CODE CONVERTERS

Code converters

- A code converter circuit will convert coded information in one form to a different coding form.
- Coded representation for 10 decimal symbols is known as binary coded decimal (or BCD) or decimal codes.
- Minimum 4-bits are required to represent decimal symbol.
- Out of 16 , 4-bit combinations, only 10 combinations are used to represent 10 decimal symbols and remaining 6 will not be used (don’t cares)

Binary and Binary coded Decimal(BCD)

Decimal	Binary	BCD
0	0000	0000
..	"	"
9	1001	1001
10	1010	0001 0000
11	1011	0001 0001
12	1100	0001 0010
13	1101	0001 0011
67		0110 0111
90		1001 0000
23		0010 0011

$$10 \rightarrow 0001 \quad 0000$$

8421 BCD code

8 4 2 1

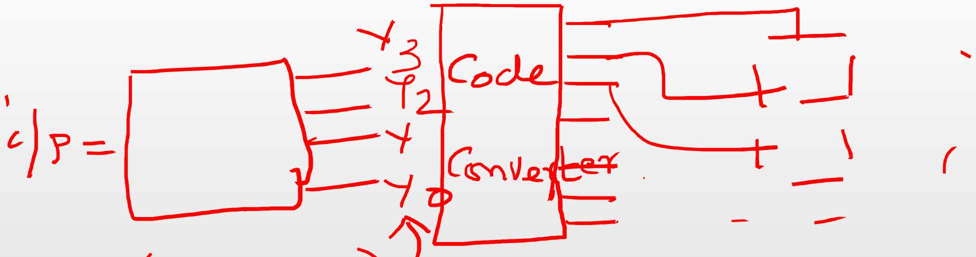
$1001 = (9)_{10}$

Difference between binary and BCD representation

- $(28)_{10}$

  Binary representation : $(11100)_2$

  8421 BCD representation : $(0010\ 1000)_2$



$(0 - F)_{16}$

$(0000 - 1111)_2$

Introduction to BCD codes (4-bit)

Weighted codes = 8421, 84-2-1, 2421

Self-Complementary codes
→ Excess-3
84-2-1
2421

Decimal digit	8421 (BCD)	Excess 3	84-2-1	2421		Gray code
0	0000	0011	0000	0000		0000
1	0001	0100	0111	0001		0001
2	0010	0101	0110	0010	1000	0011
3	0011	0110	0101	0011	1001	0010
4	0100	0111	0100	0100	1010	0110
5	0101	1000	1011	1011	0101	~~0100~~ = 0111
6	0110	1001	1010	1100	0110	0101
7	0111	1010	1001	1101	0111	0100
8	1000	1011	1000	1110		1100
9	1001	1100	1111	1111		1101
Don't cares	1010, 1011, 1100, 1101, 1110, 1111	0000, 0001, 0010, 1101, 1110, 1111	0001, 0010, 0011, 1100, 1101, 1110	1000, 1001, 1010, 0101, 0110, 0111	0010, 0011, 0100, 1011, 1100, 1101	1110, 1111, 1010, 1000, 1011, 1001

Complements

Are used for simplifying the subtraction operation and for logical manipulation.

There are two complements for each base:

- (R-1)'s complement (Diminished radix complement)
- R's complement (Radix complement)

$R = 2 \quad 8 \quad 10 \quad 16$

1's 2's 7's 8's 9's 10's 15's 16's

- (R-1)'s complement:

  (R-1)'s complement of a number is $(R^n - 1) - N$

  single-digit no : $n = 1$

  $R = 2$ $\quad N = 0$ $\quad$ (R-1)'s = 1's compl of $N = 0$

  $(R^1 - 1) - N$

  Where R → base

  N → number who's complement is to be taken

  $1 - 0 = 1$

  n → number of digits/bits in the number N

  $1 - 1 = 0$

- R's complement

  R's complement of a number is $R^n - N$

  Where R → base

  N → number who's complement is to be taken

  n → number of digits/bits in the number N

Examples: $R=2$, $N=0$, 2's compl of a no

R's

$R^n - N \Rightarrow$ single bit $= n=1$

$2^1 - N \Rightarrow N=0$,

$(R^n - 1) - N + 1 = R^n - N$

Ex: $R=10$, $n=1$

$(R-1)$'s $=$ 9's

$(R^1-1) - N = (9-N) =$ 9's compl. of N

$N = 8 \Rightarrow 9 - 8 = 1$

9's compl. of 8

9's comp. of 1 = 8

10's comp of 1 = 10 − 1

= 9

- Any questions?