Федеральное государственное автономное образовательное учреждение высшего образования «Национальный исследовательский университет ИТМО»

Факультет программной инженерии и компьютерной техники

Основы дискретной математики

Курсовая работа. Часть №2

Синтез комбинационных схем

Вариант №98

Выполнил: студент группы P3108 Васильев Никита

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Санкт-Петербург 2024

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **№** | **Выполняемые операции** | **Число переменных** | | **Разрядность операндов** | | **Фиксация переноса, заема, или переполнения** |
| **Входных** | **Выходных** | **A** | **B** |
| **98** |  | 5 | 5 | 4 | - | \* |

# Таблица истинности

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

# Минимизация на картах Карно

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | a3a4 | | | | | |
| a1a2 |  | | **00** | **01** | **11** | **10** |
| **00** | | 1 |  |  |  |
| **01** | |  |  |  |  |
| **11** | | 1 | d | d | d |
| **10** | |  | 1 | 1 | 1 |
|  | | y = 1 | | | | |

## Определение МДНФ

C1:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | a3a4 | | | | | |
| a1a2 |  | | **00** | **01** | **11** | **10** |
| **00** | |  |  |  |  |
| **01** | |  |  | 1 |  |
| **11** | |  | d | d | d |
| **10** | | 1 | 1 | 1 | 1 |
|  | | y = 0 | | | | |

C2:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | a3a4 | | | | | |
| a1a2 |  | | **00** | **01** | **11** | **10** |
| **00** | |  |  | 1 |  |
| **01** | | 1 | 1 |  | 1 |
| **11** | |  | d | d | d |
| **10** | |  |  | 1 |  |
|  | | y = 0 | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | a3a4 | | | | | |
| a1a2 |  | | **00** | **01** | **11** | **10** |
| **00** | | 1 |  |  |  |
| **01** | |  | 1 | 1 | 1 |
| **11** | |  | d | d | d |
| **10** | | 1 |  |  |  |
|  | | y = 1 | | | | |

C3:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | a3a4 | | | | | |
| a1a2 |  | | **00** | **01** | **11** | **10** |
| **00** | |  | 1 |  | 1 |
| **01** | |  | 1 |  | 1 |
| **11** | |  | d | d | d |
| **10** | |  | 1 |  | 1 |
|  | | y = 0 | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | a3a4 | | | | | |
| a1a2 |  | | **00** | **01** | **11** | **10** |
| **00** | |  |  | 1 |  |
| **01** | | 1 |  | 1 |  |
| **11** | | 1 | d | d | d |
| **10** | | 1 |  | 1 |  |
|  | | y = 1 | | | | |

C4:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | a3a4 | | | | | |
| a1a2 |  | | **00** | **01** | **11** | **10** |
| **00** | | 1 |  |  | 1 |
| **01** | | 1 |  |  | 1 |
| **11** | |  | d | d | d |
| **10** | | 1 |  |  | 1 |
|  | | y = 0 | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | a3a4 | | | | | |
| a1a2 |  | | **00** | **01** | **11** | **10** |
| **00** | |  |  |  | 1 |
| **01** | | 1 |  |  | 1 |
| **11** | | 1 | d | d | d |
| **10** | | 1 |  |  | 1 |
|  | | y = 1 | | | | |

V:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | a3a4 | | | | | |
| a1a2 |  | | **00** | **01** | **11** | **10** |
| **00** | |  |  |  |  |
| **01** | |  |  |  |  |
| **11** | | 1 | d | d | d |
| **10** | |  |  |  |  |
|  | | y = 0 | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | a3a4 | | | | | |
| a1a2 |  | | **00** | **01** | **11** | **10** |
| **00** | | 1 |  |  |  |
| **01** | |  |  |  |  |
| **11** | |  | d | d | d |
| **10** | |  |  |  |  |
|  | | y = 1 | | | | |

|  |  |
| --- | --- |
|  |  |
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|  |  |

# Преобразование минимальных форм булевой функции

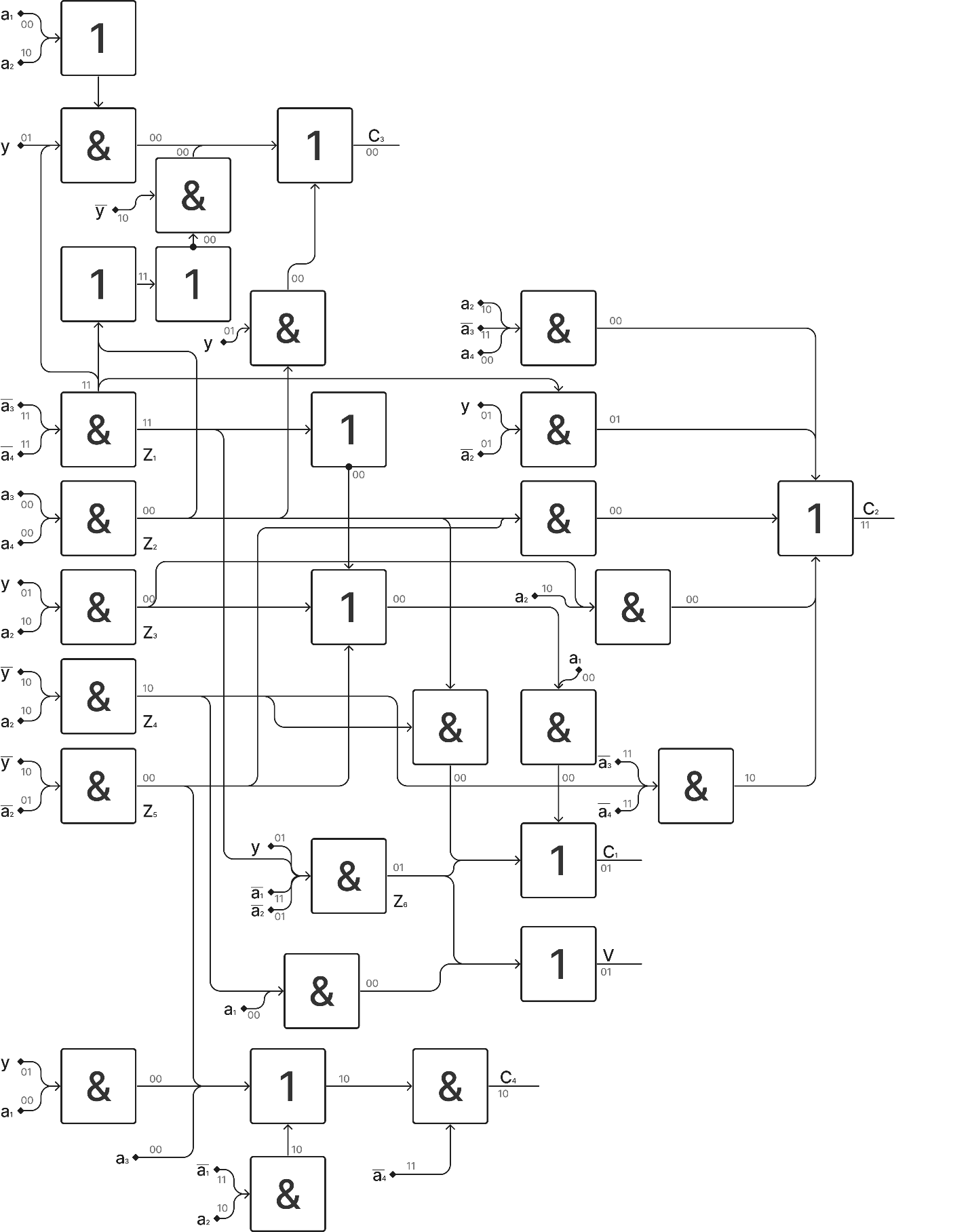
Введем вспомогательную переменную и приведем функции к скобочной форме.

|  |  |
| --- | --- |
|  |  |
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|  |  |
|  |  |

Введем новые вспомогательные переменные – и преобразуем функции системы.

|  |  |
| --- | --- |
|  |  |
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|  |  |

# Синтез многовыходной комбинационной схемы в булевом базисе



# Анализ схем

Анализ произведен на наборах: