CODES

In the coding, when numbers or letters are represented by a specific group of symbols, it is said to be that number or letter is being encoded. The group of symbols is called as code.

TYPES OF CODE

- BCD code
- Gray code
- Excess 3 code

BCD CODE

Binary Coded Decimal, or BCD, is another process for converting decimal numbers into their binary equivalents. It is a form of binary encoding where each digit in a decimal number is represented in the form of bits.

CONVERSIONS

Binary to BCD code Converson

1.First, we will convert the binary number into decimal.

2.We will convert the decimal number into BCD

EXAMPLE

(11110)2

1. First, convert the given binary number into a decimal number.

Steps	Binary Number		Decimal Number
1)	(11110)2	⟶	$((1 \times 2^4) + (1 \times 2^3) + (1 \times 2^2)$
.			$+(1 \times 2^1) + (0 \times 2^0))_{10}$
2)	(11110)2	⟶	$(16 + 8 + 4 + 2 + 0)_{10}$
3)	(11110)2	⟶	$(30)_{10}$

2. Now, we convert the decimal to the BCD

We convert each digit of the decimal number into groups of the four-bit binary number.

Steps	Decimal Number	Conversion
Step 1	$(30)_{10}$	$(0011)_2\ (0000)_2$
Step 2	$(30)_{10}$	$(00110000)_{BCD}$

Result:

$(11110)_2 = (00110000)_{BCD}$

Gray code

The Gray Code is a sequence of binary number systems, which is also known as reflected binary code.

Constructing an n-bit Gray code

n-bit Gray code can be generated recursively using reflect and prefix method which is explained as following below.

Generate code for n=1: 0 and 1 code.
Take previous code in sequence: 0 and 1.
Add reversed codes in the following list: 0, 1, 1 and 0 Now add prefix 0 for original previous code and prefix 1 for new generated code: 00, 01, 11, and 10.

Therefore, Gray code 0 and 1 are for Binary number 0 and 1 respectively. Gray codes: 00, 01, 11, and 10 are for Binary numbers: 00, 01, 10, and 11 respectively. Similarly you can construct Gray code for 3 bit binary numbers

EXAMPLE

For n = 1 bit

BINARY	GRAY
0	0
1	1

FOR n=2bit

Binary	Gray
00	00
01	01
10	11
11	10

EXCESS 3 CODE

The Excess-3 code (or EX-3) is a non-weighted code used to express code used to express decimal numbers. It is a self-complementary binary coded decimal (BCD) code and numerical system which has biased representation.

Representation of Excess-3 Code

1.Find the decimal equivalent of the given binary number.
2.Add +3 to each digit of decimal number.
Convert the newly obtained decimal number back to binary number to get required excess-3 equivalent.
You can add 0011 to each four-bit group in binary coded decimal number (BCD) to get desired excess-3 equivalent

Example-1
Convert decimal number 23 to Excess-3 code.
So, according to excess-3 code we need to add 3 to both digit in the decimal number then convert
into 4-bit binary number for result of each digit. Therefore,
= 23+33=56 =0101 0110
which is required excess-3 code for given decimal number 23

Example -2− Convert Excess-3 code 01001001 into BCD and decimal number.

So, grouping 4-bit for each group, i.e., 0100 1001 and subtract 0011 0011 from given number. Therefore,
= 0100 1001 -0011 0011 =0001 0110
So, binary coded decimal number is 0001 0110 and decimal number will be 16.