

Sequence generator :- The sequence generator circuit is used to generate a prescribed series of bits in synchronization through a CLK.
 → This kind of generator is used as a code generator, counters, random bit generators, sequence and prescribed period generator.

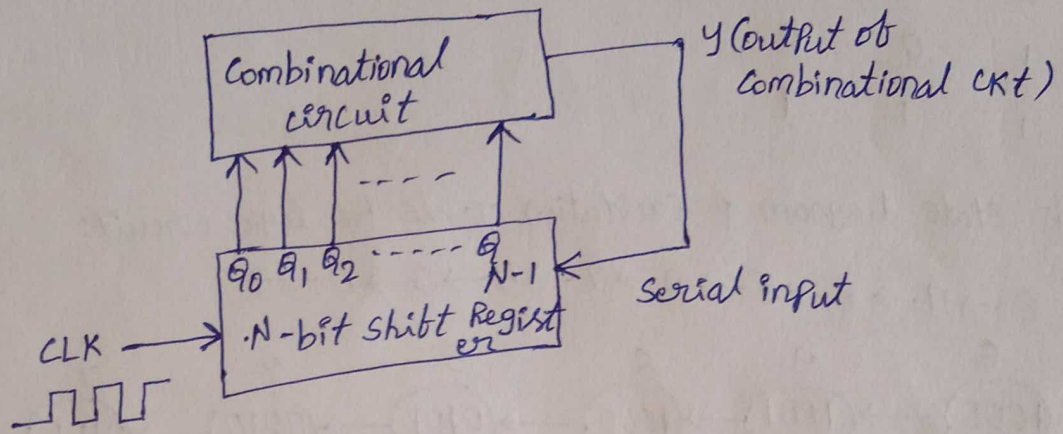


Fig: Sequence Generator.

- The N-bit shift Register outputs like Q_0 through Q_{N-1} are applied like the inputs to a combinational circuit is known as the next state decoder.
- The output of a next state decoder 'y' is given as the serial input to the shift Register. The designing of the next state decoder (combinational circuit) is done based on the sequence required.
- The sequence generator is a shift Register of FIFO (First input 1st output). The sequence generator generates a sequence of binary bits.

Mobile Number Sequence generator :- $8 \rightarrow 9 \rightarrow 8 \rightarrow 5 \rightarrow 2 \rightarrow 7 \rightarrow 4 \rightarrow 3 \rightarrow 01$

Step 1 :- Number of Flip-Flops required are,

$8 \rightarrow 1000$

$9 \rightarrow 1001 \dots \text{etc.}$

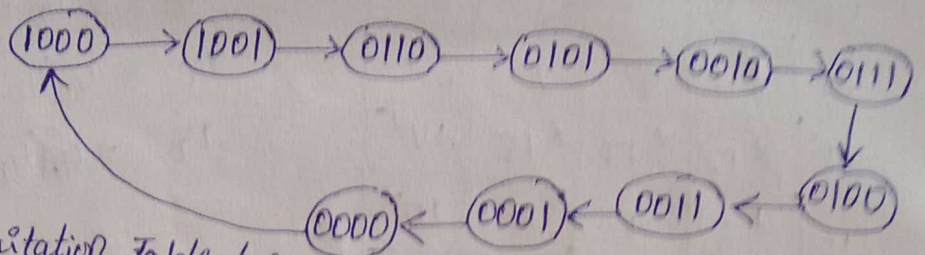
- The bit capacity is '4', The required number of D-Flip-Flops are '4'.
- '4' number of D-Flip-Flops are cascaded to each other to form the 4-bit shift Register.

Step 2:- Excitation Table for D Flip-Flop:

P.S Q_n	n.S Q_{n+1}	D
0	0	0
0	1	1
1	0	0
1	1	1

Step 3:- state diagram:

8 → 9 → 6 → 5 → 2 → 7 → 4 → 3 → 1 → 0



Step 4:- state table i.e. Excitation Table for Logic circuit:

P.S $Q_A Q_B Q_C Q_D$	n.S $Q_A^+ Q_B^+ Q_C^+ Q_D^+$
(8) 1 0 0 0	1 0 0 1
(9) 1 0 0 1	0 1 1 0
(6) 0 1 1 0	0 1 0 1
(5) 0 1 0 1	0 0 1 0
(2) 0 0 1 0	0 1 1 1
(7) 0 1 1 1	0 1 0 0
(4) 0 1 0 0	0 0 1 1
(3) 0 0 1 1	0 0 0 1
(1) 0 0 0 1	0 0 0 0
(0) 0 0 0 0	1 0 0 0

Inputs $D_A D_B D_C D_D$
1 0 0 1
0 1 1 0
0 1 0 1
0 0 1 0
0 1 1 1
0 1 0 0
0 0 1 1
0 0 0 1
0 0 0 0
1 0 0 0

$D_A = ?$

Don't care's 10, 11, 12, 13, 14, 15

$Q_C Q_D$	00	01	11	10
$Q_A Q_B$	00	1	3	2
01	4	5	7	6
11	$\times_{12}$	$\times_{13}$	$\times_{15}$	$\times_{14}$
10	8	9	$\times_{11}$	$\times_{10}$

$$D_A = \bar{Q}_B \bar{Q}_C \bar{Q}_D$$

$D_B = ?$

$Q_C Q_D$	00	01	11	10
$Q_A Q_B$	00	0	1	3
01	4	5	7	6
11	$\times_{12}$	$\times_{13}$	$\times_{15}$	$\times_{14}$
10	8	9	$\times_{11}$	$\times_{10}$

Annotations: $\bar{Q}_C \bar{Q}_D$ points to cell (00, 00). $Q_B Q_C$ points to cell (01, 00). $Q_A Q_D$ points to cell (00, 01).

$$\therefore D_B = \bar{Q}_C \bar{Q}_D + Q_A Q_D + Q_B Q_C$$

$D_C = ?$

$Q_C Q_D$	00	01	11	10
$Q_A Q_B$	00	0	1	3
01	4	5	7	6
11	$\times_{12}$	$\times_{13}$	$\times_{15}$	$\times_{14}$
10	8	9	$\times_{11}$	$\times_{10}$

$$D_C = Q_B \bar{Q}_C + Q_A Q_D + \bar{Q}_B Q_C \bar{Q}_D$$

$$D_D = ?$$

$Q_A Q_B$ \ $Q_C Q_D$	00	01	11	10
00	0	1	3'	2'
01	4	5	7	6'
11	$\times 12$	$\times 13$	$\times 15$	$\times 14$
10	8	9	$\times 11$	$\times 10$

The logic equations are,

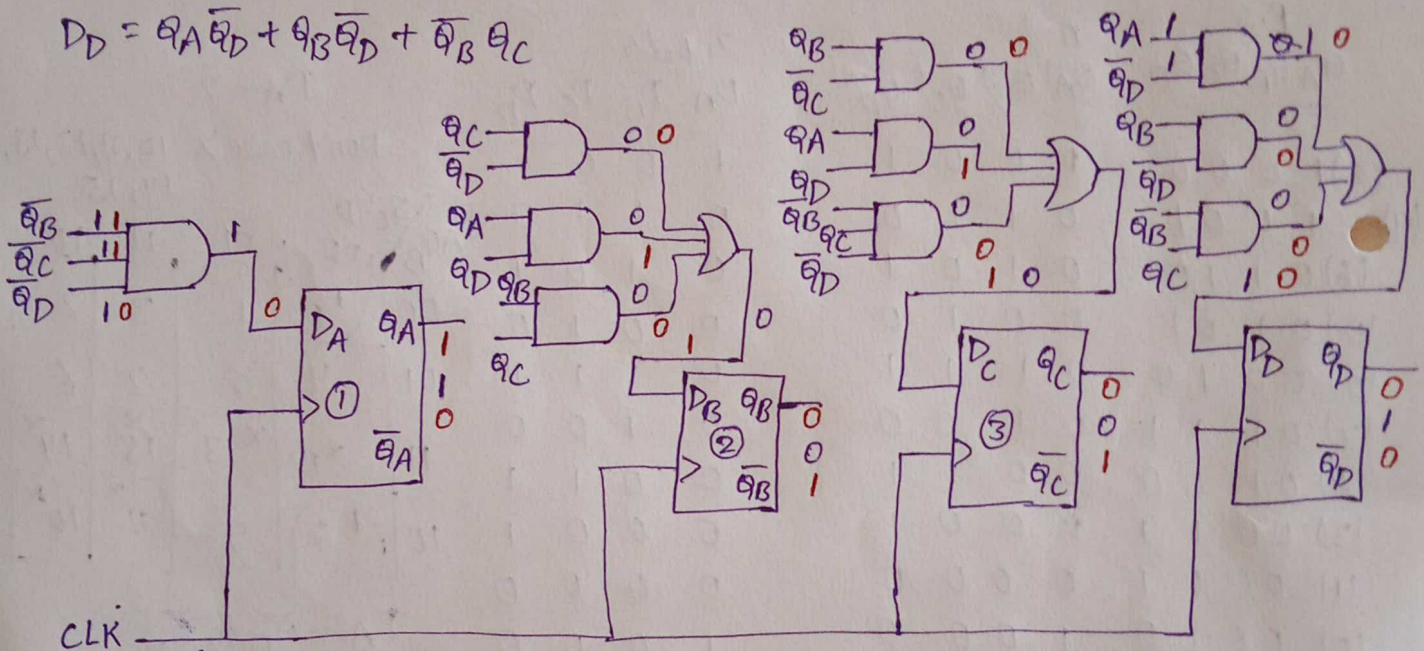
$$D_A = \bar{Q}_B \bar{Q}_C \bar{Q}_D$$

$$D_B = Q_C \bar{Q}_D + Q_A Q_D + Q_B Q_C$$

$$D_C = Q_B \bar{Q}_C + Q_A Q_D + \bar{Q}_B Q_C \bar{Q}_D$$

$$D_D = Q_A \bar{Q}_D + Q_B \bar{Q}_D + \bar{Q}_B Q_C$$

$$D_D = Q_A \bar{Q}_D + Q_B \bar{Q}_D + \bar{Q}_B Q_C$$



8
1000 → 9
1001 → 5
0110 → 5
0101 → 2
0010 →

→ 0001 → 0
0000 → 8
1000 →

→ For this approach to design the mobile number sequence generator.