Sequential Circuit Design:

Given: Problem Specification
Draw Logic diagram.

Example:

Sequence Recognizer

sequence recognizer — sequential circuit that looks for a special bit pattern in some input bits, "1101" here. Input (X): one bit coming every one cycle.

Output (Z): $Z = 1$, when desired pattern is found.

e.g: if we get sequence

$$X = 0000010011000100001101 01 1 0$$

0

1101

1 0

1 1

State diagram:

Define States & ~~Diagrams~~ transitions.

A: Initial state None of bits "1101"

No 1 found yet

B: we got "1" at end. — جسکے آخر میں 1 ہو۔

C: we got "11" at end.

D: we got "110" at end.

JK – Flipflop

$Q_0(t)$ $Q_1(t)$ X $Q_0(t+1)$ $Q_1(t+1)$ Z

$A = 110 1$

اگر 2 پیدا

اگر کیش 1 پیدا

(110)

0/0   1/0   1/0   0/0

A = 00
B = 01
C = 10
D = 11

0/0   0/0   0/0

1/1
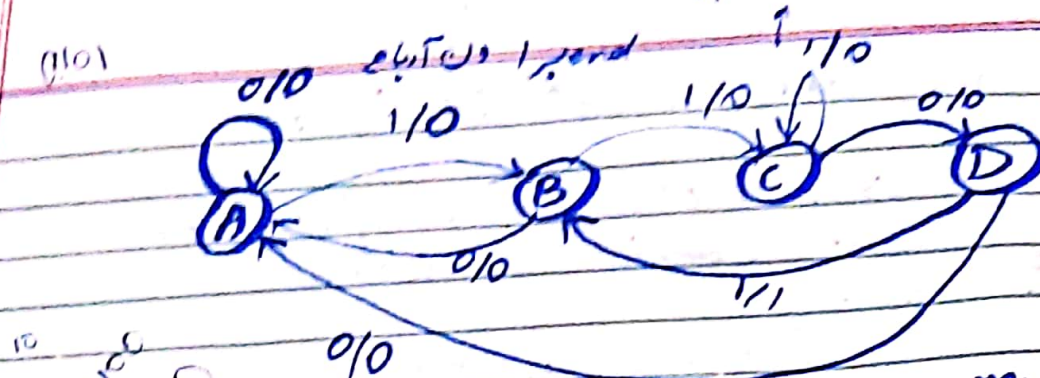
Total states $4 = 2^2$ ② → no. of flipflop

Replace   A   by   00
           B   "   01
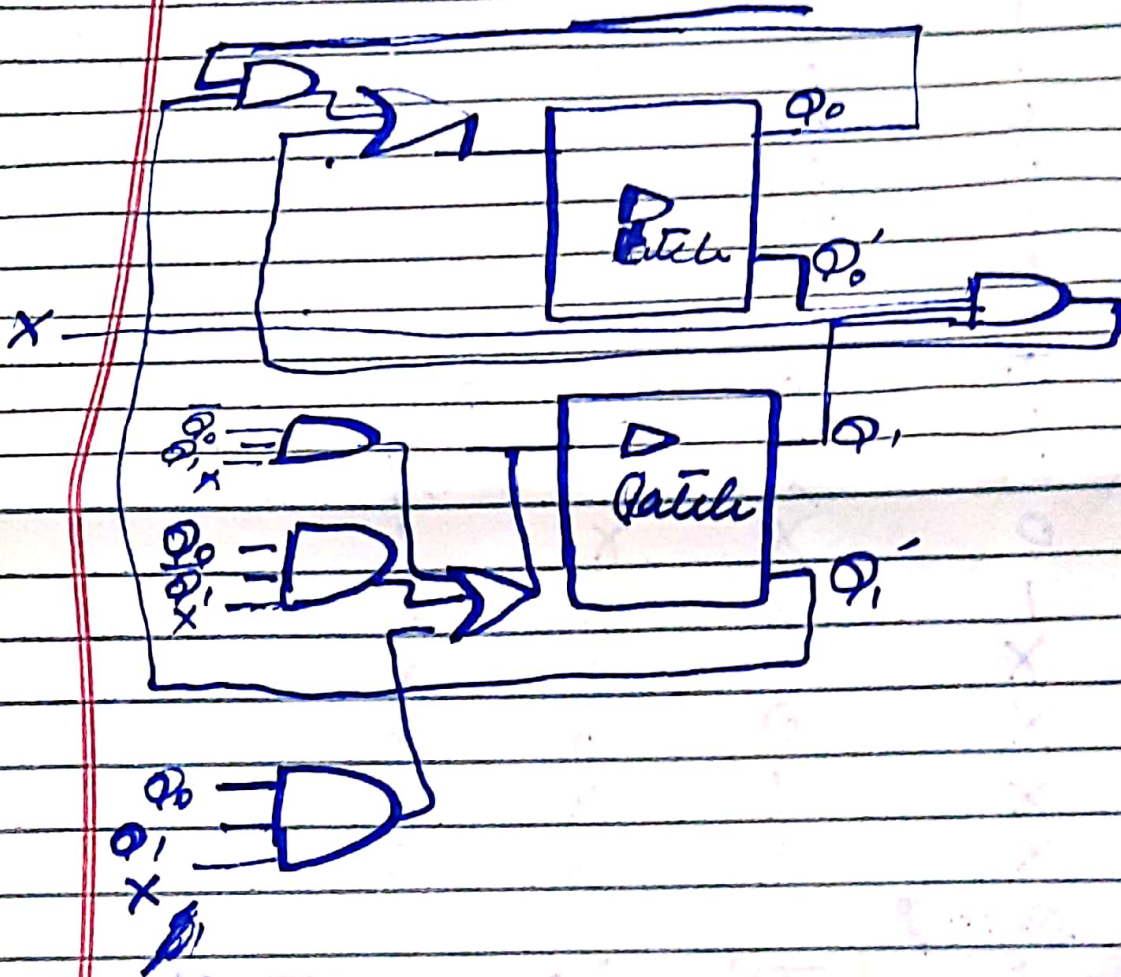   C   "   10
           D   "   11

$Q_0(t)$	$Q_1(t)$	X	$Q(t+1)$	$Q_1(t+1)$	Z
0	0	0	0	0	0
0	0	1	0	1	0
0	1	0	0	0	0
0	1	1	1	1	0
1	0	0	1	1	0
1	0	1	1	0	0
1	1	0	0	0	0
1	1	1	0	1	1

State table   draw   by   State diagram.

$Q_0(t+1)$

$Q_1 x$ / $Q_0 X$	00	01	11	10
00(1)			D	
01(1)	1	1		

$= Q_0(t) \cdot \overline{Q_1}(t) +$

$\overline{Q_0(t)}\ Q_1(t)\ X$

$$Q_0(t+1) = \overline{Q_0(t)} \; \overline{Q_1(t)} \; X + Q_0(t) \; \overline{Q_1(t)} \; \overline{X}$$
$$+ \; Q_0(t) \; Q_1(t) \, X$$

JK — Flipflop

$Q_0(t)$	$Q_1(t)$	X	$Q_0(t+1)$	$Q_1(t+1)$	Z
0	0	0	0	0	0
0	0	1	0	1	0
0	1	0	0	0	0
0	1	1	1	0	0
1	0	0	1	1	0
1	0	1	0	0	2
1	1	0	0	0	0
1	1	1	0	1	1

J_0	K_0	J_1	K_1
0	X	0	X
0	X	1	X
0	X	X	1
1	X	X	1
X	0	1	X
X	0	0	X
X	1	X	1
X	1	X	0

$J_0 = Q_0$

$$J = Q_1(t)\,X$$

$K_0 =$

$$K_0 = Q_1$$

J_1

$$J_1 = Q_0\bar{X} + \bar{Q}_0 X$$

K_1

$$K_1 = \bar{X} + \bar{Q}_0$$