SEQUENCE DETECTOR

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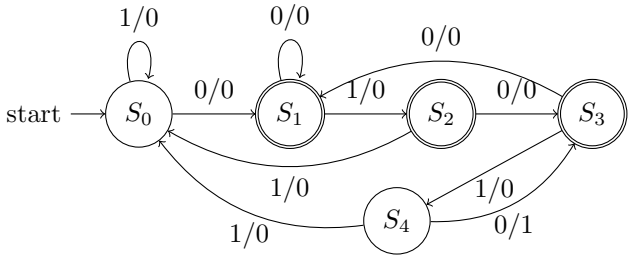
March 2023

Contents

1 Problem

(GATE EC-2020)
Q.No.39. The state diagram of a sequence detector is shown below.State S_0 is the initial state of the sequence detector.If the output is 1,then



1. the sequence 01010 is detected
2. the sequence 01011 is detected
3. the sequence 01110 is detected
4. the sequence 01001 is detected

2 Introduction

A sequence detector accepts as input a string of bits: either 0 or 1. Its output goes to 1 when a target sequence has been detected.There are two basic types: overlap and non-overlap. In a sequence detector that allows overlap, the final bits of one sequence can be the start of another sequence.

3 Components

Components	Value	Quantity
Resistor	220 Ohm	1
Arduino	UNO	1
Seven Segment Display		1
Decoder	7447	1
Flip Flop	7474	2
Bread Board		1
Jumper Wires		20

4 State Table

From state diagram,state table can be generated in Table 1.

Present State	Input	Next state	Output
S_0	0	S_1	0
S_0	1	S_0	0
S_1	0	S_1	0
S_1	1	S_2	0
S_2	0	S_3	0
S_2	1	S_0	0
S_3	0	S_1	0
S_3	1	S_4	0
S_4	0	S_3	1
S_4	1	S_0	0

Table 1: State Table

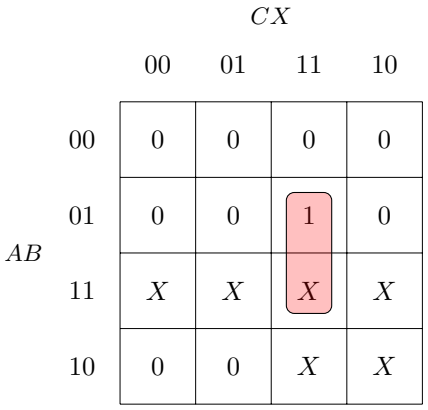
4.1 Truth Table

Present State	Input	Next state	Output
A B C	X	P Q R	Y
0 0 0	0	0 0 1	0
0 0 0	1	0 0 0	0
0 0 1	0	0 0 1	0
0 0 1	1	0 1 0	0
0 1 0	0	0 1 1	0
0 1 0	1	0 0 0	0
0 1 1	0	0 0 1	0
0 1 1	1	1 0 0	0
1 0 0	0	0 1 1	1
1 0 0	1	0 0 0	0

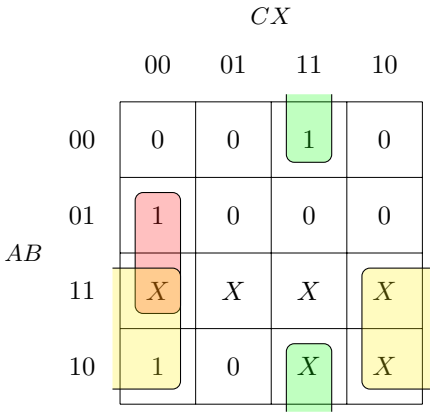
Table 2: Truth Table

5 Karnaugh Map

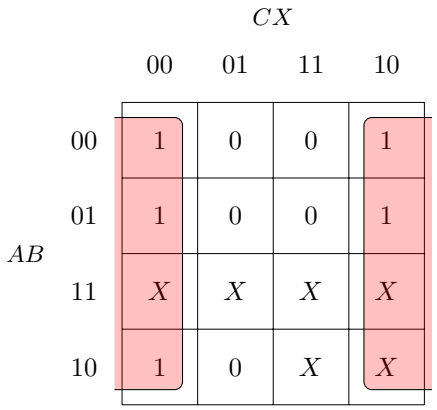
The karnaugh maps for the above truth table are given below



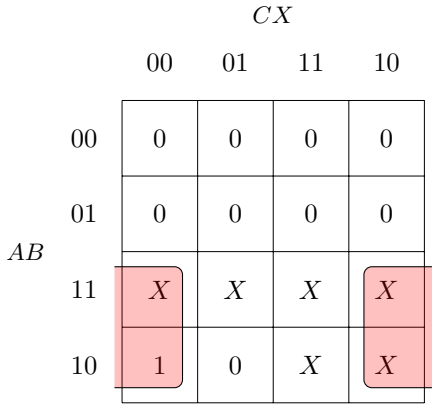
$$P = BCX \tag{1}$$



$$Q = BC'X' + B'CX + AX' \tag{2}$$



$$R = X' \tag{3}$$



$$Y = AX' \tag{4}$$

6 Connections

Connect the Arduino, 7447 ,two 7474 ICs and seven segment according to table 3.

	INPUT				OUTPUT						5V			
	A	B	C	X	P	Q	R	Y	CLOCK					
Arduino	6	7	8	9	2	3	4	5	13					
7474	5	9			2	12			CLK1	CLK2	1	4	10	13
7474			5				2		CLK1	CLK2	1	4	10	13
7447					7	1	2	6			16			

Table 3: Connection Table

7 Software

The arduino code for the given sequence detector is given below

```
#include <Arduino.h>
int X=0,C=0,B=0,A=0;
int Y,R,Q,P;

void fsm_read()
{
  A = digitalRead(6);
  B= digitalRead(7);
  C = digitalRead(8);
  X= digitalRead(9);
}

void fsm_update()
{

 P=(B&&C&&X);
 Q=(B&&!C&&!X)||(!B&&C&&X)||(A&&!X);
 R=(!X);
 Y=(A&&!X);

   digitalWrite(2, P);
   digitalWrite(3, Q);
   digitalWrite(4, R);
   digitalWrite(5, Y);
```

```
  digitalWrite(13, HIGH);
  delay(2000);
  digitalWrite(13, LOW);
  delay(2000);

}
void setup() {
    pinMode(2, OUTPUT);
    pinMode(3, OUTPUT);
    pinMode(4, OUTPUT);
    pinMode(5, OUTPUT);

    pinMode(13, OUTPUT);

    pinMode(6, INPUT);
    pinMode(7, INPUT);
    pinMode(8, INPUT);
    pinMode(9, INPUT);

}


void loop()
 {
fsm_read();
fsm_update();
}
```