

**Codes in Number Systems:** Since we have learnt that three specific coding systems are proposed by mathematicians and computer scientists for easy conversions among different number systems, following are these three:

- Binary Coded Octal
- Binary Coded Hexadecimal
- Binary Coded Decimal

### **Binary Coded Octal:**

Binary Coded Octal is a 3-digit binary representation of a single octal digit. It is based on an analogy that every octal digit can be represented by only 3-digit binary number. Basically the analogy is:  $2^3$  always equals to 8 which is the base of Octal Number System.

The following table shows the count of Octal Number System in terms of 3-digit binary numbers:

Octal	BCO
0	000
1	001
2	010
3	011
4	100
5	101
6	110
7	111
10	001 000
11	001 001
573	101 111 011

### **Binary Coded Hexadecimal:**

Very similar to BCO, Binary Coded Hexadecimal is a 4-digit binary representation of a single Hexadecimal digit. It is based on the analogy that every Hexadecimal digit can be represented by only a 4-digit binary number. Basically the analogy is:  $2^4$  always equals to 16 which is the base of Hexadecimal Number System.

The following table shows the count of Hexadecimal Number System in terms of 4-digit binary numbers:

Hex Dec	BCH	Hex Dec	BCH
0	0000	D	1101
1	0001	E	1110
2	0010	F	1111
3	0011	10	0001 0000
4	0100	11	0001 0001
5	0101	.	.
6	0110	.	.
7	0111	.	.
8	1000	3A	0011 1010
9	1001	4D	0100 1101
A	1010	2B6	0010 1011 0110
B	1011	3DA	0011 1101 1010
C	1100	C57	1100 0101 0111

## Binary Coded Decimal:

Binary Coded Decimal is also a 4-digit binary representation of a single Decimal digit. Since the base of Decimal Number System is 10 which can never be represented by 3-digit binary representation. If we use 4-digits we'll be wasting 6 different representations. But ultimately, better is to choose 4-digits.

The adjacent table shows the count of Decimal Number System in terms of 4-digit binary numbers:

Dec	BCD	Dec	BCD
0	0000	8	1000
1	0001	9	1001
2	0010	10	0001 0000
3	0011	11	0001 0001
4	0100	.	.
5	0101	.	.
6	0110	45	0100 0101
7	0111	963	1001 0110 0011

## Assignments:

1. BCD and BCH both are 4-digit codes. What is the difference there?