CODE - Converters

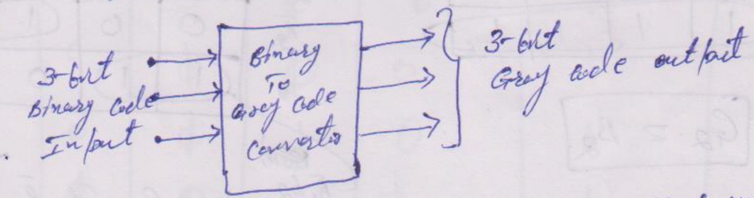
⇒ are used to convert one type of code into another type of code.

Code converters are various types, such as

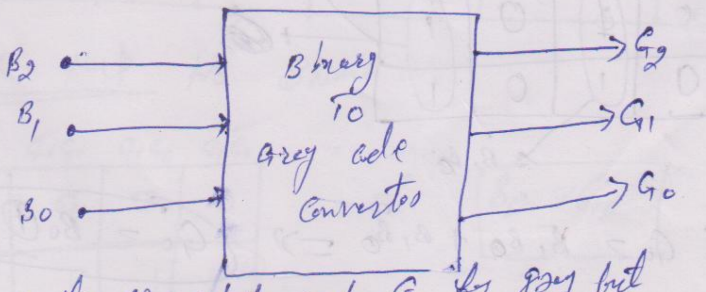
(i) Binary to Gray code converter
(ii) Gray code to Binary converter
(iii) BCD To Excess-3 code converter
(iv) Excess-3 To BCD code converter
(v) Gray code to Excess-3 code converter
(vi) BCD TO 7-Segment code converter / decoder

Binary To Gray code converter

⇔ functional Block diagram of 3-bit binary to gray code converter is:



Let the input variable be B_2, B_1, B_0 and output variable be G_2, G_1, G_0. Then functional Block diagram is



→ Here B for Binary bit and G for gray bit

Decimal Equivalent	Binary inputs B_2	B_1	B_0	Gray output G_2	G_1	G_0
0	0	0	0	0	0	0
1	0	0	1	0	0	1
2	0	1	0	0	1	1
3	0	1	1	0	1	0
4	1	0	0	1	1	0
5	1	0	1	1	1	1
6	1	1	0	1	0	1
7	1	1	1	1	0	0

⟺ Minimized logic f^n using K-map

for G_2

$B_2 \backslash B_1B_0$	$\bar{B_1}\bar{B_0}$	$\bar{B_1}B_0$	B_1B_0	$B_1\bar{B_0}$
$\bar{B_2}$	0 (0)	0 (1)	0 (3)	0 (2)
B_2	1 (4)	1 (5)	1 (7)	1 (6)

$\therefore$ $\boxed{G_2 = B_2}$

for G_1

$B_2 \backslash B_1B_0$	$\bar{B_1}\bar{B_0}$	$\bar{B_1}B_0$	B_1B_0	$B_1\bar{B_0}$
$\bar{B_2}$	0	0	1	1
B_2	1	1	0	0

$B_1\bar{B_2}$

$\bar{B_1}B_2$

$\therefore$ $G_1 = B_\phi\bar{B_2} + \bar{B_\phi}B_2$

$\boxed{G_1 = B_\phi \oplus B_2}$

$G_1 = B_1 \oplus B_2$

for G_0

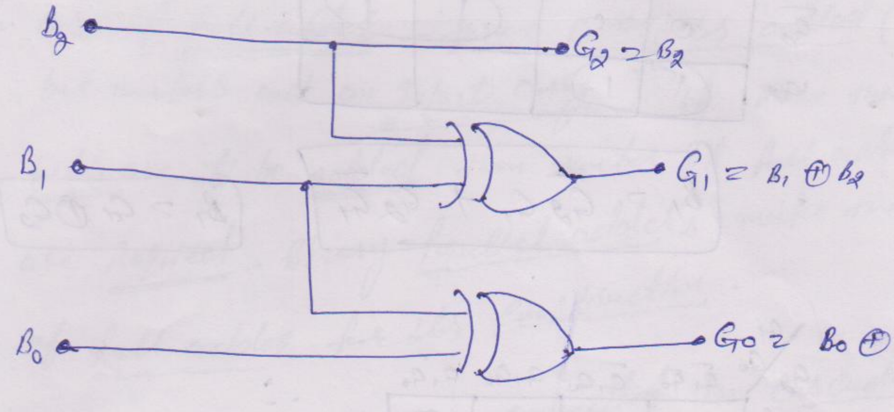
$B_2 \backslash B_1B_0$	$\bar{B_1}\bar{B_0}$	$\bar{B_1}B_0$	B_1B_0	$B_1\bar{B_0}$
$\bar{B_2}$	0	1	0	1
B_2	0	1	0	1

$B_1\bar{B_0}$

$\bar{B_1}B_0$

$\therefore G_0 = \bar{B_1}B_0 + B_1\bar{B_0} \Longrightarrow G_0 = B_0 \oplus B_1$

Circuit Implementation using gates



3-bit Gray code to Binary converter

Decimal Equivalent	Gray code			Binary code		
	G_2	G_1	G_0	B_2	B_1	B_0
0	0	0	0	0	0	0
1	0	0	1	0	0	1
2	0	1	0	0	1	1
3	0	1	1	0	1	0
4	1	0	0	1	1	1
5	1	0	1	1	1	0
6	1	1	0	1	0	0
7	1	1	1	1	0	1

For B_2 K-map is shown as

G_2 \ $G_1 G_0$	$\bar{G_1}\bar{G_0}$	$\bar{G_1} G_0$	$G_1 G_0$	$G_1 \bar{G_0}$
$\bar{G_2}$	0	0	0	0
G_2	1	1	1	1

$\therefore \boxed{B_2 = G_2}$

for B_1

$G_2 \backslash G_1G_0$	$\bar{G}_1\bar{G}_0$	$\bar{G}_1G_0$	G_1G_0	$G_1\bar{G}_0$
$\bar{G}_0$	0	0	1	1
G_2	1	1		

$$\therefore \boxed{B_1 = \bar{G}_2G_1 + G_2\bar{G}_1} \qquad \boxed{B_1 = G_1 \oplus G_2}$$

for B_0

$G_2 \backslash G_1G_0$	$\bar{G}_1\bar{G}_0$	$\bar{G}_1G_0$	G_1G_0	$G_1\bar{G}_0$
$\bar{G}_2$	0	1	0	1
G_2	1	0	1	0

$$\therefore B_0 = \bar{G}_2\bar{G}_1G_0 + \bar{G}_2G_1\bar{G}_0 + G_2\bar{G}_1\bar{G}_0 + G_2G_1G_0$$

$$B_0 = \bar{G}_2(\bar{G}_1G_0 + G_1\bar{G}_0) + G_2(\bar{G}_1\bar{G}_0 + G_1G_0)$$

$$B_0 = \bar{G}_2(G_1 \oplus G_0) + G_2(G_1 \odot G_0)$$

$$B_0 = \bar{G}_2(G_1 \oplus G_0) + G_2(\overline{G_1 \oplus G_0})$$

$$\boxed{B_0 = G_1 \oplus G_0 + G_2}$$

Circuit Implementation is as shown :-