**Вариант 1**

**Изображение выглядит как стол

Автоматически созданное описание**

**Таблица с заданиями второй части курсовой работы по дискретной математики базовый уровень ИТМО 1 курс ПИиКТ

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**1. Составление таблицы истинности**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| a1 | a2 | a3 | a4 | a5 | c1 | c2 | c3 | c4 | c5 | V |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
| 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 |
| 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 |
| 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 |
| 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | d | d | d | d | d | d |

**2. Минимизация булевых функций системы на картах Карно**

2.1. c1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 00 | 01 | 11 | 10 |
| 00 |  |  |  |  |
| 01 |  |  |  |  |
| 11 |  |  | 1 |  |
| 10 |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 00 | 01 | 11 | 10 |
| 00 | 1 | 1 | 1 | 1 |
| 01 | 1 | 1 | 1 | 1 |
| 11 | 1 | 1 | d | 0 |
| 10 | 1 | 1 | 1 | 1 |

a4a5 a4a5

a2a3 . a2a3

a1 = 0 a1 = 1

C1min = {10XXX, 1XX0X, 1X0XX, X1111}, Sa =10 , Sb = 14

2.2. c2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 00 | 01 | 11 | 10 |
| 00 |  |  |  |  |
| 01 |  |  | 1 |  |
| 11 | 1 | 1 |  | 1 |
| 10 | 1 | 1 | 1 | 1 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 00 | 01 | 11 | 10 |
| 00 |  |  |  |  |
| 01 |  |  | 1 |  |
| 11 | 1 | 1 | d |  |
| 10 | 1 | 1 | 1 | 1 |

a4a5 a4a5

a2a3 . a2a3

a1 = 0 a1 = 1

C2min = {X10XX, X1X0X, 01XX0, X0111}, Sa = 11, Sb = 15

2.3. c3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 00 | 01 | 11 | 10 |
| 00 |  |  | 1 |  |
| 01 | 1 | 1 |  | 1 |
| 11 | 1 | 1 |  | 1 |
| 10 |  |  | 1 |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 00 | 01 | 11 | 10 |
| 00 |  |  | 1 |  |
| 01 | 1 | 1 |  | 1 |
| 11 | 1 | 1 | d |  |
| 10 |  |  | 1 |  |

a4a5 a4a5

a2a3 . a2a3

a1 = 0 a1 = 1

C3min = {XX10X, XX011, 0X1X0, X01X0}, Sa = 11, Sb = 15

2.4. c4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 00 | 01 | 11 | 10 |
| 00 |  | 1 |  | 1 |
| 01 |  | 1 |  | 1 |
| 11 |  | 1 |  | 1 |
| 10 |  | 1 |  | 1 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 00 | 01 | 11 | 10 |
| 00 |  | 1 |  | 1 |
| 01 |  | 1 |  | 1 |
| 11 |  | 1 | d |  |
| 10 |  | 1 |  | 1 |

a4a5 a4a5

a2a3 . a2a3

a1 = 0 a1 = 1

C4min = {XXX01, 0XX10, X0X10, XX010}, Sa = 11, Sb = 15

2.5. c5

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 00 | 01 | 11 | 10 |
| 00 | 1 |  |  | 1 |
| 01 | 1 |  |  | 1 |
| 11 | 1 |  |  | 1 |
| 10 | 1 |  |  | 1 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 00 | 01 | 11 | 10 |
| 00 | 1 |  |  | 1 |
| 01 | 1 |  |  | 1 |
| 11 | 1 |  | d |  |
| 10 | 1 |  |  | 1 |

a4a5 a4a5

a2a3 . a2a3

a1 = 0 a1 = 1

C5min = {0XXX0, XXX00, X0XX0, X10X0}, Sa = 9, Sb = 13

2.6. V

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 00 | 01 | 11 | 10 |
| 00 |  |  |  |  |
| 01 |  |  |  |  |
| 11 |  |  |  |  |
| 10 |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 00 | 01 | 11 | 10 |
| 00 |  |  |  |  |
| 01 |  |  |  |  |
| 11 |  |  | d | 1 |
| 10 |  |  |  |  |

a4a5 a4a5

a2a3 . a2a3

a1 = 0 a1 = 1

Vmin = {1111X}, Sa = 4, Sb = 5

*Итоговые ДНФ и стоимость по Квайну*

C1min = a1**Г**a2 V a1**Г**a4 V a1**Г**a3 V a2a3a4a5 (Sq = 14)

C2min = a2**Г**a3 V a2**Г**a4 V **Г**a1a2**Г**a5 V **Г**a2a3a4a5 (Sq = 15)

C3min = a3**Г**a4 V **Г**a3a4a5 V **Г**a1a3**Г**a5 V **Г**a2a3**Г**a5 (Sq = 15)

C4min = **Г**a4a5 V **Г**a1a4**Г**a5 V **Г**a2a4**Г**a5 V **Г**a3a4**Г**a5 (Sq = 15)

C5min = **Г**a1**Г**a5 V **Г**a4**Г**a5 V **Г**a2**Г**a5 V a2**Г**a3**Г**a5 (Sq = 13)

Vmin = a1a2a3a4 (Sq = 4)

= 76

При реализации схемы в виде пяти независимых подсхем ее цена Sq=95

**3. Преобразование минимальных форм булевых функции системы**

Введем несколько вспомогательных переменных и используем их в ранее получившихся функциях. Также используем группировку, чтобы еще сильнее уменьшить цену схемы:

z1 = a4**Г**a5 (Sq = 2)

z2 = **Г**a1**Г**a5 (Sq = 2)

z3 = **Г**a2**Г**a5 (Sq = 2)

z4 = a3a4a5 (Sq = 3)

z5 = a2**Г**a3 (Sq = 2)

C1min = a1(**Г**a2 V **Г**a3 V **Г**a4) V z4a2 (Sq = 9)

C2min = z5 V a2**Г**a4 V **Г**a1a2**Г**a5 V z4**Г**a2 (Sq = 11)

C3min = a3**Г**a4 V **Г**a3a4a5 V z2a3 V z3a3 (Sq = 13)

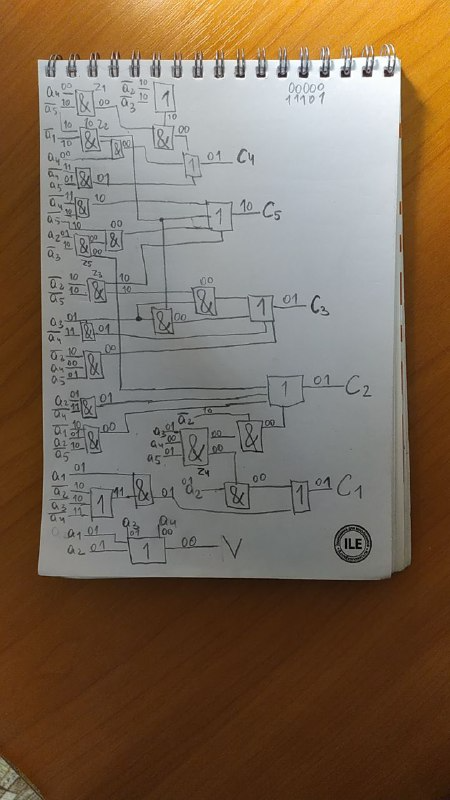
C4min = **Г**a4a5 V z2a4 V z1(**Г**a2 V **Г**a3) (Sq = 11)

C5min = z2 V **Г**a4**Г**a5 V z3 V z5**Г**a5 (Sq = 8)

Vmin = a1a2a3a4 (Sq = 4)

= 67

**4. Синтез схем**

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**5. Анализ схем**

На фото приведены значения входных сигналов, соответствующих двум входным наборам аргументов {a1, a2, a3, a4, а5}: ((00000) и (11101). На схеме отмечены два значения выходных сигналов для каждого логического элемента для первого и второго наборов аргументов соответственно. На выходах схемы С1, С2, С3, С4, C5 и V отмечены значения выходных сигналов. Сравнение этих значений с таблицей истинности, свидетельствует о корректности синтезированной схемы реверсивного счетчика, по крайней мере, в отношении двух рассматриваемых наборов аргументов.

Примечание: одно и то же значение при 2 наборах получилось только у V, но это потому, что V = 1 достигается только при С1, С2, С3, С4, C5 = 0. При этом С1, С2, С3, С4, C5 = 1 – недостижимо, потому что не попадает в ОДЗ.