1. How is binary addition done? Explain with an example.

Ans: Binary addition is similar to decimal addition. We add two or more numbers and finally get an output. In case of binary addition, it is performed using base-2. As we know binary number system only uses (or say understands) 0 and 1, it does the addition according. Some basic rules of binary addition are;

$0 + 0 = 0$
$0 + 1 = 1$
$1 + 0 = 1$
$1 + 1 = 10$ i.e (0 with carry 1).

Examples:-

$$\begin{array}{r} {\scriptstyle 1\ \ 1\ \ \ \ } \\ 1\ 0\ 1\ 0 \\ +\ 0\ 1\ 1\ 0 \\ \hline 1\ 0\ 0\ 0\ 0 \end{array}$$

$$\begin{array}{r} {\scriptstyle 1\ \ \ \ \ \ \ } \\ 1\ 0\ 0\ 1 \\ +\ 0\ 1\ 1\ 0 \\ \hline 1\ 1\ 1\ 1 \end{array}$$

2. Define decimal to binary conversion with an example.

Ans: We have studied four different number systems; they are Binary Number System, Octal Number System, Decimal Number System and Hexadecimal number System. All of these ~~Atom~~ number systems can converted into any other number systems. In case of decimal system

(base 10) conversion to binary system (base 2), this is done by repeatedly dividing the decimal number by 2 and recording the remainder until ending up to 1. All the decimal numbers have their equivalent binary numbers.
In this way, decimal number system can be converted in binary number system.
For example.

2	31	
2	15	— 1
2	7	— 1
2	3	— 1
2	1	— 1
	0	— 1

$\therefore (31)_{10} = (11111)_2$

2	27	
2	13	— 1
2	6	— 1
2	3	— 0
2	1	— 1
	0	— 1

$(27)_{10} = (11011)_2$

3. Describe the concept behind floating point number representation with example.

Ans: Floating point representation is a way to represent real numbers in computers to handle a wide range of values, from very small to very large. The concept behind floating point notation is similar to scientific notation.

Floating point uses two registers. First stores the number without the binary point and second stores a number that indicates the position of the binary point in first register. Floating point numbers have two parts which are called as Mantissa and Exponent.
For example,

Mantissa = 0101111011 (leftmost 0 indicates +ve number)
Exponent = 000100 (decimal number +4)

∴ Floating point number is Mantissa * $2^{exponent}$
i.e $+1011011 * 2^4$

4. Discuss the concept behind the fixed point number representation. What can be the fixed point representation of a signed number 8?

Ans: Fixed point number representation is a method of representating real number in computers where a specific number of bits are used to represent the integer and fractional parts of a number. The fixed point indicates that the decimal (or the binary) point's position is fixed and does not float as in floating point representation.

Fixed point number representation of signed number 8.

Binary representation of $(8)_{10} = (1000)_2$
fractional part $= (0.0000)_2$
Since 8 is positive, the sign bit is 0.
Final fixed point representation (8 bits) = 01000.0000
[The fixed point is after four bit].

(5) A particular binary number has 3 digits. What are the largest and smallest possible binary numbers and convert these numbers to base 10.

Ans For a 3 digits binary number, the smallest number is 000. This is equal to 0 in decimal number system.
Mathematically,

$$0 \times 2^2 + 0 \times 2^1 + 0 \times 2^0$$
$$= 0 + 0 + 0$$
$$= 0$$

$\therefore (000)_2 = (0)_{10}$

Similarly, the largest three digits binary number is $(111)_2$. This is equal to $(7)_{10}$ in decimal number system.

Mathematically,

$$1\times2^2 + 1\times2^1 + 1\times2^0$$
$$= 4 + 2 + 1$$
$$= 7$$

$\therefore (111)_2 = (7)_{10}$ //