

# Logical Expression through Avr-gcc

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## 1 ABSTRACT

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

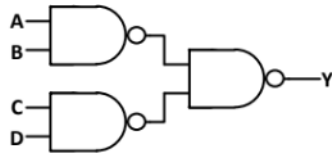


Fig. 1:  $Y=AB+CD$

## 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

$$\overline{AB} = \overline{A} + \overline{B} \quad (1)$$

$$\overline{\overline{A}} = A \quad (2)$$

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

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

By using equation(1) then the output Y is

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

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

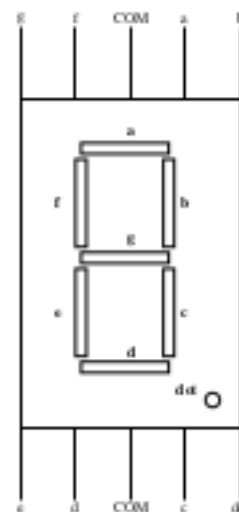


Fig. 2: Seven segment display

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

- The table(Fig. 3) given above 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.

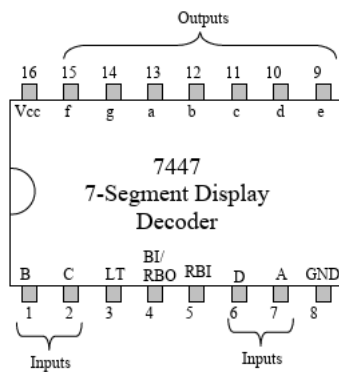


Fig. 4

### 3.2 Truth table for Boolean Logic

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

## 4 PROCEDURE

### 4.1 LED Blinking

- 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/>