Digital Circuits - Codes

A number or letter is considered to be encoded when a group of symbols are utilized to represent it during coding. Code is the term for the collection of symbols. Digital data is represented, stored, and transmitted using bit groups. This collection of bits is sometimes referred to as "binary code".

There are two distinct categories of binary coding.

- Weighted codes
- Unweighted codes

It is referred to as weighted code if it has positional weights. It is an unweighted code otherwise. Positively weighted codes and negatively weighted codes are additional categories for weighted codes.

Binary Codes for Decimal digits

The following table shows the various binary codes for decimal digits 0 to 9.

Decimal Digit	8421 Code	2421 Code	84-2-1 Code	Excess 3 Code
0	0000	0000	0000	0011
1	0001	0001	0111	0100
2	0010	0010	0110	0101

3	0011	0011	0101	0110
4	0100	0100	0100	0111
5	0101	1011	1011	1000
6	0110	1100	1010	1001
7	0111	1101	1001	1010
8	1000	1110	1000	1011
9	1001	1111	1111	1100

We use a decimal number system with ten digits. We need at least 4 bits to represent these 10 digits in binary. However, there will be 16 different zero and one possibilities for every four bits. We only have ten decimal digits, thus the other six zero-one combinations are not necessary.

8 4 2 1 code

- The weights of this code are 8, 4, 2 and 1.
- This code has all positive weights. So, it is a **positively weighted code**.
- This code is also called as **natural BCD** BinaryCodedDecimalBinaryCodedDecimal **code**.

Example

Let us find the BCD equivalent of the decimal number 786. This number has 3 decimal digits 7, 8 and 6. From the table, we can

- It is a **self-complementing** code.

Example

Let us find the 8 4-2-1 equivalent of the decimal number 786. This number has 3 decimal digits 7, 8 and 6. From the table, we can write the 8 4 -2 -1 codes of 7, 8 and 6 are 1001, 1000 and 1010 respectively.

Therefore, the 8 4 -2 -1 equivalent of the decimal number 786 is **100110001010**.

Excess 3 code

- This code doesn't have any weights. So, it is an **un-weighted code**.
- We will get the Excess 3 code of a decimal number by adding three 0011001 to the binary equivalent of that decimal number. Hence, it is called as Excess 3 code.
- It is a **self-complementing** code.

Example

Let us find the Excess 3 equivalent of the decimal number 786. This number has 3 decimal digits 7, 8 and 6. From the table, we can write the Excess 3 codes of 7, 8 and 6 are 1010, 1011 and 1001 respectively.

Therefore, the Excess 3 equivalent of the decimal number 786 is **101010111001**

Gray Code

The following table shows the 4-bit Gray codes corresponding to each 4-bit binary code.