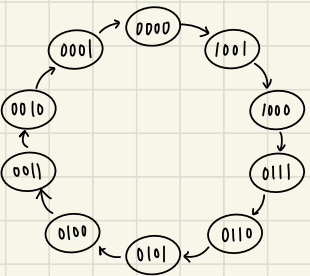


1.

(1) state graph, (2) state table,  $Q^+ = D$ ,



(3) state

AB \ CD	00	01	11	10
00	1		X	
01			X	1
11			X	X
10			X	X

$$D_A = A'B'C'D' + AD$$

AB \ CD	00	01	11	10
00			X	1
01		1	X	
11		1	X	X
10		1	X	X

$$D_B = AD' + BD + BC$$

AB \ CD	00	01	11	10
00		1	X	1
01			X	
11	1	1	X	X
10			X	X

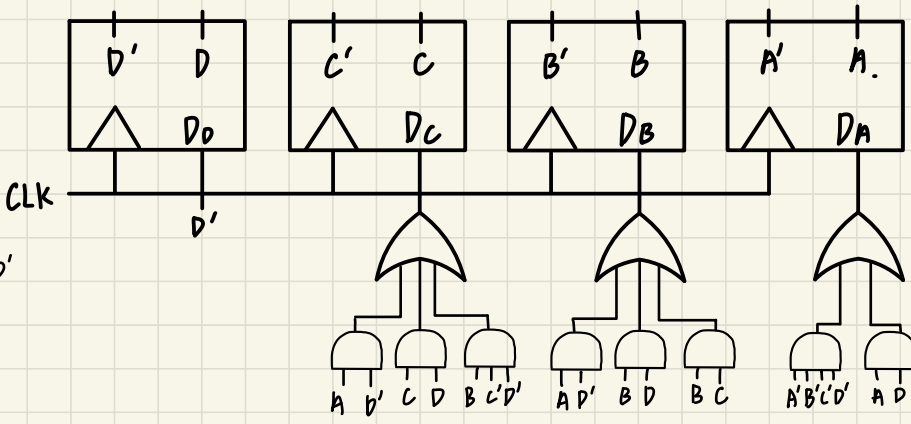
$$D_C = AD' + CD + BC'D'$$

AB \ CD	00	01	11	10
00	1	1	X	1
01			X	
11			X	X
10	1	1	X	X

$$D_D = D'$$

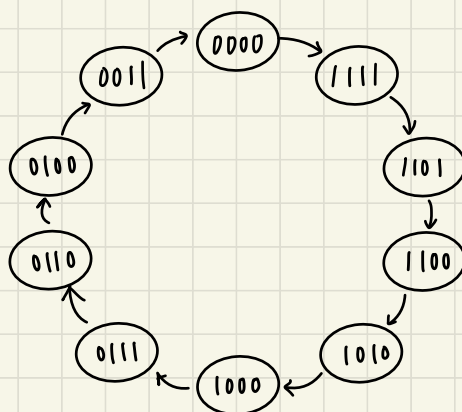
A	B	C	D	A <sup>+</sup>	B <sup>+</sup>	C <sup>+</sup>	D <sup>+</sup>	D <sub>A</sub>	D <sub>B</sub>	D <sub>C</sub>	D <sub>D</sub>
0	0	0	0	1	0	0	1	1	0	0	1
0	0	0	1	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	1	0	0	0	1
0	0	1	1	0	0	1	0	0	0	1	0
0	1	0	0	0	0	1	1	0	0	1	1
0	1	0	1	0	1	0	0	0	1	0	0
0	1	1	0	0	1	0	1	0	1	0	1
0	1	1	1	0	1	1	0	0	1	1	0
1	0	0	0	0	1	1	1	0	1	1	1
1	0	0	1	1	0	0	0	1	0	0	0
1	0	1	0	X	X	X	X	X	X	X	X
1	0	1	1	X	X	X	X	X	X	X	X
1	1	0	0	X	X	X	X	X	X	X	X
1	1	0	1	X	X	X	X	X	X	X	X
1	1	1	0	X	X	X	X	X	X	X	X
1	1	1	1	X	X	X	X	X	X	X	X

(4) circuit,



2.

(1) state graph.



(2) state table,

$$Q^+ = JQ' + K'Q.$$

Q	Q'	J	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

	A	B	C	D	A'	B'	C'	D'	J <sub>A</sub>	K <sub>A</sub>	J <sub>B</sub>	K <sub>B</sub>	J <sub>C</sub>	K <sub>C</sub>	J <sub>D</sub>	K <sub>D</sub>
0	0	0	0	0	1	1	1	1	1	X	1	X	1	X	1	X
1	0	0	0	1	X	X	X	X	X	X	X	X	X	X	X	X
2	0	0	1	0	X	X	X	X	X	X	X	X	X	X	X	X
3	0	0	1	1	0	0	0	0	0	X	0	X	X	1	X	1
4	0	1	0	0	0	0	1	1	0	X	X	1	1	X	1	X
5	0	1	0	1	X	X	X	X	X	X	X	X	X	X	X	X
6	0	1	1	0	0	1	0	0	0	X	X	0	X	1	0	X
7	0	1	1	1	0	1	1	0	0	X	X	0	X	0	X	1
8	1	0	0	0	0	1	1	1	X	1	1	X	1	X	1	X
9	1	0	0	1	X	X	X	X	X	X	X	X	X	X	X	X
10	1	0	1	0	1	0	0	0	X	0	0	X	X	1	0	X
11	1	0	1	1	X	X	X	X	X	X	X	X	X	X	X	X
12	1	1	0	0	1	0	1	0	X	0	X	1	1	X	0	X
13	1	1	0	1	1	1	0	0	X	0	X	0	0	X	X	1
14	1	1	1	0	X	X	X	X	X	X	X	X	X	X	X	X
15	1	1	1	1	1	1	0	1	X	0	X	0	X	1	X	0

### (3) state

AB \ CD	00	01	11	10
00	1	0	X	X
01	X	X	X	X
11	0	0	X	X
10	X	0	X	X

$$J_A = B'C'$$

AB \ CD	00	01	11	10
00	X	X	0	1
01	X	X	0	X
11	X	X	0	X
10	X	X	X	0

$$K_A = B'C'$$

AB \ CD	00	01	11	10
00	1	X	X	1
01	X	X	X	X
11	0	X	X	X
10	X	X	X	0

$$J_B = C'$$

AB \ CD	00	01	11	10
00	X	1	1	X
01	X	X	0	X
11	X	0	0	X
10	X	0	X	X

$$K_B = C'D'$$

AB \ CD	00	01	11	10
00	1	1	1	1
01	X	X	0	X
11	X	X	X	X
10	X	X	X	X

$$J_C = D'$$

AB \ CD	00	01	11	10
00	X	X	X	X
01	X	X	X	X
11	1	0	1	X
10	X	1	X	1

$$K_C = D' + A + B'$$

AB \ CD	00	01	11	10
00	1	1	0	1
01	X	X	X	X
11	X	X	X	X
10	X	0	X	0

$$J_D = A'C' + B'C'$$

AB \ CD	00	01	11	10
00	X	X	X	X
01	X	X	1	X
11	1	1	0	X
10	X	X	X	X

$$K_D = C' + A'$$

### (4) Circuit,

