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Question:
Minimize the door combination lock (sequential example: finite-state machine) state table, using an online Quine McCluskey tool.

Solution:

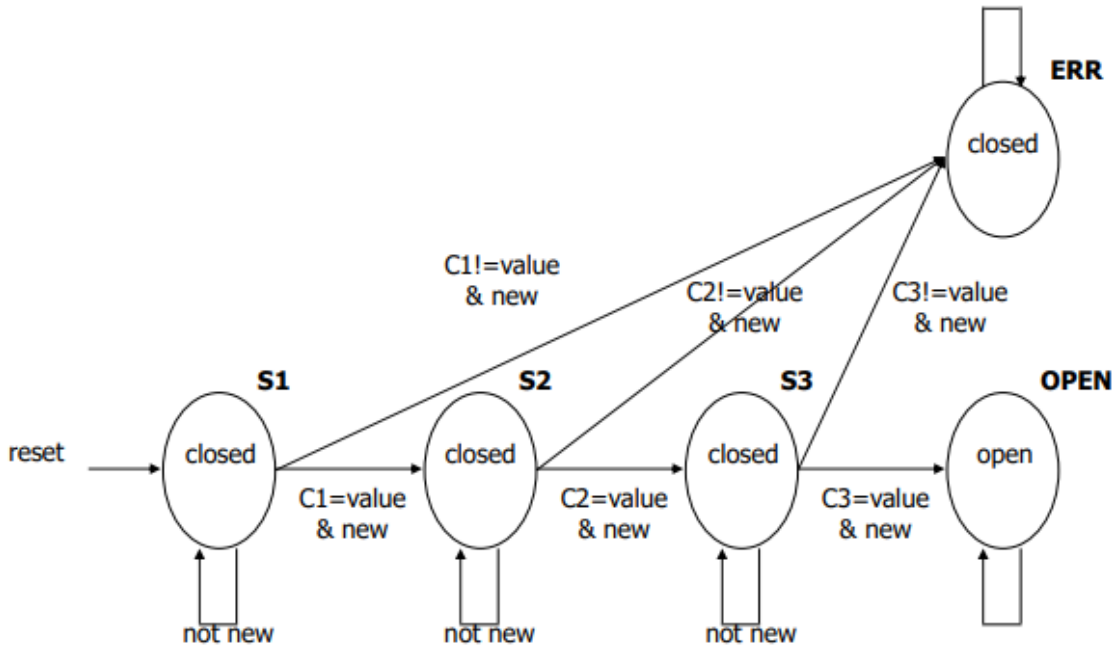

Fig. 1: Door combination lock state diagram

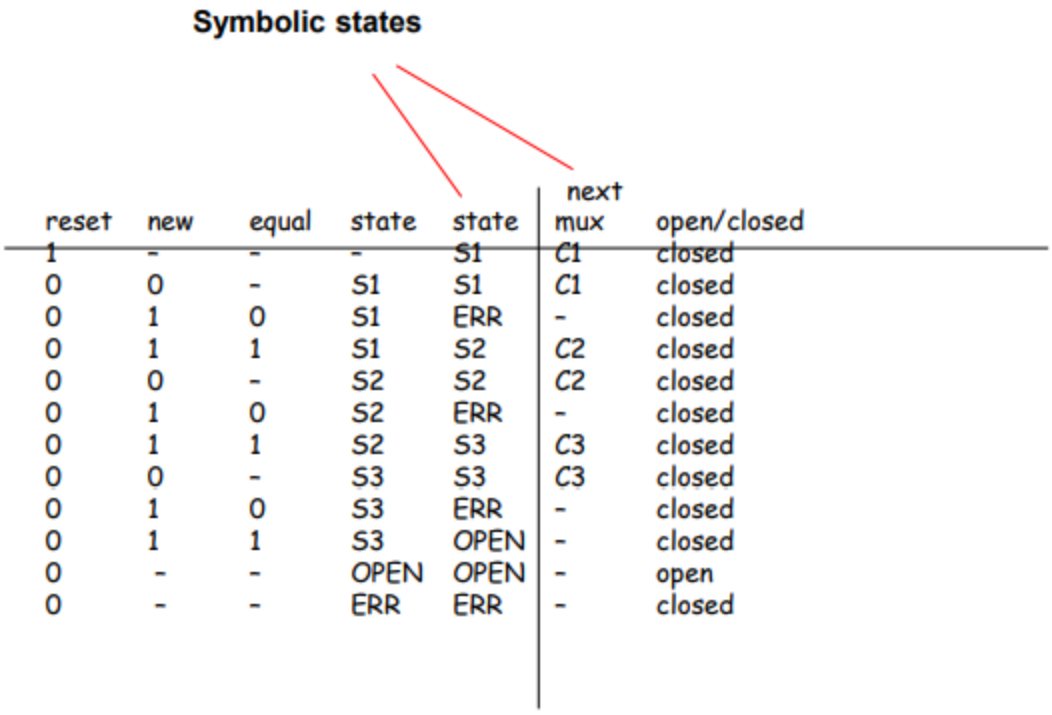

Fig. 2: State Transition Table

SYMBOLS	ENCODING
S1	000
S2	001
S3	010
OPEN	011
ERR	100
C1	00
C2	01
C3	10

Fig. 3: Encoding states Table

Reset	New	Equal	Current State s0, s1, s2	Next State n0, n1, n2	Next Mux c0, c1	Open / Closed
1	__	__	__	000	00	0
0	0	__	000	000	00	0

Reset	New	Equal	Current State s0, s1, s2	Next State n0, n1, n2	Next Mux c0, c1	Open / Closed
0	1	0	000	100	__	0
0	1	1	000	001	01	0
0	0	__	001	001	01	0
0	1	0	001	100	__	0
0	1	1	001	010	10	0
0	0	__	010	010	10	0
0	1	0	010	100	__	0
0	1	1	010	011	__	0
0	__	__	011	011	__	1
0	__	__	100	100	__	0

Fig. 4: Encoded State Transition Table

The outputs: $n0,\ n1,\ n2,\ c0,\ c1\ and\ Open.$
The input variables: $r,\ n,\ e,\ s0,\ s1,\ s2.$
AtozMath's Online Quine McCluskey tool was used to find the minimal expression for each output as shown in the following sections.

For n0

Minterm = 16,17,18,4,12,20,28
Don't Care = 5,6,7,13,14,15,21,22,23,29,30,31
Variable = r,n,e,s0,s1,s2
using Quine-McCluskey
See solution here

Prime implicant chart

PIs\Minterms	4	12	16	17	18	20	28	r,n,e,s0,s1,s2
16,17,20,21			X	X		X		010-0-
16,18,20,22			X		X	X		010--0
4,5,6,7,12,13,14,15,20,21,22,23,28,29,30,31	X	X				X	X	0--1--

Extracted essential prime implicants : 0--1--,010-0-,010--0

All extracted essential prime implicants : 0--1--,010-0-,010--0
Minimal QuineMcCluskey Expression = $r's0 + r'ne's1' + r'ne's2'$

For n1

Minterm = 25,2,10,26,3,11,19,27
Don't Care = 5,6,7,13,14,15,21,22,23,29,30,31
Variable = r,n,e,s0,s1,s2
using Quine-McCluskey
See solution here

Prime implicant chart

PIs\Minterms	2	3	10	11	19	25	26	27	r,n,e,s0,s1,s2
25,27,29,31						X		X	011--1
2,3,6,7,10,11,14,15	X	X	X	X					00--1-
3,7,11,15,19,23,27,31		X		X	X			X	0---11
10,11,14,15,26,27,30,31			X	X			X	X	0-1-1-
5,7,13,15,21,23,29,31									0--1-1
6,7,14,15,22,23,30,31									0--11-

Extracted essential prime implicants : 00--1-,0---11,011--1,0-1-1-

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All extracted essential prime implicants : 00--1-,0---11,011--1,0-1-1-
Minimal QuineMcCluskey Expression = $r'n's1 + r's1s2 + r'nes2 + r'es1$

For n2

Minterm = 24,1,9,26,3,11,19,27
Don't Care = 5,6,7,13,14,15,21,22,23,29,30,31
Variable = r,n,e,s0,s1,s2
using Quine-McCluskey
See solution here

Prime implicant chart

PIs\Minterms	1	3	9	11	19	24	26	27	r,n,e,s0,s1,s2
24,26						X	X		0110-0
26,27,30,31							X	X	011-1-
1,3,5,7,9,11,13,15	X	X	X	X					00---1
3,7,11,15,19,23,27,31		X		X	X			X	0---11
5,7,13,15,21,23,29,31									0--1-1
6,7,14,15,22,23,30,31									0--11-

Extracted essential prime implicants : 00---1,0---11,0110-0

All extracted essential prime implicants : 00---1,0---11,0110-0
Minimal QuineMcCluskey Expression = $r'n's2 + r's1s2 + r'nes0's2'$

For c0

Minterm = 25,2,10
DontCare = 16,17,18,26,4,12,20,28,3,11,19,27,5,6,7,13,14,15,21,22,23,29,30,31
Variable = r,n,e,s0,s1,s2
using Quine-McCluskey
See solution here

Prime implicant chart

PIs\Minterms	2	10	25	r,n,e,s0,s1,s2
16,17,18,19,20,21,22,23				010---
17,19,21,23,25,27,29,31			X	01---1
2,3,6,7,10,11,14,15,18,19,22,23,26,27,30,31	X	X		0---1-
4,5,6,7,12,13,14,15,20,21,22,23,28,29,30,31				0--1--

Extracted essential prime implicants : 0---1-,01---1

All extracted essential prime implicants : 0---1-,01---1
Minimal QuineMcCluskey Expression = $r's1 + r'ns2$

For c1

Minterm = 24,1,9
DontCare = 16,17,18,26,4,12,20,28,3,11,19,27,5,6,7,13,14,15,21,22,23,29,30,31
Variable = r,n,e,s0,s1,s2
using Quine-McCluskey
See solution here

Prime implicant chart

PIs\Minterms	1	9	24	r,n,e,s0,s1,s2
1,3,5,7,9,11,13,15	X	X		00---1
1,3,5,7,17,19,21,23	X			0-0--1
16,18,20,22,24,26,28,30			X	01---0
16,17,18,19,20,21,22,23				010---
3,7,11,15,19,23,27,31				0---11
18,19,22,23,26,27,30,31				01--1-
4,5,6,7,12,13,14,15,20,21,22,23,28,29,30,31				0--1--

Extracted essential prime implicants : 00---1,01---0

All extracted essential prime implicants : 00---1,01---0
Minimal QuineMcCluskey Expression = $r'n's2 + r'ns2'$

For Open

Minterm = 3,11,19,27
DontCare = 5,6,7,13,14,15,21,22,23,29,30,31
Variable = r,n,e,s0,s1,s2
using Quine-McCluskey
See solution here

Prime implicant chart

PIs\Minterms	3	11	19	27	r,n,e,s0,s1,s2
3,7,11,15,19,23,27,31	X	X	X	X	0---11
5,7,13,15,21,23,29,31					0--1-1
6,7,14,15,22,23,30,31					0--11-

Extracted essential prime implicants : 0---11

All extracted essential prime implicants : 0---11
Minimal QuineMcCluskey Expression = $r's1s2$