

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 | a | b | c | d | e | f | g |

Table 1

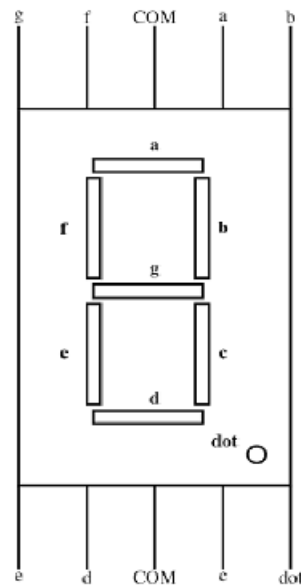


Figure 1

2 Karnaugh Map

Using Boolean logic or kmaps, 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 | 0 | 0 | 0 | 0 |
| 10 | 0 | 1 | 0 | 0 |

Kmap for G0

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

| AB \ CD | CD | | | |
|---------|----|----|----|----|
| | 00 | 01 | 11 | 10 |
| 00 | 0 | 0 | 1 | 1 |
| 01 | 1 | 1 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 |

kmap for G1

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

| AB \ CD | CD | | | |
|---------|----|----|----|----|
| | 00 | 01 | 11 | 10 |
| 00 | 0 | 0 | 0 | 0 |
| 01 | 1 | 1 | 1 | 1 |
| 11 | 0 | 0 | 0 | 0 |
| 10 | 1 | 1 | 0 | 0 |

kmap for G2

$$G2 = A'B + AB'C' \quad (3)$$

| AB \ cD | cD | | | |
|---------|----|----|----|----|
| | 00 | 01 | 11 | 10 |
| 00 | 0 | 0 | 0 | 0 |
| 01 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 |
| 10 | 1 | 1 | 0 | 0 |

Kmap for G3

$$G3 = AB'C' \quad (4)$$

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

$$a = G0'G1'G2G3' + G0G1'G2'G3' \quad (5)$$

$$b = G0'G1'G2G3 + G0'G1G2G3' + G0G1'G2G3' \quad (6)$$

$$c = G0'G1G2'G3' + G0'G1'G2G3 \quad (7)$$

$$d = G0'G1'G2G3' + G0G1G2G3' + G0G1'G2'G3' \quad (8)$$

| | | G2G3 | | | |
|------|----|------|----|----|----|
| | | 00 | 01 | 11 | 10 |
| G0G1 | 00 | 1 | 0 | 0 | 0 |
| | 01 | 0 | 0 | 0 | 0 |
| | 11 | 0 | 0 | 0 | 1 |
| | 10 | 1 | 0 | 0 | 0 |

Kmap for g

$$g = G1'G2'G3' + G1'G2G3 + G0G1G2G3' \quad (11)$$

| | | G2G3 | | | |
|------|----|------|----|----|----|
| | | 00 | 01 | 11 | 10 |
| G0G1 | 00 | 0 | 0 | 0 | 1 |
| | 01 | 0 | 0 | 0 | 0 |
| | 11 | 1 | 0 | 0 | 1 |
| | 10 | 1 | 0 | 0 | 1 |

Kmap for e

$$e = G0G3' + G0G2G3' \quad (9)$$

| | | G2G3 | | | |
|------|----|------|----|----|----|
| | | 00 | 01 | 11 | 10 |
| G0G1 | 00 | 0 | 0 | 0 | 0 |
| | 01 | 1 | 0 | 0 | 0 |
| | 11 | 1 | 0 | 0 | 1 |
| | 10 | 1 | 0 | 0 | 0 |

Kmap for f

$$f = G0G2'G3' + G1G2'G3' + G0G1G3' \quad (10)$$

Truth Table :-

| 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 | 0 | 1 | 1 | 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 |

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

<https://github.com/NavyaValmeekam/FWC/blob/main/IDE-ASSIGNMENT-1/A1gray/src/main.cpp>