

# BCD TO EXCESS3 CONVERSION

varsha reddy

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### Abstract

This manual shows how to convert a BCD numbers to Excess3 using seven segment display decoder to learn boolean logic.

## 1 COMPONENTS

component	value	quantity
Breadboard		1
Resistor	$\text{5k}\Omega=220\text{ohm}$	1
Arduino	Uno	1
Sevensegment display	common anode	1
Jumper wires		20

## 2 BCD TO EXCESS3 CONVERSION

The excess-3 code (or XS3) is a non-weighted code used to express code used to express decimal numbers. It is a self-complementary binary coded decimal (BCD) code and numerical system which has biased representation. It is particularly significant for arithmetic operations as it overcomes shortcoming encountered while using 8421 BCD code to add two decimal digits whose sum exceeds 9. Excess-3 arithmetic uses different algorithm than normal non-biased BCD or binary positional number system.

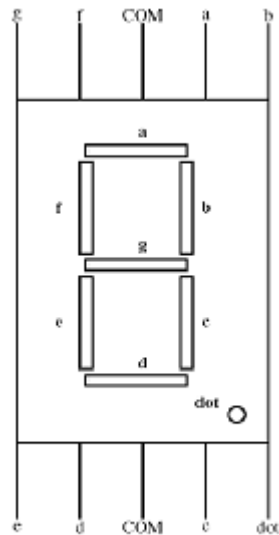
### REPRESENTATION OF EXCESS-3 CODE

Excess-3 codes are unweighted and can be obtained by adding 3 to each decimal digit then it can be represented by using 4 bit binary number for each

digit. An Excess-3 equivalent of a given binary number is obtained using the following steps:

1. Find the decimal equivalent of the given binary number.
2. Add +3 to each digit of decimal number.
3. Convert the newly obtained decimal number back to binary number to get required excess-3 equivalent.

You can add 0011 to each four-bit group in binary coded decimal number (BCD) to get desired excess-3 equivalent.



## KMAP FOR EQUATIONS

		<i>CD</i>			
		00	01	11	10
<i>AB</i>	00	0	0	0	1
	01	0	1	0	1
	11	0	1	0	0
	10	0	1	0	0

$$W = AB'C' + A'BD + A'BC$$

		<i>CD</i>			
		00	01	11	10
<i>AB</i>	00	0	1	0	0
	01	1	0	0	1
	11	1	0	0	0
	10	1	0	0	0

$$X = A'B'D + A'B'C + A'BC'D' + AB'C'D \quad (1)$$

		<i>CD</i>			
		00	01	11	10
<i>AB</i>	00	1	1	0	1
	01	0	0	0	0
	11	1	1	0	0
	10	0	0	0	0

$$Y = A'C'D' + A'C'D + AB'C'D' \quad (2)$$

		<i>CD</i>			
		00	01	11	10
<i>AB</i>	00	1	1	0	1
	01	0	0	0	0
	11	0	0	0	0
	10	1	1	0	0

$$Z = A'D' + AB'C'D' \quad (3)$$

### 3. TRUTH TABLE

DECIMAL DIGIT	BCD CODE	EXCESS3	
	A B C D	W X Y Z	a b c d e f g
<b>0</b>	0 0 0 0	0 0 1 1	0 0 0 0 1 1 0
<b>1</b>	0 0 0 1	0 1 0 0	1 0 0 1 1 0 0
<b>2</b>	0 0 1 0	0 1 0 1	0 1 0 0 1 0 0
<b>3</b>	0 0 1 1	0 1 1 0	0 1 0 0 0 0 0
<b>4</b>	0 1 0 0	0 1 1 1	0 0 0 1 1 1 1
<b>5</b>	0 1 0 1	1 0 0 0	0 0 0 0 0 0 0
<b>6</b>	0 1 1 0	1 0 0 1	0 0 0 1 1 0 0
<b>7</b>	0 1 1 1	1 0 1 0	0 0 0 1 0 0 0
<b>8</b>	1 0 0 0	1 0 1 1	0 0 0 0 0 0 0
<b>9</b>	1 0 0 1	1 1 0 0	0 1 1 0 0 0 1

5. Make connections according to the table

<b>Arduino</b>	2	3	4	5	6	7	8
<b>display</b>	a	b	c	d	e	f	g

<https://github.com/9705701645/FWC/blob/main/BTOXS3assembly/main.asm>