

МГТУ им. Н.Э. Баумана

Лабораторный практикум №4
По дисциплине: Архитектура ЭВМ
По теме: «Счетчики»

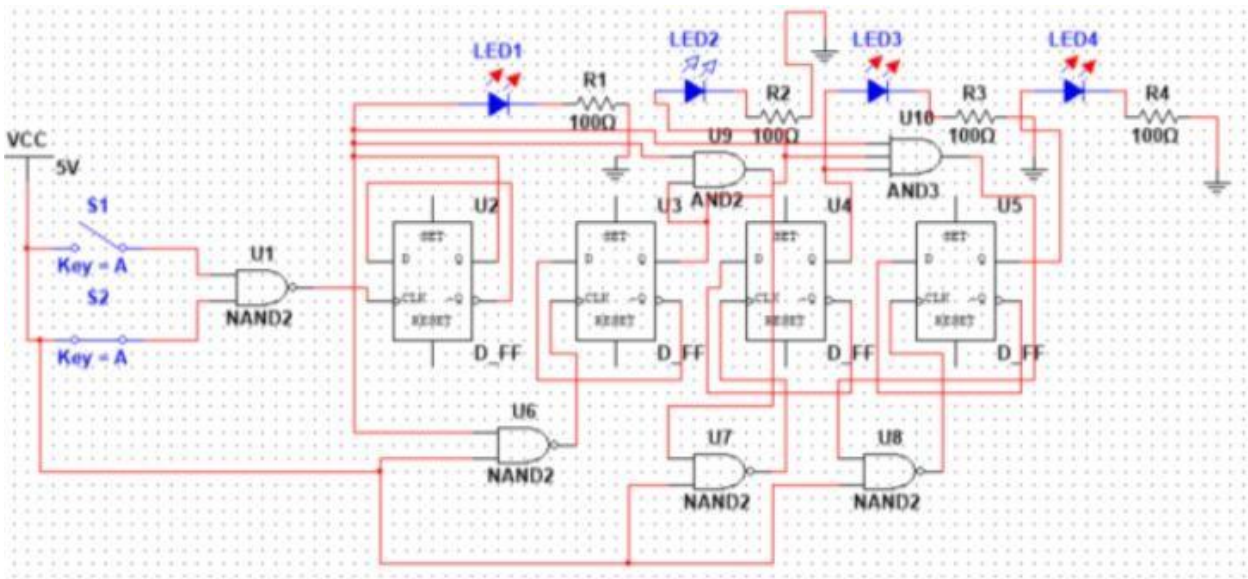
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Работу проверил:

Москва, 2019

Цель: изучение принципов построения счетчиков, сборка схем счетчиков и их экспериментальное исследование.

Задание №1. Счетчик на Т-триггерах



Задание №2. Счетчик на JK-триггерах.

Вариант 17. Набор переменных: 0, 1, 2, 3, 6, 7, 8, 9, 10, 11

| q3 | q2 | q1 | q0 | q3' | q2' | q1' | q0' | J3 | K3 | J2 | K2 | J1 | K1 | J0 | K0 | 0,1,2,3,6,7,8,9,10,11 |
|----|----|----|----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|-----------------------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | λ | 0 | λ | 0 | λ | 1 | λ | λ |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | λ | 0 | λ | 1 | λ | λ | 1 |
| 2 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | λ | 0 | λ | λ | 0 | 1 | λ |
| 3 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | λ | 1 | λ | λ | 0 | λ | 1 |
| 6 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | λ | λ | 0 | λ | 0 | 1 | λ |
| 7 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | λ | λ | 1 | λ | 1 | λ | 1 |
| 8 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | λ | 0 | λ | 0 | λ | 1 | 1 | λ |
| 9 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | λ | 0 | 0 | λ | 1 | λ | λ | 1 |
| 10 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | λ | 0 | 0 | λ | λ | 0 | 1 | λ |
| 11 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | λ | 1 | 0 | λ | λ | 1 | λ | 1 |

| J3 | q3\q0 | 00 | 01 | 11 | 10 |
|----|-------|----|----|----|----|
| 00 | 0 | - | - | λ | |
| 01 | 0 | - | - | λ | |
| 11 | 0 | 1 | - | λ | |
| 10 | 0 | 0 | - | λ | |

| J2 | q3\q0 | 00 | 01 | 11 | 10 |
|----|-------|----|----|----|----|
| 00 | 0 | - | - | - | 0 |
| 01 | 0 | - | - | - | 0 |
| 11 | 1 | λ | - | - | 0 |
| 10 | 0 | λ | - | - | 0 |

| J1 | q3\q0 | 00 | 01 | 11 | 10 |
|----|-------|----|----|----|----|
| 00 | 0 | - | - | - | 0 |
| 01 | 1 | - | - | - | 1 |
| 11 | λ | λ | - | - | λ |
| 10 | λ | λ | - | - | λ |

| J0 | q3\q0 | 00 | 01 | 11 | 10 |
|----|-------|----|----|----|----|
| 00 | 1 | - | - | - | 1 |
| 01 | λ | - | - | - | λ |
| 11 | λ | λ | - | - | λ |
| 10 | 1 | 1 | - | - | 1 |

| K3 | q3\q2 | 00 | 01 | 11 | 10 |
|----|-------|----|----|----|----|
| 00 | λ | - | - | - | 0 |
| 01 | λ | - | - | - | 0 |
| 11 | λ | λ | - | - | 1 |
| 10 | λ | λ | - | - | 0 |

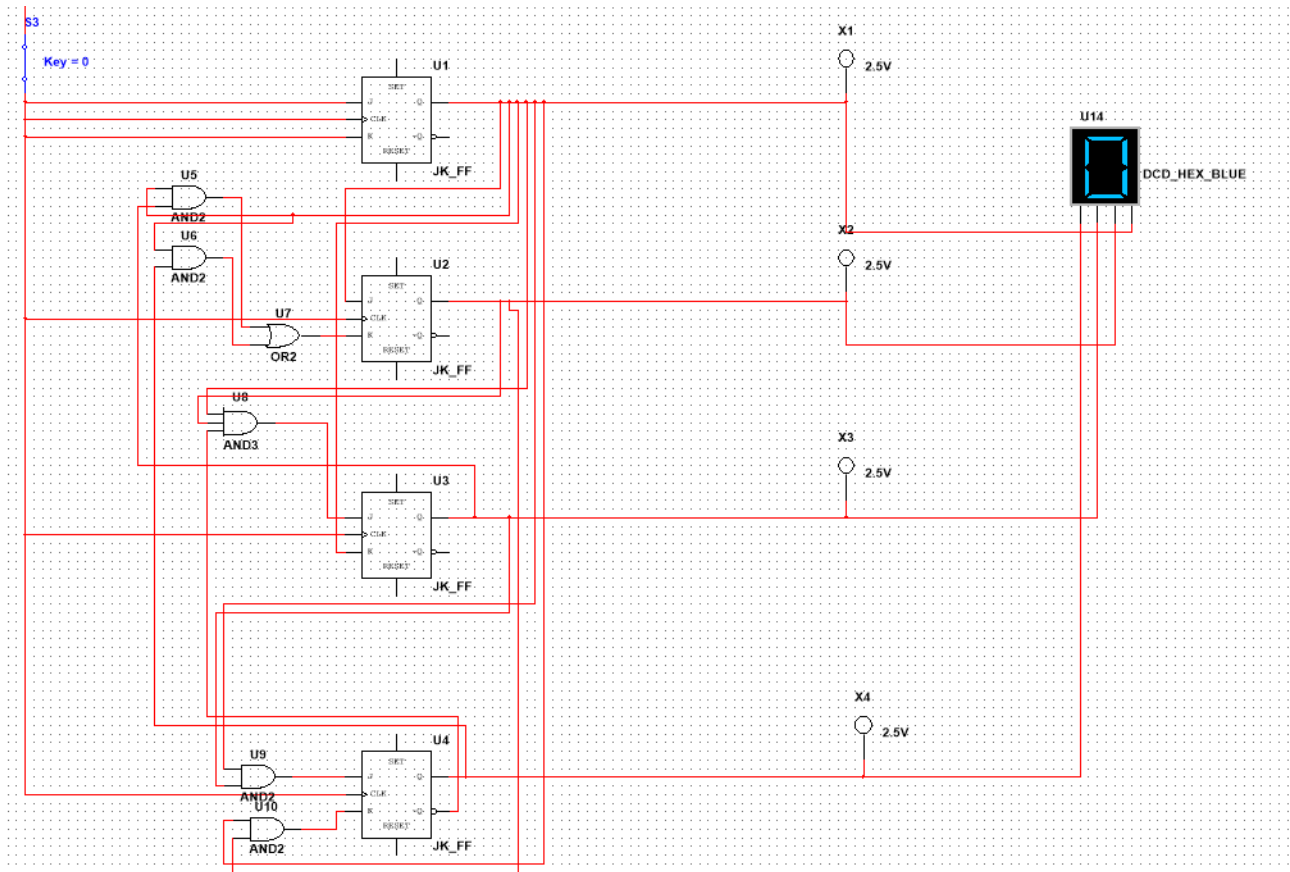
| K2 | q3\q2 | 00 | 01 | 11 | 10 |
|----|-------|----|----|----|----|
| 00 | λ | - | - | - | λ |
| 01 | λ | - | - | - | λ |
| 11 | λ | 1 | - | - | λ |
| 10 | λ | 0 | - | - | λ |

| K1 | q3\q2 | 00 | 01 | 11 | 10 |
|----|-------|----|----|----|----|
| 00 | λ | - | - | - | λ |
| 01 | λ | - | - | - | λ |
| 11 | 0 | 1 | - | - | 1 |
| 10 | 0 | 0 | - | - | 0 |

| K0 | q3\q2 | 00 | 01 | 11 | 10 |
|----|-------|----|----|----|----|
| 00 | λ | - | - | - | λ |
| 01 | 1 | - | - | - | 1 |
| 11 | 1 | 1 | - | - | 1 |
| 10 | λ | λ | - | - | λ |

| |
|--------------------|
| J3 = q0 & q2 |
| J2 = q1 & q0 & ~q3 |
| J1 = q0 |
| J0 = ----- |

| |
|------------------------|
| K3 = q1 & q0 |
| K2 = q0 |
| K1 = q0 & q2 ∨ q0 & q3 |
| K0 = ----- |



Задание №3. Исследование четырёхразрядного синхронного суммирующего счётчика с параллельными переносом.

Таблица чисел от 0 до 10

| Q3 | Q2 | Q1 | Q0 | Q3 * | Q2 * | Q1 * | Q0 * | J3 | K3 | J2 | K2 | J1 | K1 | J0 | K0 |
|----|----|----|----|---------|---------|---------|---------|----|----|----|----|----|----|----|----|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | α | 0 | α | 0 | α | 1 | α |
| 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | α | 0 | α | 1 | α | α | 1 |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | α | 0 | α | α | 0 | 1 | α |
| 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | α | 1 | α | α | 1 | α | 1 |
| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | α | α | 0 | 0 | α | 1 | α |
| 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | α | α | 0 | 1 | α | α | 1 |
| 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | α | α | 0 | α | 0 | 1 | α |
| 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | α | α | 1 | α | 1 | α | 1 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | α | 0 | 0 | α | 0 | α | 1 | α |
| 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | α | 0 | 0 | α | 1 | α | α | 1 |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | α | 1 | 0 | α | α | 1 | 0 | α |

$$J3 = q0 \& q1 \& q2$$

| Q3Q2 Q1Q0 | 00 | 01 | 11 | 10 |
|--------------|----|----|----|----|
| | 0 | 0 | — | α |
| 01 | 0 | 0 | — | α |
| | 0 | 1 | — | — |
| 10 | 0 | 0 | — | α |

$$K3 = q1$$

| Q3Q2 Q1Q0 | 00 | 01 | 11 | 10 |
|--------------|----|----|----|----|
| | α | α | — | 0 |
| 01 | α | α | — | 0 |
| | α | α | — | — |
| 10 | α | α | — | 1 |

$$J2 = q1 \& q0$$

| Q3Q2 Q1Q0 | 00 | 01 | 11 | 10 |
|--------------|----|----|----|----|
| | 0 | α | — | 0 |
| 01 | 0 | α | — | 0 |
| | 1 | α | — | — |
| 10 | 0 | α | — | 0 |

$$K2 = q1 \& q0$$

| Q3Q2 Q1Q0 | 00 | 01 | 11 | 10 |
|--------------|----|----|----|----|
| | α | 0 | — | α |
| 01 | α | 0 | — | α |
| | α | 1 | — | — |
| 10 | α | 0 | — | α |

$$J1 = q0$$

| Q3Q2 Q1Q0 | 00 | 01 | 11 | 10 |
|--------------|----------|----------|----|----------|
| | 0 | 0 | — | 0 |
| 01 | 1 | 1 | — | 1 |
| | α | α | — | — |
| 10 | α | α | — | α |

$$K1 = q0 \mid q3$$

| Q3Q2 Q1Q0 | 00 | 01 | 11 | 10 |
|--------------|----------|----------|----|----------|
| | α | α | — | α |
| 01 | α | α | — | α |
| | 1 | 1 | — | — |
| 10 | 0 | 0 | — | 1 |

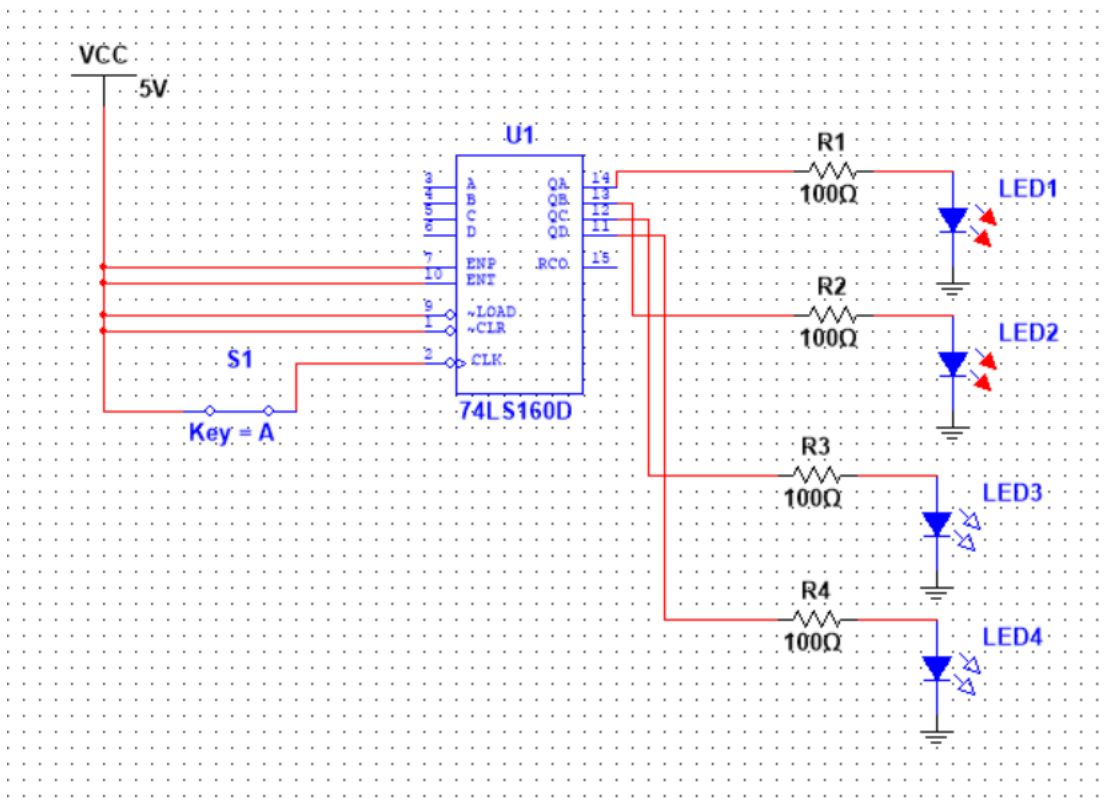
$$J0 = !q1 \mid !q3$$

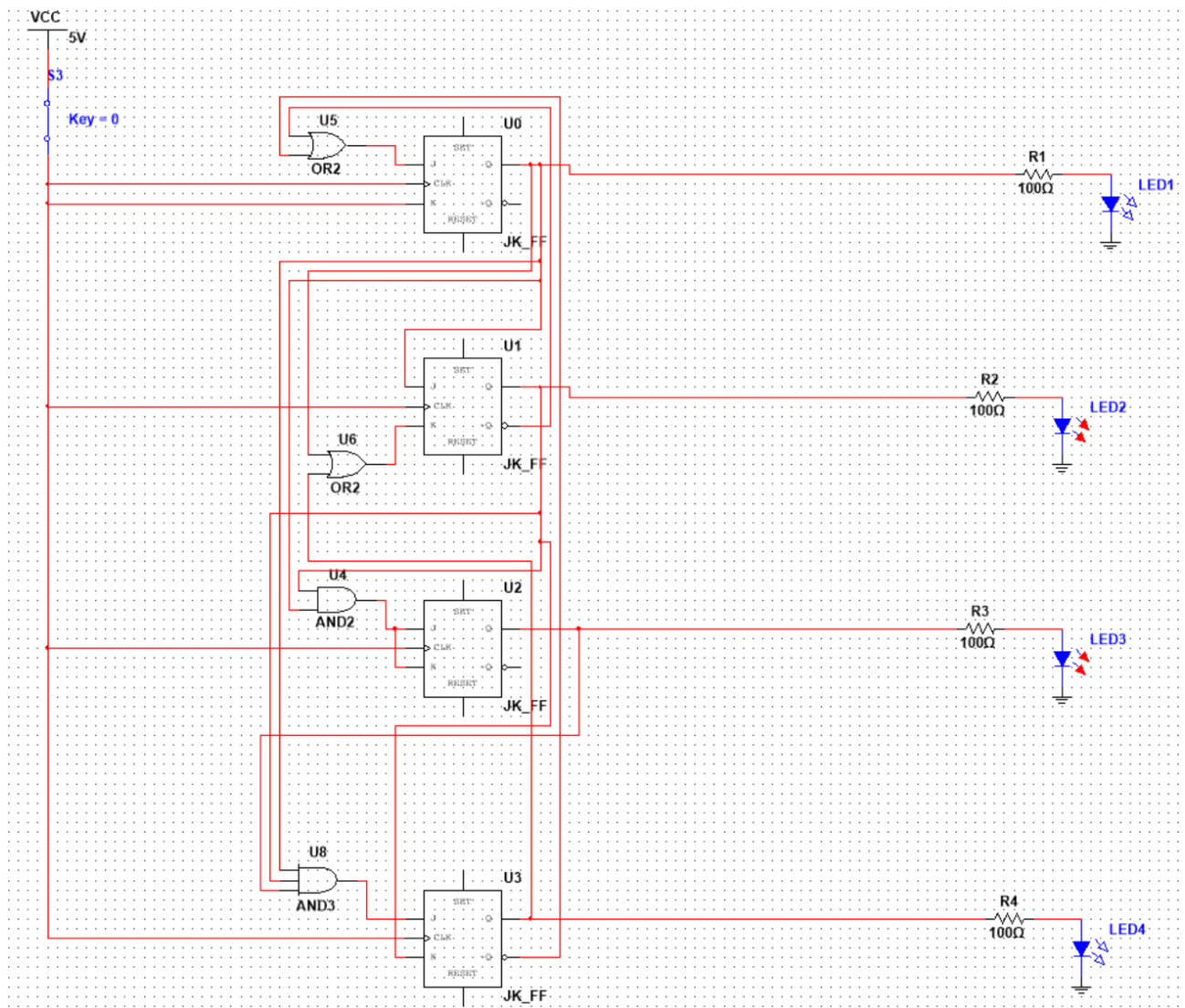
| Q3Q2 Q1Q0 | 00 | 01 | 11 | 10 |
|--------------|----------|----------|----|----------|
| | 1 | 1 | — | 1 |
| 01 | α | α | — | α |
| | α | α | — | — |
| 10 | 1 | 1 | — | 0 |

$$K0 = 1$$

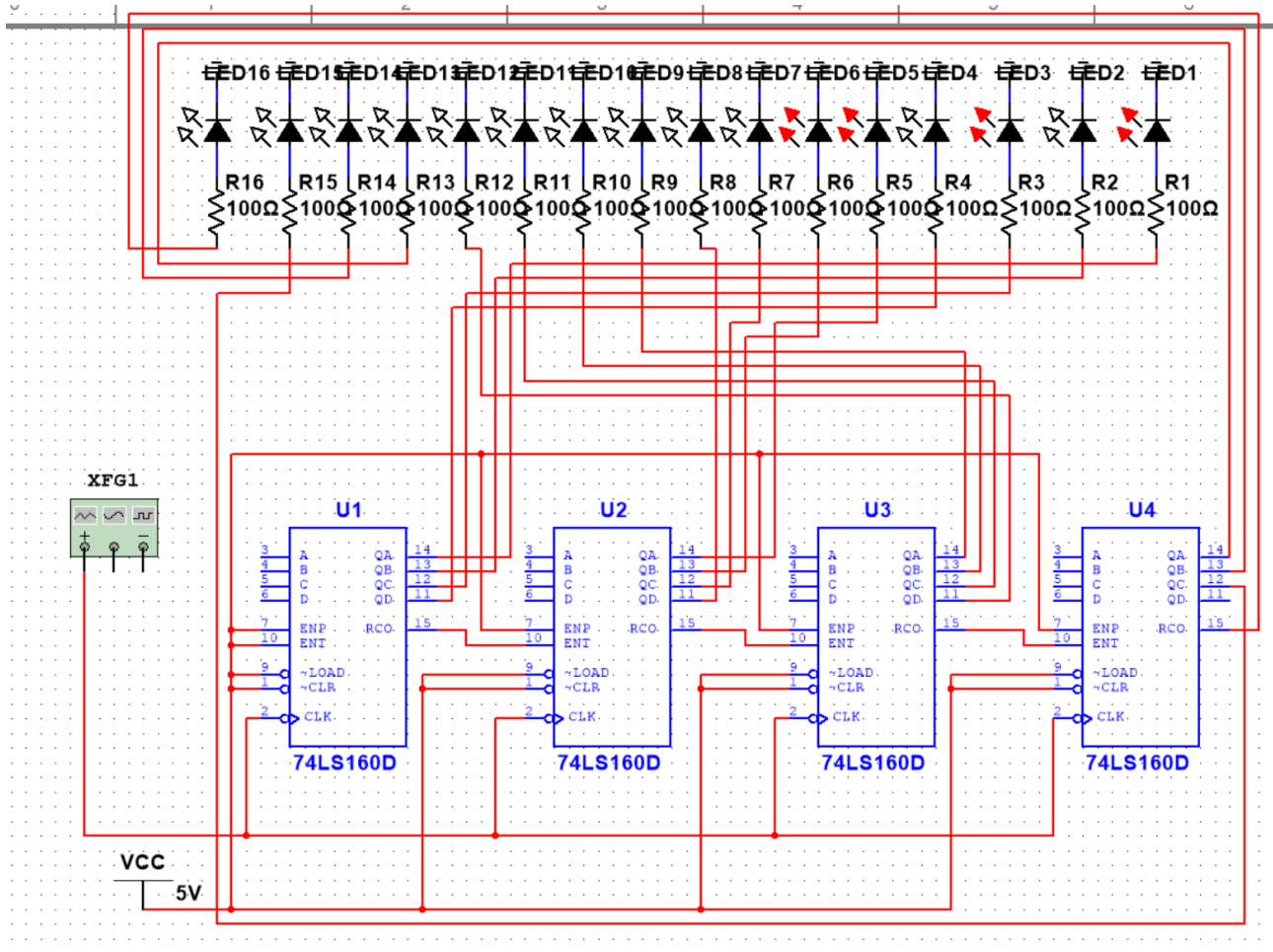
| Q3Q2 Q1Q0 | 00 | 01 | 11 | 10 |
|--------------|----------|----------|----|----------|
| | α | α | — | α |
| 01 | 1 | 1 | — | 1 |
| | 1 | 1 | — | — |
| 10 | α | α | — | α |

Задание №4.





Задание №5.



Вывод: я узнала основные принципы работы счетчиков. Познакомилась с их применением. Научилась строить схемы для работы с ними в Micro-Cap.