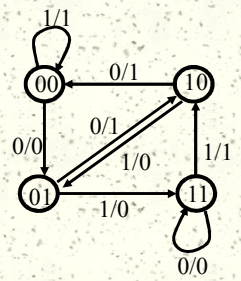
Sequential System Design

- Given: system description
- Goal: logic diagram, Boolean function expression
  1. System specification
  2. State transition table construction
  3. State minimization and encoding
  4. Flip-flop selection
  5. Excitation/output table derivation
  6. Logic simplification
  7. Logic diagram drawing

Example: Sequential System Design

- System spec. → state transition table/graph
  → state minimization/encoding
  → flip-flop selection
  → excitation/output table derivation

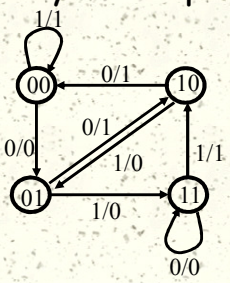


Q(t)	Q(t+1)	T
0	0	0
0	1	1
1	0	1
1	1	0

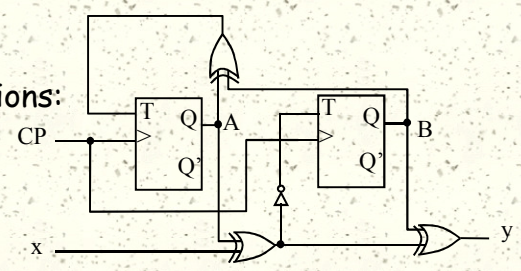
Current State		In	Next State		Flip-flop inputs		Out
A	B	x	A	B	TA	TB	y
0	0	0	0	1	0	1	0
0	0	1	0	0	0	0	1
0	1	0	1	0	1	1	1
0	1	1	1	1	1	0	0
1	0	0	0	0	1	0	1
1	0	1	0	1	1	1	0
1	1	0	1	1	0	0	0
1	1	1	1	0	0	1	1

Example: Sequential System Design

- System spec. → state transition table/graph
  → state minimization/encoding
  → flip-flop selection
  → excitation/output table derivation
  → logic simplification/minimization
  → logic diagram drawing

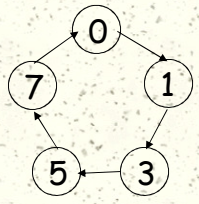


- Flip-flop input functions:
  - TA = A⊕ B
  - TB = (A⊕x)'
- Output:
  - y = A⊕B⊕x



Self-Correcting Design

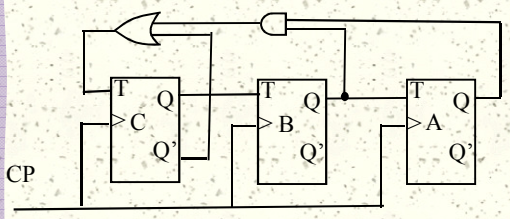
- Design a system that generates repeated binary sequence of 0,1,3,5,7.



	A	B	C	A	B	C
0	0	0	0	0	0	1
1	0	0	1	0	1	1
3	0	1	1	1	0	1
5	1	0	1	1	1	1
7	1	1	1	0	0	0

Self-Correcting Design

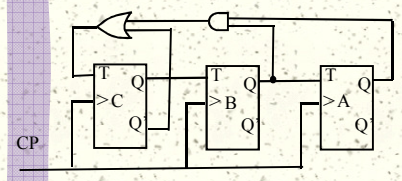
- $T_A = B$
- $T_B = C$
- $T_C = C'+AB$



A	B	C	T_A	T_B	T_C
0	0	0	0	0	1
0	0	1	0	1	0
0	1	1	1	1	0
1	0	1	0	1	0
1	1	1	1	1	1
0	1	0	-	-	-
1	0	0	-	-	-
1	1	0	-	-	-

Self-Correcting Design

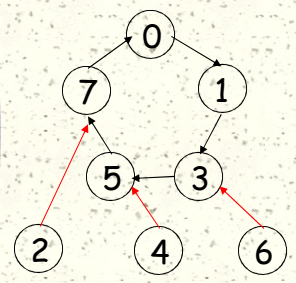
- $T_A = B$
- $T_B = C$
- $T_C = C'+AB$



	A	B	C	A	B	C	T_A	T_B	T_C
0	0	0	0	0	0	1	0	0	1
1	0	0	1	0	1	1	0	1	0
3	0	1	1	1	0	1	1	1	0
5	1	0	1	1	1	1	0	1	0
7	1	1	1	0	0	0	1	1	1
2	0	1	0						
4	1	0	0						
6	1	1	0						

Self-Correcting Design

- $T_A = B$
- $T_B = C$
- $T_C = C'+AB$



	A	B	C	A	B	C	T_A	T_B	T_C
0	0	0	0	0	0	1	0	0	1
1	0	0	1	0	1	1	0	1	0
3	0	1	1	1	0	1	1	1	0
5	1	0	1	1	1	1	0	1	0
7	1	1	1	0	0	0	1	1	1
2	0	1	0	1	1	1	1	0	1
4	1	0	0	1	0	1	0	0	1
6	1	1	0	0	1	1	1	0	1

Design is self-correcting