Logical Expression through Avr-gcc

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1 ABSTRACT

In the ciruit A,B,C and D are digital inputs, Y is digital output.The equivalent circuit shows the logical expression Y=AB+CD.

Fig. 1: Y=AB+CD
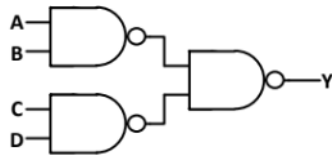
2 COMPONENTS

Component	Value	Quantity
Resistor	220 Ohm	1
Arduino	UNO	1
Seven Segment Display		1
Decoder	7447	1
Jumper Wires	M-M	20
Breadboard		1

TABLE I

3 SOLUTION :

3.1 Theoretical Solution

Based on Demorgans Law

$$\overline{AB} = \overline{A} + \overline{B} \tag{1}$$

$$\overline{\overline{A}} = A \tag{2}$$

As per the boolean circuit A,B,C and D are inputs and Y is the output. The equivalent expression of the boolean logic is

$$Y = \overline{\overline{AB}.\overline{CD}}$$

By using equation(1) then the output Y is

$$Y = \overline{\overline{AB}} + \overline{\overline{CD}}$$

Again by using equation(2) then the output Y is

$$Y = AB + CD$$

- The figure given below is the pin diagram of Seven Segment Display
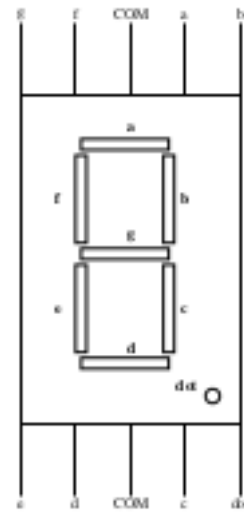

Fig. 2: Seven segment display

- The table(Fig. 3) given abvoe is the connections between 7447 BCD Decoder and Seven Segment Display
- The diagram below shows the pin diagram of 7447 BCD Decoder.The output pins of 7447 is connected to Seven Segment Display using fig 3.

7447	$\bar{a}$	$\bar{b}$	$\bar{c}$	$\bar{d}$	$\bar{e}$	$\bar{f}$	$\bar{g}$
Display	a	b	c	d	e	f	g

Fig. 3
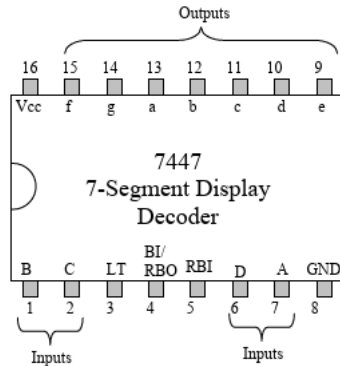
Fig. 4

A	B	C	D	Y
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

TABLE II

3.2 Truth table for Boolean Logic

4 PROCEDURE

4.1 LED Blinking

1) 1 Connect Arduino ground to the led - resistor end
2) Connect Arduino 13 pin to the LED Positive
3) Execute the following code
4) Observe the results as per below TABLE III by changing input values

4.2 Testing on Seven Segment Display using 7447

1) connect the circuit using 7447 BCD-Seven segment display decoder and Arduino
2) connect the seven segment pins to 7447 using fig 3.
3) Make the connections according to TABLE II

7447	D	C	B	A
Arduino	5	4	3	2

TABLE III

4) connect the output pins of 7447 to Ground(Gnd)
5) Verify the Boolean operation in Arduino using the following code and making pin connections according to fig 2,3.

Observe the circuit and verify the program by executing the link provided below.

https://github.com/naveed790/FWC/