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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 $V_{CC} =$

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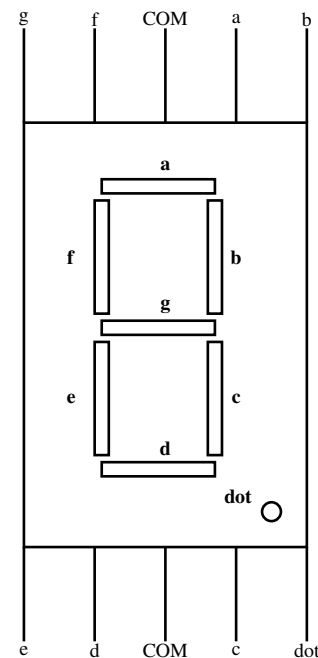


Fig. 2.1

5V. You should see the number 0 displayed for 0000 and 1 for 0001.

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

TABLE 2.2

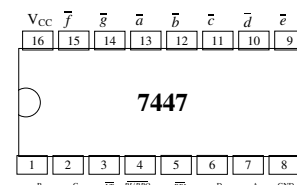


Fig. 2.2

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,

$$D = WXYZ' + W'X'Y'Z \quad (3.1.1)$$

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.