Boolean Logic through 7447

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Contents

Abstract—**This manual shows how to use the 7447 BCD-Seven Segment Display decoder to learn Boolean logic.**

1 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 1.0

2 Hardware

Problem 2.1. Make connections between the seven segment display in Fig. 2.1 and the 7447 IC in Fig. 2.2 as shown in Table 2.1

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

TABLE 2.1

Problem 2.2. Make connections to the lower pins of the 7447 according to Table 2.2 and connect V_{CC} = 5V. You should see the number 0 displayed for 0000 and 1 for 0001.

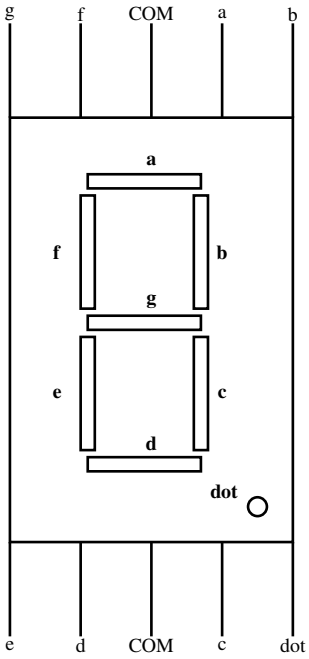

Fig. 2.1

D	C	B	A	Decimal
0	0	0	0	0
0	0	0	1	1

TABLE 2.2

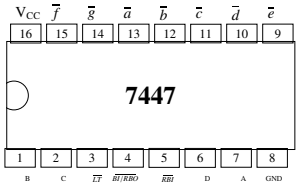

Fig. 2.2

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Problem 2.3. Complete Table 2.2 by generating all numbers between 0-9.

3 Software

Problem 3.1. Now make the connections as per Table 3.1 and execute the following program after downloading

```
wget https://raw.githubusercontent.com/gadepall/
    arduino/master/7447/codes/gvv_ard_7447/
    gvv_ard_7447.ino
```

7447	D	C	B	A
Arduino	5	4	3	2

TABLE 3.1

In the truth table in Table 3.2, W, X, Y, Z are the inputs and A, B, C, D are the outputs. This table represents the system that increments the numbers 0-8 by 1 and resets the number 9 to 0 Note that $D = 1$ for the inputs 0111 and 1000. Using *boolean* logic,

$$D = WXYZ' + W'X'Y'Z \tag{3.1.1}$$

Note that 0111 results in the expression $WXYZ'$ and 1000 yields $W'X'Y'Z$.

Problem 3.2. The code below realizes the Boolean logic for B, C and D in Table 3.2. Write the logic for A and verify.

```
wget https://raw.githubusercontent.com/gadepall/
    arduino/master/7447/codes/inc_dec/inc_dec.
    ino
```

Problem 3.3. Now make additional connections as shown in Table 3.3 and execute the following code. Comment.

```
wget https://raw.githubusercontent.com/gadepall/
    arduino/master/7447/codes/ip_inc_dec/
    ip_inc_dec.ino
```

Solution: In this exercise, we are taking the number 5 as input to the arduino and displaying it on the seven segment display using the 7447 IC.

Problem 3.4. Verify the above code for all inputs from 0-9.

Problem 3.5. Now write a program where

Z	Y	X	W	**D**	**C**	**B**	**A**
0	0	0	0	**0**	**0**	**0**	**1**
0	0	0	1	**0**	**0**	**1**	**0**
0	0	1	0	**0**	**0**	**1**	**1**
0	0	1	1	**0**	**1**	**0**	**0**
0	1	0	0	**0**	**1**	**0**	**1**
0	1	0	1	**0**	**1**	**1**	**0**
0	1	1	0	**0**	**1**	**1**	**1**
0	1	1	1	**1**	**0**	**0**	**0**
1	0	0	0	**1**	**0**	**0**	**1**
1	0	0	1	**0**	**0**	**0**	**0**

TABLE 3.2

	Z	Y	X	W
Input	0	1	0	1
Arduino	9	8	7	6

TABLE 3.3

1) the binary inputs are given by connecting to 0 and 1 on the breadboard
2) incremented by 1 using Table 3.2 and
3) the incremented value is displayed on the seven segment display.

Problem 3.6. Write the truth table for the 7447 IC and obtain the corresponding boolean logic equations.

Problem 3.7. Implement the 7447 logic in the arudino. Verify that your arduino now behaves like the 7447 IC.