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Условия при которых f = 1: 3≤|x41x5-x1x2x3|<6

Условия при которых f = d: |x41x5-x1x2x3|=0

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| N | X1X2X3X4X5 | X41X5 | (X41X5)10 | X1X2X3 | (X1X2X3)10 | (-) | f |
| 0 | 00000 | 010 | 2 | 000 | 0 | 2 | 0 |
| 1 | 00001 | 011 | 3 | 000 | 0 | 3 | 1 |
| 2 | 00010 | 110 | 6 | 000 | 0 | 6 | 0 |
| 3 | 00011 | 111 | 7 | 000 | 0 | 7 | 0 |
| 4 | 00100 | 010 | 2 | 001 | 1 | 1 | 0 |
| 5 | 00101 | 011 | 3 | 001 | 1 | 2 | 0 |
| 6 | 00110 | 110 | 6 | 001 | 1 | 5 | 1 |
| 7 | 00111 | 111 | 7 | 001 | 1 | 6 | 0 |
| 8 | 01000 | 010 | 2 | 010 | 2 | 0 | D |
| 9 | 01001 | 011 | 3 | 010 | 2 | 1 | 0 |
| 10 | 01010 | 110 | 6 | 010 | 2 | 4 | 1 |
| 11 | 01011 | 111 | 7 | 010 | 2 | 5 | 1 |
| 12 | 01100 | 010 | 2 | 011 | 3 | -1 | 0 |
| 13 | 01101 | 011 | 3 | 011 | 3 | 0 | D |
| 14 | 01110 | 110 | 6 | 011 | 3 | 3 | 1 |
| 15 | 01111 | 111 | 7 | 011 | 3 | 4 | 1 |
| 16 | 10000 | 010 | 2 | 100 | 4 | -2 | 0 |
| 17 | 10001 | 011 | 3 | 100 | 4 | -1 | 0 |
| 18 | 10010 | 110 | 6 | 100 | 4 | 2 | 0 |
| 19 | 10011 | 111 | 7 | 100 | 4 | 3 | 1 |
| 20 | 10100 | 010 | 2 | 101 | 5 | -3 | 1 |
| 21 | 10101 | 011 | 3 | 101 | 5 | -2 | 0 |
| 22 | 10110 | 110 | 6 | 101 | 5 | 1 | 0 |
| 23 | 10111 | 111 | 7 | 101 | 5 | 2 | 0 |
| 24 | 11000 | 010 | 2 | 110 | 6 | -4 | 1 |
| 25 | 11001 | 011 | 3 | 110 | 6 | -3 | 1 |
| 26 | 11010 | 110 | 6 | 110 | 6 | 0 | d |
| 27 | 11011 | 111 | 7 | 110 | 6 | 1 | 0 |
| 28 | 11100 | 010 | 2 | 111 | 7 | -5 | 1 |
| 29 | 11101 | 011 | 3 | 111 | 7 | -4 | 1 |
| 30 | 11110 | 110 | 6 | 111 | 7 | -1 | 0 |
| 31 | 11111 | 111 | 7 | 111 | 7 | 0 | d |

Канонический вид КДНФ : (¬x1∧¬x2∧¬x3∧¬x4∧x5) ∨ (¬x1∧¬x2∧x3∧x4∧¬x5) ∨ (¬x1∧x2∧¬x3∧x4∧¬x5) ∨ (¬x1∧x2∧¬x3∧x4∧x5) ∨ (¬x1∧x2∧x3∧x4∧¬x5) ∨ (¬x1∧x2∧x3∧x4∧x5) ∨ (x1∧¬x2∧¬x3∧x4∧x5) ∨ (x1∧¬x2∧x3∧¬x4∧¬x5) ∨ (x1∧x2∧¬x3∧¬x4∧¬x5) ∨ (x1∧x2∧¬x3∧¬x4∧x5) ∨ (x1∧x2∧x3∧¬x4∧¬x5) ∨ (x1∧x2∧x3∧¬x4∧x5)

ККНФ: (x1∨x2∨x3∨x4∨x5) ∧ (x1∨x2∨x3∨¬x4∨x5) ∧ (x1∨x2∨x3∨¬x4∨¬x5) ∧ (x1∨x2∨¬x3∨x4∨x5) ∧ (x1∨x2∨¬x3∨x4∨¬x5) ∧ (x1∨x2∨¬x3∨¬x4∨¬x5) ∧ (x1∨¬x2∨x3∨x4∨¬x5) ∧ (x1∨¬x2∨¬x3∨x4∨x5) ∧ (¬x1∨x2∨x3∨x4∨x5) ∧ (¬x1∨x2∨x3∨x4∨¬x5) ∧ (¬x1∨x2∨x3∨¬x4∨x5) ∧ (¬x1∨x2∨¬x3∨x4∨¬x5) ∧ (¬x1∨x2∨¬x3∨¬x4∨x5) ∧ (¬x1∨x2∨¬x3∨¬x4∨¬x5) ∧ (¬x1∨¬x2∨x3∨¬x4∨¬x5) ∧ (¬x1∨¬x2∨¬x3∨¬x4∨x5)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| N | K0 |  | N | K1 |  | N | K2 |
| 1 | 00001 |  | 8,10 | 010X0 | ✓ | 8,10,24,26 | X10X0 |
| 8 | 01000 | ✓ | 8,24 | X1000 | ✓ |  |  |
|  |  |  |  |  |  | 10,11,14,15 | 01X1X |
| 6 | 00110 | ✓ | 6,14 | 0X110 |  | 24,25,28,29 | 11X0X |
| 10 | 01010 | ✓ | 10,11 | 0101X | ✓ |  |  |
| 20 | 10100 | ✓ | 10,14 | 01X10 | ✓ | 13,15,29,31 | X11X1 |
| 24 | 11000 | ✓ | 10,26 | X1010 | ✓ |  |  |
|  |  |  | 20,28 | 1X100 |  | 1 | 00001 |
| 11 | 01011 | ✓ | 24,25 | 1100X | ✓ | 6,14 | 0X110 |
| 13 | 01101 | ✓ | 24,26 | 110X0 | ✓ | 20,28 | 1X110 |
| 14 | 01110 | ✓ | 24,28 | 11X00 | ✓ | 19 | 10011 |
| 19 | 10011 |  |  |  |  |  |  |
| 25 | 11001 | ✓ | 11,15 | 01X11 | ✓ |  |  |
| 26 | 11010 | ✓ | 13,15 | 011X1 | ✓ |  |  |
| 28 | 11100 | ✓ | 13,29 | X1101 | ✓ |  |  |
|  |  |  | 14,15 | 0111X | ✓ |  |  |
| 15 | 01111 | ✓ | 25,29 | 11X01 | ✓ |  |  |
| 29 | 11101 | ✓ | 28,29 | 1110X | ✓ |  |  |
|  |  |  |  |  |  |  |  |
| 31 | 11111 | ✓ | 15,31 | X1111 | ✓ |  |  |
|  |  |  | 29,31 | 111X1 | ✓ |  |  |

*Составление импликантной таблицы.*

Импликантная таблица (табл. 4) в первоначальном виде содержит 6 строки (по числу простых импликант) и 12 столбцов (по числу существенных вершин).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Простые импликанты (максимальные кубы) | | 0-кубы | | | | | | | | | | | |
| 00001 | 00110 | 01010 | 01011 | 01110 | 01111 | 10011 | 10100 | 11000 | 1  1  0  0  1 | 1  1  1  0  0 | 1  1  1  0  1 |
|  |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 1. 00001 | A | \* |  |  |  |  |  |  |  |  |  |  |  |
| 2. 0X110 | B |  | \* |  |  | \* |  |  |  |  |  |  |  |
| 3. 1X110 | C |  |  |  |  |  |  |  | \* |  |  | \* |  |
| 4. 01X10 | D |  |  | \* | \* | \* | \* |  |  |  |  |  |  |
| 5. 11X0X | E |  |  |  |  |  |  |  |  | \* | \* | \* | \* |
| 6. 10011 | F |  |  |  |  |  |  | \* |  |  |  |  |  |

*Определение существенных импликант*

Все Импликанты – существенные, так как каждая покрывают вершины от 1..12, не покрытые другими импликантами.

Ядро покрытия:

Sa = 24, Sb= 30

f = (x1x2¬x4) ∨ (¬x1x2x4) ∨ (x1x3¬x4x5) ∨ (¬x1x3x4¬x5) ∨ (x1¬x2¬x3x4x5) ∨ (¬x1¬x2¬x3¬x4x5)

**2.4. Минимизация булевой функции на картах Карно**

**2.4.1. Определение МДНФ**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| x1x2/x3x4x5 | 000 | 001 | 011 | 010 | 110 | 111 | 101 | 100 |
| 00 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 01 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| 11 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |

**Минимизированная ДНФ:**

f = (x1x2¬x4) ∨ (¬x1x2x4) ∨ (x1x3¬x4x5) ∨ (¬x1x3x4¬x5) ∨ (x1¬x2¬x3x4x5) ∨ (¬x1¬x2¬x3¬x4x5)

Sa = 24, Sb= 30

Отметим, что цены минимальных покрытий, полученных методом Квайна – Мак-Класки и с помощью карт Карно, совпадают, так как цена минимального покрытия булевой функции не зависит от метода его нахождения

**2.4.2. Определение МКНФ**

f = (x2∨x3∨x5) ∧ (¬x1∨x2∨x4∨¬x5) ∧ (¬x1∨x2∨¬x3∨¬x5) ∧ (¬x1∨¬x3∨¬x4∨x5) ∧ (x1∨x2∨x3∨¬x4) ∧ (¬x1∨¬x2∨x3∨¬x4∨¬x5) ∧ (x1∨¬x3∨x4∨x5) ∧ (x2∨¬x3∨¬x5) ∧ (x1∨¬x2∨x3∨x4∨¬x5)

Sa = 36, Sb= 45