Fundamentals Of Information Science **2022 Spring**

Homework2

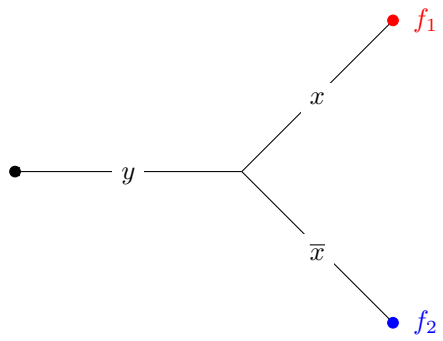
学生：华园（202000120027）) *时间：2022.3.3*

Problem 1.

(a)Construct a circuit with 3 relays that implements the functions

$$f_1 = x \cdot y$$
$$f_2 = \overline{x} \cdot y$$

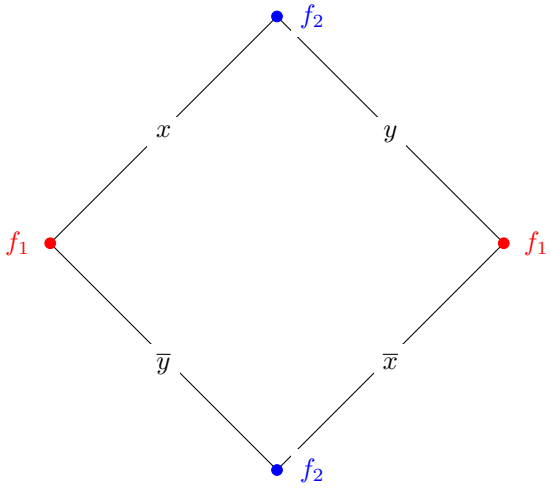
Solution.



(b)Construct a circuit with 4 relays that implements the functions

$$f_1 = x \cdot y + \overline{x} \cdot \overline{y}$$
$$f_2 = \overline{x} \cdot y + x \cdot \overline{y}$$

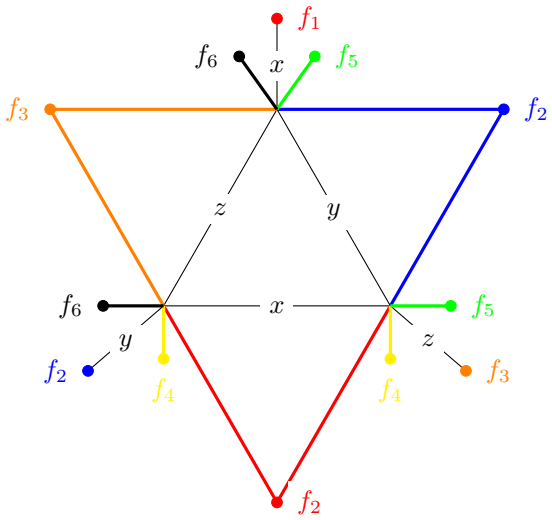
Solution.



(c)Construct a circuit with 6 relays that implements the functions

$$f_1 = x \cdot (y + z)$$
$$f_2 = y \cdot (x + z)$$
$$f_3 = z \cdot (x + y)$$
$$f_4 = x + y \cdot z$$
$$f_5 = y + x \cdot z$$
$$f_6 = z + x \cdot y$$

Solution.



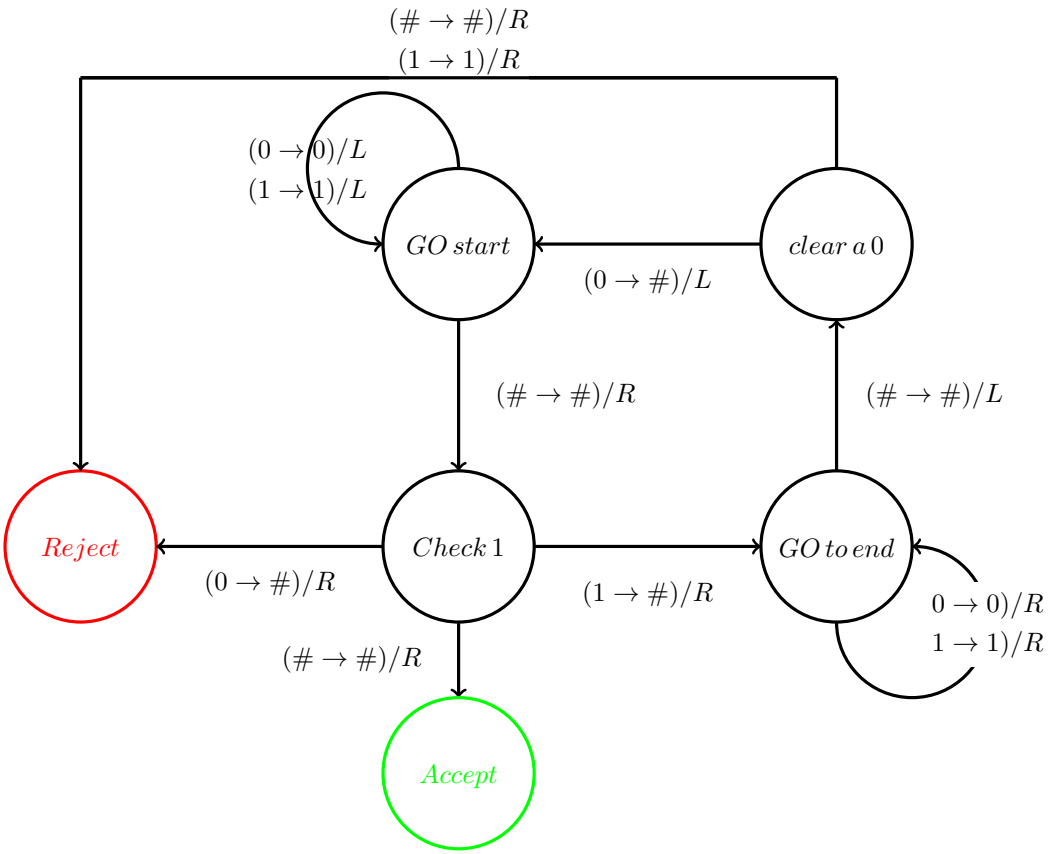
Problem 2.

You are asked to design a Turing machine that accepts the following languages:some number of 1's followed by the same number of 0' s.

[#10#,#1100#,#111000#,#11110000#,...]

Explain your design.

Solution.



Problem 3.

（1）write CQ(X) with 6 inputs function| X|. Note that there 7 entries in the table.

Solution.

|X|	CQ(X)
0	0
1	0
2	1
3	1
4	0
5	0
6	1

(2)For an arbitrary n,express CQ(X) as a function of |X|. Namely,you need to specify,as a mathematical expression,the value of |X| for whick CQ(X)=1,Jusify your solution.

Solution.

XOR is a symmetric function,when the number of 1 in the input is odd, the output is 1.thus:

$$when: \qquad C_{|x|}^{2} = \frac{|x| \cdot (|x|-1)}{2} = 2k+1 \qquad (|x| \geq 2, k \in N)$$
$$CQ(X) = 1$$