How are BCD and Hexadecimal Used

### Advantages and applications of binary-coded decimal

The binary-coded decimal system provides a way to get around the size limitations imposed on integer arithmetic. It also enables easy conversion between machine-readable and human-readable numerals. Compared to the binary system, it is easy to code and decode binary-coded decimal numbers. Thus, binary-coded decimal offers a fast and efficient system to convert decimal numbers into binary numbers.

Binary-coded decimal is useful in digital displays, where it can be difficult to manipulate or display large numbers. Since binary-coded decimal treats each digit as a separate subcircuit, data manipulation in such devices becomes easier. Integrated circuits that are configured to give a binary-coded decimal output on such displays are available.

The binary-coded decimal conversion system is also used in some currency applications where floating-point representations are not completely accurate.

### Limitations of binary-coded decimal

Despite its advantages, binary-coded decimal comes with certain limitations. For example, representing a decimal number as binary-coded decimal requires extra bits of storage in a computer's memory, making it an inefficient way to store numbers. It also takes increased circuit complexity when compared to the standard binary system. Binary-coded decimal code can also be wasteful since many 4-bit states (10 to 16) are not used.

Another limitation of binary-coded decimal is that performing arithmetic tasks using binary-coded decimal numbers can be cumbersome since no digit can exceed 9. Consequently, adding of two decimal digits in binary-coded decimal could create a carry bit of 1, which must be added to the next group of 4 bits to arrive at the correct binary-coded decimal representation.

### Types of binary-coded decimal

There are two types of binary-coded decimal.

#### **Unpacked binary-coded decimal**: In unpacked binary-coded decimal numbers, each 4-bit binary-coded decimal group is stored in a separate register inside a computer. The drawback here is that, if the registers are 8 bits or wider, space is wasted storing the binary-coded decimal numbers.

#### **Packed binary-coded decimal**: In packed binary-coded decimal numbers, a single 8-bit register stores two binary-coded decimal digits. By shifting the number in the upper register to the left four times and then adding the numbers in the upper and lower registers, the process combines two binary-coded decimal digits, which enables storage in a single register.

## Uses of Hexadecimal

The close relationship between binary and hexadecimal is why hexadecimal is used so extensively by programmers. It is used to simplify the computer numbering system. The data on the computer is in binary, if the programmer needs to examine this data, then pages of 1s and 0s would appear and this makes it quite difficult to analyze, therefore the hexadecimal system becomes much easier to work with. The computer stores its data into registers and memory in the computer.

Different ways Hexadecimal is used in Computers

* Hexadecimal is used in the HTML code for colours. It defines colours on the webpage. Each of the primary colours are represented by two (2) hexadecimal digits. The format being used is #RRGGBB.  RR stands for red, GG stands for green and BB stands for blue. Working with hexadecimal numbers is much easier than working with the binary equivalent 101011011101100011100110
* Hexadecimal numbers are also used in MAC addresses. Media Access Control (MAC) technology provides unique identification and access control for computers on an Internet Protocol (IP) network. Media Access Control assigns a unique number to each IP network adapter called the MAC address.   
  The format being used is either MM:MM:MM:SS:SS:SS or MMMM-MMSS-SSSS. The first 6 digits of the MAC address represent the ID of the adapter manufacturer while the last 6 digits represent the serial number of the adapter. It has an address that is 48 bits long.   
  The MAC address is commonly written as a sequence of 12 hexadecimal digits as follows:

48-3F-0A-91-00-BC

* Hexadecimal numbers are used in assembly languages. Assembly languages use a set of mnemonics to represent the possible machine operations which include instructions in Hexadecimal.
* **To display error messages.** Hexadecimals are used to define the memory location of the error.  This is useful for programmers in finding and fixing errors.

## Advantages of the Hexadecimal System

Here are some advantages of using the hexadecimal system:

* It is very concise and by using a base of 16 means that the number of digits used to signify a given number is usually less than in binary or decimal. It allows you to store more information using less space.
* It is fast and simple to convert between hexadecimal numbers and binary. Hexadecimal can be used to write large binary numbers in just a few digits.
* It makes life easier as it allows grouping of binary numbers which makes it easier to read, write and understand. It is more human-friendly, as humans are used to grouping together numbers and things for easier understanding.  Also, writing in less digits lowers the possibility of error occurring.