МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ АВТОНОМНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ «Санкт-Петербургский национальный исследовательский университет ИТМО»

ФАКУЛЬТЕТ ПРОГРАММНОЙ ИНЖЕНЕРИИ И КОМПЬЮТЕРНОЙ ТЕХНИКИ

**Курсовая работа (часть 2)**

по дисциплине

«Дискретная математика»

Вариант № 95

***Выполнил:***

Студент группы P3116

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***Преподаватель:***

Поляков Владимир Иванович

Санкт-Петербург, 2023

**Задание**

Операция:

Входных переменных: 5

Выходных переменных: 5

Разрядность : 3

Разрядность: 2

Запрет на

**Таблица истинности**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **0** | **0** | **0** | **0** | **0** | **0** | **d** | **d** | **d** | **d** | **d** | **0** | **0** | **d** |
| **1** | **0** | **0** | **0** | **0** | **1** | **d** | **d** | **d** | **d** | **d** | **0** | **1** | **d** |
| **2** | **0** | **0** | **0** | **1** | **0** | **d** | **d** | **d** | **d** | **d** | **0** | **2** | **d** |
| **3** | **0** | **0** | **0** | **1** | **1** | **d** | **d** | **d** | **d** | **d** | **0** | **3** | **d** |
| **4** | **0** | **0** | **1** | **0** | **0** | **d** | **d** | **d** | **d** | **d** | **1** | **0** | **d** |
| **5** | **0** | **0** | **1** | **0** | **1** | **0** | **0** | **0** | **0** | **1** | **1** | **1** | **1** |
| **6** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **1** | **0** | **1** | **2** | **2** |
| **7** | **0** | **0** | **1** | **1** | **1** | **0** | **0** | **0** | **1** | **1** | **1** | **3** | **3** |
| **8** | **0** | **1** | **0** | **0** | **0** | **d** | **d** | **d** | **d** | **d** | **2** | **0** | **d** |
| **9** | **0** | **1** | **0** | **0** | **1** | **0** | **0** | **0** | **1** | **0** | **2** | **1** | **2** |
| **10** | **0** | **1** | **0** | **1** | **0** | **0** | **0** | **1** | **0** | **0** | **2** | **2** | **4** |
| **11** | **0** | **1** | **0** | **1** | **1** | **0** | **0** | **1** | **1** | **0** | **2** | **3** | **6** |
| **12** | **0** | **1** | **1** | **0** | **0** | **d** | **d** | **d** | **d** | **d** | **3** | **0** | **d** |
| **13** | **0** | **1** | **1** | **0** | **1** | **0** | **0** | **0** | **1** | **1** | **3** | **1** | **3** |
| **14** | **0** | **1** | **1** | **1** | **0** | **0** | **0** | **1** | **1** | **0** | **3** | **2** | **6** |
| **15** | **0** | **1** | **1** | **1** | **1** | **0** | **1** | **0** | **0** | **1** | **3** | **3** | **9** |
| **16** | **1** | **0** | **0** | **0** | **0** | **d** | **d** | **d** | **d** | **d** | **4** | **0** | **d** |
| **17** | **1** | **0** | **0** | **0** | **1** | **0** | **0** | **1** | **0** | **0** | **4** | **1** | **4** |
| **18** | **1** | **0** | **0** | **1** | **0** | **0** | **1** | **0** | **0** | **0** | **4** | **2** | **8** |
| **19** | **1** | **0** | **0** | **1** | **1** | **0** | **1** | **1** | **0** | **0** | **4** | **3** | **12** |
| **20** | **1** | **0** | **1** | **0** | **0** | **d** | **d** | **d** | **d** | **d** | **5** | **0** | **d** |
| **21** | **1** | **0** | **1** | **0** | **1** | **0** | **0** | **1** | **0** | **1** | **5** | **1** | **5** |
| **22** | **1** | **0** | **1** | **1** | **0** | **0** | **1** | **0** | **1** | **0** | **5** | **2** | **10** |
| **23** | **1** | **0** | **1** | **1** | **1** | **0** | **1** | **1** | **1** | **1** | **5** | **3** | **15** |
| **24** | **1** | **1** | **0** | **0** | **0** | **d** | **d** | **d** | **d** | **d** | **6** | **0** | **d** |
| **25** | **1** | **1** | **0** | **0** | **1** | **0** | **0** | **1** | **1** | **0** | **6** | **1** | **6** |
| **26** | **1** | **1** | **0** | **1** | **0** | **0** | **1** | **1** | **0** | **0** | **6** | **2** | **12** |
| **27** | **1** | **1** | **0** | **1** | **1** | **1** | **0** | **0** | **1** | **0** | **6** | **3** | **18** |
| **28** | **1** | **1** | **1** | **0** | **0** | **d** | **d** | **d** | **d** | **d** | **7** | **0** | **d** |
| **29** | **1** | **1** | **1** | **0** | **1** | **0** | **0** | **1** | **1** | **1** | **7** | **1** | **7** |
| **30** | **1** | **1** | **1** | **1** | **0** | **0** | **1** | **1** | **1** | **0** | **7** | **2** | **14** |
| **31** | **1** | **1** | **1** | **1** | **1** | **1** | **0** | **1** | **0** | **1** | **7** | **3** | **21** |

**Минимизация булевых функций системы с помощью карт Карно**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | b1b2 | | | | |
| a2a3 |  | 00 | 01 | 11 | 10 |
| 00 | d | d | d | d |
| 01 | d |  |  |  |
| 11 | d |  |  |  |
| 10 | d |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | b1b2 | | | | |
| a2a3 |  | 00 | 01 | 11 | 10 |
| 00 | d |  |  |  |
| 01 | d |  |  |  |
| 11 | d |  | 1 |  |
| 10 | d |  | 1 |  |

a1 = 0 a1 = 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | b1b2 | | | | |
| a2a3 |  | 00 | 01 | 11 | 10 |
| 00 | d | d | d | d |
| 01 | d | 0 | 0 | 0 |
| 11 | d | 0 |  | 0 |
| 10 | d | 0 | 0 | 0 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | b1b2 | | | | |
| a2a3 |  | 00 | 01 | 11 | 10 |
| 00 | d | 0 |  |  |
| 01 | d | 0 |  |  |
| 11 | d | 0 | 0 |  |
| 10 | d | 0 | 0 |  |

a1 = 0 a1 = 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | b1b2 | | | | |
| a2a3 |  | 00 | 01 | 11 | 10 |
| 00 | d | d | d | d |
| 01 | d | 0 | 0 | 0 |
| 11 | d | 0 | 0 |  |
| 10 | d | 0 |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | b1b2 | | | | |
| a2a3 |  | 00 | 01 | 11 | 10 |
| 00 | d |  |  | 0 |
| 01 | d |  |  | 0 |
| 11 | d |  |  |  |
| 10 | d |  | 0 |  |

a1 = 0 a1 = 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | b1b2 | | | | |
| a2a3 |  | 00 | 01 | 11 | 10 |
| 00 | d | d | d | d |
| 01 | d | 0 |  |  |
| 11 | d |  | 0 |  |
| 10 | d |  |  | 0 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | b1b2 | | | | |
| a2a3 |  | 00 | 01 | 11 | 10 |
| 00 | d | 0 | 0 | 0 |
| 01 | d | 0 |  |  |
| 11 | d |  | 0 |  |
| 10 | d |  |  | 0 |

a1 = 0 a1 = 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | b1b2 | | | | |
| a2a3 |  | 00 | 01 | 11 | 10 |
| 00 | d | d | d | d |
| 01 | d | 1 | 1 |  |
| 11 | d | 1 | 1 |  |
| 10 | d |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | b1b2 | | | | |
| a2a3 |  | 00 | 01 | 11 | 10 |
| 00 | d |  |  |  |
| 01 | d | 1 | 1 |  |
| 11 | d | 1 | 1 |  |
| 10 | d |  |  |  |

В результате получилась следующая система булевых функций:

**Преобразование минимальных форм булевых функций системы**

Выполним раздельную факторизацию системы.

За счет раздельной факторизации цена схемы уменьшилась:

Выполним совместную декомпозицию системы.

После совместной декомпозиции цена схемы еще уменьшилась:

**Синтез многовыходной комбинационной схемы в булевом базисе**

Проверка схемы на следующем наборе аргументов:

Цена схемы и ее задержка

