1. Truth table for A, B, C:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A | B | C | !(A + !B) x C | !( (A x B ) + (C x B) ) | Output |
| 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 0 | 1 | 1 |
| 0 | 1 | 0 | 0 | 1 | 1 |
| 0 | 1 | 1 | 1 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 0 | 0 |

1. Output 1

(!A x B x !C) + (!A x B x C) + (A x !B x !C) + (A x !B x C) + (A x B x !C)

= [ (!A x B x !C) + (!A x B x C) ] + [ (A x !B x !C) + (A x !B x C) ] + (A x B x !C)

= (!A x B) + (A x !B) + (A x B x !C)

Output 2

(!A x !B x !C) + (!A x B x !C) + (A x !B x !C) + (A x B x C)

= [ (!A x !B x !C) + (!A x B x !C) ] + (A x !B x !C) + (A x B x C)

= (!A x !C) + (A x !B x !C) + (A x B x C)

1. Part a:

10, 01

10, 01

10, 01

00, 11

00, 11

00, 11

00, 11

01, 10

**State 00:** start state. **State 01:** last cycle had different input bits. **State 10:** last 2 cycles had different input bits. **State 11:** last 3 cycles had different input bits.

**Output:** 1 if at state 11, 0 otherwise.

Part b:

Truth table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Current state | |  |  |  | Next state | |
| Q1 | Q0 | Output | Input 1 | Input 2 | D1 | D0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 |

Output = Q1 x Q0

D1 = (!Q1 x Q0 x !In1 x In2) + (!Q1 x Q0 x In1 x !In2) + (Q1 x !Q0 x !In1 x In2) + (Q1 x !Q0 x In1 x !In2) + (Q1 x Q0 x !In1 x In2) + (Q1 x Q0 x In1 x !In2)

D0 = (!Q1 x !Q0 x !In1 x In2) + (!Q1 x !Q0 x In1 x !In2) + (Q1 x !Q0 x !In1 x In2) + (Q1 x !Q0 x In1 x !In2) + (Q1 x Q0 x !In1 x In2) + (Q1 x Q0 x In1 x !In2)