IDE ASSIGNMENT

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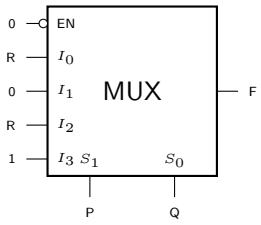
Contents

1 Problem

(GATE EC-2020)
Q.No 10 The figure below shows a multiplexer where S_1 and S_0 are select lines, I_0 to I_3 are the input data lines, EN is the enable line, and $F(P, Q, R)$ is the output, F is


0
EN
R
I_0
0
I_1
MUX
F
R
I_2
1
I_3
S_1
S_0
P
Q

1. $PQ + \overline{Q}R$
2. $P + Q\overline{R}$
3. $P\overline{Q}R + \overline{P}Q$
4. $\overline{Q} + PR$

2 Components

Component	Value	Quantity
Arduino UNO	-	1
Breadboard	-	1
7447 IC	-	1
Seven segment display	-	1
Resistor	200ohms	1
Jumper wires	M-M	20

2.1 Arduino

The Arduino Uno has some ground pins, analog input pins A0-A3 and digital pins D1-D13 that can be used for both input as well as output. It also has two power pins that can generate 3.3V and 5V.

2.2 Seven Segment Display

The seven segment display has eight pins, a, b, c, d, e, f, g and dot that take an active LOW input, i.e. the LED will glow only if the input is connected to ground. Each of these pins is connected to an LED segment. The dot pin is reserved for the · LED.

3 Implementation

We know that output of a mux is given as:

$F = \overline{S_1}\ \overline{S_0} I_0 + \overline{S_1} S_0 I_1 + S_1 \overline{S0} I_2 + S_1 S_0 I_3$

By subsituting the values from the figure,

$F = \overline{P}\ \overline{Q}(R) + \overline{P}Q(0) + P\overline{Q}(R) + PQ(1)$

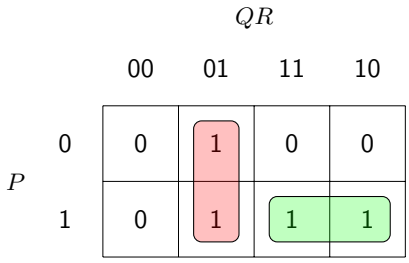
$F = \overline{P}\ \overline{Q}R + P\overline{Q}R + PQ$

3.1 Truth Table

P	Q	R	F
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

3.2 K-map

From the above truth table, K-map is drawn as follows:


QR
00
01
11
10
0
1
P
0
1
0
1
0
1
1
0
1
1

3.3 Boolean Expression

By Solving the above K-map, we get a boolean equation as: $F = PQ + \overline{Q}R$

4 Hardware

1. Connect the arduino to computer and upload the code in to the arduino.
2. Make 2,3,4,5 as output pins and 6,7,8 as input pins.
3. By changing inputs check the corresponding outputs.

5 Software

```
#include<Arduino.h>
int P,Q,R;
int A,B,C,D;
void disp_7447(int D,int C,int B,int A)
{
        digitalWrite(2,A);
        digitalWrite(3,B);
        digitalWrite(4,C);
        digitalWrite(5,D);
        digitalWrite(6,P);
        digitalWrite(7,Q);
        digitalWrite(8,R);
}
void setup()
{
        pinMode(2,OUTPUT);
        pinMode(3,OUTPUT);
        pinMode(4,OUTPUT);
        pinMode(5,OUTPUT);
        pinMode(6,INPUT);
        pinMode(7,INPUT);
        pinMode(8,INPUT);
}
void loop()
{
        P=digitalRead(6);
        Q=digitalRead(7);
        R=digitalRead(8);
        A=(R&&!Q)||(P&&Q);
        B=0;
        C=0;
        D=0;
        disp_7447(D,C,B,A);
}
```