UNIT – I

Number system: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement ,Two's complement method, binary multiplication, binary division Concept of Information Systems and Software : Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project

Number Systems

The number system is a way to represent or express numbers. You have heard of various types of number systems such as the whole numbers and the real numbers. But in the context of computers, we define other types of number systems. They are:

- The decimal number system
- The binary number system
- The octal number system and
- The hexadecimal number system

Decimal Number System (Base 10)

In this number system, the digits 0 to 9 represents numbers. As it uses 10 digits to represent a number, it is also called the base 10 number system. Each digit has a value based on its position called place value. The value of the position increases by 10 times as we move from right to left in the number.
For example, the value of 786 is
$= 7 \times 10^2 + 8 \times 10^1 + 6 \times 10^0$
$= 700 + 80 + 6$

Binary Number System (Base 2)

A computer can understand only the "on" and "off" state of a switch. These two states are represented by 1 and 0. The combination of 1 and 0 form binary numbers. These numbers represent various data. As two digits are used to represent numbers, it is called a binary or base 2 number system.
The binary number system uses positional notation. But in this case, each digit is multiplied by the appropriate power of two based on its position.
For example, $(101101)_2$ in decimal is
$= 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$
$= 1 \times 32 + 0 \times 16 + 1 \times 8 + 1 \times 4 + 0 \times 2 + 1 \times 1$

$= 32 + 8 + 4 + 1$
$= (45)_{10}$

Octal Number System (Base 8)

This system uses digits 0 to 7 (i.e. 8 digits) to represent a number and the numbers are as a base of 8.
For example, $(24)_8$ in decimal is
$= 2\times8^1+4\times8^0$
$= (20)_{10}$

Hexadecimal Number System (Base 16)

In this system, 16 digits used to represent a given number. Thus it is also known as the base 16 number system. Each digit position represents a power of 16. As the base is greater than 10, the number system is supplemented by letters. Following are the hexadecimal symbols: 0, 1, 2, 3, 4, 5, 6,
7, 8, 9, A, B, C, D, E, F
To take A, B, C, D, E, and F as part of the number system is conventional and has no logical or deductive reason.

Number System Chart

Name	Base	Symbols	Example
Decimal	10	0,1,2,3,4,5,6,7,8,9	$(2795)_{10}$
Binary	2	0,1	111000010
Octal	8	0,1,2,3,4,5,6,7	$(1576)_8$
Hexadecimal	16	0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F	3DB

Information system

Information systems (**IS**) are formal, sociotechnical, organizational systems designed to collect, process, store, and distribute information. In a sociotechnical perspective, information systems are composed by four components: task, people, structure (or roles), and technology.

The six components that must come together in order to produce an information system are: (Information systems are organizational procedures and do not need a

computer or software, this data is erroneous)

1. Hardware: The term hardware refers to machinery. This category includes the computer itself, which is often referred to as the central processing unit (CPU), and all of its support equipment. Among the support, equipment are input and output devices, storage devices and communications devices.
2. Software: The term software refers to computer programs and the manuals (if any) that support them. Computer programs are machine-readable instructions that direct the circuitry within the hardware parts of the system to function in ways that produce useful information from data. Programs are generally stored on some input/output medium, often a disk or tape.
3. Data: Data are facts that are used by programs to produce useful information. Like programs, data are generally stored in machine-readable form on disk or tape until the computer needs them.
4. Procedures: Procedures are the policies that govern the operation of a computer system. "Procedures are to people what software is to hardware" is a common analogy that is used to illustrate the role of procedures in a system.
5. People: Every system needs people if it is to be useful. Often the most overlooked element of the system are the people, probably the component that most influence the success or failure of information systems. This includes "not only the users, but those who operate and service the computers, those who maintain the data, and those who support the network of computers."
6. Feedback: it is another component of the IS, that defines that an IS may be provided with a feedback

Data is the bridge between hardware and people. This means that the data we collect is only data until we involve people. At that point, data is now information.

Types of information system

Some examples of such systems are:

- data warehouses
- enterprise resource planning
- enterprise systems
- expert systems
- search engines
- geographic information system
- global information system
- office automation.

Systems Development Life Cycle

An effective System Development Life Cycle (SDLC) should result in a high quality system that meets customer expectations, reaches completion within time and cost

evaluations, and works effectively and efficiently in the current and planned Information Technology infrastructure.

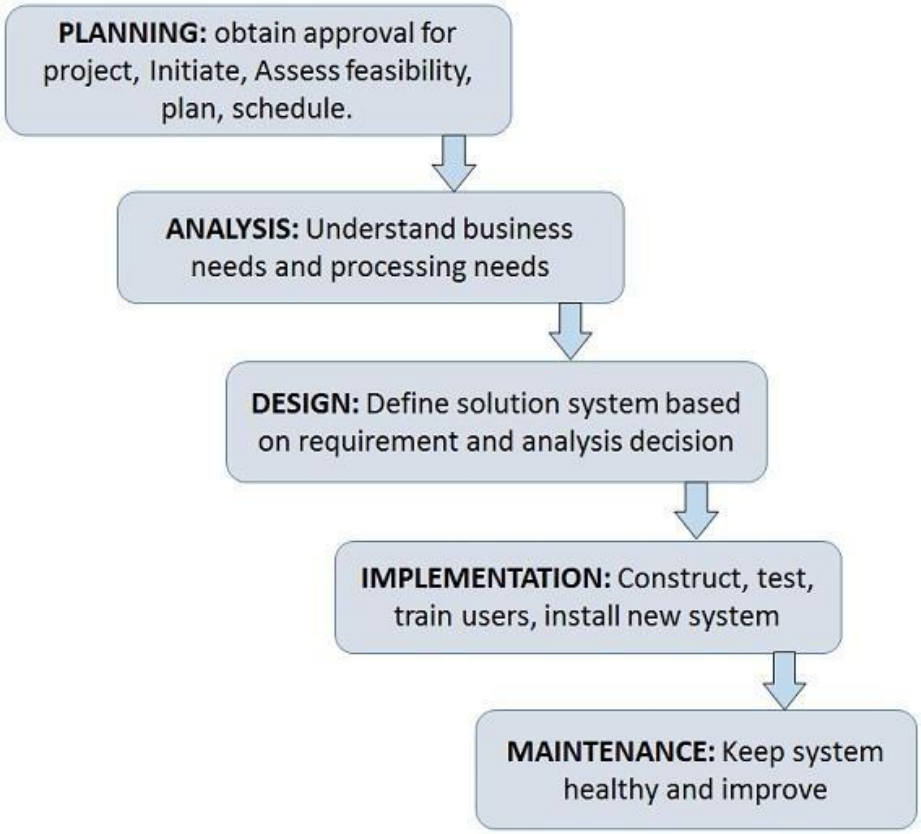
System Development Life Cycle (SDLC) is a conceptual model which includes policies and procedures for developing or altering systems throughout their life cycles.

SDLC is used by analysts to develop an information system. SDLC includes the following activities –

- requirements
- design
- implementation
- testing
- deployment
- operations
- maintenance

Phases of SDLC

Systems Development Life Cycle is a systematic approach which explicitly breaks down the work into phases that are required to implement either new or modified Information System.



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Binary to Decimal Conversion

Method 1
Multiply bits with powers of two

1. Write the powers of two (8 bit representation)

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

2. Calculate the powers of two

128	64	32	16	8	4	2	1

3. Write the corresponding bit of the binary number under each power of two

0	0	1	1	1	0	0	1

4. Multiply each bit with its corresponding power of two. Add all products.

$0 \cdot 128 + 0 \cdot 64 + 1 \cdot 32 + 1 \cdot 16 + 1 \cdot 8 + 0 \cdot 4 + 0 \cdot 2 + 1 \cdot 1$
$= 32 + 16 + 8 + 1 = 57$

5. The result of the sum is the decimal number

$$111001_2 = 57_{10}$$

Decimal to Binary Conversion

Method 1
Descending Powers of Two and Subtraction

1. Write the power of two

$2^0 = 1$
$2^1 = 2$
$2^2 = 4$
$2^3 = 8$
$2^4 = 16$
$2^5 = 32$
$2^6 = 64$
$2^7 = 128$
$2^8 = 256$

2. Write the number as a sum of powers of two

$57 = 32 + 25$
$= 32 + 16 + 9$
$= 32 + 16 + 8 + 1$
$= 1 \times 32 + 1 \times 16 + 1 \times 8 + 1 \times 1$
$= 1 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^0$
$= 1 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$

3. Extract the coefficients of the powers of two

$$57_{10} = 111001_2$$

Octal to Binary

Octal number is one of the number systems which has value of base is 8, that means there only 8 symbols: 0, 1, 2, 3, 4, 5, 6, and 7. Whereas **Binary** number is most familiar number system to the digital systems, networking, and computer professionals. It is base 2 which has only 2 symbols: 0 and 1, these digits can be represented by off and on respectively.

Conversion from Octal to Binary number system

There are various direct or indirect methods to convert a octal number into binary number. In an indirect method, you need to convert an octal number into other number system (e.g., decimal or hexadecimal), then you can convert into binary number by converting each digit into binary number from hexadecimal system and using conversion system from decimal to binary number.

There is a simple direct method to convert an octal number to binary number. Since there are only 8 symbols (i.e., 0, 1, 2, 3, 4, 5, 6, and 7) in octal representation system and its base (i.e., 8) is equivalent of 23=8. So, you can represent each digit of octal in group of 3 bits in binary number.

Octal Symbol	Binary equivalent
0	000
1	001
2	010
3	011
4	100
5	101
6	110
7	111

This method is simple and also works as reverse of Binary to Octal Conversion. The algorithm is explained as following below.

- Take Octal number as input
- Convert each digit of octal into binary.
- That will be output as binary number.

Example-1 Convert octal number 540 into binary

number. According to above algorithm, equivalent

binary number will be,

$= (540)_8$
$= (101\ 100\ 000)_2$
$= (101100000)_2$

This is very simple conversion, you can use for mixed (integer with fractional) octal number as well.

Example-2 − Convert octal number 352.563 into binary number.

According to above algorithm, equivalent binary number will be,

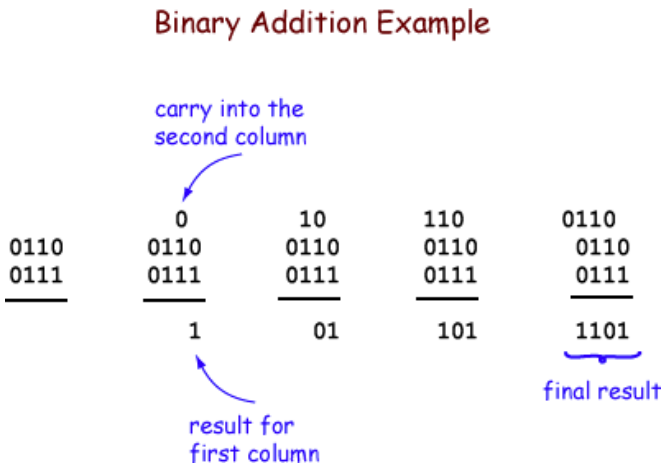
$= (352.563)_8$
$= (011\ 101\ 010\ .\ 101\ 110\ 011)_2$

$= (011101010.101110011)_2$

Binary addition

Binary Addition

A	B	Sum	Carry
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1



One's Complement and Two's Complement

One's complement and two's complement are two important binary concepts. Two's complement is especially important because it allows us to represent signed numbers in binary, and one's

complement is the interim step to finding the two's complement.

Two's complement also provides an easier way to subtract numbers using addition instead of using the longer.

One's Complement

If all bits in a byte are inverted by changing each 1 to 0 and each 0 to 1, we have formed the one's complement of the number.

```
Original        One's Complement
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10011001   -->   01100110
10000001   -->   01111110
11110000   -->   00001111
11111111   -->   00000000
00000000   -->   11111111
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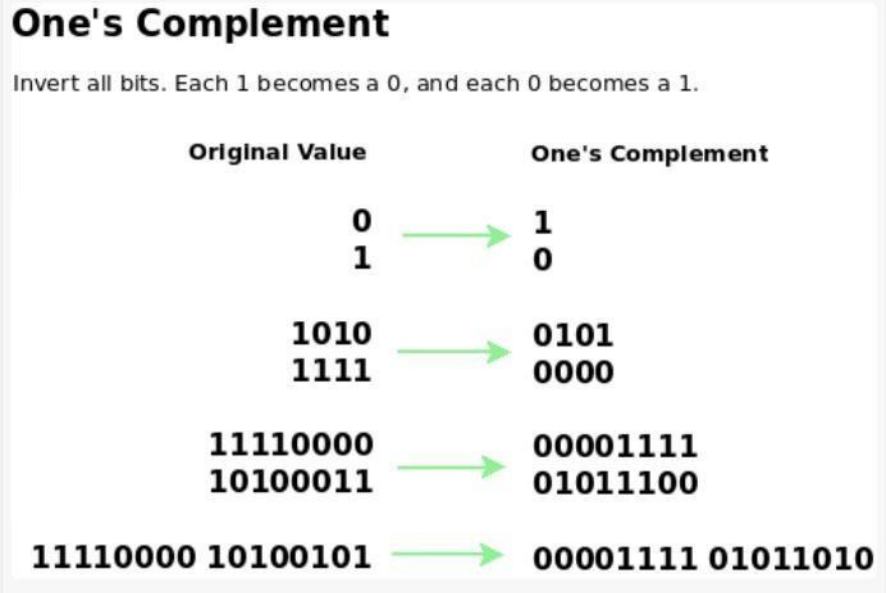

One's complement is useful for forming the two's complement of a number.

Two's Complement (Binary Additive Inverse)

The two's complement is a method for representing positive and negative integer values in binary. The useful part of two's complement is that it automatically includes the sign bit.

Rule: To form the two's complement, add 1 to the one's complement.

```
Step 1: Begin with the original binary value

    10011001  Original byte

Step 2: Find the one's complement

    01100110  One's complement

Step 3: Add 1  to the one's complement

    01100110  One's complement
  +        1  Add 1
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    01100111  <---  Two's complement
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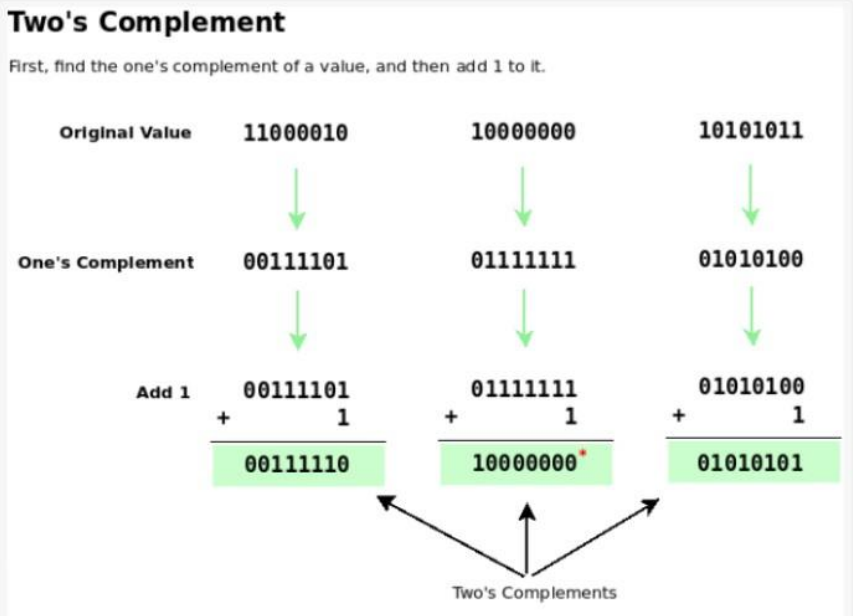

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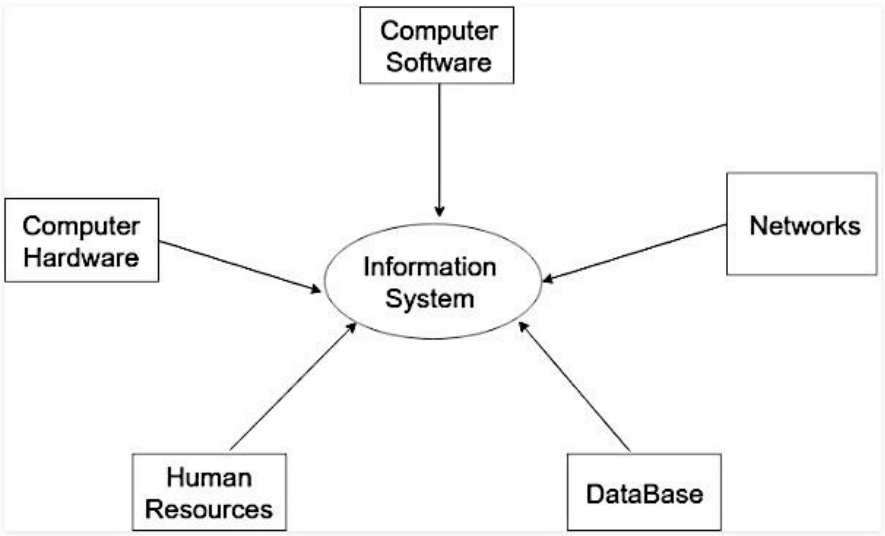
Components Of Information System

An **Information system** is a combination of hardware and software and telecommunication networks that people build to collect, create and distribute useful data, typically in an organisational, It defines the flow of information within the system. The objective of an information system is to provide appropriate information to the user, to gather the data, processing of the data and communicate information to the user of the system.



Components of the information system are as follows:

1. Computer Hardware:
Physical equipment used for input, output and processing. What hardware to use it depends upon the type and size of the organisation. It consists of input, an output device, operating system, processor, and media devices. This also includes computer peripheral devices.

2. Computer Software:
The programs/ application program used to control and coordinate the hardware components. It is used for analysing and processing of the data. These programs include a set of instruction used for processing information.
Software is further classified into 3 types:

1. System Software
2. Application Software
3. Procedures

3. Databases:
Data are the raw facts and figures that are unorganised that are and later processed to generate information. Softwares are used for organising and serving data to the user, managing physical storage of media and virtual resources. As the hardware can't work without software the same as software needs data for processing. Data are managed using Database management system.
Database software is used for efficient access for required data, and to manage knowledge bases.

4. Network:

- Networks resources refer to the telecommunication networks like the intranet, extranet and the internet.
- These resources facilitate the flow of information in the organisation.
- Networks consists of both the physicals devises such as networks cards, routers, hubs and cables and software such as operating systems, web servers, data servers and application servers.

- Telecommunications networks consist of computers, communications processors, and other devices interconnected by communications media and controlled by software.
- Networks include communication media, and Network Support.

5. Human Resources:

It is associated with the manpower required to run and manage the system. People are the end user of the information system, end-user use information produced for their own purpose, the main purpose of the information system is to benefit the end user. The end user can be accountants, engineers, salespersons, customers, clerks, or managers etc. People are also responsible to develop and operate information systems. They include systems analysts, computer operators, programmers, and other clerical IS personnel, and managerial techniques.

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Project

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Definition

Project management is the application of processes, methods, skills, knowledge and experience to achieve specific project objectives according to the project acceptance criteria within agreed parameters.

What is a project?

A project is a unique, transient endeavour, undertaken to achieve planned objectives, which could be defined in terms of outputs, outcomes or benefits. A project is usually deemed to be a success if it achieves the objectives according to their acceptance criteria, within an agreed timescale and budget. Time, cost and quality are the building blocks of every project.

Time: scheduling is a collection of techniques used to develop and present schedules that show when work will be performed.
Cost: how are necessary funds acquired and finances managed?
Quality: how will fitness for purpose of the deliverables and management processes be assured?

The core components of project management are:

- defining the reason why a project is necessary;
- capturing project requirements, specifying quality of the deliverables, estimating resources and timescales;

- preparing a business case to justify the investment;
- securing corporate agreement and funding;
- developing and implementing a management plan for the project;
- leading and motivating the project delivery team;
- managing the risks, issues and changes on the project;
- monitoring progress against plan;
- managing the project budget;
- maintaining communications with stakeholders and the project organisation;
- provider management;
- closing the project in a controlled fashion when appropriate

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