BINARY CODES

- Binary codes are codes which are represented in binary system with modification from the original ones. Below we will be seeing the following:

- Weighted Binary Systems

- Non Weighted Codes

BCD NUMBER

- Meaning of BCD – "Binary Coded Decimal", is a method that use binary digits 0 which represent “off” and 1 which represent “on”.
- It is used to represent each decimal digit (0 through 9)
- The configuration of BCD is "8421“

- It is a 4 bit binary called a nibble .
- The BCD code described above is more precisely known as the 8421 BCD code, with 8, 4, 2 and 1 representing the weights of different bits in the four-bit groups, starting from MSB and proceeding towards LSB.

Decimal	Binary	BCD
0	0000 0000	0000 0000
1	0000 0001	0000 0001
2	0000 0010	0000 0010
3	0000 0011	0000 0011
4	0000 0100	0000 0100
5	0000 0101	0000 0101
6	0000 0110	0000 0110
7	0000 0111	0000 0111
8	0000 1000	0000 1000
9	0000 1001	0000 1001
10	0000 1010	0001 0000
11	0000 1011	0001 0001
12	0000 1100	0001 0010
13	0000 1101	0001 0011
14	0000 1110	0001 0100
15	0000 1111	0001 0101

Excess-3 Code

- The excess-3 code is another important BCD code.
- The excess-3 code for a given decimal number is determined by adding ‘3’ to each decimal digit in the given number and then replacing each digit of the newly found decimal number by
- Excess-3 is a non weighted code used to express decimal numbers.
- The code derives its name from the fact that each binary code is the corresponding 8421 code plus 0011(3).

Decimal	Excess 3	Excess 3 Binary no.
0	3	0011
1	4	0100
2	5	0101
3	6	0110
4	7	0111
5	8	1000
6	9	1001
7	10	1010
8	11	1011
9	12	1100
10	13	- ----------
11	14	----------
12	15	----------

- Example:

- obtain excess 3 code of $(56)_{10} = (\ ?\ )_{10} = (\ ?\ )_2$

  - obtain
  - $(\ 10001001\ )_{EX3} = (\ ?\ )_{BCD}$

GREY CODE

- The gray code belongs to a class of codes called minimum change codes, in which only one bit in the code changes when moving from one code to the next.
- The Gray code is non-weighted code, as the position of bit does not contain any weight.
- This is also called a unit-distance code.

Decimal Number	Binary Code	Gray Code
0	0000	0000
1	0001	0001
2	0010	0011
3	0011	0010
4	0100	0110
5	0101	0111
6	0110	0101
7	0111	0100
8	1000	1100
9	1001	1101

Binary to Gray

- Example: $(a\ b\ c\ d)_2 = (\ldots.\ ?\ \ldots.)_{Gray}$

- $(010101)_2$ is converted into $(\ldots?\ldots)_{GREY}$

$(011111)_{GREY}$

Gray to Binary

- Converted: $(p\ q\ r\ s)_{Gray} = (\ldots.\ ?\ \ldots.)_2$

- Example : $(011111)_{GREY}$ is converted into (…?...)

- (010101)