

# BCD or Binary Coded Decimal

**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.

This encoding can be done in either 4-bit or 8-bit (usually 4-bit is preferred).

It is a fast and efficient system that converts the decimal numbers into binary numbers as compared to the existing binary system.

These are generally used in digital displays where the manipulation of data is quite a task.

Thus BCD plays an important role here because the manipulation is done treating each digit as a separate single sub-circuit.

Many decimal values, have an infinite place-value representation in binary but have a finite place-value in binary-coded decimal. For example, 0.2 in binary is .001100... and in BCD is 0.0010. It avoids fractional errors and is also used in huge financial calculations.

Consider the following truth table and focus on how these are represented.

**Truth Table for Binary Coded Decimal**

Decimal Digit	BCD			
	8	4	2	1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

In the **BCD numbering system**, the given decimal number is segregated into chunks of four bits for each decimal digit within the number. Each decimal digit is converted into its direct binary form (usually represented in 4-bits).

**For example:**

1. Convert (123)<sub>10</sub> in BCD

From the truth table above,

1 -> 0001

2 -> 0010

3 -> 0011

thus, BCD becomes -> 0001 0010 0011

2. Convert (324)<sub>10</sub> in BCD

(324)<sub>10</sub> -> 0011 0010 0100 (BCD)

Again from the truth table above,

3 -> 0011

2 -> 0010

4 -> 0100

thus, BCD becomes -> 0001 0010 0011

This is how decimal numbers are converted to their equivalent BCDs.

It is noticeable that the BCD is nothing more than a binary representation of each digit of a decimal number.

It cannot be ignored that the BCD representation of the given decimal number uses extra bits, which makes it heavy-weighted.

1. Binary coded decimal is a combination of \_\_\_\_\_

- a) Two binary digits
- b) Three binary digits
- c) Four binary digits
- d) Five binary digits

Answer: c

2. The decimal number 10 is represented in its BCD form as \_\_\_\_\_

- a) 10100000
- b) 01010111
- c) 00010000
- d) 00101011

Answer: c

3. Add the two BCD numbers:  $1001 + 0100 = ?$

- a) 10101111
- b) 01010000
- c) 00010011
- d) 00101011

Answer: c

Explanation: Firstly, Add the 1001 and 0100. We get 1101 as output but it's not in BCD form. So, we add 0110 (i.e. 6) with 1101. As a result we get 10011 and it's BCD form is 0001 0011.

4. Carry out BCD subtraction for  $(68) - (61)$  using 10's complement method.

- a) 00000111
- b) 01110000
- c) 100000111
- d) 011111000

Answer: a

Explanation: First the two numbers are converted into their respective BCD form using 8421 sequence. Then binary subtraction is carried out.

5. Code is a symbolic representation of \_\_\_\_\_ information.

- a) Continuous
- b) Discrete
- c) Analog
- d) Both continuous and discrete

Answer: b

Explanation: Code is a symbolic representation of discrete information, which may be present in the form of numbers, letters or physical quantities. Mostly, it is represented using a particular number system like decimal or binary and such like.

6. A three digit decimal number requires \_\_\_\_\_ for representation in the conventional BCD format.

- a) 3 bits
- b) 6 bits
- c) 12 bits
- d) 24 bits

Answer: c

Explanation: The number of bits needed to represent a given decimal number is always greater than the number of bits required for a straight binary encoding of the same. Hence, a three digit decimal number requires 12 bits for representation in BCD format

7. BCD uses 6 bits to represent a symbol.

- a) True
- b) False

Answer: a

Explanation: In a Binary Coded Decimal format, 64 characters i.e. 26 different characters can be represented. It is one of the early computer codes.

8. The weights used in Binary coded decimal code are:

- a) 4,2,1
- b) 8,4,2,1
- c) 6,4,2,1
- d) 2,1

Answer: b

Explanation: BCD is a weighted code and it uses the weights 8,4,2,1 respectively. It is often called the 8421 code. Since, it uses 4 bits for the representation therefore the weights are assigned as :  $2^3 = 8$ ,  $2^2 = 4$ ,  $2^1 = 2$ ,  $2^0 = 1$ .

9. Write the decimal equivalent for  $(110001)_{BCD}$ .

- a) 31
- b) 13
- c) C1
- d) 1C

Answer: a

Explanation: To obtain the decimal equivalent :

We start from the rightmost bit and make groups of 4, then write the decimal equivalent accordingly.

$$0011\ 0001 = (31)_{10}.$$