

# VERIFICATION OF BOOLEAN IDENTITIES USING EMBEDDED-C

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## 1 PROBLEM

(GATE CS-2019)

Q.6 Which one the following is not a valid identity?

(A)  $(x \oplus y) \oplus z = x \oplus (y \oplus z)$

(B)  $(x + y) \oplus z = x \oplus (y + z)$

(C)  $x \oplus y = x + y, \text{ if } xy = 0$

(D)  $x \oplus y = (xy + x'y')'$

## 2 COMPONENTS

Components	Value	Quantity
Resistor	220 Ohm	1
Arduino	UNO	1
Bread Board		1
Jumper Wires	M-M	10
LED		1

Table 1: Components

## 3 INTRODUCTION

An "identity" is merely a relationship that is always true, regardless of the values that any variables involved might take on; similar to laws or properties. Many of these can be analogous to normal multiplication and addition, particularly when the symbols 0,1 are used for FALSE, TRUE.

## 4 TRUTH TABLE

The Truth Table for the above identities is as follows:

(A)  $(x \oplus y) \oplus z = x \oplus (y \oplus z)$   
where  $Y1 = (x \oplus y) \oplus z, Y2 = x \oplus (y \oplus z)$

<b>x</b>	<b>y</b>	<b>z</b>	<b>Y1</b>	<b>Y2</b>	<b>F</b>
0	0	0	0	0	1
0	0	1	1	1	1
0	1	0	1	1	1
0	1	1	0	0	1
1	0	0	1	1	1
1	0	1	0	0	1
1	1	0	0	0	1
1	1	1	1	1	1

Table 2: Truth Table

(B)  $(x + y) \oplus z = x \oplus (y + z)$   
where  $Y1 = (x + y) \oplus z, Y2 = x \oplus (y + z)$

<b>x</b>	<b>y</b>	<b>z</b>	<b>Y1</b>	<b>Y2</b>	<b>F</b>
0	0	0	0	0	1
0	0	1	1	1	1
0	1	0	1	1	1
0	1	1	0	1	0
1	0	0	1	1	1
1	0	1	0	0	1
1	1	0	1	0	0
1	1	1	0	0	1

Table 3: Truth Table

(C)  $x \oplus y = x + y, if xy = 0$   
where  $Y1 = x \oplus y = x + y, if xy = 0$

<b>x</b>	<b>y</b>	<b>Y1</b>	<b>Y2</b>	<b>F</b>
0	0	0	0	1
0	1	1	1	1
1	0	1	1	1

Table 4: Truth Table

- (D)  $x \oplus y = (xy + x'y')'$   
 where  $(xy + x'y')' = (x' + y')(x + y)$   
 $= x \oplus y$   
 The Truth Table for  $x \oplus y$  is as follows:

<b>x</b>	<b>y</b>	$x \oplus y$
0	0	0
0	1	1
1	0	1
1	1	0

Table 5: Truth Table

Here, Except (B) identity all other identities are valid according to the mentioned truth tables.

## 5 IMPLEMENTATION

<b>Arduino PIN</b>	<b>INPUT</b>	<b>OUTPUT</b>
<b>2</b>	x	
<b>3</b>	y	
<b>4</b>	z	
<b>13</b>		F

Table 6: Connections

### 5.1 PROCEDURE

1. Connect the circuit as per the above table.
2. Connect one end of the resistor to anode of LED and cathode of LED to ground.
3. Connect the output pin to LED.
4. Connect inputs to Vcc for logic 1, ground for logic 0.
5. Execute the circuit using the below code.

## 6 SOFTWARE

Now execute the following codes and upload in arduino to see the results.

<a href="https://github.com/SivaLakkireddy/FWC/blob/main/Embedded-C/codes">https://github.com/SivaLakkireddy/FWC/blob/main/Embedded-C/codes</a>
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