

IDE Assignment

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Abstract—State and Prove Associative Law

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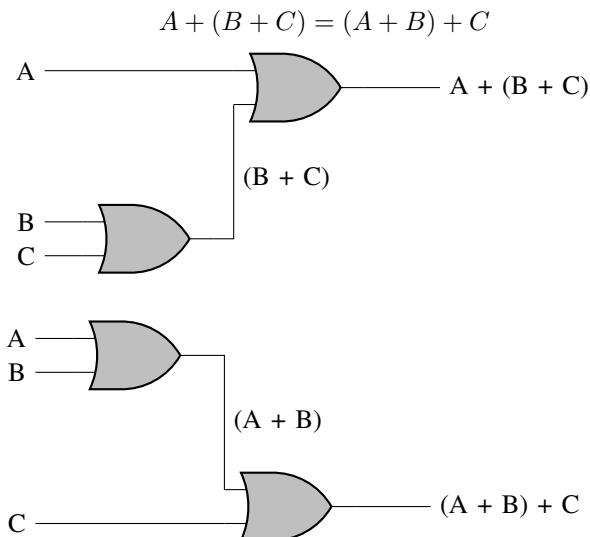
I. COMPONENTS

Component	Value	Count
Arduino	UNO	1
LED	Red	1
Resistor	220 Ohm	1
Jumper wires	-	as required

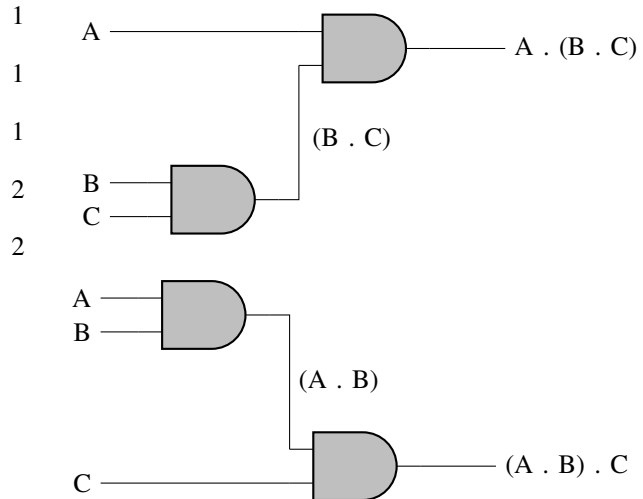
II. ASSOCIATIVE LAW

This law states that OR ing or AND ing more than two variables will return the same value irrespective of the grouping of variables in an equation.

If a logical operation of any two Boolean variables is performed first and then the same operation is performed with the remaining variable gives the same result, then that logical operation is said to be 'Associative'. The logical OR and logical AND operations of three Boolean variables A, B and C are shown below.



$$A.(B.C) = (A.B).C$$



III. PROOF

If A, B and C are three variables, then the grouping of 3 variables with 2 variables in each set will be of 3 types, such as $(A + B)$, $(B + C)$ and $(C + A)$.

According to associative law

$$(A + B + C) = (A + B) + C = A + (B + C) = B + (C + A)$$

We know that, $A + AB = A$ (according to Absorption law)
Now let's assume that,

$$x = A + (B + C)$$

and

$$y = (A + B) + C$$

According to associative law, we need to prove that

$$x = y.$$

Now, find

$$Ax = A[A + (B + C)]$$

$$= AA + A(B + C)$$

→ since $AA = A$

$$= A + AB + AC$$

$$= (A + AB) + AC$$

→ since $A + AB = A$

$$= A + AC$$

→ since $A + AC = A$

$$= A$$

Therefore

$$Ax = A$$

Similarly, for $Bx = B[A + (B + C)]$

$$= AB + B(B + C)$$

$$= AB + BB + BC$$

→ since $BB = B$

$$= AB + B + BC$$

$$= (B + BC) + AB$$

→ since $B + BC = B$

$$= B + AB$$

→ since $B + AB = B$

$$= B$$

Using these above equations, we can say that the relation between A, B, C and + operator does not change when multiplied by other variable like x, such as $xy = yx = x = y$

$$yx = ((A + B) + C)x$$

$$= (A + B)x + Cx$$

$$= (Ax + Bx) + Cx$$

$$= (A + B) + C$$

$$= yxy = (A + (B + C))y$$

$$= Ay + (B + C)y$$

$$= Ay + (By + Cy)$$

$$= A + (B + C)$$

$$= x$$

So $x = y$, which means

$$A + (B + C) = (A + B) + C = B + (A + C)$$

Example:

Take three variables 0, 1 and 0, then

According to associative law,

$$(0 + 1) + 0 = 0 + (1 + 0)$$

$$1 + 0 = 0 + 1$$

$$1 = 1$$

Hence associative law is verified.

Hence the Associative law is proved,

$$(A + B + C) = (A + B) + C = A + (B + C) = B + (C + A)$$

Truth Table

$$A + (B + C) = (A + B) + C$$

A	B	C	(B + C)	A + (B + C)	(A + B)	(A + B) + C
0	0	0	0	0	0	0
0	0	1	1	1	0	1
0	1	0	1	1	1	1
0	1	1	1	1	1	1
1	0	0	0	1	1	1
1	0	1	1	1	1	1
1	1	0	1	1	1	1
1	1	1	1	1	1	1

$$A.(B.C) = (A.B).C$$

A	B	C	(B.C)	A.(B.C)	(A.B)	(A.B).C
0	0	0	0	0	0	0
0	0	1	0	0	0	0
0	1	0	0	0	0	0
0	1	1	0	0	1	0
1	0	0	0	0	0	0
1	0	1	0	0	0	0
1	1	0	1	0	0	0
1	1	1	1	1	1	1

IV. HARDWARE

Make connections between Digital Pin 8 of Arduino with LED in Breadboard.

V. SOFTWARE

LED lights up when LHS = RHS

Make the connections and connect the arduino to the PC via USB and use below commands

- 1) svn co <https://github.com/namwave/fwc/ide/assignment>
- 2) cd ide_assignment
- 3) pio run
- 4) pio run -t upload

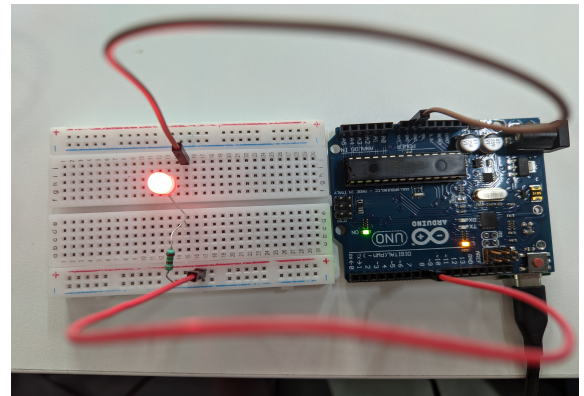


Fig. 1. Result