МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ   
РОССИЙСКОЙ ФЕДЕРАЦИИ

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ БЮДЖЕТНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ

**«БЕЛГОРОДСКИЙ ГОСУДАРСТВЕННЫЙ**

**ТЕХНОЛОГИЧЕСКИЙ УНИВЕРСИТЕТ им. В. Г. ШУХОВА»**

**(БГТУ им. В.Г. Шухова)**

Кафедра программного обеспечения вычислительной техники и автоматизированных систем

Лабораторная работа №1

по дисциплине: Теория цифровых автоматов

тема: «Синтез и анализ комбинационных схем с одним

выходом в базисе И-ИЛИ-НЕ»

Выполнил: ст. группы ВТ-32

Воскобойников И. С.

Проверил: Рязанов Ю. Д,

Белгород 2020 г.

**Цель работы**: научиться строить эффективные по быстродействию и затратам оборудования комбинационные схемы.

**Задание**

1. Составить таблицу истинности заданной булевой функции (см. варианты заданий в таблице 1). Булева функция здесь задана условием, зависящим от значений аргументов булевой функции. Значение булевой функции на наборе аргументов равно значению условия на этом наборе аргументов. В условии значение аргумента отождествляется с двоичной цифрой, а последовательность аргументов — с двоичным числом. Для составления таблицы истинности рекомендуется написать программу.

2. Получить минимальную дизъюнктивную нормальную форму булевой функции.

3. Применить факторизационный метод синтеза многоярусной комбинационной схемы в базисе И-ИЛИ-НЕ с двухвходовыми элементами И и ИЛИ по минимальной дизъюнктивной нормальной форме булевой функции.

4. Получить минимальную конъюнктивную нормальную форму булевой функции.

5. Применить факторизационный метод синтеза многоярусной комбинационной схемы в базисе И-ИЛИ-НЕ с двухвходовыми элементами И и ИЛИ по минимальной конъюнктивной нормальной форме булевой функции.

6. Написать программы, моделирующие работу схем, полученных в пунктах 3 и 5, на всех входных наборах и строящие таблицу истинности каждой схемы. Сравнить полученные таблицы истинности с таблицей истинности исходной функции.

7. Сравнить полученные в пунктах 3 и 5 схемы по Квайну и по быстродействию.

**Вариант 3**

**C:\Users\500a5\Desktop\06-10-2020 14-41-43.png**

1. Составить таблицу истинности заданной булевой функции (см. варианты заданий в таблице 1). Булева функция здесь задана условием, зависящим от значений аргументов булевой функции. Значение булевой функции на наборе аргументов равно значению условия на этом наборе аргументов. В условии значение аргумента отождествляется с двоичной цифрой, а последовательность аргументов — с двоичным числом. Для составления таблицы истинности рекомендуется написать программу.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | *(x4x5+x1x2x3)=0,5,8,10* |  |
| 0 | 0 | 0 | 0 | 0 | *(00+000)=0,5,8,10* | 1 |
| 0 | 0 | 0 | 0 | 1 | *(01+000)=0,5,8,10* | 0 |
| 0 | 0 | 0 | 1 | 0 | (10+000)\_=*0,5,8,10* | 0 |
| 0 | 0 | 0 | 1 | 1 | *(11+000)=0,5,8,10* | 0 |
| 0 | 0 | 1 | 0 | 0 | *(00+001)=0,5,8,10* | 0 |
| 0 | 0 | 1 | 0 | 1 | *(01+001)=0,5,8,10* | 0 |
| 0 | 0 | 1 | 1 | 0 | *(10+001)=0,5,8,10* | 0 |
| 0 | 0 | 1 | 1 | 1 | *(11+001)=0,5,8,10* | 0 |
| 0 | 1 | 0 | 0 | 0 | *(00+010)=0,5,8,10* | 0 |
| 0 | 1 | 0 | 0 | 1 | *(01+010)=0,5,8,10* | 0 |
| 0 | 1 | 0 | 1 | 0 | *(10+010)=0,5,8,10* | 0 |
| 0 | 1 | 0 | 1 | 1 | *(11+010)=0,5,8,10* | 1 |
| 0 | 1 | 1 | 0 | 0 | *(00+011)=0,5,8,10* | 0 |
| 0 | 1 | 1 | 0 | 1 | *(01+011)=0,5,8,10* | 0 |
| 0 | 1 | 1 | 1 | 0 | *(10+011)=0,5,8,10* | 1 |
| 0 | 1 | 1 | 1 | 1 | *(11+011)=0,5,8,10* | 0 |
| 1 | 0 | 0 | 0 | 0 | *(00+100)=0,5,8,10* | 0 |
| 1 | 0 | 0 | 0 | 1 | *(01+100)=0,5,8,10* | 1 |
| 1 | 0 | 0 | 1 | 0 | *(10+100)=0,5,8,10* | 0 |
| 1 | 0 | 0 | 1 | 1 | *(11+100)=0,5,8,10* | 0 |
| 1 | 0 | 1 | 0 | 0 | *(00+101)=0,5,8,10* | 1 |
| 1 | 0 | 1 | 0 | 1 | *(01+101)=0,5,8,10* | 0 |
| 1 | 0 | 1 | 1 | 0 | *(10+101)=0,5,8,10* | 0 |
| 1 | 0 | 1 | 1 | 1 | *(11+101)=0,5,8,10* | 1 |
| 1 | 1 | 0 | 0 | 0 | *(00+110)=0,5,8,10* | 0 |
| 1 | 1 | 0 | 0 | 1 | *(01+110)=0,5,8,10* | 0 |
| 1 | 1 | 0 | 1 | 0 | *(10+110)=0,5,8,10* | 1 |
| 1 | 1 | 0 | 1 | 1 | *(11+110)=0,5,8,10* | 0 |
| 1 | 1 | 1 | 0 | 0 | *(00+111)=0,5,8,10* | 0 |
| 1 | 1 | 1 | 0 | 1 | *(01+111)=0,5,8,10* | 1 |
| 1 | 1 | 1 | 1 | 0 | *(10+111)=0,5,8,10* | 0 |
| 1 | 1 | 1 | 1 | 1 | *(11+111)=0,5,8,10* | 1 |

2. Получить минимальную дизъюнктивную нормальную форму булевой функции.

СДНФ:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 |
| 00000 |  | 10001  10100 | 01011  01110  11010 | 11101+  10111+ | 11111+ |
|  |  |  |  | 111-1  1-111 |  |
|  |  |  |  |  |  |

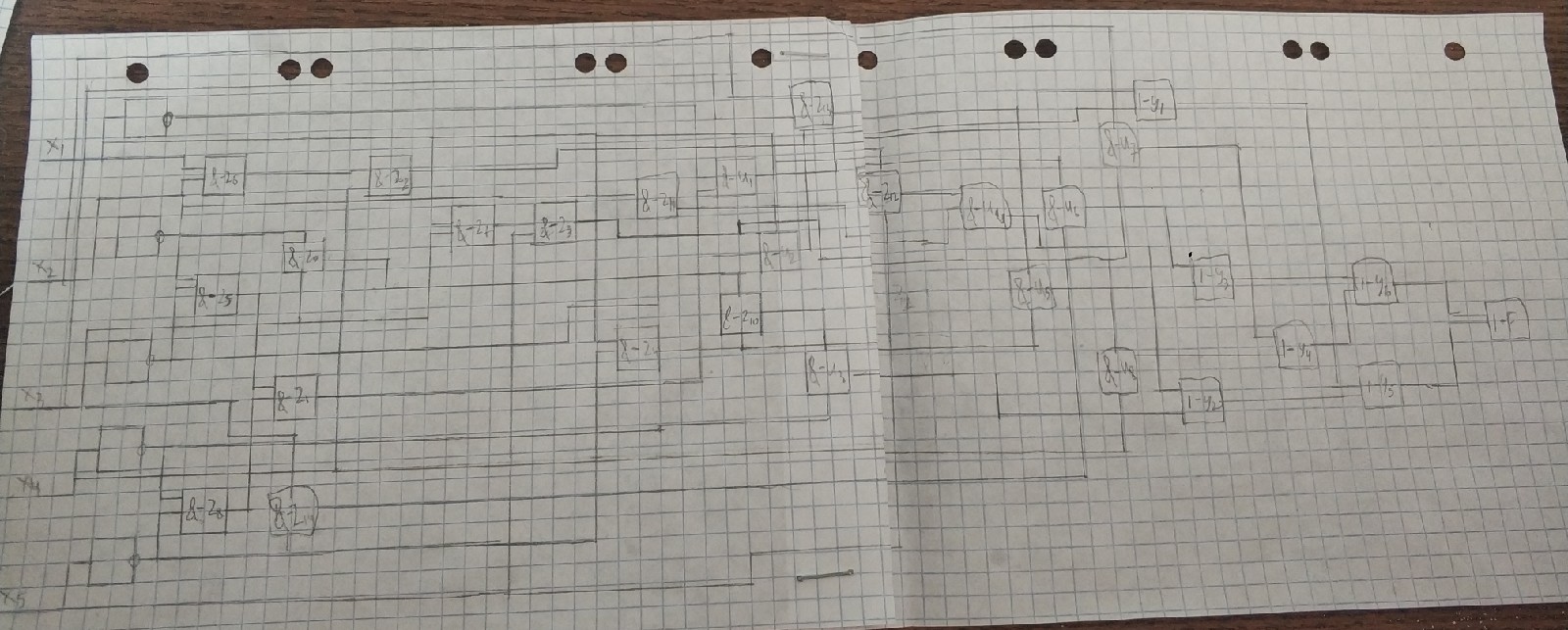
|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 00000 | 01000 | 10001 | 10100 | 01011 | 01110 | 11010 | 11101 | 11111 |
| 1-111 |  |  |  |  |  |  |  | + | + |
| 111-1 |  |  |  |  |  |  |  | + | + |

Минимальная ДНФ:

1. Применить факторизационный метод синтеза многоярусной комбинационной схемы в базисе И-ИЛИ-НЕ с двухвходовыми элементами И и ИЛИ по минимальной дизъюнктивной нормальной форме булевой функции.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 0 | 1 | 0 | 1\* | 0 | 1\* | 0 | 1\* | 0 | 1\* | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 1 | 0 | 0 | 1\* | 0 | 1\* | 0 | 1\* | 0 | 1\* | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 1\* | 0 | 0 | 1\* | 1\* | 0 | 0 | 1 | 0 | 1\* | 0 | 0 | 0 | 1\* | 0 | 0 | 0 | 0 | 1\* | 1 | 0 | 0 | 0 | 0 |
|  | 0 | 1\* | 1\* | 0 | 0 | 1\* | 1\* | 0 | 1\* | 0 | 0 | 1\* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
|  | 1\* | 0 | 1\* | 0 | 0 | 1\* | 1 | 0 | 0 | 1\* | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
|  | 0 | 1\* | 1\* | 0 | 1\* | 0 | 1\* | 0 | 0 | 1\* | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
|  | 1\* | 0 | 1 | 0 | 1\* | 0 | 0 | 0 | 1\* | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 1\* | 0 | 0 | 0 | 1\* | 0 | 1 | 0 | 1\* | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 1\* | 0 | 1\* | 0 | 1\* | 0 | 1\* | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 1\* | 1\* | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 1\* | 0 | 0 | 0 | 1\* | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |



1. Получить минимальную конъюнктивную нормальную форму булевой функции.

СКНФ:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 |
|  | 00001+  00010+  00100+  01000+  10000+ | 00011+  00101+  00110+  01001+  01010+  01100+  10010+  11000+ | 00111+  01101+  10011+  10101+  10110+  11001+  11100+ | 01111+  11011+  11110+ |  |
|  | 000-1+  0001-+  00-01+  0-001+  00-10+  0-010  -0010+  001-0+  0-100+  0100-+  010-0  01-00+  -1000+  100-0  1-000 | 00-11+  -0011+  001-1+  0-101+  -0101  0011-+  -0110+  01-01+  -1001+  1010-  10-10+  0110-+  -1100+  1001-+  1100-+  11-00 | 0-111+  1-011  1-110  110-1  111-0 |  |  |
|  | 00--1  00-1-  -001-  0--01  -0-10 001--  0-10-  -100-  01-0-  -1-00 | 0-1-1 |  |  |  |
|  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 00001 | 00010 | 00100 | 01000 | 10000 | 00011 | 00101 | 00110 | 01001 | 01010 | 01100 | 10010 | 11000 | 00111 | 01101 | 10011 | 10101 | 10110 | 11001 | 11100 | 01111 | 11011 | 11110 |
| 0-010 |  | + |  |  |  |  |  |  |  | + |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 010-0 |  |  |  | + |  |  |  |  |  | + |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 100-0 |  |  |  |  | + |  |  |  |  |  |  | + |  |  |  |  |  |  |  |  |  |  |  |
| 1-000 |  |  |  |  | + |  |  |  |  |  |  |  | + |  |  |  |  |  |  |  |  |  |  |
| -0101 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | + |  |  |  |  |  |  |
| 1010- |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | + |  |  |  |  |  |  |
| 11-00 |  |  |  |  |  |  |  |  |  |  |  |  | + |  |  |  |  |  |  | + |  |  | + |
| 1-011 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | + |  |  |  |  |  | + |  |
| 1-110 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | + |  |  |  |  | + |
| 110-1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | + |  |  |  |  |
| 111-0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | + |  |  | + |
| 00—1 | + |  |  |  |  | + | + |  |  |  | + |  |  | + | + |  |  |  |  |  |  |  |  |
| 00-1- |  |  |  |  |  | + |  | + |  |  |  |  |  | + |  |  |  |  |  |  |  |  |  |
| -001- |  |  |  |  |  | + |  |  |  |  |  | + |  |  |  | + |  |  |  |  |  |  |  |
| 0—01 | + |  |  |  |  |  | + |  | + |  |  |  |  |  | + |  |  |  |  |  |  |  |  |
| -0-10 |  | + |  |  |  |  | + | + |  |  |  | + |  |  |  |  |  |  |  |  |  |  |  |
| -00-- |  |  |  |  | + |  |  |  |  |  |  | + |  |  |  |  |  |  |  |  |  |  |  |
| 001-- |  |  | + |  |  |  | + | + | + |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0-10- |  |  | + |  |  |  |  |  |  |  | + |  |  |  |  |  |  |  |  |  |  |  |  |
| -100- |  |  |  | + |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 01-0- |  |  | + | + |  |  |  |  |  |  | + |  |  |  |  |  |  |  |  |  |  |  |  |
| -1-00 |  |  |  | + |  |  |  |  |  |  | + |  | + |  |  |  |  |  |  |  |  |  |  |
| 0-1-1 |  |  |  |  |  |  | + |  |  |  |  |  |  | + | + |  |  |  |  |  | + |  |  |

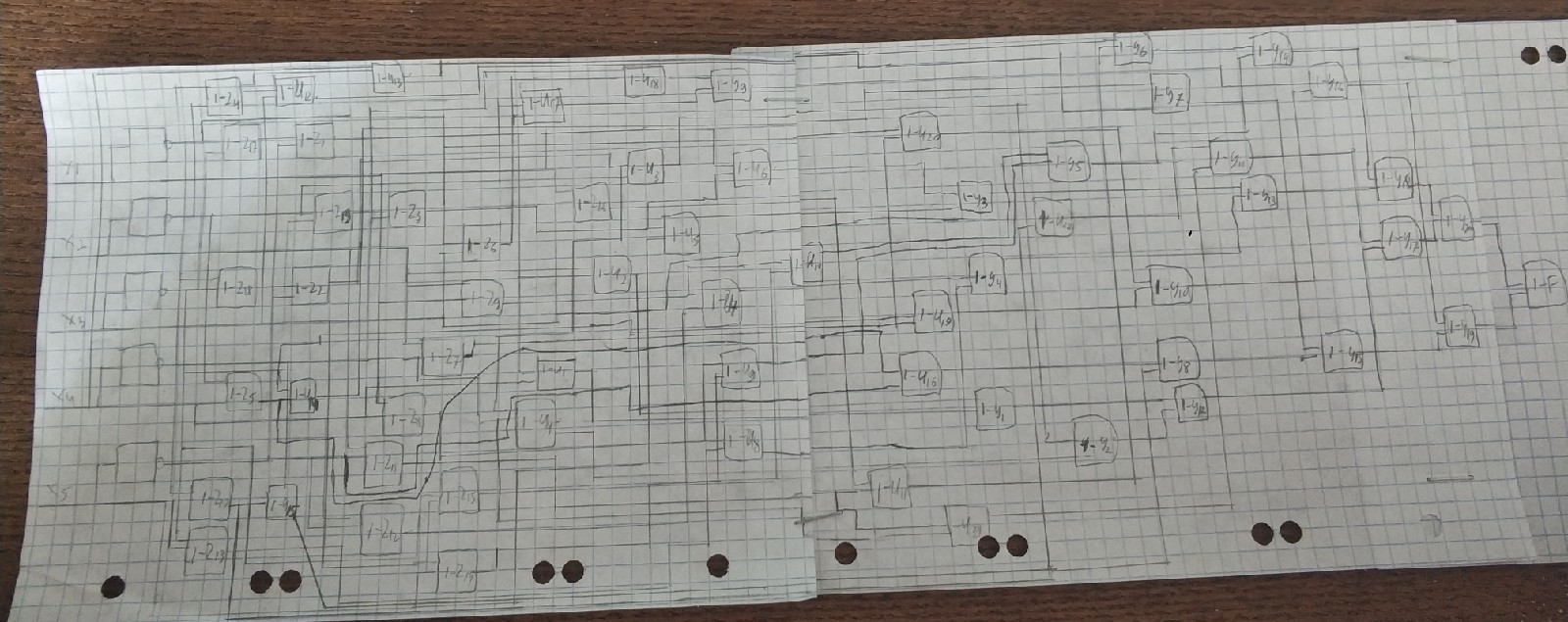
Минимальная КНФ:

1. Применить факторизационный метод синтеза многоярусной комбинационной схемы в базисе И-ИЛИ-НЕ с двухвходовыми элементами И и ИЛИ по минимальной конъюнктивной нормальной форме булевой функции.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 0 | 1\* | 0 | 0 | 0 | 1\* | 1 | 0 | 0 | 1\* | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 1\* | 1 | 0 | 0 | 1\* | 0 | 0 | 0 | 1\* | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 1\* | 0 | 0 | 1 | 0 | 1\* | 0 | 0 | 0 | 1\* | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 1\* | 0 | 0 | 0 | 0 | 1\* | 0 | 1 | 0 | 1\* | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 1\* | 1\* | 0 | 0 | 1\* | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 1 | 0 | 0 | 1\* | 1\* | 0 | 0 | 1\* | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 1\* | 0 | 1\* | 0 | 0 | 0 | 0 | 1\* | 0 | 1\* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 1\* | 0 | 0 | 0 | 0 | 1\* | 1\* | 0 | 1\* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 1\* | 0 | 0 | 0 | 1\* | 0 | 1\* | 0 | 0 | 1\* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
|  | 1\* | 0 | 1\* | 0 | 0 | 1\* | 0 | 0 | 1\* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
|  | 1\* | 0 | 1\* | 0 | 1\* | 0 | 0 | 0 | 0 | 1\* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
|  | 0 | 1\* | 0 | 1\* | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 1\* | 0 | 1\* | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 1\* | 0 | 1 | 1\* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 1\* | 0 | 0 | 0 | 0 | 0 | 1 | 1\* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 1\* | 0 | 0 | 1\* | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 1\* | 0 | 1 | 1\* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 1\* | 0 | 0 | 1\* | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 1\* | 0 | 0 | 1 | 0 | 1\* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 1 | 1\* | 0 | 0 | 0 | 0 | 1\* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 1\* | 0 | 0 | 0 | 0 | 1 | 0 | 1\* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 1\* | 0 | 0 | 1 | 0 | 0 | 0 | 1\* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 1\* | 0 | 0 | 0 | 1\* | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
|  | 1\* | 0 | 0 | 0 | 0 | 1\* | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
|  | 0 | 0 | 0 | 1\* | 1\* | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
|  | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |



|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |



1. Написать программы, моделирующие работу схем, полученных в пунктах 3 и 5, на всех входных наборах и строящие таблицу истинности каждой схемы. Сравнить полученные таблицы истинности с таблицей истинности исходной функции.

Исходный код:

bool FuncDNF(bool \*x)

{

bool z14 = x[2] && !x[4],

z13 = x[1] && !x[2],

z4 = x[0] && !x[4],

z5 = !x[1] && !x[2],

z6 = !x[0] && x[1],

z7 = x[0] && x[2],

z8 = !x[3] && !x[4],

z9 = !x[1] && x[2],

z10 = z4 && z9,

z11 = x[1] && !x[2],

z2 = x[3] && z6,

z12 = x[4] && z2,

z1 = z5 && z8,

z3 = x[4] && z7;

bool u1 = !x[0] && z1,

u2 = x[0] && z1,

u3 = !x[3] && z10,

u4 = z11 && z12,

u5 = x[3] && z4,

u6 = z2 && z14,

u7 = x[1] && z3,

u8 = x[3] && z3;

bool y1 = u1 || u2,

y2 = u3 || u4,

y3 = u5 || u6,

y4 = u7 || u8,

y5 = y1 || y2,

y6 = y3 || y4;

return y5 || y6;

}

bool FuncKNF(bool \*x)

{

bool z4 = !x[0] || !x[1],

z5 = !x[1] || x[3],

z6 = x[0] || x[2],

z7 = x[1] || !x[3],

z8 = x[0] || x[3],

z9 = x[0] || x[1],

z10 = !x[0] || x[4]

z11 = x[1] || !x[4],

z12 = !x[3] || !x[4],

z13 = !x[2] || x[4],

z14 = x[2] || !x[4],

z15 = !x[2] || x[4],

z16 = x[0] || x[2],

z17 = !x[0] || !x[2],

z18 = x[0] || !x[2],

z19 = !x[1] || x[2],

z1 = !x[4] || z17,

z2 = !x[4] || z18,

z3 = !x[3] || z19;

bool u1 = x[3] || z1,

u2 = x[1] || z1,

u3 = !x[1] || z2,

u4 = !x[3] || z2,

u5 = x[4] || z3,

u6 = x[0] || z3,

u7 = z9 || z12,

u8 = z8 || z13,

u9 = z8 || z14,

u10 = z9 || z15,

u11 = z11 || z16,

u12 = x[2] || z4,

u13 = x[3] || z4,

u14 = !x[2] || z5,

u15 = !x[3] || z10,

u16 = !x[4] || z5,

u17 = !x[1] || z6,

u18 = !x[3] || z6,

u19 = !x[2] || z7,

u20 = !x[0] || z7,

u21 = !x[3] || z11,

u22 = x[2] || z10;

bool y1 = u1 && u2,

y2 = u3 && u4,

y3 = u5 && u6,

y4 = u7 && u8,

y5 = u9 && u10,

y6 = u11 && u12,

y7 = u13 && u14,

y8 = u15 && u16,

y9 = u17 && u18,

y10 = u19 && u20,

y11 = u21 && u22,

y12 = y1 && y2,

y13 = y3 && y4,

y14 = y5 && y6,

y15 = y7 && y8,

y16 = y9 && y10,

y17 = y11 && y12,

y18 = y13 && y14,

y19 = y15 && y16,

y20 = y17 && y18,

return y19 && y20;

}

int main()

{

bool a[5] = { 0 };

cout << "x1 \t x2 \t x3 \t x4 \t x5" << endl;

for (short i1 = 0; i1 < 2; i1++)

{

a[0] = i1;

for (short i2 = 0; i2 < 2; i2++)

{

a[1] = i2;

for (short i3 = 0; i3 < 2; i3++)

{

a[2] = i3;

for (short i4 = 0; i4 < 2; i4++)

{

a[3] = i4;

for (short i5 = 0; i5 < 2; i5++)

{

a[4] = i5;

if (FuncDNF(a))

{

cout << a[0] << "\t" << a[1] << "\t" <<

a[2] << "\t" << a[3] << "\t" << a[4] <<

"\t" << "1" << endl;

}

else

{

cout << a[0] << "\t" << a[1] << "\t" <<

a[2] << "\t" << a[3] << "\t" << a[4] <<

"\t" << "0" << endl;

}

}

}

}

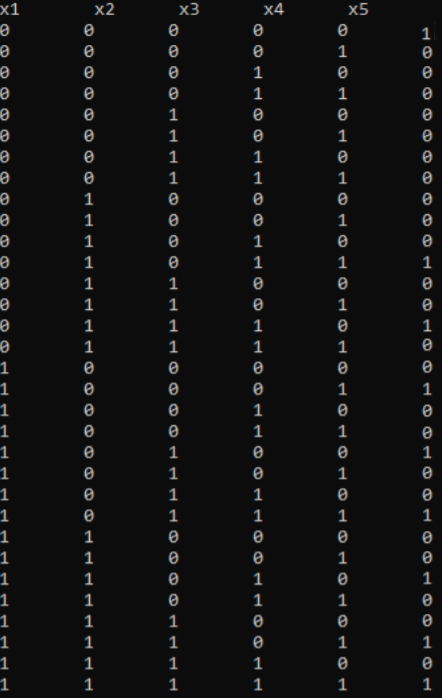
}

\_getch();

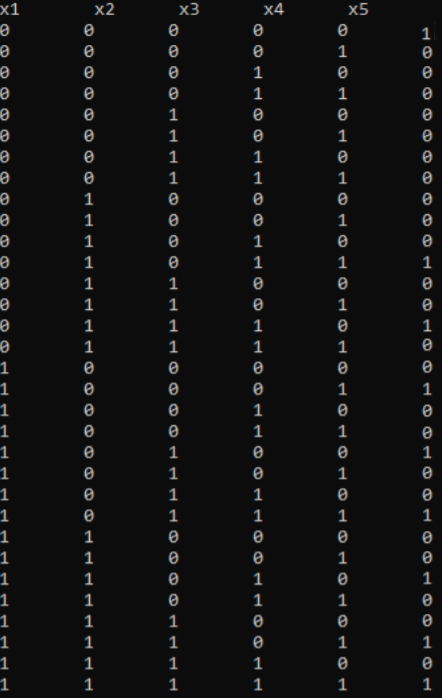
return 0;

}

Днф:



КНФ:



7.

ДНФ:  
Сложность по Квайну = 63  
Сложность по быстродействию =7

КНФ:  
Сложность по Квайну = 129  
Сложность по быстродействию =8