**МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РФ**

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ БЮДЖЕТНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ **«БЕЛГОРОДСКИЙ ГОСУДАРСТВЕННЫЙ ТЕХНОЛОГИЧЕСКИЙ УНИВЕРСИТЕТ ИМ. В. Г. ШУХОВА»**

Кафедра программного обеспечения вычислительной техники и автоматизированных систем

**ЛАБОРАТОРНАЯ РАБОТА №5**

**Дисциплина: Синтез и анализ многовыходных комбинационных схем**

**в базисе И-ИЛИ-НЕ**

Выполнил: ст. группы ВТ-31

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Проверил: доцент ПОВТиАС

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**Белгород 2019**

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

**Вариант 13**

**Ход выполнения работы**

1. Составить таблицу истинности системы булевых функций, которая состоит из трех функций f1(X), f2(X) и f3(X), где X = {x1, x2, x3, x4, x5}. Булева функция fi(X) для k-го варианта определяется как , где gj(X) — булева функция, представленная в таблице 1 в строке j.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| x1 | x2 | x3 | x4 | x5 | f1 | f2 | f3 |
| 0 | 0 | 0 | 0 | 0 | **1** | **1** | **0** |
| 0 | 0 | 0 | 0 | 1 | **0** | **0** | **1** |
| 0 | 0 | 0 | 1 | 0 | **0** | **0** | **1** |
| 0 | 0 | 0 | 1 | 1 | **0** | **0** | **0** |
| 0 | 0 | 1 | 0 | 0 | **1** | **1** | **0** |
| 0 | 0 | 1 | 0 | 1 | **1** | **1** | **0** |
| 0 | 0 | 1 | 1 | 0 | **0** | **0** | **1** |
| 0 | 0 | 1 | 1 | 1 | **0** | **0** | **1** |
| 0 | 1 | 0 | 0 | 0 | **1** | **1** | **1** |
| 0 | 1 | 0 | 0 | 1 | **1** | **1** | **0** |
| 0 | 1 | 0 | 1 | 0 | **1** | **0** | **1** |
| 0 | 1 | 0 | 1 | 1 | **0** | **0** | **1** |
| 0 | 1 | 1 | 0 | 0 | **0** | **0** | **1** |
| 0 | 1 | 1 | 0 | 1 | **0** | **1** | **0** |
| 0 | 1 | 1 | 1 | 0 | **1** | **1** | **0** |
| 0 | 1 | 1 | 1 | 1 | **1** | **0** | **1** |
| 1 | 0 | 0 | 0 | 0 | **1** | **0** | **0** |
| 1 | 0 | 0 | 0 | 1 | **0** | **1** | **1** |
| 1 | 0 | 0 | 1 | 0 | **1** | **1** | **1** |
| 1 | 0 | 0 | 1 | 1 | **0** | **0** | **0** |
| 1 | 0 | 1 | 0 | 0 | **1** | **0** | **0** |
| 1 | 0 | 1 | 0 | 1 | **1** | **0** | **1** |
| 1 | 0 | 1 | 1 | 0 | **0** | **1** | **1** |
| 1 | 0 | 1 | 1 | 1 | **0** | **1** | **0** |
| 1 | 1 | 0 | 0 | 0 | **1** | **0** | **0** |
| 1 | 1 | 0 | 0 | 1 | **1** | **0** | **0** |
| 1 | 1 | 0 | 1 | 0 | **1** | **1** | **1** |
| 1 | 1 | 0 | 1 | 1 | **0** | **1** | **1** |
| 1 | 1 | 1 | 0 | 0 | **1** | **1** | **1** |
| 1 | 1 | 1 | 0 | 1 | **1** | **0** | **0** |
| 1 | 1 | 1 | 1 | 0 | **1** | **0** | **1** |
| 1 | 1 | 1 | 1 | 1 | **1** | **1** | **1** |

1. Получить систему минимальных дизъюнктивных нормальных форм булевых функций f1(X), f2(X) и f3(X).

f1(X)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 |
| 00000 + | 00100 +  01000 +  10000 + | 00101 +  01001 +  01010 +  10010 +  10100 +  11000 + | 01110 +  10101 +  11001 +  11010 +  11100 + | 01111 +  11101 +  11110 + | 11111 + |
| 00-00 +  0-000 +  -0000 + | 0010- +  -0100 +  0100- +  010-0 +  -1000 +  100-0 +  10-00 +  1-000 + | -0101 +  -1001 +  01-10 +  -1010 +  1-010 +  1010- +  1-100 +  1100- +  110-0 +  11-00 + | 0111- +  -1110 +  1-101 +  11-01 +  11-10 +  1110- +  111-0 + | -1111 +  111-1 +  1111- + |  |
| **-0-00 <**  **--000 <** | **-010- <**  **-100- <**  **-10-0 <**  **1-0-0 <**  **1--00 <** | **-1-10 <**  **1-10- <**  **11-0- <**  **11--0 <** | **-111- <**  **111-- <** |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **-0-00** | + | + |  |  |  |  |  |  | + |  |
| --000 | + |  |  | + |  |  |  |  | + |  |
| **-010-** |  | + | + |  |  |  |  |  |  |  |
| **-100-** |  |  |  | + | + |  |  |  |  |  |
| -10-0 |  |  |  | + |  | + |  |  |  |  |
| **1-0-0** |  |  |  |  |  |  |  |  | + | + |
| 1--00 |  |  |  |  |  |  |  |  | + |  |
| **-1-10** |  |  |  |  |  | + | + |  |  |  |
| **1-10-** |  |  |  |  |  |  |  |  |  |  |
| 11-0- |  |  |  |  |  |  |  |  |  |  |
| 11--0 |  |  |  |  |  |  |  |  |  |  |
| **-111-** |  |  |  |  |  |  | + | + |  |  |
| 111-- |  |  |  |  |  |  |  |  |  |  |
|  | 00000 | 00100 | 00101 | 01000 | 01001 | 01010 | 01110 | 01111 | 10000 | 10010 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| + |  |  |  |  |  |  |  |  | **-0-00** |
|  |  | + |  |  |  |  |  |  | --000 |
| + | + |  |  |  |  |  |  |  | **-010-** |
|  |  | + | + |  |  |  |  |  | **-100-** |
|  |  | + |  | + |  |  |  |  | -10-0 |
|  |  | + |  | + |  |  |  |  | **1-0-0** |
| + |  | + |  |  | + |  |  |  | 1--00 |
|  |  |  |  | + |  |  | + |  | **-1-10** |
| + | + |  |  |  | + | + |  |  | **1-10-** |
|  |  | + | + |  | + | + |  |  | 11-0- |
|  |  | + |  | + | + |  | + |  | 11--0 |
|  |  |  |  |  |  |  | + | + | **-111-** |
|  |  |  |  |  | + | + | + | + | 111-- |
| 10100 | 10101 | 11000 | 11001 | 11010 | 11100 | 11101 | 11110 | 11111 |  |



f2(X)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 |
| 00000 + | 00100 +  01000 + | 00101 +  01001 +  **10001 <**  10010 + | 01101 +  **01110 <**  10110 +  11010 +  **11100 <** | 10111 +  11011 + | 11111 + |
| **00-00 <**  **0-000 <** | **0010- <**  **0100- <** | **0-101 <**  **01-01 <**  **10-10 <**  **1-010 <** | 1. **<** 2. **<** | **1-111 <**  **11-11 <** |  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **00-00** | + | + |  |  |  |  |  |  |
| **0-000** | + |  |  | + |  |  |  |  |
| 0010- |  |  | + |  |  |  |  |  |
| 0100- |  |  |  | + | + | + |  |  |
| **10001** |  |  |  |  |  |  |  | + |
| **0-101** |  |  | + |  |  | + |  |  |
| **01-01** |  |  |  |  | + | + |  |  |
| **10-10** |  |  |  |  |  |  |  |  |
| 1-010 |  |  |  |  |  |  |  |  |
| **01110** |  |  |  |  |  |  | + |  |
| **11100** |  |  |  |  |  |  |  |  |
| 1011- |  |  |  |  |  |  |  |  |
| **1101-** |  |  |  |  |  |  |  |  |
| **1-111** |  |  |  |  |  |  |  |  |
| 11-11 |  |  |  |  |  |  |  |  |
|  | 00000 | 00100 | 00101 | 01000 | 01001 | 01101 | 01110 | 10001 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  | **00-00** |
|  |  |  |  |  |  |  | **0-000** |
|  |  |  |  |  |  |  | 0010- |
|  |  |  |  |  |  |  | 0100- |
|  |  |  |  |  |  |  | **10001** |
|  |  |  |  |  |  |  | **0-101** |
|  |  |  |  |  |  |  | **01-01** |
| + | + |  |  |  |  |  | **10-10** |
| + |  |  | + |  |  |  | 1-010 |
|  |  |  |  |  |  |  | **01110** |
|  |  |  |  |  | + |  | **11100** |
|  | + | + |  |  |  |  | 1011- |
|  |  |  | + | + |  |  | **1101-** |
|  |  | + |  |  |  | + | **1-111** |
|  |  |  |  | + |  | + | 11-11 |
| 10010 | 10110 | 10111 | 11010 | 11011 | 11100 | 11111 |  |



f3(X)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 |
|  | 00001 +  00010 +  01000 + | 00110 +  01010 +  01100 +  10001 +  10010 + | 00111 +  01011 +  10101 +  10110 +  11010 +  11100 + | 01111 +  11011 +  11110 + | 11111 + |
|  | **-0001 <**  00-10 +  0-010 +  -0010 +  **010-0 <**  **01-00 <** | **0011- <**  **-0110 <**  0101- +  -1010 +  **-1100 <**  **10-01 <**  10-10 +  1-010 + | **0-111 <**  01-11 +  -1011 +  1-110 +  1101- +  11-10 +  **111-0 <** | -1111 +  11-11 +  1111- + |  |
|  | **-0-10 <**  **--010 <** | **-101- <**   1. **-10 <** | **-1-11 <**  **11-1- <** |  |  |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **-0001** | + |  |  |  |  |  | + |  |  |
| **010-0** |  |  | + |  | + |  |  |  |  |
| 01-00 |  |  | + |  |  | + |  |  |  |
| **-0-10** |  | + |  | + |  |  |  | + |  |
| --010 |  | + |  |  | + |  |  | + |  |
| 0011- |  |  |  | + |  |  |  |  | + |
| -0110 |  |  |  | + |  |  |  |  |  |
| **-1100** |  |  |  |  |  | + |  |  |  |
| **10-01** |  |  |  |  |  |  | + |  |  |
| -101- |  |  |  |  | + |  |  |  |  |
| **1--10** |  |  |  |  |  |  |  |  |  |
| **0-111** |  |  |  |  |  |  |  |  | + |
| 111-0 |  |  |  |  |  |  |  |  |  |
| **-1-11** |  |  |  |  |  |  |  |  |  |
| 11-1- |  |  |  |  |  |  |  |  |  |
|  | 00001 | 00010 | 01000 | 00110 | 01010 | 01100 | 10001 | 10010 | 00111 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  | **-0001** |
|  |  |  |  |  |  |  |  |  | **010-0** |
|  |  |  |  |  |  |  |  |  | 01-00 |
|  |  | + |  |  |  |  |  |  | **-0-10** |
|  |  |  | + |  |  |  |  |  | --010 |
|  |  |  |  |  |  |  |  |  | 0011- |
|  |  | + |  |  |  |  |  |  | -0110 |
|  |  |  |  | + |  |  |  |  | **-1100** |
|  | + |  |  |  |  |  |  |  | **10-01** |
| + |  |  | + |  |  | + |  |  | -101- |
|  |  | + | + |  |  |  | + |  | **1--10** |
|  |  |  |  |  | + |  |  |  | **0-111** |
|  |  |  |  | + |  |  | + |  | 111-0 |
| + |  |  |  |  | + | + |  | + | **-1-11** |
|  |  |  | + |  |  | + | + | + | 11-1- |
| 01011 | 10101 | 10110 | 11010 | 11100 | 01111 | 11011 | 11110 | 11111 |  |



1. Применить факторизационный метод синтеза многоярусной комбинационной схемы в базисе И-ИЛИ-НЕ с двухвходовыми элементами И и ИЛИ по системе минимальных дизъюнктивных нормальных форм булевых функций f1(X), f2(X) и f3(X).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | x1 | !x1 | x2 | !x2 | x3 | !x3 | x4 | !x4 | x5 | !x5 | z1 | z2 | z3 | z4 | z5 | z6 | z7 | z8 | z9 |
| u1 |  |  |  | 1+ |  |  |  | 1+ |  | + | + |  |  |  |  |  |  |  |  |
| u2 |  |  |  | 1+ | + |  |  | 1+ |  |  | + |  |  |  |  |  |  |  |  |
| u3 |  |  | 2+ |  |  | + |  | 2+ |  |  |  | + |  |  |  |  |  |  |  |
| u4 | 3+ |  |  |  |  | + |  |  |  | 3+ |  |  | + |  |  |  |  |  |  |
| u5 |  |  | 4+ |  |  |  | 4+ |  |  | + |  |  |  | + |  |  |  |  |  |
| u6 | + |  |  |  | 5+ |  |  | 5+ |  |  |  |  |  |  | + |  |  |  |  |
| u7 |  |  | 4+ |  | + |  | 4+ |  |  |  |  |  |  | + |  |  |  |  |  |
| u8 |  | 6+ |  | 1+ |  |  |  | 1+ |  | 6+ | + |  |  |  |  | + |  |  |  |
| u9 |  | 6+ |  |  |  | 7+ |  | 7+ |  | 6+ |  |  |  |  |  | + | + |  |  |
| u10 | 8+ |  |  | 1+ |  | 9+ |  | 1+ | 8+ |  | 9+ |  |  |  |  |  |  | + | + |
| u11 |  | 10+ |  |  | 5+ |  |  | 5+ | 10+ |  |  |  |  |  | + |  |  |  |  |
| u12 |  | 10+ | 2+ |  |  |  |  | 2+ | 10+ |  |  | + |  |  |  |  |  |  |  |
| u13 | 3+ |  |  | 11+ |  |  | 11+ |  |  | 3+ |  |  | + |  |  |  |  |  |  |
| u14 |  | 6+ | 4+ |  | 12+ |  | 4+ |  |  | 6+ |  |  |  | 12+ |  | + |  |  |  |
| u15 | 3+ |  | 2+ |  | 13+ |  |  | 2+ |  | 3+ |  | 13+ | + |  |  |  |  |  |  |
| u16 | 14+ |  | 4+ |  |  | 14+ | 4+ |  |  |  |  |  |  | + |  |  |  |  |  |
| u17 | 8+ |  |  |  | 15+ |  | 15+ |  | 8+ |  |  |  |  |  |  |  |  | + |  |
| u18 |  |  |  | 1+ |  | 9+ |  | 1+ | + |  | 9+ |  |  |  |  |  |  |  | + |
| u19 |  | 6+ | 16+ |  |  | 16+ |  |  |  | 6+ |  |  |  |  |  | + |  |  |  |
| u20 |  |  |  | 11+ |  |  | 11+ |  |  | + |  |  |  |  |  |  |  |  |  |
| u21 |  |  | 2+ |  | 13+ |  |  | 2+ | + |  |  | 13+ |  |  |  |  |  |  |  |
| u22 | 8+ |  |  | 1+ |  |  |  | 1+ | 8+ |  | + |  |  |  |  |  |  | + |  |
| u23 | 3+ |  |  |  |  |  | + |  |  | 3+ |  |  | + |  |  |  |  |  |  |
| u24 |  | 10+ |  |  | 17+ |  | 17+ |  | 10+ |  |  |  |  |  |  |  |  |  |  |
| u25 |  |  | 4+ |  |  |  | 4+ |  | + |  |  |  |  | + |  |  |  |  |  |
| z1 |  |  |  | **+** |  |  |  | **+** |  |  |  |  |  |  |  |  |  |  |  |
| z2 |  |  | **+** |  |  |  |  | **+** |  |  |  |  |  |  |  |  |  |  |  |
| z3 | **+** |  |  |  |  |  |  |  |  | **+** |  |  |  |  |  |  |  |  |  |
| z4 |  |  | **+** |  |  |  | **+** |  |  |  |  |  |  |  |  |  |  |  |  |
| z5 |  |  |  |  | **+** |  |  | **+** |  |  |  |  |  |  |  |  |  |  |  |
| z6 |  | **+** |  |  |  |  |  |  |  | **+** |  |  |  |  |  |  |  |  |  |
| z7 |  |  |  |  |  | **+** |  | **+** |  |  |  |  |  |  |  |  |  |  |  |
| z8 | **+** |  |  |  |  |  |  |  | **+** |  |  |  |  |  |  |  |  |  |  |
| z9 |  |  |  |  |  | **+** |  |  |  |  | **+** |  |  |  |  |  |  |  |  |
| z10 |  | **+** |  |  |  |  |  |  | **+** |  |  |  |  |  |  |  |  |  |  |
| z11 |  |  |  | **+** |  |  | **+** |  |  |  |  |  |  |  |  |  |  |  |  |
| z12 |  |  |  |  | **+** |  |  |  |  |  |  |  |  | **+** |  |  |  |  |  |
| z13 |  |  |  |  | **+** |  |  |  |  |  |  | **+** |  |  |  |  |  |  |  |
| z14 | **+** |  |  |  |  | **+** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| z15 |  |  |  |  | **+** |  | **+** |  |  |  |  |  |  |  |  |  |  |  |  |
| z16 |  |  | **+** |  |  | **+** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| z17 |  |  |  |  | **+** |  | **+** |  |  |  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | f1 | f2 | f3 | v1 | v2 | v3 | v4 | v5 | v6 | v7 | v8 | v9 | v10 | v11 | v12 | v13 |
| u1 | 1+ |  |  | + |  |  |  |  |  |  |  |  |  |  |  |  |
| u2 | 1+ |  |  | + |  |  |  |  |  |  |  |  |  |  |  |  |
| u3 | 2+ |  |  |  | + |  |  |  |  |  |  |  |  |  |  |  |
| u4 | 2+ |  |  |  | + |  |  |  |  |  |  |  |  |  |  |  |
| u5 | 3+ |  |  |  |  | + |  |  |  |  |  |  |  |  |  |  |
| u6 | 3+ |  |  |  |  | + |  |  |  |  |  |  |  |  |  |  |
| u7 | 5+ |  |  |  |  |  |  | + |  |  |  |  |  |  |  |  |
| u8 |  | 6+ |  |  |  |  |  |  | + |  |  |  |  |  |  |  |
| u9 |  | 6+ |  |  |  |  |  |  | + |  |  |  |  |  |  |  |
| u10 |  | 7+ |  |  |  |  |  |  |  | + |  |  |  |  |  |  |
| u11 |  | 7+ |  |  |  |  |  |  |  | + |  |  |  |  |  |  |
| u12 |  | 8+ |  |  |  |  |  |  |  |  | + |  |  |  |  |  |
| u13 |  | 8+ |  |  |  |  |  |  |  |  | + |  |  |  |  |  |
| u14 |  | 9+ |  |  |  |  |  |  |  |  |  | + |  |  |  |  |
| u15 |  | 9+ |  |  |  |  |  |  |  |  |  | + |  |  |  |  |
| u16 |  | 10+ |  |  |  |  |  |  |  |  |  |  | + |  |  |  |
| u17 |  | 10+ |  |  |  |  |  |  |  |  |  |  | + |  |  |  |
| u18 |  |  | 14+ |  |  |  |  |  |  |  |  |  |  |  |  |  |
| u19 |  |  | 14+ |  |  |  |  |  |  |  |  |  |  |  |  |  |
| u20 |  |  | 15+ |  |  |  |  |  |  |  |  |  |  |  |  |  |
| u21 |  |  | 15+ |  |  |  |  |  |  |  |  |  |  |  |  |  |
| u22 |  |  | 16+ |  |  |  |  |  |  |  |  |  |  |  |  |  |
| u23 |  |  | 16+ |  |  |  |  |  |  |  |  |  |  |  |  |  |
| u24 |  |  | 17+ |  |  |  |  |  |  |  |  |  |  |  |  |  |
| u25 |  |  | 17+ |  |  |  |  |  |  |  |  |  |  |  |  |  |
| v1 | 4+ |  |  |  |  |  | + |  |  |  |  |  |  |  |  |  |
| v2 | 4+ |  |  |  |  |  | + |  |  |  |  |  |  |  |  |  |
| v3 | 5+ |  |  |  |  |  |  | + |  |  |  |  |  |  |  |  |
| v4 | + |  |  | + | + |  |  |  |  |  |  |  |  |  |  |  |
| v5 | + |  |  |  |  | + |  |  |  |  |  |  |  |  |  |  |
| v6 |  | 11+ |  |  |  |  |  |  |  |  |  |  |  | + |  |  |
| v7 |  | 11+ |  |  |  |  |  |  |  |  |  |  |  | + |  |  |
| v8 |  | 12+ |  |  |  |  |  |  |  |  |  |  |  |  | + |  |
| v9 |  | 12+ |  |  |  |  |  |  |  |  |  |  |  |  | + |  |
| v10 |  | + |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| v11 |  | 13+ |  |  |  |  |  |  |  |  |  |  |  |  |  | + |
| v12 |  | 13+ |  |  |  |  |  |  |  |  |  |  |  |  |  | + |
| v13 |  | + |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| v14 |  |  | 18+ |  |  |  |  |  |  |  |  |  |  |  |  |  |
| v15 |  |  | 18+ |  |  |  |  |  |  |  |  |  |  |  |  |  |
| v16 |  |  | 19+ |  |  |  |  |  |  |  |  |  |  |  |  |  |
| v17 |  |  | 19+ |  |  |  |  |  |  |  |  |  |  |  |  |  |
| v18 |  |  | + |  |  |  |  |  |  |  |  |  |  |  |  |  |
| v19 |  |  | + |  |  |  |  |  |  |  |  |  |  |  |  |  |

1. Получить минимальную дизъюнктивную нормальную форму системы булевых функций f1(X), f2(X) и f3(X).
2. x1x2x3x4x5 (1,2) 11. x1!x2x3!x4!x5 (3) 21. !x1x2!x3!x4x5 (2,3)
3. x1x2x3x4!x5 (3) 12. x1!x2!x3x4x5 (3) 22. !x1x2!x3!x4!x5 (2)
4. x1x2x3!x4x5 (3) 13. x1!x2!x3x4!x5 (2) 23. !x1!x2x3x4x5 (1)
5. x1x2!x3x4x5 (1,2) 14. x1!x2!x3!x4x5 (1,2) 24. !x1!x2x3x4!x5 (1)
6. x1x2!x3x4!x5 (1,2) 15. x1!x2!x3!x4!x5 (1,3) 25. !x1!x2x3!x4x5 (1,2,3)
7. x1x2!x3!x4x5 (3) 16. !x1x2x3x4x5 (1) 26. !x1!x2x3!x4!x5 (2,3)
8. x1x2!x3!x4!x5 (3) 17. !x1x2x3x4!x5 (2,3) 27. !x1!x2!x3x4x5 (1,2,3)
9. x1!x2x3x4x5 (1,2,3) 18. !x1x2x3!x4x5 (1,2,3) 28. !x1!x2!x3x4!x5 (1)
10. x1!x2x3x4!x5 (1,2) 19. !x1x2!x3x4x5 (1) 29. !x1!x2!x3!x4x5 (1,3)
11. x1!x2x3!x4x5 (1,3) 20. !x1x2!x3x4!x5 (1,3) 30. !x1!x2!x3!x4!x5 (1,2,3)