Conversion

1. Binary to hexadecimal

Grouping method is used to change a number from binary to hexadecimal. Separate a binary number into groups of four digits starting from the right. Groups are then converted to hexadecimal digits from 0 to F. To change from hexadecimal, the reverse is done. Grouping is usually removed after converting hexadecimal digits to binary (Table 1.1).

Table 1.1: Conversion of binary to hexadecimal

Binary	*Groupings*				*Hexadecimal*
01100101			0110	0101	65
010010110110		0100	1011	0110	4B6
1101011101011010	1101	0111	0101	1010	D75A

2. Hexadecimal to decimal

One way to find the decimal equivalent of a hexadecimal number is to first convert the hexadecimal number to binary and then convert from binary to decimal.

Convert the hexadecimal number 1C to decimal:

1 C

0001 1100 = $2^4 + 2^3 + 2^2 = 16 + 8 + 4 = 28$

3. Decimal to hexadecimal

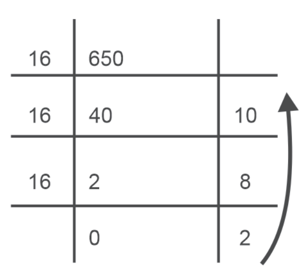
Repeated division of a decimal number by 16 will produce the equivalent hexadecimal number, formed by the remainders of the divisions. The first remainder produced is the least significant digit (LSD). Each successive division by 16 yields a remainder that becomes a digit in the equivalent hexadecimal number. When a quotient has a fractional part, the fractional part is multiplied by the divisor to get the remainder.

Convert the decimal number 650 to hexadecimal by repeated division by 16:

650/16 = 40.625	0.625 × 16 = 10 = A (LSD)
40/16 = 2.5	0.5 × 16 = 8 = 8
2/16 = 0.125	0.125 × 16 = 2 = 2 (MSD)

The hexadecimal number is 28A

And another method to solve ***decimal to hexadecimal*** *is given below*:



Hence the hexadecimal number is 2 8 10, i.e. 28A (because 10 = A in hexadecimal).

–1 1 0 1	⇒	1 0 0 1 0	(taking 1′s complement)
		0 0 0 0 0	
		1	carry
		0 0 0 0 1	

Hence the required sum is + 0001.

ii. +1101 and –1011

(Assume that the representation is in a signed 5-bit register).

Solution:

+1 1 0 1	⇒	0 1 1 0 1	
–1 0 1 1	⇒	1 0 1 0 0	(taking 1′s complement)
		0 0 0 0 1	
		1	carry
		0 0 0 1 0	

Hence the required sum is + 0010.

Case II: When the negative number has greater magnitude.

In this case the addition is carried in the same way as in case 1 but there will be non end-around carry. The sum is obtained by taking 1′s complement of the magnitude bits of the result and it will be negative.

The following examples will illustrate this method in binary addition using 1′s complement

Find the sum of the following binary numbers represented in a sign-plus-magnitude 5-bit register:

i. +1010 and –1100

Solution:

+1 0 1 0	⇒	0 1 0 1 0	
–1 1 0 0	⇒	1 0 0 1 1	(1′s complement)
		1 1 1 0 1	

Hence the required sum is – 0010.

Binary Addition using 2's Complement

When negative numbers are expressed in binary addition using 2′s complement the addition of binary numbers becomes easier. This operation is almost similar to that in 1′s complement system and is explained with examples given below:

We consider the following cases.

Case I: When the positive number has a greater magnitude.

In this case the carry which will be generated is discarded and the final result is the result of addition.

In a 5-bit register find the sum of the following by using 2′s complement

iv. 101.11 ÷ 111

Solution:

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111)  101.11   (0.11
       11 1
       10 01
        1 11
          10
```

Thus, the quotient is 0.11 up to 2 places of binary point and the remainder is 0.1.

ISOLATED KEY POINTS

- **Natural numbers:** The numbers 1, 2, 3, 4.... are called natural numbers or positive integers.
- **Whole numbers:** The numbers 0, 1, 2, 3.... are called whole numbers. Whole numbers include "0".
- **Integers:** The numbers .... –3, –2, –1, 0, 1, 2, 3,.... are called integers. You will see questions on integers in almost all the exams where you see number system aptitude questions.
- **Negative integers:** The numbers –1, –2, –3, ... are called negative integers.
- **Positive fractions:** The numbers (2/3), (4/5), (7/8) ... are called positive fractions.
- **Negative fractions:** The numbers –(6/8), –(7/19), –(12/17) ... are called negative fractions.
- **Rational numbers:** Any number which is a positive or negative integer or fraction, or zero is called a rational number. A rational number is one which can be expressed in the following format ⇒(a/b) , where b ≠ 0 and a and b are positive or negative integers.
- **Irrational numbers:** An infinite non-recurring decimal number is known as an irrational number. These numbers cannot be expressed in the form of a proper fraction a/b where b ≠ 0, e.g. √2 , ∏, etc.
- **Surds:** Any root of a number, which cannot be exactly found is called a surd. Essentially, all surds are irrational numbers, e.g. √2 , √5, etc.
- **Even numbers:** The integers which are divisible by 2 are called even numbers, e.g. –4, 0, 2, 16, etc.
- **Odd numbers:** The integers which are not divisible by 2 are odd numbers e.g. –7, –15, 5, 9, etc.
- **Prime numbers:** Those numbers, which are divisible only by themselves and 1, are called prime numbers. In other words, a number, which has only two factors, 1 and itself, is called a prime number, e.g. 2, 3, 5, 7, etc.

PRACTICE QUESTIONS

Long Answer Type Questions

1. **What is computer? Explain the characteristics of computer.**
2. **Explain the block diagram of computer.**
3. **Explain number system.**

i. Functional hierarchy showing the functions to be performed by the new system and their relationship with each other.
ii. Functional network, which are similar to function hierarchy but they highlight the functions which are common to more than one procedure.
iii. List of attributes of the entities—these are the data items which need to be held about each entity (record).

System Analysis

Systems analysis is a process of collecting factual data, understand the processes involved, identifying problems and recommending feasible suggestions for improving the system functioning. This involves studying the business processes, gathering operational data, understand the information flow, finding out bottlenecks and evolving solutions for overcoming the weaknesses of the system so as to achieve the organizational goals. System analysis also includes subdividing of complex process involving the entire system, identification of data store and manual processes.

The major objectives of systems analysis are to find answers for each business process: What is being done, how is it being done, who is doing it, when is he doing it, why is it being done and how can it be improved? It is more of a thinking process and involves the creative skills of the system analyst. It attempts to give birth to a new efficient system that satisfies the current needs of the user and has scope for future growth within the organizational constraints. The result of this process is a logical system design. Systems analysis is an iterative process that continues until a preferred and acceptable solution emerges.

System Design

Based on the user requirements and the detailed analysis of the existing system, the new system must be designed. This is the phase of system designing. It is the most crucial phase in the developments of a system. The logical system design arrived at as a result of systems analysis is converted into physical system design. Normally, the design proceeds in two stages:

i. Preliminary or general design
ii. Structured or detailed design

Preliminary or general design: In the preliminary or general design, the features of the new system are specified. The costs of implementing these features and the benefits to be derived are estimated. If the project is still considered to be feasible, we move to the detailed design stage.

Structured or detailed design: In the detailed design stage, computer oriented work begins in earnest. At this stage, the design of the system becomes more structured. Structure design is a blue print of a computer system solution to a given problem having the same components and interrelationships among the same components as the original problem. Input, output, databases, forms, codification schemes and processing specifications are drawn up in detail. In the design stage, the programming language and the hardware and software platform in which the new system will run are also decided. There are several tools and techniques used for describing the system design of the system.