Coding

The modern digital computers only understand the binary language ie the language interms 0 & 1. We use the different informations in the computers and those information can only understood by the computers by converting that into the binary forms. The process of converting such information into the binary forms is called the coding. There are various codes to represent the data. eg BCD, ASCII, EBCDIC (extended binary coded decimal interchange code.

BCD Straight assignment of binary equivalent
It require a minimum of four bits / numeric also two zone bit
weight in BCD codes are 8, 4, 2, 1
ie bit assignment for 0110 equivalent to the decimal no. 6 can be interpreted as

$$0\times8+1\times4+1\times2+0\times1$$
$$=0+4+2+0$$
$$=6$$

8 4 $\bar{2}$ $\bar{1}$ or 8 4 -2 -1

the bit assign ment for 0110 equivalent to the decimal number 2 can be interpreted as

$$0\times8+1\times4+1\times-2+0\times-1$$
$$=0+4-2+0$$
$$=2$$

2421

$$1\times2+1\times4+0\times2+0\times1$$
$$=2+4+0+0$$
$$=6$$

Excess 3 code

Code derived from 8421 by adding 0011 (three) to all code groups.

Consider the following table

Decimal no.	8421 code	8 4-2-1 code	2421 code	excess-3 code
0	0000	0000	0000	0011
1	0001	0111	0001	0100
2	0010	0110	0010	0101
3	0011	0101	0011	0110
4	0100	0100	0100	0111
5	0101	1011	1011	1000
6	0110	1010	1100	1001
7	0111	1001	1101	1010
8	1000	1000	1110	1011
9	1001	1111	1111	1100

The codes where the sum of the weights is 9 are called the self complementing codes. Means any code is self complementing when we complement each bit of a code representing digit d, we get the code for 9-d. Here 8 4-2-1, 2421 are the self complementing codes. The excess 3 code is also the self complementing code.

Due to the total no of 6 bits ie 2 zone bits & 4 numeric bits it can represent $2^6 = 64$ unique code for the alphabets (26) numerals (10) and special characters (28)

ASCII codes

Comes in two versions

ASCII 7 having 7 bit code having 3 zone bits and 4 numeric bits. It has 52 binary values for Alphabets both upper & lower case. 10 for numerals & 66 for special characters. It is considered as the improvement of BCD code.

ASCII 8

It consists of 8 bits code having 4 zone bits & 4 numeric bits. It has possibility of representing $2^8 = 256$ codes.

EBCDIC

This code can be used to handle all types of data ie alphabets (both cases), numerals and special symbols. The modern digital computers use this code and also have the 4 zone bits and four numeric bits.

Error detection code:-

Message (a)	P(Odd)	Message (b)	P(even)
0000	1	0000	0
0001	0	0001	1
0010	0	0010	1
0011	1	0011	0
0100	0	0100	1
0101	1	0101	0
0110	1	0110	0
0111	0	0111	1
1000	0	1000	1
1001	1	1001	0
1010	1	1010	0
1011	0	1011	1
1100	1	1100	0
1101	0	1101	1
1110	0	1110	1
1111	1	1111	0

Derived the process of code conversion the changing of bit values from 0 to 1 or vice versa takes place and during the transmission of the data values the errors may be occurs. For detecting the error the code is used and known as the error detection code. Actually the error during the transmission is not corrected but only detected. The concept of the parity bit is used and the parity bits in case of the error detection code is an extra bit included with a message to make the total number of 1's either odd or even. A message of 4-bits and a parity bit P, are shown as in the table in (a) The value of P is choosen so that the sum of all 1's is odd (in all five bits), and in (b) P is choosen so that the sum of all 1's is even.

The reflected code / Gray code :-

The reflected code of the any decimal number can be obtained by the equivalent binary number series in such a way that it changes by only one bit as it proceeds from one number to next. A typical application of the reflected code occurs when the analog data are represented by a continuous change of a shaft position. The shaft is partitioned into segments and ~~continuous then~~ each segment is assigned a number. The Gray code of the decimal number from 0 to 15 are as follows -

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

Gray code can be easily generated by using the kmap for 4-variables as shown below