Елабужский Филиал Казанского Государственного Технического Университета им. А.Н. Туполева

Курсовая работа

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"Разработка функциональной схемы конечного автомата"

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Содержание

Абстрактный синтез

Автомат Мили

Структурный синтез

Кодирование состояний автомата

Таблица кодирования входных сигналов

Таблица кодирования выходных сигналов

Таблица переходов и выходов абстрактного автомата

## Абстрактный синтез

Товары стоимостью 3 и 7 рублей, принимаемые монеты достоинством 1 и 2 рубля.

1-й товар:

1+1+1

1+1+2 (сдача 1 руб.)

1+2

2+1

2+2 (сдача 1 руб.)

2-й товар:

1+1+1+1+1+1+1

2+1+1+1+1+1

1+2+1+1+1+1

1+1+2+1+1+1

1+1+1+2+1+1

1+1+1+1+2+1

1+1+1+1+1+2

2+2+1+1+1

2+1+2+1+1

2+1+1+2+1

2+1+1+1+2

1+2+2+1+1

1+1+2+2+1

1+1+1+2+2

1+2+1+2+1

2+2+2+1

1+2+2+2

2+1+2+2

2+2+1+2

2+2+2+2 (сдача 1 руб.)

1+1+1+1+1+1+2 (сдача 1 руб.)

1+1+1+2+1+2 (сдача 1 руб.)

1+1+2+1+1+2 (сдача 1 руб.)

1+2+1+1+1+2 (сдача 1 руб.)

2+1+1+1+1+2 (сдача 1 руб.)

1+1+1+1+2+2 (сдача 1 руб.)

X= (x1, x2, x3, x4) - множество входных сигналов

x1 - выбор 1-го товара

x2 - выбор 2-го товара

x3 - бросок 1 рубля в монетоприемник

x4 - бросок 2 рублей в монетоприемник

Y= (y0, y1, y2, y3; y4, y5) - множество выходных сигналов

y0 - ожидание выбора товара, щель монетоприемника закрыта

y1 - идет прием денег

y2 - выдача 2-го товара без сдачи

y3 - выдача 2-го товара со сдачей 1 руб.

y4 - выдача 1-го товара

y5 - выдача 1-го товара со сдачей 1 руб.

A= (a0, a1, a3, a4, a5, a6, a7, a8, a9, a10, a11, a12, a13, a14) - множество состояний

a0 - начальное состояние

a1 - выбран 1-ый товар, в автомате 0 руб.

a2 - выбран 1-ый товар, в автомате 1 руб.

a3 - выбран 1-ый товар, в автомате 2 руб.

a4 - выбран 1-ый товар, в автомате 3 руб. - выдача 1-го товара

a5 - выбран 1-ый товар, в автомате 4 руб. - выдача 1-го товара со сдачей 1 руб.

a6 - выбран 2-ой товар, в автомате 0 руб.

a7 - выбран 2-ой товар, в автомате 1 руб.

a8 - выбран 2-ой товар, в автомате 2 руб.

a9 - выбран 2-ой товар, в автомате 3 руб.

a10 - выбран 2-ой товар, в автомате 4 руб.

a11 - выбран 2-ой товар, в автомате 5 руб.

a12 - выбран 2-ой товар, в автомате 6 руб.

a13 - выбран 2-ой товар, в автомате 7 руб. - выдача 2-го товара

a14 - выбран 2-ой товар, в автомате 8 руб. - выдача 2-го товара со сдачей 1 руб.

## Автомат Мили

Запишем алгоритм работы автомата Мили в табличном виде.

ai - состояния абстрактного автомата, xj - входные сигналы абстрактного автомата

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Таблица № 1 | | | | | | | | | | | | | | | |
| ai  xj | a0 | a1 | a2 | a3 | a4 | a5 | a6 | a7 | a8 | a9 | a10 | a11 | a12 | a13 | a14 |
| x1 | a1  y1 | a1  y1 | a2  y1 | a3  y1 | a0  y0 | a0  y0 | a6  y1 | a7  y1 | a8  y1 | a9  y1 | a10  y1 | a11  y1 | a12  y1 | a0  y0 | a0  y0 |
| x2 | a2  y1 | a1  y1 | a2  y1 | a3  y1 | a0  y0 | a0  y0 | a6  y1 | a7  y1 | a8  y1 | a9  y1 | a10  y1 | a11  y1 | a12  y1 | a0  y0 | a0  y0 |
| x3 | a0  y0 | a2  y1 | a3  y1 | a4  y4 | a0  y0 | a0  y0 | a7  y1 | a8  y1 | a9  y1 | a10  y1 | a11  y1 | a12  y1 | a13  y2 | a0  y0 | a0  y0 |
| x4 | a0  y0 | a3  y1 | a4  y4 | a5  y5 | a0  y0 | a0  y0 | a8  y1 | a9  y1 | a10  y1 | a11  y1 | a12  y1 | a13  y1 | a14  y3 | a0  y0 | a0  y0 |

Запишем алгоритм работы автомата Мили, используя графический способ задания автомата.

Рисунок № 1

## Структурный синтез

R =] log215 [=4 - количество элементов памяти

L=] log24 [=2 - количество входных каналов

N=] log26 [=3 - количество выходных каналов

Синтез автомата Мили будем проводить на Т-триггерах.

Т-триггер (триггер со счетным входом) имеет один вход. Он "переворачивается", изменяя свое состояние, каждый раз, когда на его вход поступает сигнал, соответствующий логической единице.

При поступлении фронта импульса значение входного напряжения изменяет значение с уровня, равного логическому нулю, на значение, равное логической единице. При поступлении среза импульса значение входного напряжения изменяет значение с уровня, равного логической единице, на значение, равное уровню логического нуля.

## Кодирование состояний автомата

Qk - состояния элементарного автомата, ai - состояния абстрактного автомата

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Таблица № 2 | | | | |
| Qk  ai | Q1 | Q2 | Q3 | Q4 |
| a0 | 0 | 0 | 0 | 0 |
| a1 | 0 | 0 | 0 | 1 |
| a2 | 0 | 0 | 1 | 0 |
| a3 | 0 | 0 | 1 | 1 |
| a4 | 0 | 1 | 0 | 0 |
| a5 | 0 | 1 | 0 | 1 |
| а6 | 0 | 1 | 1 | 0 |
| а7 | 0 | 1 | 1 | 1 |
| а8 | 1 | 0 | 0 | 0 |
| а9 | 1 | 0 | 0 | 1 |
| а10 | 1 | 0 | 1 | 0 |
| а11 | 1 | 0 | 1 | 1 |
| а12 | 1 | 1 | 0 | 0 |
| а13 | 1 | 1 | 0 | 1 |
| а14 | 1 | 1 | 1 | 0 |

## Таблица кодирования входных сигналов

αm - входные сигналы структурного автомата, xj - входные сигналы абстрактного автомата

|  |  |  |
| --- | --- | --- |
| Таблица № 3 | | |
| αm  xj | α1 | α2 |
| x1 | 0 | 0 |
| x2 | 0 | 1 |
| x3 | 1 | 0 |
| x4 | 1 | 1 |

## Таблица кодирования выходных сигналов

zp - выходные сигналы структурного автомата, ys - входные сигналы абстрактного автомата

|  |  |  |  |
| --- | --- | --- | --- |
| Таблица № 4 | | | |
| zp  ys | z1 | z2 | z3 |
| y0 | 0 | 0 | 0 |
| y1 | 0 | 0 | 1 |
| y2 | 0 | 1 | 0 |
| y3 | 0 | 1 | 1 |
| y4 | 1 | 0 | 0 |
| y5 | 1 | 0 | 1 |

## Таблица переходов и выходов абстрактного автомата

ai - состояния абстрактного автомата, xj - входные сигналы абстрактного автомата

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Таблица № 5 | | | | | | | | |
| ai  xj | a0  0000 | a1  0001 | a2  0010 | a3  0011 | a4  0100 | a5  0101 | a6  0110 | a7  0111 |
| 00 | 0001  001 | 0001  001 | 0010  001 | 0011  001 | 0000  000 | 0000  000 | 0110  001 | 0111  001 |
| 01 | 0010  001 | 0001  001 | 0010  001 | 0011  001 | 0000  000 | 0000  000 | 0110  001 | 0111  001 |
| 10 | 0000  000 | 0010  001 | 0011  001 | 0100  100 | 0000  000 | 0000  000 | 0111  001 | 1000  001 |
| 11 | 0000  000 | 0011  001 | 0100  100 | 0101  101 | 0000  000 | 0000  000 | 1000  001 | 1001  001 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Таблица № 5 (продолжение) | | | | | | | |
| ai  αm | a8  1000 | a9  1001 | a10  1010 | a11  1011 | a12  1100 | a13  1101 | a14  1110 |
| 00 | 1000  001 | 1001  001 | 1010  001 | 1011  001 | 1100  001 | 0000  000 | 0000  000 |
| 01 | 1000  001 | 1001  001 | 110  001 | 1011  001 | 1100  001 | 0000  000 | 0000  000 |
| 10 | 1001  001 | 1010  001 | 1011  001 | 1100  010 | 1101  010 | 0000  000 | 0000  000 |
| 11 | 1010  001 | 1011  001 | 1100  001 | 1101  001 | 1110  011 | 0000  000 | 0000  000 |

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| Таблица № 6 | | | | | | | | | | | | | | | | |
| α1 | α2 | Q1 | Q2 | Q3 | Q4 | Q1 (t+1) | Q2 (t+1) | Q3 (t+1) | Q4 (t+1) | z1 | z2 | z3 | T1 | T2 | T3 | T4 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 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 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| 0 | 0 | 1 | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| 0 | 1 | 1 | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| 1 | 0 | 1 | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
| 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
| 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - |

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| Т1 Таблица № 7 | | | | | | | | | | | | | | | | |
| Qk  αm | 0000 | 0001 | 0011 | 0010 | 0110 | 0111 | 0101 | 0100 | 1100 | 1101 | 1111 | 1110 | 1010 | 1011 | 1001 | 1000 |
| 00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | - | 1 | 0 | 0 | 0 | 0 |
| 01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | - | 1 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | - | 1 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | - | 1 | 0 | 0 | 0 | 0 |

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| Т2 Таблица № 8 | | | | | | | | | | | | | | | | |
| Qk  αm | 0000 | 0001 | 0011 | 0010 | 0110 | 0111 | 0101 | 0100 | 1100 | 1101 | 1111 | 1110 | 1010 | 1011 | 1001 | 1000 |
| 00 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | - | 1 | 0 | 0 | 0 | 0 |
| 01 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | - | 1 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | - | 1 | 1 | 1 | 0 | 0 |
| 10 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | - | 1 | 0 | 1 | 0 | 0 |

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| Т3 Таблица № 9 | | | | | | | | | | | | | | | | |
| Qk  αm | 0000 | 0001 | 0011 | 0010 | 0110 | 0111 | 0101 | 0100 | 1100 | 1101 | 1111 | 1110 | 1010 | 1011 | 1001 | 1000 |
| 00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 1 | 0 | 0 | 0 | 0 |
| 01 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 1 | 0 | 0 | 0 | 0 |
| 11 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | - | 1 | 1 | 1 | 1 | 1 |
| 10 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | - | 1 | 0 | 1 | 1 | 0 |

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| Т4 Таблица № 10 | | | | | | | | | | | | | | | | |
| Qk  αm | 0000 | 0001 | 0011 | 0010 | 0110 | 0111 | 0101 | 0100 | 1100 | 1101 | 1111 | 1110 | 1010 | 1011 | 1001 | 1000 |
| 00 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | - | 0 | 0 | 0 | 0 | 0 |
| 01 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | - | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | - | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | - | 0 | 1 | 1 | 1 | 1 |

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| Z1 Таблица № 11 | | | | | | | | | | | | | | | | |
| Qk  αm | 0000 | 0001 | 0011 | 0010 | 0110 | 0111 | 0101 | 0100 | 1100 | 1101 | 1111 | 1110 | 1010 | 1011 | 1001 | 1000 |
| 00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 |
| 01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 |

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| Z2 Таблица № 12 | | | | | | | | | | | | | | | | |
| Qk  αm | 0000 | 0001 | 0011 | 0010 | 0110 | 0111 | 0101 | 0100 | 1100 | 1101 | 1111 | 1110 | 1010 | 1011 | 1001 | 1000 |
| 00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 |
| 01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | - | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | - | 0 | 0 | 0 | 0 | 0 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Z3 Таблица № 13 | | | | | | | | | | | | | | | | |
| Qk  αm | 0000 | 0001 | 0011 | 0010 | 0110 | 0111 | 0101 | 0100 | 1100 | 1101 | 1111 | 1110 | 1010 | 1011 | 1001 | 1000 |
| 00 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | - | 0 | 1 | 1 | 1 | 1 |
| 01 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | - | 0 | 1 | 1 | 1 | 0 |
| 11 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | - | 0 | 1 | 1 | 1 | 1 |
| 10 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | - | 0 | 1 | 1 | 1 | 1 |

Записываем выражения для функции возбуждения и выходов.

T1=α1 α2Q1Q2Q3+ α1Q1Q2Q3Q4+Q1Q2Q4+Q1Q2Q3=

=Q2 (α1Q1 (Q3 (α2+Q4)) +Q1 (Q4+Q3))

T2= α1Q1Q2Q3Q4+ α1 α2 Q1Q3+ +α1Q1Q2Q4+Q1Q2Q3+Q1Q2Q4+Q1Q2Q3+ α1 α2Q1Q3+

+α1 Q1Q2Q3Q4=

=α1 Q3 (α2+Q2Q4) +Q2

T3= α1 α2Q1Q2Q3Q4+ α1Q1Q2Q4+ α1 α2Q1+ +α1Q1Q2Q3Q4+ α1 α2Q1Q2Q3Q4+Q1Q2Q3+ α1 α2Q1Q2+ +α1Q1Q2Q4=

=α1Q1 (α2+Q2Q3Q4) + α2Q3Q4+Q1 (α1Q2 (α2+Q4) +Q2Q3)

T4= α1 α2Q1Q2Q3Q4+ α1 α2Q1+ α1 α2Q1+Q1Q2Q3Q4+ +α1 α2Q1Q2Q3+Q1Q2Q4+ α1 α2Q1Q2=

= α1 α2Q1 (Q2Q3+Q2) + α2Q1 ( α1Q2Q3Q4+ +α1) +Q2Q4 (Q1Q3+Q1)

z1= α1Q1Q2Q3Q4+ α1 α2Q1Q2Q3=

= α1Q1Q2 (Q3 (Q4+ α2))

z2= α1Q1Q2Q2Q4

z3= α1Q1Q2+ α2Q1Q2Q4+ α1 α2Q1Q3Q4+Q1Q2Q3+

+ α1Q1Q2Q3Q4+ α2Q1Q2Q3Q4=

=Q1Q2Q3Q4 ( α1+α2) + Q1 (Q2 ( α1+ α2Q4)) +Q3 (α1 α2Q4+Q2)