

# BCD to GRAY CONVERSION

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## Abstract

This manual explains BCD to GRAY code conversion by finding boolean equations.

## 1 BCD to GRAY Conversion

The BCD to GRAY code converter takes the numbers 0, 1, . . . , 9 in binary as inputs and generates the converted number as output. Make connections as shown in table 1. Gray code – also known as Cyclic Code, Reflected Binary Code (RBC), Reflected Binary (RB) or Grey code.

**Problem : -** Implement BCD to GRAY conversion

## Connections :-

Arduino	2	3	4	5	6	7	8
Display	f	e	d	c	b	a	g

Table 1

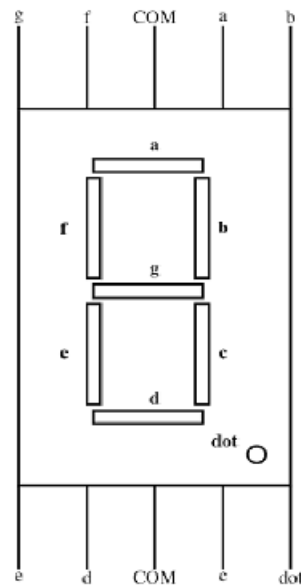


Figure 1

## 2 Karnaugh Map

Using Boolean logic or kmaps with dontcare conditions, G0, G1, G2, G3 in the truth table can be expressed in terms of the inputs A,B,C,D

AB \ CD	CD			
	00	01	11	10
00	0	1	0	1
01	0	1	0	1
11	X	X	X	X
10	0	1	X	X

Kmap for G0

$$G0 = C'D + CD' \quad (1)$$

AB \ CD	CD			
	00	01	11	10
00	0	0	1	1
01	1	1	0	0
11	X	X	X	X
10	0	0	X	X

kmap for G1

$$G1 = B'C + BC' \quad (2)$$

AB \ CD	CD			
	00	01	11	10
00	0	0	0	0
01	1	1	1	1
11	X	X	X	X
10	1	1	X	X

kmap for G2

$$G2 = A + B \quad (3)$$

AB \ cD	cD			
	00	01	11	10
00	0	0	0	0
01	0	0	0	0
11	X	X	X	X
10	1	1	X	X

Kmap for G3

$$G3 = A \quad (4)$$

Using Boolean logic or kmaps with dontcare conditions, a,b,c,d,e,f,g in the truth table can be expressed in terms of G0,G1,G2,G3 as:

		$G2G3$			
		00	01	11	10
$G0G1$	00	0	X	0	1
	01	0	X	X	0
	11	1	X	X	1
	10	1	X	0	0

Kmap for a

$$a = G0G1'G2' + G0'G1'G2G3' \quad (5)$$

		$G2G3$			
		00	01	11	10
$G0G1$	00	0	X	1	0
	01	0	X	X	1
	11	0	X	X	0
	10	0	X	0	1

Kmap for b

$$b = G0'G3 + G0'G1G2 + G0G1'G2G3' \quad (6)$$

		$G2G3$			
		00	01	11	10
$G0G1$	00	0	X	1	0
	01	1	X	X	0
	11	0	X	X	0
	10	0	X	0	0

Kmap for c

$$c = G0'G3 + G0'G1G2' \quad (7)$$

		$G2G3$			
		00	01	11	10
$G0G1$	00	0	X	0	1
	01	0	X	X	0
	11	0	X	X	1
	10	1	X	0	0

Kmap for d

$$d = G0G1'G2' + G0G1G2 + G0'G1'G2G3' \quad (8)$$

		$G_2G_3$			
		00	01	11	10
$G_0G_1$	00	0	X	0	1
	01	0	X	X	0
	11	1	X	X	1
	10	1	X	0	1

Kmap for e

		$G_2G_3$			
		00	01	11	10
$G_0G_1$	00	1	X	1	0
	01	0	X	X	0
	11	0	X	X	1
	10	1	X	1	0

Kmap for g

$$g = G_3 + G_1'G_2' + G_0G_1G_2 \quad (11)$$

$$e = G_0G_1 + G_0G_2' + G_1'G_2G_3' \quad (9)$$

		$G_2G_3$			
		00	01	11	10
$G_0G_1$	00	0	X	0	0
	01	1	X	X	0
	11	1	X	X	1
	10	1	X	0	0

Kmap for f

$$f = G_0G_1 + G_0G_2' + G_1G_2' \quad (10)$$

**Truth Table :-**

A	B	C	D	G3	G2	G1	G0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	1
0	0	1	1	0	0	1	0
0	1	0	0	0	1	1	0
0	1	0	1	0	1	1	1
0	1	1	0	0	1	0	1
0	1	1	1	0	1	0	0
1	0	0	0	1	1	0	0
1	0	0	1	1	1	0	1
1	0	1	0	X	X	X	X
1	0	1	1	X	X	X	X
1	1	0	0	X	X	X	X
1	1	0	1	X	X	X	X
1	1	1	0	X	X	X	X
1	1	1	1	X	X	X	X

A	B	C	D	G3	G2	G1	G0	a	b	c	d	e	f	g
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	1	0	0	0	1	1	0	0	1	1	1	1
0	0	1	0	0	0	1	1	0	0	0	0	1	1	0
0	0	1	1	0	0	1	0	0	0	1	0	0	1	0
0	1	0	0	0	1	1	0	0	1	0	0	0	0	0
0	1	0	1	0	1	1	1	0	0	0	1	1	1	1
0	1	1	0	0	1	0	1	0	1	0	0	1	0	0
0	1	1	1	0	1	0	0	1	0	0	1	1	0	0
1	0	0	0	1	1	0	0	0	1	1	0	0	0	1
1	0	0	1	1	1	0	1	0	0	0	0	0	0	1
1	0	1	0	1	1	1	1	X	X	X	X	X	X	X
1	0	1	1	1	1	1	0	X	X	X	X	X	X	X
1	1	0	0	1	0	1	0	X	X	X	X	X	X	X
1	1	0	1	1	0	1	1	X	X	X	X	X	X	X
1	1	1	0	1	0	0	1	X	X	X	X	X	X	X
1	1	1	1	1	0	0	0	X	X	X	X	X	X	X

Make the connections and execute the following code. And verify the truth table.

[https://github.com/NavyaValmeekam/FWC/blob/main/ASM-ASSIGNMENT-1/Assembly\\_codes/Assignment1.asm](https://github.com/NavyaValmeekam/FWC/blob/main/ASM-ASSIGNMENT-1/Assembly_codes/Assignment1.asm)