

Number Representation & Conversion

Fundamental Concepts & Conversions

Q.1 Store the word "Phone" in computer memory starting from address 7003 where each letter needs one byte to store in the memory.

Human's View (Character)	Code in Decimal	Code in Binary	Address
'P'	80	01010000	7003
'h'	104	01101000	7004
'o'	111	01101111	7005
'n'	110	01101110	7006
'e'	101	01100101	7007

Q.2 What is a number system?

A number system is the system for representation of numeric data. A Number system is defined as a set of values used to represent different quantities. We are all familiar with the decimal number system where each number consists of digits from 0 to 9. In a computer system, other number systems are also used, e.g., Binary, Hexadecimal, etc.

Q.3 What do you mean by conversion of number system?

A process to convert one number system to another number system is called conversion of number system. For example, converting a decimal number to a binary number.

Q.4 How is data represented in computer memory?

Digital computers store data in binary form. It means that whether it is text, a picture, a movie, or some application, it is stored in computer's memory in the form of 0s and 1s.

Q.5 What is ASCII?

ASCII (American Standard Code for Information Interchange) is one such coding scheme published by ISO (International Standards Organization). It is a 7-bit coding scheme. The codes are assigned to various characters. Most computers also use 8-bit ASCII code.

Example: A = 65 , B = 66 , and a = 97 , etc.

Q.6 What is a bit and why is the binary number system important for our computer?

Bit stands for **Binary Digit**. A bit is the smallest unit of data and has a value of 1 or 0, representing an ON or OFF state. A computer understands only machine language, which consists of binary codes (0 and 1). So, the binary number system is very important for our computer.

Q.7 What is a byte or character?

A collection of 8 bits is called a byte. It is a set of bits that represents a particular character or symbol. In memory, one byte can store only one character.

Q.8 Convert $2 + 2 = 4$ into ASCII code.

Character	Decimal Code	Binary Code
2	50	00110010
+	43	00101011
2	50	00110010
=	61	00111101
4	52	00110100

So the message in ASCII is: 00110010 00101011 00110010 00111101
00110100

Q.9 Convert $(ABCD)_{16}$ to binary.

Hexa-Decimal	Binary
A	1010
B	1011
C	1100
D	1101

$$(ABCD)_{16} = (1010101111001101)_2$$

Q.10 Convert $(0010110010001101001)_2$ to hexadecimal.

Binary	Hexa-decimal
1001	9
0110	6
0100	4
0110	6
0001	1

$$(0010110010001101001)_2 = (16469)_{16}$$

Q.11 Convert $0B9_{(16)}$ into decimal.

$$\begin{aligned}
 0B9_{(16)} &= (0 \times 16^2) + (B \times 16^1) + (9 \times 16^0) \\
 &= (0 \times 256) + (11 \times 16) + (9 \times 1) \\
 &= 0 + 176 + 9 \\
 &= 185_{(10)}
 \end{aligned}$$

Q.12 What is Octal number system?

The octal numbering system is a base-8 number system that uses digits from 0 to 7. Each digit represents a power of 8. In octal, the place values from right to left are $8^0, 8^1, 8^2$, and so on. For example, the octal number 157 means:

$$1 \times 8^2 + 5 \times 8^1 + 7 \times 8^0 = 64 + 40 + 7 = 111_{10}$$

Q.13 Convert $(100000)_2$ to decimal.

$$\begin{aligned}
 1 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 0 \times 2^0 \\
 &= 32 + 0 + 0 + 0 + 0 + 0 \\
 &= (32)_{10}
 \end{aligned}$$

Q.14 Convert $(C921)_{16}$ to decimal.

$$\begin{aligned}
 (C921)_{16} &= (C \times 16^3) + (9 \times 16^2) + (2 \times 16^1) + (1 \times 16^0) \\
 &= (12 \times 4096) + (9 \times 256) + (2 \times 16) + (1 \times 1) \\
 &= 49152 + 2304 + 32 + 1
 \end{aligned}$$

$$= (51489)_{10}$$

Advanced Data Representation

Q.15 Define Encoding.

Encoding is the conversion of data from one format or representation to another, usually for storage, transport, or processing. To put it simply, it converts information into a format that computers, devices, or software can understand, transfer, or store.

Q.16 Differentiate between signed and unsigned integer.

The major distinction between signed and unsigned integers is their capacity to represent both positive and negative numbers.

- **Signed Integer:** Can represent both positive and negative numbers, including zero.
- **Unsigned Integer:** Can only represent non-negative values (zero and positive numbers).

Q.17 How are real values stored in computer memory?

In computers, real values (also known as floating-point numbers) are used to represent numbers that have fractions or decimal points. These values are stored using the IEEE standard, where each standard is represented by:

- i. Sign bit

- ii. Exponent
- iii. Mantissa

Q.18 What are the binary Arithmetic Operations?

Binary arithmetic refers to the operations of addition, subtraction, multiplication and division performed on binary numbers. Binary numbers are the basis of all operations in digital computers. Binary arithmetic operations are similar to decimal operations but follow binary rules.

Q.19 Describe the rule of binary addition.

- $0 + 0 = 0$
- $0 + 1 = 1$
- $1 + 0 = 1$
- $1 + 1 = 0$ (with a carry of 1)

Q.20 What do you know about Booth's Algorithm?

Booth's Algorithm is an efficient algorithm for multiplying binary numbers, especially when dealing with large numbers.

Q.21 How Central Processing Unit (CPU) works?

The central processing unit (CPU) of a computer performs millions of binary multiplications every second to execute complex instructions and run programs.

Q.22 Write common types of encoding schemes.

Here are some of the most common text encoding schemes used in computers:

- ASCII (American Standard Code for Information Interchange)
- Extended ASCII
- Unicode (Universal Code)
- UTF-8 (Unicode Transformation Format-8)
- UTF-16 (Unicode Transformation Format-16)
- UTF-32 (Unicode Transformation Format-32)

Media & File Representation

Q.23 How are images stored in computer memory?

Images are made up of tiny dots called pixels. Each pixel has a color, and the combination of all these pixels forms the complete picture. Computers store images using numbers to represent these colors.

Q.24 Define Pixel.

A pixel (Picture Element) is the smallest unit of a digital image or display that may be independently manipulated for color and brightness. Pixels are the

fundamental components of all digital images and screens, including those on smartphones, computers, and televisions.

Q.25 How are colors represented in computer memory?

In a color image, each pixel's color can be represented by three numbers: **Red, Green, and Blue (RGB)**. Each of these numbers typically ranges from 0 to 255. For example, a pixel with RGB values (255, 0, 0) will be bright red.

Q.26 Define the following image formats: JPEG, PNG, GIF.

- **JPEG (Joint Photographic Experts Group)**: Common format for photos. It compresses the image to save space but might lose some quality.
- **PNG (Portable Network Graphics)**: Supports transparency and maintains high quality without losing data.
- **GIF (Graphics Interchange Format)**: Used for simple animations and images with few colors.

Q.27 How are audios stored in computer memory?

Audio files are stored by capturing sound waves and converting them into digital data. This process involves sampling and quantization.

Q.28 Define the following terms: MP3, WAV, AAC.

- **MP3**: A common format that compresses audio to save space but may lose some quality.

- **WAV:** Uncompressed format that maintains high quality.
- **AAC:** Used by many streaming services for high-quality audio with efficient compression.

Q.29 What do you know about frame and frame rates?

The number of frames shown per second, measured in frames per second (fps). Common frame rates are 24 fps (used in movies) and 30 fps (used in TV). Higher frame rates result in smoother motion in videos. (TV stands for Television).

Q.30 Define the following terms: Hard Disk Drives (HDD), Solid State Drive (SSD).

- **Hard Disk Drives (HDD)**
- **Solid State Drive (SSD)**